S. HRG. 111–1187

OVERSIGHT OF THE GSA AND ENERGY EFFICIENCY IN PUBLIC BUILDINGS

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED ELEVENTH CONGRESS

FIRST SESSION

APRIL 22, 2009

Printed for the use of the Committee on Environment and Public Works

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COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED ELEVENTH CONGRESS
FIRST SESSION

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C O N T E N T S

OVERSIGHT OF THE GSA AND ENERGY EFFICIENCY IN PUBLIC BUILDINGS

WEDNESDAY, APRIL 22, 2009

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The full committee met, pursuant to notice, at 10 a.m. in room 406, Dirksen Senate Office Building, Hon. Barbara Boxer (chairman of the full committee) presiding.

Present: Senators Boxer, Inhofe, Lautenberg, Klobuchar, Udall, and Merkley.

OPENING STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Senator BOXER. Good morning. Happy Earth Day to all.

We are going to skip opening statements because we want to get right to our panel. We have two purposes this morning. One is to see how we are doing on the Recovery Act, because there was a good chunk of money that we provided to GSA to convert their facilities to high-performance green buildings. We want to know how that is coming. That is the first thing.

The second panel, we will hear from building and energy efficiency experts from outside of Government regarding the progress that has been made to date and the barriers to further improvement. We are working across the aisle to write some legislation to see if we can do more to move even faster and further on our GSA efficiency efforts.

So with that, I am very happy to open it up and glad to have those of you here. There is a lot going on today. I think Al Gore is over on the other side of the building talking about global warming, and John Kerry, I just left a hearing, he is talking about the progress on the international side, of the treaty that we are working on global warming.

So Mr. Prouty, why don't you go ahead and proceed.

STATEMENT OF PAUL F. PROUTY, ACTING ADMINISTRATOR, GENERAL SERVICES ADMINISTRATION, ACCOMPANIED BY: TONY COSTA, ACTING COMMISSIONER, PUBLIC BUILDINGS SERVICE; BILL GUERIN, RECOVERY EXECUTIVE, RECOVERY PROGRAM MANAGEMENT OFFICE, PUBLIC BUILDINGS SERVICE; AND KEVIN KAMPSCHROER, ACTING DIRECTOR, OFFICE OF FEDERAL HIGH-PERFORMANCE GREEN BUILDINGS

Mr. PROUTY. Thank you very much.

Good morning, Madam Chair, Ranking Member Inhofe and members of this Committee. My name is Paul Prouty and I am the Acting Administrator of the General Services Administration.

Thank you for inviting me to appear before you on Earth Day. It is a fantastic opportunity for us to talk to you about the things we are doing to make our Federal buildings more energy efficient.

I am pleased to discuss GSA's contribution to our Nation's economic recovery through green building modernization and construction. The funds Congress provided GSA through the American Recovery and Reinvestment Act are a sound investment in many respects. First, the money will help GSA reduce energy consumption and improve the environmental performance of our inventory.

Second, the funds in large part will be invested in existing infrastructure. This will help reduce our backlog of repair and alteration needs and increase asset value, prolonging their useful life and ultimately further conserving our Country's resources.

Third, the money will lessen our reliance on costly operating leases by providing more Government-owned solutions for long-term client requirements.

Finally, we will stimulate job growth in the construction and real estate sectors and prompt long-term improvements in alternative energy solutions and green building and energy-efficient technologies.

Today, I will describe the steps we have taken to carry out the public buildings services portion of the Recovery Act. With me today are Tony Costa, Acting Commissioner of the Public Buildings Service; Bill Guerin, the recovery executive in our newly established Recovery Program Management Office; and Kevin Kampschroer, our Acting Director of the Office of Federal High-Performance Green Buildings.

It is not business as usual at GSA. We are moving forward with speed, tempered by careful consideration of our procurement responsibilities and our ultimate accountability to the citizens. To streamline business processes and provide tools and resources to assist GSA's regional recovery project delivery, we have established a nationally managed, regionally executed Project Management Office. The PMO works closely with counterparts in the core PBS organization to leverage resources and expertise.

The PMO office develops and maintains consistent processes, policies and guidelines, manages customer requirements and expectations at the national level, drives successful project oversight and management, ensures accurate tracking and reporting of the Recovery Act funds, manages cross-agency resources, and enables PBS to adopt leading practices.

PBS and the Program Management Office have moved forward quickly. On March 31, GSA on behalf of the Administration, delivered to Congress a list of 254 projects in all 50 States, the District of Columbia, and two U.S. territories to be completed with funds provided by the Recovery Act. These projects fall in the following categories: new Federal construction, full or partial building modernizations, and limited scope, high-performance green building projects.

In the new Federal construction category, we will invest $1 billion in 17 projects. In the building modernization category, we will

invest $3.2 billion in 43 projects. And in the limited scope green buildings category, we will invest $806 million in 194 projects.

GSA selected the best projects for accomplishing the goals of the Recovery Act, based on a detailed analysis of a number of factors. Our goals in developing the list were to put people back to work quickly and to dramatically increase the sustainability of our buildings.

Many of the projects in the new Federal construction and building modernization categories have previously received partial funding. We can start construction quickly on these projects, while also identifying ways that existing designs can be improved.

These categories include projects such as the Bishop Henry Whipple Federal Building in Fort Snelling, Minnesota, a multi-tenant office building project where heating, ventilation and air conditioning, plumbing, electrical and life safety improvements are expected to deliver a 23.6 percent energy savings. This is over and above the 20 percent in energy savings we have achieved in this building in recent years.

Examples of the ways in which we will improve new construction and major modernization projects we have selected include thicker insulation than required by the newest energy codes in climates where it makes sense; installing variable frequency drives to reduce energy and extend the life of mechanical equipment; converting parking structure lighting to light emitting diode LED, which dramatically lowers energy consumption, improves safety and visibility, and reduces maintenance; retrofitting or replacing less efficient windows; and specifying dual flush toilets and waterless or low water urinals to save water and reduce demand on aging city sewer systems.

An example of the innovative improvements we will be making in some of the construction and modernization projects is the Edith Green-Wendell Wyatt Federal Building in Portland, Oregon. As part of this project, GSA will install a new high-performance double glass enclosure over the entire building, which will dramatically enhance energy performance and blast resistance. On the west facade, vegetative fins will provide shade, and reduce the load of the new high-efficiency heating, ventilation and air conditioning system that will be installed.

These are just some of the green improvements that GSA will make as part of this project. We expect the building to attain a LEED gold rating.

By using well-established contracting techniques, we can start work quickly and make simultaneous improvements on existing designs.

In the limited scope category, we have identified a number of basic projects that can rapidly be deployed in many buildings at once, buildings as varied as Oklahoma City Federal Building, the Burlington Federal Building, U.S. Post Office and Courthouse, and the J. Caleb Boggs Courthouse and Federal Buildings in Wilmington, Delaware.

Through these basic projects, we can make significant improvement to the energy performance of a building and also improve the working conditions for the people in them.

Three examples of these improvements are installing intelligent lighting systems that provide daylight and controls for occupants to adjust for ambient light versus task light; replacing flat roofs with ENERGY STAR membranes, integrated photovoltaic panels bonded to the membrane or planted roofs; accelerating the installation of advanced meters, which is required to be completed by 2012 under the Energy Policy Act. Advanced meters enable us to better manage buildings by instantaneously providing information on buildings' energy use and encouraging immediate operational changes.

For these projects, we have developed standard national scopes of work, some of which were provided by the national laboratories run by the Department of Energy. DOE's Federal Energy Management Program, in conjunction with the National Renewable Energy Laboratory has provided specifications for the four most common types of solar installation. The Commercial Buildings Program at DOE and the Pacific Northwest National Laboratory have provided specifications for three classes of lighting and control strategies. We have also developed standards using GSA's past projects as models.

Today, I have described the unprecedented and exciting opportunity that lies before us to contribute to our Nation's economic recovery by investing in green technologies and reinvesting in our public buildings.

Greening our buildings will be an ongoing process. As the Committee knows, the Energy Independence and Security Act of 2007 and other laws require GSA, among other things, to reduce its energy consumption by 30 percent by 2015; reduce fossil fuel generated energy consumption in our new buildings by increasing amounts from 55 percent in 2010 to 100 percent in 2030; and to green an even greater portion of our inventory. Although the Recovery Act will accelerate our progress in these areas, it alone will not enable us to meet these goals.

We look forward to working with you and Members of this Committee as we engage in this important work.

Madam Chair, Ranking Member Inhofe, this concludes my prepared statement. We will be pleased to answer any questions that you or any other members of this Committee may have. I would like to request that Messrs. Costa, Guerin, and Kampschroer join me for the questions.

[The prepared statement of Mr. Prouty follows:]

PAUL F. PROUTY

ACTING ADMINISTRATOR

GENERAL SERVICES ADMINISTRATION

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

APRIL 22, 2009

Good Morning Madam Chair, Ranking Member Inhofe and members of this Committee. My name is Paul Prouty and I am the Acting Administrator of the General Services Administration (GSA). Thank you for inviting me to appear before you today to discuss GSA's contribution to our nation's economic recovery through the green modernization and construction of our buildings.

GSA's Public Buildings Service (PBS) is one of the largest and most diversified public real estate organizations in the world. Our inventory consists of over 8,600 assets with nearly 354 million square feet of rentable space across all 50 states, 6 territories and the District of Columbia. Our portfolio is comprised primarily of office buildings, courthouses, land ports of entry, and warehouses. GSA's and PBS's goal is to manage these assets responsibly while delivering and maintaining superior workplaces at best value to our client agencies and the American taxpayer.

The funds Congress has provided us through the American Recovery and Reinvestment Act (the Recovery Act) are a sound investment in several respects. First, the money will help GSA reduce its energy consumption and improve the environmental performance of its inventory. Second, the funds, in large part, will be invested in the existing infrastructure, which will help reduce our backlog of repair and alteration needs, thus increasing the assets' value, prolonging their useful life, and ultimately further conserving our country's resources. Third, the money will lessen our reliance on costly operating leases by providing more government owned solutions for the long-term requirements of our customers. Finally, we will stimulate job growth in the construction and real estate sectors and long-term improvements in energy efficient technologies, alternative energy solutions, and green building technologies.

Today, I will describe the steps we have taken to carry out PBS's portion of the Recovery Act. With me is Tony Costa, Acting Commissioner of the Public Buildings Service, Bill Guerin, the Recovery Executive in our newly established Recovery Program Management Office in PBS, and Kevin Kampschroer, Acting Director of the Office of Federal High-Performance Green Buildings.

We know that this is not business as usual and we are moving forward with speed, tempered by careful consideration of our procurement responsibilities and our ultimate accountability to the taxpayer. In order to streamline business processes and provide tools and resources to assist GSA's regional Recovery project delivery, we have established a nationally managed, regionally executed Project Management Office (PMO). The PMO works closely with counterparts in the core PBS organization to leverage PBS resources and expertise. This national operation will be accountable for the following:

- Develop and maintain consistent processes, policies and guidelines;

- Manage customer requirements and expectations at the national level;
- Drive successful project oversight and management;
- Ensure accurate tracking and reporting of Recovery Act funds;
- Manage cross-agency resources; and
- Enable PBS to adopt leading practices in the PBS organization generally.

PBS and the PMO have moved forward quickly. On March 31st, GSA delivered to Congress a list of 254 projects in all 50 states, the District of Columbia, and two U.S. territories to be completed with funds provided by the Recovery Act. These projects fall into the following categories: new federal construction; full and partial building modernizations; and limited-scope, high-performance green building projects. In the new federal construction category, we will invest $1 billion in 17 projects; in the building modernization category, we will invest $3.2 billion in 43 projects; and in the limited-scope green buildings category, we will invest $807 million in 194 projects totaling over $5 billion. GSA selected the best projects for accomplishing the goals of the Recovery Act based on a detailed analysis of a number of factors. Our goals in developing this list were to both put people back to work quickly and increase the sustainability of our buildings to the maximum extent possible.

Many of the projects in the new federal construction and building modernization categories have previously received partial funding. These are projects for which we can start construction quickly while also identifying ways that existing designs can be improved. These categories include projects such as the Bishop Henry Whipple Federal Building in Fort Snelling, Minnesota, a multi-tenant office building project where HVAC, plumbing, electrical and life safety improvements are expected to deliver 23.6% energy savings once the project is completed. This is over and above the 20% in energy savings we have achieved in this building in recent years.

Examples of ways in which we will improve new construction and major modernization projects we have selected include:

- Adding thicker insulation than required by the newest energy codes in climates where it makes sense;
- Installing variable frequency drives to reduce energy and extend the life of mechanical equipment;

- Converting parking structure lighting to LED (light-emitting diode), which dramatically lowers energy consumption, improves safety and visibility and reduces maintenance as LEDs can last two to three times as long as typical parking lot lights;
- Retrofitting or replacing less efficient windows — this component is often eliminated from a building renovation because of the initial expense and long payback period; and
- Specifying dual flush toilets and waterless or low water urinals to save water and reduce demand on aging city sewer systems.

An example of the innovative improvements we will be making in some of the construction and modernization projects is the Edith Green - Wendell Wyatt Federal Building in Portland, Oregon. As part of this project, GSA will install a new high-performance double glass enclosure over the entire building which will dramatically enhance energy performance and blast resistance. On the west façade, vegetative "fins" will provide shade, reducing the load on the new high-efficiency HVAC system that will be installed. These are just some of the "green" improvements that GSA will make as part of this project. We expect the building to attain a LEED Gold rating.

By using well-established contracting techniques, such as design-build contracts, we can start work quickly, and make simultaneous improvements to the existing designs.

In the limited scope category, we have identified a number of projects that can rapidly be deployed in many buildings at once – buildings as varied as the Oklahoma City Federal Building, the Burlington Federal Building US Post Office and Courthouse, and the J. Caleb Boggs Courthouse and Federal Building in Wilmington, Delaware. Through these projects, we can make significant improvement to the energy performance of a building and also improve the working conditions for the people in them.

Three examples of such improvements include:

- Installing intelligent lighting systems that provide daylight and provide controls for occupants to adjust for ambient light versus task light.
- Replacing flat roofs with ENERGY STAR membranes; integrated photovoltaic panels bonded to the membrane; or planted roofs. These options offer benefits ranging from increasing the life of the roof, to producing energy and to reducing the "heat island" effect of a black roof.
- Accelerating the installation of advanced meters—required under the Energy Policy Act to be completed by 2012. Advanced meters enable us to better manage buildings by instantaneously providing information on a building's energy use and encouraging immediate operational changes.

For these projects, we have developed standard national scopes of work, some of which were provided by the national laboratories run by the Department of Energy (DoE). DoE's Federal Energy Management Program, in conjunction with the National Renewable Energy Laboratory, has provided specifications for the four most common types of solar installation. The Commercial Buildings Program at DoE and the Pacific Northwest National Laboratory have provided specifications for three classes of lighting and control strategies. We have also developed standards using GSA's past projects as models.

Conclusion

Today, I have described the unprecedented and exciting opportunity that lies before us to contribute to our nation's economic recovery by investing in green technologies and reinvesting in our public buildings. Greening our buildings will be an ongoing process. As this Committee knows, the Energy Independence and Security Act of 2007 and other laws require GSA, among other things, to reduce its energy consumption by 30 percent by 2015; reduce fossil fuel-generated energy consumption in our new buildings by increasing amounts – from 55 percent in 2010 to 100 percent in 2030; and "green" an even greater portion of our inventory. Although the Recovery Act will accelerate our progress in these areas, it alone will not enable us to meet these goals. We look forward to working with you and members of this Subcommittee as we engage in this important work.

Madam Chairman, Ranking Member Inhofe, this concludes my prepared statement. I will be pleased to answer any questions that you or any other members of this Committee may have.

Senate Committee on Environment and Public Works
Hearing
"Oversight of the GSA and Energy Efficiency in Public Buildings"
April 22, 2009
Answers to Questions for the Record

Questions from Senator Thomas R. Carper

1. GSA has identified selection criteria for the modernization projects for Recovery Act funding to transform existing buildings into high performance federal buildings. Please provide examples of how GSA applied these criteria to help achieve energy savings for targeted facilities.

Designs for modernizations of existing buildings have been upgraded by substituting more efficient equipment, integrating designs, or adding components to improve energy efficiency, reduce consumption, or generate electricity. Examples of this include:

- Adding thicker insulation than required by newest energy codes;
- Installing more efficient motors to reduce energy and extend the life of mechanical equipment;
- Converting parking structure lighting to LED (light-emitting diode), which dramatically lowers energy consumption, improves safety and visibility, and reduces maintenance as LEDs can last two to three times as long as typical parking lot lights; and
- Retrofitting or replacing less efficient windows—this component is often eliminated from a building renovation because of the initial expense and long payback period.

Examples of what we are doing in specific building modernizations include:

- The Internal Revenue Service Center in Andover, Massachusetts. This will include a new roof with a photovoltaic array, seismic repairs, window replacement, HVAC upgrades and improved energy efficiency with replacement of existing electrical equipment with new state-of-the-art electrical equipment, new energy efficient fixtures and new switchgear.

- The Edith Green - Wendell Wyatt Federal Building in Portland, Oregon. As part of this project, GSA will install a new high-performance double glass enclosure over the entire building which will dramatically enhance energy performance and blast resistance. On the west façade, vegetative "fins" will provide shade, reducing the load on the new high-efficiency HVAC system that will be installed.

EPW-09-0263A

- The Kluczynski Federal Building and Loop Station Post Office in Chicago, Illinois. Air-handlers in both buildings will be upgraded with new cooling coils and control valves. The chilled water distribution systems will be converted from a constant flow system to a variable flow system. Heat exchangers will be replaced to improve the efficiency of chilled and hot water systems. Perimeter fan-coil units original to the Kluczynski Building will be replaced with more efficient units controlled by electronic direct digital controls. New temperature controls on perimeter fan-coil units will provide tighter control of space temperatures and allow for more sophisticated control program strategies to save additional energy. Significant energy savings will be realized by reducing both air-handler fan and pump horsepower. The modernization of public restrooms throughout the Kluczynski Building will include installation of water-conserving plumbing fixtures.

We have also identified a number of projects that can rapidly be deployed in many existing buildings at once. Three examples of such improvements include:

- Installing intelligent lighting systems that provide daylight and controls for occupants to adjust for ambient light versus task light.
- Replacing flat roofs with ENERGY STAR membranes; integrated photovoltaic panels bonded to the membrane; photovoltaic panels; or planted roofs.
- Accelerating the installation of advanced meters—required under the Energy Policy Act to be completed by 2012. Advanced meters enable us to better manage buildings by instantaneously providing information on a building's energy use and encouraging immediate operational changes.

2. How much energy and cost savings does GSA estimate it will achieve as a result of modernization projects funded by the Recovery Act?

There are two types of Recovery Act projects in which we will achieve energy savings: (a) limited scope projects and (b) full and partial building modernizations. We will implement limited scope projects (i.e. smaller projects targeted to achieve energy and water conservation and increase use of renewable energy) in almost 200 buildings. Energy-saving features of these projects will include new building controls and tune ups; lighting replacements; and building mechanical system upgrades. There are many variables that can affect savings in these projects.

- If, for example, we find that to do a lighting replacement, we will need to replace the entire suspended ceiling, the cost will be greater.
- The condition of individual motors and sensors will determine how much it will cost to achieve the energy savings goals for those projects.
- We are doing detailed surveys of each building, and unforeseen conditions might change the cost to achieve the goals or change the amount of work we can do for the same amount of money.

Therefore, we will be able to estimate energy savings from the limited scope projects only when we have more detailed information about existing conditions in each building.

For the full and partial building modernizations, in order to create jobs quickly we used projects that were already designed. We are reexamining all of these designs for the possibility of further improvements in high-performance green building features. As we finish these detailed energy models and select those improvements to existing designs that will yield the greatest amount of energy savings without unduly delaying the project (and thus the creation of jobs) we will be able to estimate the anticipated savings in energy consumption for those projects.

3. What steps has GSA taken to ensure it has the capacity (i.e., management, procurement, human capital) to spend the Recovery Act funds on modernization projects efficiently and within the given timeframes?

At both the headquarters and regional levels, PBS defined our resource needs based on the workload generated by the Recovery Act project funding. Generally speaking, experienced existing FTEs have been moved to support Recovery Act work. The gaps created by the movement as well as new staffing requirements will be filled, as appropriate, with temporary/term federal FTEs or contractors. Recruitment efforts are underway for the following categories: 1102 series - Contracting; 800 series - Architects/Engineers; 1100 series - Project Managers; other subject matter experts; and other program support staff.

A combination of federal hires (coordinated with OPM) and centralized contract vehicles have been established to expedite the hiring process. We have requested additional direct hire authority for Project Managers (1100 series) and Interdisciplinary Architects/Engineers (800 series). In addition, we have received OPM's approval for a waiver to offset the compensation penalty for reemployed annuitants for other than the 1102 series.

We have established standing registers for Contracting Specialists, Project Managers, and Interdisciplinary Architect/Engineer positions. The first referrals were available to managers on May 19. Using the referrals, managers are able to begin the selection process. PBS continues to work closely with our Chief Human Capital Officer to develop a marketing campaign that includes job fairs, newspaper advertisements, and advertising with professional organizations.

4. Once GSA has modernized a building, what steps will be taken to ensure that the buildings are operated and maintained in an efficient manner to achieve desired energy savings?

GSA will take the necessary steps in order to ensure that buildings achieve desired energy savings. Such steps include:

- Installing monitoring stations such as those currently used by Region 7;
- Installing advanced (smart) meters which are tied into a national network and are required for all buildings receiving Recovery Act funding;
- Requiring training and certification for every building; and
- Continue with the recommissioning program required by EISA every four years.

5. For more than three decades, federal agencies have been subject to energy intensity reduction goals or mandates. The current goals, codified in the Energy Independence and Security Act of 2007, require federal agencies to reduce energy intensity by three percent each year, or 30 percent by 2015 compared to 2003 energy intensity levels. Is the GSA on track to meet these goals?

GSA is currently on track to meet its 2015 goals as determined by OMB in the recent Green rating received on the January 2009 Energy Management Scorecard. On this scorecard GSA reported the required reduction of 9 percent over the FY 2003 baseline in FY 2008 and was on track for 30 percent in FY 2015.

6. Although many energy-efficiency investments save money over time, available capital for energy-efficiency projects have historically been insufficient. The gap has often been bridged with private sector financing from energy services companies (ESCOs) and energy utilities. ESCOs and utilities finance and help implement energy-saving projects through Utility Energy Services Contracts, in which the contractor is paid out of the resulting stream of energy bill savings. Could you describe GSA's involvement with Utility Energy Service Contracts and private sector financing?

GSA involvement with Utility Energy Service Contracts (UESCs) and Energy Savings Performance Contracts (ESPCs) has been as follows:

SUMMARY OF FINANCED ENERGY PROJECT ACTIVITY

Contract Type	Total Contracts		Total # of Contracts	Investment Amount	Financed Amount	Annual MBTU Saved
	Active	Completed or Bought Out				
ESPC	29	11	40	$118,606,213	$100,814,193	875,261
UESC	23	3	26	$85,768,574	$80,291,411	213,452
GRAND TOTAL:	52	14	66	**$204,374,787**	$181,105,605	1,088,713

7. Can you describe the limited-scope green building projects you've identified for the J. Caleb Boggs Courthouse and Federal Building in Wilmington, Delaware? What is the timeframe on the work at this facility?

The J. Caleb Boggs Courthouse and Federal Building in Wilmington, Delaware project includes renovations to the public access of the main lobby entrance of the building. The lobby improvements will implement a new energy efficient entrance vestibule with energy efficient lighting fixtures inside and under the breezeway and exterior glazing. In addition, lighting fixtures in the parking garage and stairwells will be replaced with energy efficient fixtures.

This project is expected to be completed in December 2010.

8. As you know, the federal government is the nation's single largest energy consumer. In recent years, a range of policies has been implemented to reduce costs and save energy, including energy intensity targets, alternative project financing, efficient procurement requirements, and a variety of training and technical assistance. How can we expand or refine these policies and programs to maximize efficiency and cost savings?

a. Section 433 of the Energy Independence and Security Act of 2007 requires federal agencies to dramatically reduce fossil fuel consumption in new Federal buildings and Federal buildings undergoing major renovations by the following percentages in the specified fiscal years:

FY 2010	55%
FY 2015	65%
FY 2020	80%
FY 2025	90%
FY 2030	100%

Under the provision as it is currently written, an agency may petition the Department of Energy to adjust the required fossil fuel reductions downward if the head of the agency certifies in writing that the requirement would be "technically impracticable in light of the agency's specified functional needs for that building" and the Secretary concurs with the agency's conclusion. However, the provision contains the following sentence at the end: "This subclause shall not apply to the General Services Administration." We believe the intent of this sentence was to allow GSA to make its own determinations as to whether the provision was technically impracticable with respect to its own buildings. Unfortunately, the current wording in this provision not only does not provide unique authority to the Administrator, but prevents the Administrator from petitioning the Department of Energy as all other agencies are authorized. The President's Budget proposed language to amend EISA to allow the GSA Administrator to issue waivers for GSA buildings in instances where certain criteria are met. Amending EISA with such an exemption when meeting the requirement is technically impracticable will avoid the expenditure of resources trying to achieve these reductions in buildings where it is overwhelmingly difficult to do so. This would allow us to focus on fossil fuel reductions where they are possible.

b. In order for us to meet our renewable energy purchasing requirements, GSA needs long-term contracting authority for renewable energy. Currently, GSA may enter into contracts for public utility services for 10 years. However, renewable power plant developers often need an energy purchase contract of up to 20 years in order to develop increased renewable capacity. If provided with this authority, GSA would also benefit from the relatively inexpensive and stable rates that would be available through long-term renewable contracts.

c. Section 203 of EPACT 2005 requires that the following percentages of electric energy purchased by the Federal government be renewable energy:

- not less than 3% in FY 2007-09;
- not less than 5% in FY 2010-2012; and
- not less than 7.5% in FY 2013 and each FY thereafter.

Thermal, not just electric, energy should be considered when determining both the energy purchased and the percentage of renewable energy consumed. Currently these requirements only consider electric energy, resulting in unbalanced decision-making regarding investments in renewable electric energy rather than renewable thermal energy.

Questions from Senator Frank R. Lautenberg

Lighting at government buildings is a major cost to the taxpayer and a large user of energy. But green buildings are about more than just energy use. Reducing exposure to toxic chemicals and other harmful substances must also be a priority, both in the building and throughout the lifecycle of the building materials and appliances. Light emitting diodes (LEDs) are a promising technology in terms of both energy efficiency and lifecycle sustainability. They produce light using less energy than conventional light bulbs and do not contain the mercury or lead that is found in compact fluorescent lights.

Does GSA use LEDs in its properties? Will you consider using them in the future?

Yes. We currently use them in outdoor applications, and are targeting parking structures, garages and parking lots for LED installation. Converting parking structure lighting to LED (light-emitting diode), which dramatically lowers energy consumption, improves safety and visibility and reduces maintenance as LEDs can last two to three times a long as typical parking lot lights.

Questions from Senator Benjamin L. Cardin

1. Protecting Federal Employees from Passive Smoking

Currently smoking is banned in all federal buildings. However federal employees working in buildings not owned by the federal government are not protected from passive smoking. Passive smoking, also called secondhand smoke, is a tremendous health risk. A 2004 study by the World Health Organization concluded that nonsmokers are exposed to the same carcinogens as active smokers, exposing innocent bystanders to more than 4,000 chemicals, including 69 known carcinogens such as formaldehyde, lead, arsenic, benzene, and radioactive polonium-21 O. A 1992 report in the Journal of the American Medical Association estimated that passive smoking was responsible for 35,000 to 40,000 deaths per year in the United States in the 1980s.

What steps is the GSA taking to protect all federal employees from the dangers of passive smoke? I am especially interested in what steps are being taken in GSA-leased space. Are nonsmoking provisions included in requests for proposal, leases, etc?

Although nonsmoking provisions are not expressly included in lease solicitations or leases, the use of the space is subject to applicable law and regulation. On December 19, 2008, the General Services Administration amended the Federal Management Regulation (41 CFR §§ 102-74.315-351) to prohibit the smoking of tobacco products in all interior space owned, rented or leased by the Executive Branch. In addition, effective June 19, 2009, the regulation also will prohibit smoking in courtyards and within 25 feet of doorways and air intake ducts on outdoor space under the jurisdiction, custody or control of GSA. However, where there is an exclusive representative for the employees, Federal agencies must meet their obligations under the Federal Service Labor-Management relations Act, prior to implementing this regulation. If a facility is privately owned, then Federal tenants also would be subject to the provisions of the state or local ordinance, even in the Federally leased space, if the state or local restrictions are more stringent than the Federal policy.

The Federal policy does not apply in:

- residential accommodations;
- portions of Federally owned buildings leased, rented or otherwise provided in their entirety to non-Federal parties;
- places of employment in the private sector or in other non-Federal Governmental units that serve as the permanent or intermittent duty station of one or more Federal employees; and
- instances where an agency head establishes limited and narrow exceptions that are necessary to accomplish agency missions. Such

exceptions must be in writing, approved by the agency head and, to the fullest extent possible, provide protection of nonsmokers from exposure to environmental tobacco smoke.

2. Stormwater Runoff Requirements for federal development projects The Energy Independence and Security Act (EISA) of2007, signed into law December 19, 2007, establishes stormwater runoff requirements for federal development projects. Specifically, Section 438 states that any development or redevelopment involving a federal facility with a footprint greater than 5,000 square feet shall use site planning, design, construction, and maintenance strategies to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property. Mitigating stormwater runoff will reduce municipal and industrial discharges into our watersheds of harmful nutrients, sediments and metals.

What efforts to comply with Section 438 to reduce stormwater runoff impacts has the GSA taken? What is the total number of projects falling within the jurisdiction of Section 438 and how many of those projects are in full compliance? What is the GSA's schedule for ensuring system-wide Section 438 compliance?

GSA has designed 28 new construction, modernization, and lease construction projects since EISA was enacted on December 19, 2007 and has been implementing low impact development strategies where feasible for many years (examples include vegetated swales, permeable paving, green roofs, and rainwater capture for irrigation and reuse). The Environmental Protection Agency (EPA) will soon finalize guidance specifying definitions for such EISA terms as "predevelopment hydrology" and "the maximum extent technically feasible" and methods of measuring whether predevelopment hydrology has been maintained or restored. Once the EPA finalizes its guidance, GSA will include the requirements in agency standards and will track compliance. EPA's guidance will also assist GSA in determining how many of the 28 buildings reference above are in compliance with Section 438 of EISA.

Questions from Senator Sheldon Whitehouse

1. With the funding received by the General Services Administration (GSA) under the American Recovery and Reinvestment Act of 2009 and the Energy Independence and Security Act of 2007 to dramatically improve the energy efficiency of public buildings, does the GSA intend to use energy services companies (ESCO) to facilitate these improvements in GSA administered buildings? If so, will the GSA follow a model similar to current practices at the Department of Energy to leverage private dollars with Energy Savings Performance Contracts (ESPC)?

Energy Services Companies will be welcome to bid on the competitive procurements GSA conducts for these projects. The Spending Plan submitted to Congress on March 31, 2009 identified the work that will be accomplished with Recovery Act funds. The work funded by this direct appropriation does not require the financing mechanism of an Energy Savings Performance Contract (ESPC). In buildings where GSA is not spending Recovery Act funds, GSA will continue to use ESPCs to accomplish energy conservation work. In addition, in a limited number of cases GSA may use ESPC's in connection with Recovery Act work where energy improvements have been identified that were not included in the original Recovery Act scope of work for a project. We have issued guidance internally for the use of this option as part of Recovery Act projects where appropriate and where contracts can be awarded in the time that the Recovery Act specifies to create jobs quickly. We have worked, and will continue to work, with the Department of Energy in the award of these contracts. Further, GSA has significant experience in awarding a similar form of contract, the UESC (Utility Energy Services Contract), which we will also consider.

2. How does the General Services Administration intend to measure and verify the success of these projects?

GSA will use its Energy Usage and Analysis System (EUAS) to measure performance of energy efficiency enhancements. EUAS calculates energy performance based upon British Thermal Units per Gross Square Foot in every GSA building that pays a utility invoice. EUAS has the capability to track post construction energy performance from a pre-stimulus baseline for each building.

In addition, GSA will use a suite of other measures and techniques:

- We will measure tenant satisfaction before and after construction.
- We will monitor indoor environmental quality during and after construction.
- We will install advanced, or "smart" meters on every building that does not have them already, and monitor the energy consumption in far greater detail than we have been able to do in the past. Monitoring will be local, regional and national.
- We will measure electric generation from all renewable installations.
- We will continue to re-commission these buildings every 4 years as required by the Energy Independence and Security Act.

Questions from Senator James M. Inhofe

1. As noted in my opening statement, I am extremely concerned that the buildings we characterize as "green" are under performing. I request that GSA provide any post-occupancy evaluations of new "green" and non-green buildings and any studies on the performance of federal green buildings to the committee for review.

In 2008, GSA examined the performance of 12 of its sustainably designed buildings, both owned and leased, and issued a report, "Assessing Green Building Performance: A Post Occupancy Evaluation of 12 GSA Buildings." The study found that GSA's sustainably-designed buildings cost less to operate, have excellent energy performance, and have occupants that are more satisfied with the overall building than the occupants in typical commercial buildings. The full study can be found at www.gsa.gov/appliedresearch.

2. Please tell me how GSA is tracking and evaluating taxpayer dollars being spent under the American Recovery and Reinvestment Act?

We have modified our financial systems so we can track information at the level required to meet Recovery.gov requirements and to ensure we can measure the impact of each dollar spent. In addition, contract notifications and awards will be posted on the Federal Business Opportunities website (FedBizOpps.gov). Weekly Recovery Act Financial and Activity Reports are posted on GSA's web site and on Recovery.gov tracking obligations, contract awards, and major completed actions. GSA has indicated performance measures that it will utilize to measure progress as part of the agency and program plans, which are publicly available on the GSA website. GSA is also supporting the Recovery.gov website (the official website of the federal government that will report progress on the Recovery Act mandates) under the Recovery Board's direction and managing content updates to the site.

3. What barriers have you identified as challenges toward spending the ARRA money? What is GSA doing to address these barriers?

As there are a variety of reporting requirements mandated for the Recovery Act work, we evaluated our existing project management reporting system, the Project Information Portal, and found that it was more a database than an interactive reporting tool. Our Office of Design and Construction had been piloting a program to use an Enterprise Project Management (ePM) program that would be compatible with the types of programs our contractors would use to track scope, schedule and budget. We expedited the procurement of this system so that we could use it for the Recovery Act reporting activity. Introducing a new reporting system would result in a huge learning curve for our project managers in the field. This could delay the input of information or data output that we need to meet the AARA reporting requirements. Hence, we are in the process of procuring a contract that will provide data management resources in all of our regional offices to maintain this system and ensure that the data is accurate and submitted in a timely manner.

In addition, we established a national Program Management Office (PMO) as a solution to the problem of how to manage a $5.5 billion program. The influx of this significant amount of work required a response that was not "business as usual." The PMO manages the program from a corporate perspective and oversees the execution of the work through our 11 regional offices. The PMO interacts with every group within GSA, with one overarching purpose: to ensure that GSA meets all of the goals set in the Recovery Act.

4. I am pleased that President Obama supports energy efficiency in the federal government. As you know, Executive Order 13423 directed Federal agencies to implement sustainable practices for energy efficiency, as well as implement plans to create high performance buildings, increased recycling and other efficiency practices. Did GSA use any agency reports on sustainability when deciding how to spend ARRA money? How were these used?

GSA has produced several reports related to sustainability over the past several years, which, in turn, have influenced GSA's strategies to improve the sustainability of its inventory generally and our decisions regarding how to spend Recovery Act money. In particular, the selection criteria for Recovery Act projects considered the results of two studies - Sustainability Matters (2008) and Assessing Green Building Performance: A Post Occupancy Evaluation of 12 GSA Buildings (2008). These studies identified the benefits of building tune-ups, re-commissioning, HVAC retrofits, lighting upgrades, water conservation strategies and renewable energy installations.

5. What formal or institutionalized process does GSA use to examine the best energy and environmental practices at other federal agencies, and what use do you make of them?

There are four main venues for this:

1. GSA participates in the Inter-Agency Energy Management Task Force, coordinated by the Department of Energy. One of the specific functions of this group is to examine the best energy practices at federal agencies and encourage their adoption.
2. GSA participates in the Council on Indoor Air Quality, facilitated by the Environmental Protection Agency, which has similar goals.
3. GSA participates as a lead agency with the Office of the Federal Environmental Executive, under the President's Council on Environmental Quality in the Inter-Agency Sustainability Working Group. The overall lead support and management of this group is provided by the Department of Energy's Federal Energy Management Program.
4. GSA participates in the Federal Real Property Council, which disseminates best practices for real property asset management activities generally.

In all cases, GSA incorporates the best practices of other agencies that are appropriate for GSA's real property inventory, and its tenants, into GSA's operations, capital budgeting, design, construction, and facilities standards.

6. How do you determine what your customers want in the way of energy and water use and efficiency?

GSA encourages the use of an integrated design approach for projects. This approach involves working with the client during the early stages of design to identify their specific needs. EPA, for example, has a strong focus on indoor environmental quality and GSA works with them to incorporate more of these features within the building.

7. How do you coordinate with the EISA-mandated energy managers at each agency?

The Director of GSA's Energy Division participates in the Interagency Energy Management Task Force, which meets quarterly at the Department of Energy Headquarters buildings. Each agency energy manager is represented in these meetings, which provide an opportunity for agency energy managers to share technical information. Also, GSA is a co-sponsor of GovEnergy, which is the largest annual conference and expo of Federal Energy Managers.

8. What are you doing with agency performance data for energy and water consumption, greenhouse gas reduction, and other such metrics?

GSA has established energy reduction as one of its most important internal business performance measures. GSA Central Office sets energy targets for its 11 regional offices at the beginning of each year and tracks their performance on a quarterly basis to achieve these targets. In addition, these data are used to:

- Identify high energy consuming buildings to target audits and develop energy conservation opportunities which ultimately reduce energy consumption at the regional level.
- Specifically focus attention on the biggest energy consuming buildings to ensure corrective actions are cost effective.
- Track performance of new construction/modernization projects to assist our project managers in energy efficiency in design.
- Determine quantities of renewable energy GSA must procure to meet electricity percentage procurement goals.
- Provide an effective energy awareness tool to inform tenants of energy consumption trends as part of newsletters.
- Create competitive goals amongst buildings managers as well as in the form of annual performance evaluations.
- Prioritize investment of additional capital.
- Determine where future ESPC and UESC investment may be fruitful.

9. How does GSA calculate the return on investment on any "green" projects or products?

The answer to this question depends on the nature of the investment. Overall, GSA uses the NIST guidelines on life-cycle cost analysis (LCCA). For renewable energy generation, GSA calculates the return on investment using both the NIST LCCA analysis and models developed by the Energy Information Administration and Department of Energy's Energy Efficiency and Renewable Energy programs.

10. GSA has been involved with higher performance building specifications for some time, including green building rating systems. To what extent has GSA returned to those buildings after construction and occupancy to see how they are actually performing? What sort of energy savings and other benefits have you found as measured against comparable public and private buildings? Are you doing this evaluation on an ongoing basis?

GSA's 2008 study, "Assessing Green Building Performance," examined actual building performance after at least 18 months of occupancy. The study, which can be found at www.gsa.gov/appliedresearch, found that GSA's sustainably-designed buildings cost less to operate, have excellent energy performance, and have occupants that are more satisfied with the overall building than the occupants in typical commercial buildings. GSA is currently studying additional buildings using the same performance metrics as the 2008 study. We plan to make this an ongoing practice.

11. Given the considerable advances in green building products over the past 5 years why have you relied on your 2006 Pacific National Lab study (with 2005 data) to justify your decision on which green building system to use in 2009?

GSA closely monitors the rating systems that are appropriate to the business of the agency and participates in the development of many rating systems and industry standards. In making its recommendation on rating systems to the Secretary of Energy as required by EISA, GSA updated the information from the 2006 study. The updated information did not materially change the conclusions of that study; they are just as valid today as they were in 2006 with respect to applicability, infrastructure support, technical rigor and the delivered value of the 3rd party verification.

12. With so many Green Building Standards or Rating Systems in addition to LEED in operation (Green Globes for New Construction, (a Rating System) Green Globes for Continual Improvement of Existing Buildings (a Rating System), EPA Energy Star Target Finder (a Energy Rating System for New Buildings), EPA Energy Star Portfollo Manager (a Energy Rating System for Existing Buildings), CHPS -- Collaborative for High Performance Schools (a Rating System for Schools), ICC-700 National Green Building Standard (an American National Standards Institute (ANSI), consensus process Rating System for New Residential Buildings (developed by the International Codes Council», and with so many Green Building Standards or Rating Systems in addition to LEED about to be completed (such as: GBI/ANSI for New Construction (a new version of the Green Globes rating system developed using the ANSI consensus process – due to be completed by the end of 2009), ASHRAE 189P Standard for the Design of High Performance Green Buildings (an ANSI consensus process Standard - due to be completed by the beginning of 20 I0), California's Green Building Standard (a statewide Standard which will have two performance levels for energy compliance - due to be completed by August 2009, does GSA believe it would be good federal green building policy to allow just one approach? How will the industry mature if the government has already chosen a winner?

GSA is either directly engaged in the development of each of the standards and rating systems listed in the question or closely monitors and evaluates each new standard and rating system offered. Many of the standards and rating systems listed in the question are for particular building types or specific sustainable goals (such as energy efficiency), so they are not mutually exclusive. With respect to comprehensive certification systems for green buildings, the Department of Energy, GSA, and the Department of Defense are currently working together to finalize a standardized approach. With respect to other standards, the Office of Federal High-Performance Green Buildings will be looking at all of the mentioned standards as it works on developing a suite of standards appropriate for the wide variety of buildings and structures in the federal government's inventory. It is important to note that rating systems designated for use by federal agencies are generally optional; an agency can use another rating system if it wishes.

13. When will you re-evaluate the options available for green building certification?

EISA requires that GSA re-evaluate the options every five years at a minimum. GSA will advance that date if conditions warrant.

14. What was GSA's role in the beginning and early years of USGBC and the development of LEED? We understand that a key GSA manager was on the board of the USGBC for a number of years. How did that arrangement come about? Why and when did that GSA manager remove himself from the USGBC Board? Was there ever a concern on the part of GSA that this action might constitute a conflict? Is this a continuing concern?

A GSA employee was an advisor to the Board of the USGBC as a non-voting member for 2 years; a different and more senior employee was an advisor to the Board of GBI, which introduced and developed Green Globes for the U.S. market. Similarly, GSA has provided Federal advisors to the Boards of the Building Owners and Managers Association, CoreNet Global (a real estate industry organization), and others. In addition, GSA participates in a number of voluntary consensus standards bodies pursuant to Section 12(d) of the National Technology Transfer and Advancement Act of 1995. Each advisory position is different, depending on the rules of the individual board. In the case of USGBC, the term of the advisory position was finite. Given GSA's broad participation in standards and rating systems development by multiple bodies, and the broad participation of other agencies and the independence of the PNNL Study (which was peer-reviewed as well), this participation did not constitute a conflict.

15. How much money has GSA provided USGBC in the past 10 years?

GSA has paid the fees required of any building owner to obtain certifications using the rating system. GSA also pays the annual USGBC membership dues for Federal government members ($1,000 per year). Because leased space is an important part of our inventory, in 2002-3 GSA provided research funding (a total of $100,000) to USGBC to assist in the development of the first green rating system for leased space in 2002.

16. Have you ever received a request from a regional office to use a different green building rating system? How has GSA responded to requests from its regions on these requests? When making the decision to go with LEED Silver, did GSA consider the input of its regional offices?

Since GSA uses its green rating system for performance measurement, the agency prefers using one rating system agency-wide. However, two regions are piloting a different rating system. The first region to pilot this system has found that the ease of use of the rating tool and its support infrastructure are not consistent with what was marketed directly to the region. However, the pilot and its evaluation are not complete. The other region has not started using the tool.

GSA consulted its regional offices before requiring LEED Silver for new construction, major renovations, and lease construction.

17. What additional costs were involved in getting higher performance requirements into those buildings, including additional design fees, third party verification and certification fees, and hard construction costs? How do these costs compare to the maintenance and operation savings?

GSA's LEED Cost Study in 2004 found that the soft costs (design fees and documentation costs) for a $220 per square foot LEED Silver rated courthouse were between 41 and 55 cents per square foot higher and hard costs between 7 cents *less* and $9.57 higher per square foot. For a $130 per square foot LEED Silver office modernization, soft costs were 38 to 49 cents per square foot higher and hard costs between $3.94 and $5.55 higher. As the industry has developed experience in high-performance green design and construction, these costs have decreased. GSA's 2008 study of actual building performance, "Assessing Green Building Performance," found that the average maintenance costs of green buildings are 13% lower and the energy use is 26% lower each year. GSA employs LEED third party verification to help to assure that performance expectations are met.

18. What are the usual costs of building maintenance staff for a typical GSA building? Have the individuals maintaining the buildings been trained to specifically maintain and operate the newer high performance public buildings? What are the costs and benefits to training that staff to be more efficient stewards compared to the cost and benefit of the pre-occupancy design guides and certifications the GSA has been using?

For the 2nd quarter of FY 2009, the average mechanical maintenance cost per square foot was $1.68.

Few of the individuals maintaining PBS buildings have been fully trained to maintain and operate high-performance buildings. The shortage of building operators trained and qualified to run high-performing buildings with modern control systems is industry-wide, not just for government buildings. The number of high-performance buildings in our inventory is low but increasing (the average age of the owned inventory is 45 years), so training in the operation of these buildings is becoming increasingly important. We plan to begin specifying more stringent employee qualification requirements in our mechanical maintenance contracts. In a few cases, we have addressed this issue by extending commissioning contracts to include the operation and maintenance of facilities. This way we get operation and maintenance services from highly qualified companies and individuals that understand the complexity of a building's systems and can operate the building to maximize performance.

Costs to train are unknown at this time. Benefits could be significant, since pre-occupancy design predictions and certifications do not always match the facilities' actual performance.

19. Has the GSA done a more thorough evaluation of its long-term maintenance and operations of buildings to ensure actual higher performance monitoring?

Yes, in 2008, PBS issued a standard specification to be used for all new maintenance contracts. This specification increased the required qualifications of personnel performing the maintenance. Electrical maintenance is to be performed by InterNational Electrical Testing Association (NETA) certified technicians.

With regard to monitoring, PBS continuously monitors energy consumption as well as mechanical and custodial operating costs.

20. How is GSA planning to allocate the $3 million appropriated under ARRA for on the- job pre-apprenticeship and apprenticeship training programs? Will you be conducting an analysis of those trades most needed for federal greening projects? What role is the Department of Labor playing in assisting with this process? Will you be issuing grants or contracts? Will this funding be limited to programs that have already been approved by DOL or allow for additional programs to obtain this certification as part of the award process? What is the anticipated timeline?

The Recovery Act requires GSA to spend up to $3,000,000 for on-the-job pre-apprenticeship and apprenticeship training programs registered with the Department of Labor, for the construction, repair, and alteration of Federal buildings.

The pre-apprenticeship and apprenticeship programs will be implemented through GSA's construction contracts. All of PBS' Recovery Act apprenticeship programs must be registered with the U.S. Department of Labor (USDOL), or a State Apprenticeship Agency recognized by USDOL. Where a Recovery Act contractor already has a registered apprenticeship program in place, we will use that program. Where contractors do not have established programs, we will use the prescribed Recovery Act funds to help them establish registered programs. We will also help contractors establish pre-apprenticeship programs where none exist. DOL will recommend to GSA locations impacted by the economic downturn suitable for certified pre-apprenticeship and/or registered apprenticeship programs. The pre-apprenticeship and apprenticeship program shall be implemented through the construction contracts. DOL will maintain data on the PBS' GSA construction contractor's implementation of the certified pre-apprenticeship and/or registered apprenticeship program, including the number of certified pre-apprenticeship and/or registered apprenticeship participants, wages for participants, and on-the-job training and classroom training hours. DOL will provide this data to GSA upon request.

21. What is GSA doing to help incentivize agencies to go green?

GSA associates promote the benefits of sustainably designed and operated buildings to our customers through initiatives covering green leasing, sustainable workplaces, teleworking and energy efficiency.

Has GSA explored ways to pass the savings gained from energy efficiency measures on to the agencies?

We have explored ways to pass on savings to the client agencies. In "Return-on-Investment"-priced properties and delegated buildings, all of the savings go directly to the occupying agency. We are still exploring ways to provide incentives to customers in other buildings to reduce consumption. Challenges we are working to overcome are:

- Where individual tenants are in multi-tenant buildings that are not submetered, it is difficult to tie reductions in consumption to an individual tenant's actions.
- Sometimes utility costs will increase, even where a customer agency has reduced demand, because the cost of energy increased.
- Many of our building systems are designed to run the entire building, so if any one tenant in the building requires additional heating or cooling the entire building must be brought up to temperature.

The funds from the Recovery Act will enable us to address some of these issues by installing "smart meters" and replacing building systems with advanced controls.

22. Is there anything that the committee should consider in drafting new legislation on greening of federal buildings?

a. Section 433 of the Energy Independence and Security Act of 2007 requires federal agencies to dramatically reduce fossil fuel consumption in new Federal buildings and Federal buildings undergoing major renovations by the following percentages in the specified fiscal years:

FY 2010	55%
FY 2015	65%
FY 2020	80%
FY 2025	90%
FY 2030	100%

Under the provision as it is currently written, an agency may petition the Department of Energy to adjust the required fossil fuel reductions downward if the head of the agency certifies in writing that the requirement would be "technically impracticable in light of the agency's specified functional needs for that building" and the Secretary concurs with the agency's conclusion. However, the provision contains the following sentence at the end: "This subclause shall not apply to the General Services Administration." We believe the intent of this sentence was to allow GSA to make its own determinations as to whether the provision was technically impracticable with respect to its own buildings. Unfortunately, the current wording in this provision not only does not provide unique authority to the Administrator, but prevents the Administrator from petitioning the Department of Energy as all other agencies are authorized. The President's Budget proposed language to amend EISA to allow the GSA Administrator to issue waivers for GSA building in instances where certain criteria are me. Amending EISA with such an exemption when meeting the requirement is technically impracticable will avoid expending resources trying to achieve these reductions in buildings where it is overwhelmingly difficult to do so. This would allow us to focus on fossil fuel reductions where they are possible.

b. In order for us to meet our renewable energy purchasing requirements, GSA needs long-term contracting authority for renewable energy. Currently, GSA may enter into contracts for public utility services for ten years. However, renewable power plant developers often need an energy purchase contract of up to 20 years in order to develop increased renewable capacity. If provided with this authority, GSA would also benefit from the relatively inexpensive and stable rates that would be available through long-term renewable contracts.

c. Section 203 of EPACT 2005 requires that the following percentages of electric energy purchased by the Federal government be renewable energy:

- not less than 3% in FY 2007-09;
- not less than 5% in FY 2010-2012; and

- not less than 7.5% in FY 2013 and each FY thereafter.

Thermal, not just electric, energy should be considered when determining both the energy purchased and the percentage of renewable energy consumed. Currently these requirements only consider electric energy, resulting in unbalanced decision-making regarding investments in renewable electric energy rather than renewable thermal energy.

23. What specifically is being done at the 3 Oklahoma projects in Muskogee, Oklahoma City and Tulsa?

Muskogee Federal Building Courthouse:

Building Tune-up Project:
The first step in the building tune up is re-commissioning. In re-commissioning our buildings we will evaluate the operating efficiency of our building systems as well as other components that impact building energy consumption. We can then adjust and fix those building system components so that they perform as designed. In addition we will be upgrading building control system hardware and software, or where appropriate, we will replace the existing Building Automation Software systems. These building tune-ups include many small-cost, high-impact changes to motors, sensors, and equipment. Our goal is to reduce energy demand, reduce operation and maintenance costs, improve building system control and occupant comfort. This first step of the building tune up will also identify opportunities and priorities for additional modifications and energy savings. Associated with re-commissioning work, is the installation of advanced utility meters and meteorological instrumentation which will help us better predict and manage our energy consumption.

Oklahoma City Federal Building:

Lighting Replacement Project:
A high-performance lighting replacement project will both decrease energy consumption and cost, and improve working conditions and productivity for building occupants. It will use standard scopes of work and specifications and lighting design solutions. In most cases, it is expected that the work will not require re-location of people working in the building. It will both improve the quality of light and working conditions and will result in significant reduction in the lighting energy consumption - often up to 30%. The project will include some or all of the following:

- Highly efficient overhead lighting fixtures;
- Lower overhead lighting intensity supplemented with task lighting to create better lighting levels at the work surface;
- Dimming fluorescent ballasts for all perimeter areas with windows, so that lights will dim as incoming daylight supplies more of the required light level, and occupancy sensors throughout;
- LED lighting in some special applications, such as parking garages, fire exit signage;
- Stairwell lighting with new sensors and reduced 24/7 requirements;
- More user controls;
- Central on-off lighting control through the building energy management control system.

Building Tune-up Project:

The first step in the building tune up is re-commissioning. In re-commissioning our buildings we will evaluate the operating efficiency of our building systems as well as other components that impact building energy consumption. We can then adjust and fix those building system components so that they perform as designed. In addition we will be upgrading building control system hardware and software, or where appropriate, we will replace the existing Building Automation Software systems. These building tune-ups include many small-cost, high-impact changes to motors, sensors, and equipment. Our goal is to reduce energy demand, reduce operation and maintenance costs, improve building system control and occupant comfort. This first step of the building tune up will also identify opportunities and priorities for additional modifications and energy savings. Associated with re-commissioning work, is the installation of advanced utility meters and meteorological instrumentation which will help us better predict and manage our energy consumption.

Tulsa U.S. Courthouse:

This is a window replacement project.

Senator BOXER. Well, Mr. Prouty, I just want to say I am very excited about your presentation. Would you like to introduce the people you brought with you?

Mr. PROUTY. I would very much like to do so.

This is Tony Costa. He is the Acting Commissioner of the Public Buildings Service. This is Bill Guerin, who is running our recovery work for the Public Buildings Service. And Kevin Kampschroer, who is head of our Green Program.

Senator BOXER. Wonderful.

I am so happy we have been joined by Senator Lautenberg, who is such a leader in the whole area of green buildings and worked so hard to get some of those laws passed that you talked about.

I want to just say people don't realize, and Senator Lautenberg, you and I know this, buildings are 39 percent of the problem when it comes to greenhouse gas emissions. So when we make a building green, we are not only saving money, we are not only improving air quality, but we are absolutely confronting head on the issue of greenhouse gas emissions and global warming.

I have long believed, and you have, Senator, and I am sure you have all out there believed that the Federal Government ought to be a model when it comes to the environment. And today is Earth Day, and the reason I held this hearing is I want to make sure that you are on track with this stimulus bill. It sounds very good. And Senator, I am going to make available to you a list of all their projects that they have already decided they are going to do under the Stimulus Act.

And what I also wanted to say just for the record is that GSA is the lessee or owner of over 354 million square feet of space in 8,600 buildings located in more than 2,200 communities nationwide. And you know, frankly, we have lost this opportunity before, but now this new President and this Congress believe that we can make a real difference if we take the lead here, not only in the actual improvements that will be made to the buildings, our buildings, the people's buildings, but also showing that yes, there is a model for everyone else to follow. I want us to be that model.

So I will make sure that everybody has this list. I am looking to see what is going on in New Jersey. Yes, the Paterson, the Robert A. Roe Federal Building in Paterson, New Jersey is getting a big hunk of the stimulus money to make it energy efficient.

Senator LAUTENBERG. The fact that I was born in Paterson has nothing to do with it.

[Laughter.]

Senator BOXER. Well, I am sure it is just a coincidence here, but you know, there is so much room for improvement.

So I have just a couple of questions. Is there anything in particular, and I would ask all of you if you have a point, that this Committee can do to ensure the successful execution of the stimulus bill, otherwise known as the American Recovery and Reinvestment Act? Are you experiencing any problems, issues? And in your answer, could you tell me if most of these improvements are being done in-house or are they contracted out to the outside work force? And how is the new National Recovery Executive Office operating to ensure that all these projects are on track? Have you had any

interaction with them, because this Committee needs to oversee GSA.

We want to make sure, A, any problems you are having on execution, how this National Recovery Executive Office is working, and are you contracting out for most of these things or doing them in-house?

Mr. PROUTY. First of all, as far as any help we might need, we at this point think that we quite frankly have all the help that we need in all regards.

Senator BOXER. Good.

Mr. PROUTY. This is a massive amount of funding and it is a huge opportunity and we are up for the task.

As far as who is going to be doing the work, it is primarily contracted out. Obviously, we have a staff that manages the contracts for that.

Senator BOXER. So this is a boon to a lot of our businesses across this Country. Is that correct? Out of all the contracts—and I know I am interrupting you, but I am sorry—out of all the contracts you will be letting, how many have been let already, do you think? Probably a small percent, I would think at this point.

Mr. Costa.

Mr. COSTA. Madam Chair, our plans are to award over $1 billion worth of project contracts by August, and so far——

Senator BOXER. A billion of the 4 billion?

Mr. COSTS. A billion of the $5.5 billion.

Senator BOXER. OK. By August? And the rest?

Mr. COSTA. The rest throughout the 18 months that we have to spend the rest of the money.

Senator BOXER. Well, let me just say to you, and I know our President has said this, the point of the stimulus bill is to be a stimulus to this economy. In my State, I can only tell you, 11.2 percent, the fifth worst unemployment. So we need these funds to get out there, and we are going to be working. I know that President Obama's team also believes that.

So that leads me to his National Recovery Executive Office. Tell me, how is that working? Are they working in a good way with you?

Mr. COSTA. From the standpoint of outside of GSA, the recovery?

Senator BOXER. Yes.

Mr. COSTA. They have provided great support. We work closely with them in two basic areas. As you know, there is a lot of reporting that goes beyond anything we are used to that we are going to be responding to. We think that is a great thing because it will be not only better for us to manage our own work, but letting the public and our stakeholders know how we are doing actually is a great continuing check for us. So we are looking forward to that and we have been working closely with the recovery folks on doing that.

GSA is actually helping to manage recovery.gov, the mechanism that is being used to pull all that information together. So we are both involved.

Senator BOXER. Well, let me just say as Chairman of this Committee, and I know I speak for Senator Inhofe on this, if you run into any difficulties making this happen in any way, you need to

let us know. We want to encourage you to move quickly, of course carefully, but quickly because the point of the stimulus is just that. You know, to get a billion out by August is good, but that leaves you with the bulk of the funds, so we encourage you.

I guess my last question to Mr. Prouty at this point is, do you have enough staff to get this done? I trust you are using some of this to staff up. Is that correct?

Mr. PROUTY. That particular money is not going to be what we use for staffing, but we do have funding for additional staff. We have been working with the Office of Personnel Management to look for opportunities. We are going to bring back people who previously worked for us.

Senator BOXER. Good.

Mr. PROUTY. Obviously, there are some contracting vehicles. We don't expect a large increase in permanent staff, but temporary staff we do expect.

Senator BOXER. I think that is key, because otherwise, the funds won't get there.

Now, I will tell you that I am working on a bill now with my colleagues on both sides of the aisle to do even more with GSA. I know our staff has been in close touch with you, and we are just about ready to get that bill done. Is that correct, Bettina? And so we will run it by you to make sure that it is right where you want it to be and it is a reasonable bill. But you know, my view is very strongly felt that we can be the model, and that is what we should be.

We can't talk the game and not, you know, really walk the walk. So I am very happy with what you have said today. I am very happy at the spirit that I feel. I feel this is a new time, new challenges. Everything you do will be marked. As Chairman, I intend to go to visit some of these programs as they get down the road a bit just to make the point of what we are doing.

So with that, let me call on Senator Lautenberg.

Senator LAUTENBERG. Thank you, Madam Chairman.

Thank you, Mr. Prouty and your team, for doing the work that you are. We are very encouraged by the early signs, I must tell you. It is not the most glamorous part of assignments in the Government. On the other hand, it is because there is a question of believability in the public's minds whether or not green can be that good for you. When a person has lost a job or the economy is so shaky in front of us, it is a little hard to say, OK, we are going to swap that kind of reality for a green mission, one that will make our Country healthier, our families.

As a matter of fact, I think Earth Day ought to have been perhaps called something like Good Health Day, or Save the Children Day, something that connotes a little more directness and serious tone to things.

So I was happy, Madam Chairman, that the legislation that I wrote in 2007 established the targets, established the mission, established the Office of Federal High Performance Green Buildings at GSA.

What kind of a role, Mr. Prouty, has that office taken on to help get the reductions that are already there? We are using 26 percent

less energy than we did just few years ago. That is a major victory, or a major step forward. What did that office have to do with it?

Mr. PROUTY. Excuse me, if I may. That office obviously has a large role Government-wide and also a large role in GSA. Kevin Kampschroer is leading that office. If I might, I would like to have him answer that question.

Mr. KAMPSCHROER. For the last year when the office was created by the Energy Independence and Security Act, and then by the Administrator of General Services shortly thereafter, we have been working with other Federal agencies to make sure that the work of every agency is in concert with the others, both in energy reductions and the improvement of high-performance green buildings across the Government.

With regard to the application of those things, the work that we did for the year enabled us to be poised when the Recovery Act was passed to be able to make some very good judgments very quickly on the projects that would be most likely to yield the greatest returns in high-performance improvements in the buildings. And those were the sets of criteria that we were able to use.

We made use of the national labs, as the Administrator mentioned in his statement, to help us analyze these data, and also yield the limited scope, high-performance green building projects that comprise the bulk of the number of projects on the list, which are really focused on making the highest return improvements both in the areas of building tune-up, building mechanical systems improvements, and the lighting. Lighting in particular because the technology has changed so significantly over the last decade in lighting that we can make significant improvements even in the case of a retrofit that might have been done 10 or 15 years ago, which many were in our buildings.

And last, we are using in the case of roof replacement sort of the judicious application of every form of renewable energy generation that is appropriate both for the geographical location and the physical configuration of the roof. So we have some 20-odd projects where photovoltaic, for example, generation will be included at the same time as dealing with a significant infrastructure problem within our inventory, that is to say leaking roofs and about 40 or so leaking roofs across the Country. As a part of the Recovery Act, we will be repairing every major leaking roof in our entire inventory.

Senator LAUTENBERG. I am sure that would be good news to lots of people around the Country.

How many jobs might you think were created as a result of that effort, this reduction in energy use? Were these jobs that were handled within it sounds like a relatively simple program because of the changes in technology in light bulbs and so forth? How much of that was responsible for the reduction? And did we have any significant job gain out there as a result of this?

Mr. KAMPSCHROER. Senator, we estimate based on a couple of different studies that we researched, and we are not economists, but based on the models that we have read about, we believe that for every billion dollars of Recovery Act funding in the construction arena, there will be 28,000 jobs created across the Country in all different categories. They might be construction jobs. They might

also be design jobs in many different professions. And that is a rough estimate. It is maybe not the world's best economic model, but it is what we were able to find.

Senator LAUTENBERG. So that is a future expectation. I am really struck by this reduction in energy use of 26 percent. That is over a period of a couple of years. Is that right?

Mr. KAMPSCHROER. Nearly 30, yes, sir.

Senator LAUTENBERG. Nearly 30 years?

Mr. KAMPSCHROER. Yes.

Senator LAUTENBERG. Oh, so we are going back a lot further than I thought. Did we start in a serious way 30 years ago trying to install less energy, lower energy projects?

Mr. KAMPSCHROER. Between 1985 and 2005, in GSA's inventory we reduced the overall energy consumption compared to the baseline by 30 percent, and the Government as a whole by 26 percent during that same period.

Senator LAUTENBERG. OK. So this wasn't induced by the legislation that was passed in these last couple of years. This was a continuation of programs that were begun before.

Mr. KAMPSCHROER. That is correct. And since the legislation was passed in the last several years, beginning with the Energy Policy Act in 2005 and the Energy Independence and Security Act of 2007, the goals were increased first double and then triple what they had been in previous laws. So now whereas we reduced by 30 percent in 30 years under the old laws, our goal today is 30 percent in 10 years. And GSA is currently on track to meet that goal as well. So we have significantly increased our efforts in energy reduction even before the Recovery Act was passed.

Senator LAUTENBERG. Yes. Because one of the things that we see in the testimony is that GSA, among other things to reduce energy consumption, the goal is 30 percent by 2015. Now, is that a goal that was established based on the energy consumption of 2007? Are we looking at a 2-year reduction? I am sorry, in the 8-year period a reduction of 30 percent in fossil fuel use?

Mr. KAMPSCHROER. There are two interrelated goals in the law. First of all is to reduce by 30 percent in 10 years with a baseline of 2003 consumption in the buildings. So we reset the baseline in 2003. As a part of that resetting the baseline, we also increased the number of buildings that are being measured.

And second, we have a goal of reducing compared to private sector the fossil fuel consumption of our buildings by 55 percent for those buildings that are under design today, either new construction or major modernization, and then that number between 2015 and 2030 ratchets up from 55 percent below to 100 percent below. So by 2030, our goal will be to design and deliver buildings that consume no fossil fuel energy.

Senator LAUTENBERG. That is a terrific target. We hope you don't miss it.

Mr. KAMPSCHROER. Every project on the major modernization list is being designed to use 55 percent less fossil fuel than the commercial equivalents.

Senator LAUTENBERG. And one last thing. You talk about releasing $1 billion by August for projects. What would you say would be the principal programs that would help you achieve your goal

that this $1 billion will foster? And how long might it be before we see that return on the $1 billion that we can talk about?

Mr. GUERIN. Senator, we have a series of things that we are working on. We have several large projects that we are getting ready to award that were designed and on the shelf ready to go. An example of that would be the Austin Courthouse. We have a series of programmatic activities, as Kevin was describing. The single system projects in buildings that we will be pursuing in the short term to get those awarded as well.

Senator LAUTENBERG. What are the single system projects?

Mr. GUERIN. Like photovoltaics or the new roofs that Kevin was referring to earlier. Those types of projects that can be installed fairly quickly into buildings, we are going to design and get those awarded as quickly as we can.

And then finally, we have a series of additional phases and completions of projects that were waiting for funds, and we are awarding those very quickly as well.

Senator LAUTENBERG. And this $1 billion will respond to the formulas as we heard. How many jobs are created with each $1 billion expended?

Mr. KAMPSCHROER. Roughly 28,000, sir.

Senator LAUTENBERG. Thanks.

Thank you, Madam Chairman.

Senator BOXER. You have gone almost 5 minutes over. I am trying to get to the next panel because of their time constraints.

Senator LAUTENBERG. Fine. Thank you.

Senator BOXER. And Senator Lautenberg, I think pressing on this is important because we are going to see job creation, green job creation right here.

So we want to thank all of you.

And Kevin, will you do me a favor and just put into the record your recommendations of what more we can do as a Committee to give you even more resources for more green in our buildings, as we write our new legislation?

Mr. KAMPSCHROER. Thank you. I would be happy to do so.

Senator BOXER. Thank you so much.

And thank you all. We are very proud of the work you are doing. We love this attitude of yes we can. Who said that?

[Laughter.]

Senator BOXER. Who says, yes we can?

Senator LAUTENBERG. [Phrase in Spanish].

Senator BOXER. [Phrase in Spanish]. It sounds even better in Spanish.

Will our next panel come up? Very happy to have you here.

And now we are going to have a vote, Senator Lautenberg, on our global warming legislation.

I move it. Is there a second?

Senator LAUTENBERG. I second.

Senator BOXER. OK. I don't see Senator Inhofe here. What a shame.

[Laughter.]

Senator BOXER. OK. Just have to have a little sense of humor as we move forward. Thank you.

Our second panel: Doug Gatlin, Vice President, Market Development, U.S. Green Building Council; Lane Burt, Energy Policy Analyst, Natural Resources Defense Council; Harvey Bryan, Ph.D., School of Architecture and Landscape, School of Sustainability at Arizona State.

Are all three of our folks here? Yes, good. And we are very happy to have you here. What we really want is to follow your leadership on what more do you think we can do to make the Government a real model of green. If we do that, I know I speak for Senator Lautenberg and myself, we think this is a great way to not only make measurable progress on greenhouse gas emission reductions, but also to be a model.

So Mr. Gatlin, would you like to start off? U.S. Green Building Council, Market Development, thank you.

STATEMENT OF DOUG GATLIN, VICE PRESIDENT, MARKET DEVELOPMENT, U.S. GREEN BUILDING COUNCIL

Mr. GATLIN. Madam Chair, thank you very much, and Ranking Member Inhofe, on behalf of the U.S. Green Building Council's 20,000 organizational members and 78 local chapters. We would very much like to thank you and the Committee for the opportunity to testify about the role that the U.S. General Services Administration can play in improving the energy efficiency and sustainability of Federal buildings.

My name is Doug Gatlin and I am the Vice President of Market Development for the U.S. Green Building Council.

We have an opportunity before us as a Nation, an opportunity to reach out and grab from an enormous pool of untapped resources lying virtually under our noses. I am referring to the flows of energy, water and materials that are consumed in our buildings and homes each day. By marshaling a combination of new efficiency technologies, integrated design, and targeted building management practices, we can tap into these flows and collectively achieve a 30 percent or greater reduction in energy consumption and even more substantial reductions in water consumption and solid waste generation.

As you know, buildings are responsible for 38 percent of U.S. greenhouse emissions every year and consumer 13.6 percent of all fresh drinking water, as well as 40 percent of raw materials globally. Recognizing this impact, green buildings are an essential element of both an energy security strategy and a climate change response.

The potential returns are tremendous. According to a 2007 report by McKinsey and Company, improvements in the efficiency of buildings and appliances could generate $160 billion in cumulative savings by the year 2030. Now, tune-ups to building systems and equipment known as existing building commissioning present opportunities for greater savings without any new capital investment. Commissioning of existing buildings can improve energy efficiency by roughly 15 percent additional at a median cost of only 27 cents per square foot. This offers an attractive payback of roughly 6 months.

In the Federal sector, this could translate into some $650 million in annual savings if the entire Federal stock were simply to be re-

commissioned or tuned up. Again, that is for roughly 25 cents per square foot in buildings that typically costs hundreds of dollars to build, and three to five dollars a square foot just to operate. And this will create thousands of new highly skilled jobs in the buildings trades and in particular in the mechanical service contracting arena because it is a virtually new service.

With an inventory of more than 1,500 Government-owned buildings and 7,000 leased spaces, GSA is a critical partner in the effort to reduce the environmental impact of our buildings. GSA has already taken several significant steps to improve its stock, including requiring that all new capital projects and major renovation projects earn LEED certification. These projects are yielding significant results. A 2008 GSA study of 12 green buildings in its portfolio found that the buildings achieved a 30 percent reduction in energy usage and a 13 percent decline in average maintenance costs.

And last month, USGBC certified the world's first LEED platinum-level building under our new existing buildings operations and maintenance rating system. It is occupied by the FBI in Chicago and it is leased through GSA. Numerous other Federal projects have made similarly impressive strides.

Green building efforts stand to become an even greater focus of GSA through the work of GSA's Office of Federal High-Performance Green Buildings, coupled with the $5.5 billion received by GSA through the American Recovery and Reinvestment Act. Importantly, the bulk of GSA's Recovery Act funds are dedicated to a mix of new construction and major renovation efforts in approximately 60 key projects.

The remaining funds for limited scope upgrades can be augmented even further to greater ends through public-private partnerships in the form of energy saving and green performance contracts, and we recommend an increased adoption of these measures by GSA. This is crucial, as the average age of the Federal building stock is now currently right at 50 years on average. So significant opportunities exist.

Green performance contracting draws upon an integrated approach to encompassing energy and water-saving measures, as well as features designed to improve the indoor health and environmental quality of the buildings. Combining this model with third party verifications such as that provided by the LEED system can ensure that the buildings are both sustainable and achieve optimal cost reductions. Expanding GSA's authority to enter longer renewable power purchase agreements presents similar opportunities for greening the Federal sector.

On Monday, April 27, the U.S. Green Building Council will be launching our newest version of the LEED rating system. We call is Version 2009, and we will also be adding a new customer data entry platform which can accommodate up to one million registered building projects. All told, this is for our organization a more than 1,000 percent increase in our current system capacity and we are doing this because of the enormous exponential growth in demand for green building certification.

In sum, green building improvements to our existing stock are so good that we really just can't afford not to do them. They are

cheap. In fact, they are profitable. They are good for the planet and they are available immediately.

Thank you for your time and I would be happy to take any further questions.

[The prepared statement of Mr. Gatlin follows:]

STATEMENT OF DOUG GATLIN
OF THE U.S. GREEN BUILDING COUNCIL

BEFORE
THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ON
OVERSIGHT OF THE GSA AND ENERGY EFFICIENCY IN PUBLIC BUILDINGS

APRIL 22, 2009

On behalf of the U.S. Green Building Council's (USGBC) more than 20,000 organizational members and 78 local chapters, I would like to thank Chairman Boxer and Ranking Member Inhofe for the opportunity to testify about the role that the U.S. General Services Administration can play in improving the energy efficiency and sustainability of federal buildings. My name is Doug Gatlin, and I am the Vice President of Market Development for the U.S. Green Building Council.

Introduction

The U.S. Green Building Council is a national nonprofit organization working to address current climate and energy challenges by advancing more environmentally responsible, healthy and profitable buildings.

Green buildings are an essential element of a climate change mitigation strategy: they reduce greenhouse gas emissions and owners' utility bills, and they have a positive and increasingly well-understood impact on health and well-being. While new buildings offer the potential to integrate innovative green technologies and practices from the start, existing buildings offer an unparalleled opportunity to transform the built environment on a massive scale.

With an inventory of more than 7,000 government-leased and 1,500 government-owned buildings representing more than 354 million square feet of space nationwide, GSA is a critical partner in the effort to reduce the environmental impact of the nation's buildings. GSA has already taken several significant steps to this end through a number of far-reaching energy efficiency and green building initiatives. We commend the Committee for its leadership in convening this important hearing to explore additional opportunities to improve oversight of energy efficiency in and the environmental performance of GSA facilities.

The Impact of the Built Environment

On the aggregate, buildings are responsible for 38% of U.S. CO_2 emissions per year.[1] In addition, buildings annually account for 39% of U.S. primary energy use;[2] use 13.6% of all potable water or 15 trillion gallons per year;[3] and consume 40% of raw materials globally (3 billion tons annually).[4] The EPA estimates that 136 million tons of building-related construction and demolition debris are generated in the U.S. in a single year.[5] (By way of comparison, the U.S. creates 209.7 million tons of municipal

[1] *Energy Information Administration (2008). Assumptions to the Annual Energy Outlook.*
[2] *Energy Information Administration (2008). EIA Annual Energy Outlook.*
[3] *U.S. Geological Survey (2000). 2000 data.*
[4] *Lenssen and Roodman, 1995, "Worldwatch Paper 124: A Building Revolution: How Ecology and Health Concerns are Transforming Construction," Worldwatch Institute.*
[5] *U.S. EPA Characterization of Construction and Demolition Debris in the United States, 1997 Update.*

solid waste per year.[6]) It is clear that we must act quickly to reduce the impact of the built environment on our planet.

Policymakers and building owners alike are now embracing green building as one of the most effective strategies for meeting the challenges of energy consumption and climate change. By addressing the whole building, from construction materials to energy systems and even cleaning supplies and waste management, green buildings generate opportunities to reduce emissions and environmental impact throughout the supply chain and the complete building lifecycle, targeting:

- reduced energy consumption through the use of energy-efficient heating and cooling systems, renewable power, and building commissioning;
- reduced water consumption through the use of low-flow fixtures and appliances, and the on-site treatment of storm water;
- reduced waste and improved environmental performance through the use of salvaged, recycled, and local materials, and the development of plans for managing construction waste; and
- reduced emissions and environmental impact by promoting the location of facilities near public transportation, the use of hybrid or electric cars, and the use of alternative means of transportation, such as bicycles and walking.

Importantly, the technology to make substantial reductions in energy use and CO_2 emissions in buildings already exists; modest investments in energy-saving and other climate-friendly technologies can yield buildings and communities that are significantly less carbon intensive, and are also more profitable and healthy places to live and work. In its December 2007 report evaluating potential solutions for reducing greenhouse gas emissions, McKinsey & Company highlighted improvements to the energy efficiency of buildings and appliances as a "negative-cost" option, suggesting that investments of this kind would yield positive financial returns over the course of their life cycle.[7] The potential returns are tremendous: McKinsey estimates that improvements in the efficiency of buildings and appliances could generate some $160 billion in cumulative savings by the year 2030.[8]

"Tune-ups" to building systems and equipment (known as "commissioning") present similarly impressive opportunities for operational savings. According to a 2004 study of building commissioning sponsored by the Department of Energy,[9] commissioning

[6] *U.S. EPA Characterization of Municipal Solid Waste in the United States, 1997 Update. Report No. EPA530-R-98-007.*

[7] McKinsey & Company, *Reducing Greenhouse Gas Emissions: How Much at What Cost?, available at http://www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf.*

[8] *Id.* at 29.

[9] Mills, E., Friedman, H., Powell, T., et al., *The Cost-Effectiveness of Commercial-Buildings Commissioning: A Meta-Analysis of Energy and Non-Energy Impacts in Existing Buildings and New Construction in the United States (December 2004), available at* http://eetd.lbl.gov/emills/PUBS/Cx-Costs-Benefits.html.

of existing buildings can improve energy efficiency by roughly 15 percent at a median cost of only 27 cents per square foot—offering an attractive payback period of roughly 6 months.[10] If undertaken by all of the nation's existing commercial buildings, building commissioning could yield a staggering $18 billion or more in energy savings annually.[11]

Reducing Impact through Measurement and Verification

Existing buildings present a readily available and significant resource for meeting the climate and energy challenges that are now commanding international attention. Through an integrated approach to sustainability that encompasses the day-to-day operations and maintenance of our building stock, we can not only reduce our environmental footprint in a cost-effective way, but also realize significant health and economic gains.

Recognizing this potential, USGBC has worked for more than a decade to provide building owners, operators, and users with the tools and resources they need achieve lasting environmental improvements in the places they live, work, and learn. Chief among USGBC's suite of resources for advancing market transformation to sustainability is the LEED (Leadership in Energy and Environmental Design) rating system--a voluntary, third-party certification system for green buildings that was developed by USGBC to provide the building community with a measurable consensus definition of leadership in energy and environmental design.

LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas, with an additional category to recognize innovation: sustainable site development, water savings, energy efficiency, materials and resources and indoor environmental quality. Each category includes certain minimum requirements ("prerequisites") that all projects must meet, followed by additional credits that are earned by incorporating green design and construction techniques. Four progressive levels of LEED certification--Certified, Silver, Gold and Platinum--are awarded based on the number of credits achieved. The Green Building Certification Institute (GBCI) provides independent, third-party verification to ensure a building meets LEED's high performance standards.

Originally launched in 2001 for new commercial construction projects, LEED is continuously improved to ensure its responsiveness to technical innovation and market demand--seeking to make obsolete its greatest triumphs. USGBC released rating systems for the operations and maintenance and commercial interiors markets in 2006, and for the schools and residential sectors in 2007. USGBC is also pilot-testing and nearing completion of rating systems for neighborhood developments, healthcare facilities, and retail spaces.

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[10] *Id.* at 1.
[11] *Id.* at 57.

The next version of LEED, known as LEED 2009, will be released at the end of April 2009. This new version involves several key advancements, including the weighting of LEED credits based on their ability to impact different environmental and human health concerns; and the regionalization of credits to acknowledge specific environmental issues and priorities that arise in different locations. Additional improvements to the online platform for LEED and an expanded certification structure through the Green Building Certification Institute will accompany the launch of LEED 2009--together known as LEED Version 3.

Existing Buildings

USGBC's work is guided by an understanding that building performance is a process, not an isolated act. Optimal building performance hinges on a three-part foundation of good design and equipment specifications, quality construction, and effective management. Without well trained and adequately staffed building management, the best-designed buildings in the world will fail to achieve their full potential of high-performance and reduced cost of operations.

Case studies of high-performance buildings compiled by the Department of Energy underscore the tremendous importance of operations and maintenance to maximizing the energy-saving potential of sustainable design.[12] For example, although one high-performance building was designed to achieve energy savings of 50 percent when compared to the national average, it in actuality achieved energy savings of just over 10 percent—a significant achievement gap.[13] Closing this gap is essential to meeting mounting climate and energy challenges, and to realizing the $160 billion in potential cumulative savings that are possible through improvements to building and appliance efficiency.

LEED for Existing Buildings: Operations & Maintenance (O & M) provides building owners and managers with a set of performance targets and best practices for improving their facilities and their building management practices to yield substantial savings in energy, water, and solid waste. Participating buildings have demonstrated a 35 percent reduction in greenhouse emissions, a 35 to 50 percent reduction in potable water consumption and a 70 percent reduction in waste generation.[14] Developed by industry experts from the facility and property management and engineering fields, the LEED for Existing Buildings: Operations & Maintenance rating system provides a set of best green practices in building operations, highlighting opportunities to use less energy, water and natural resources; improve the indoor environment; and uncover hidden opportunities for savings. A key requirement is that the facility manager develop a comprehensive plan for reporting, inspecting, and reviewing building operations and maintenance practices to ensure optimal performance throughout the building's life. Projects are required to submit actual performance data through

[12] *See id.* at p. 8, Fig. 1.
[13] *Id.*
[14] USGBC LEED project data.

LEED's online portal as part of the certification process to demonstrate that they are achieving the indicated performance measures.

Mindful that diligent operations and maintenance practices are an imperative for *all* buildings, USGBC encourages new construction projects certified under LEED to embrace the operational and maintenance practices set forth in LEED for Existing Buildings. Additionally, LEED 2009--to be launched at the end of April 2009—requires that all certified projects permit USGBC to access actual energy and water use data in the future to ensure performance, and to support research on best practices and building performance.

Greening Federal Buildings

As the owner, tenant, or manager of more than 3.3 billion square feet of building space valued at more than $772 billion, the federal government has one of the country's largest real estate portfolios,[15] including many of the nation's most recognized and cherished landmarks. With this vast portfolio comes the power to forge a greener, more energy efficient, healthier, and prosperous path for the nation's buildings and communities. By leveraging the unparalleled purchasing power of taxpayer dollars to support green building, the federal government can not only reduce its significant environmental footprint, but also speed the adoption of green building strategies by the private sector, and save money and resources through reduced utility bills and operating costs.

The potential environmental and economic savings are extraordinary. If the federal government were to re-commission its entire building stock and achieve the estimated 15 percent reductions in energy use,[16] it could generate more than $650 million in annual energy savings and eliminate roughly 2.7 million tons of carbon in one year.[17]

Recognizing the impact of the federal building sector, 12 federal agencies or departments have made policy commitments to use or encourage LEED certification. Some 18 million square feet of federally owned or leased building space is currently certified under LEED, and more than 200 million square feet of space is registered with LEED. These policies, coupled with various policies referencing LEED in 31 states and more than 180 localities, are having a marked impact on the larger green building landscape. To date, more than 19,500 building projects are registered with LEED, and more than 2,400 projects have earned LEED certification.

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[15] Federal Real Property Council, FY 2007 Federal Real Property Profile (May 2008), http://gsa.gov/graphics/ogp/FRPP_FY07.pdf.

[16] *See* Mills, E., Friedman, H., Powell, T., et al., *The Cost-Effectiveness of Commercial-Buildings Commissioning: A Meta-Analysis of Energy and Non-Energy Impacts in Existing Buildings and New Construction in the United States (December 2004), available at* http://eetd.lbl.gov/emills/PUBS/Cx-Costs-Benefits.html.

[17] Extrapolations from federal building consumption data in the U.S. Department of Energy's Buildings Data Energy Book, *available at* http://buildingsdatabook.eren.doe.gov/ChapterView.aspx?chap=4#1. Total federal primary energy consumption in buildings and facilities for FY 2005 was .65 quadtrillion Btu. The federal government spent $4,390,100,000 in FY 2005 on energy for buildings. The above extrapolations assume that all of the energy comes from coal-fired electricity production.

General Services Administration

Known as the nation's largest civilian landlord, with some 8,600 buildings in its portfolio serving 1.1 million federal employees, the U.S. General Services Administration (GSA) is an essential partner in the effort to reduce the environmental impact of the nation's building stock.[18] GSA has worked steadily in recent years to reduce the environmental footprint of federal buildings, serving as a participant in the development of interagency policies that inform federal legislation and executive orders, and highlighting sustainable design as a key agency priority. In addition to promoting the use of Energy Savings Performance Contracts (ESPCs) to generate energy savings, GSA requires that all new capital construction and major renovation projects earn LEED certification, and encourages projects to reach beyond basic certification to LEED Silver. GSA is similarly promoting the use of cost-effective technologies for reducing energy through a technology acceleration program as well as the use of other practices, including daylighting, insulation of building envelopes, and the installation of green roofs.

These projects are yielding significant environmental and economic results, and are informing the creation of best practices for sustainable construction, renovation, and operations and maintenance projects. In July 2008, GSA released a study evaluating the post-occupancy performance of 12 green building projects in its portfolio, with impressive results.[19] Green buildings in the study achieved a nearly 30% reduction in average energy usage and a 13% decline in average maintenance costs, as compared to national averages.

The following additional LEED case studies highlight the potential energy and environmental benefits of sustainable practices in GSA facilities:

- ***FBI Regional Building, Chicago, IL:*** Last month, USGBC certified the world's first LEED Platinum building under its LEED for Existing Buildings: Operations and Maintenance rating system. Occupied by the FBI and leased through GSA, the building demonstrates the environmental and economic gains that can be achieved through public-private partnerships in the green building process.

- ***Potomac Yards, Arlington, VA:*** Occupied by EPA and leased through GSA, the Potomac Yards complex has twice earned LEED Gold certification—once under LEED for New Construction, and in 2008, under LEED for Existing Buildings. The building, which earned an Energy Star label in 2007, also achieved a 41 percent reduction in water use, recycled 71 percent of waste during construction,

[18] General Services Administration, Public Buildings Service, *available at* http://www.gsa.gov/Portal/gsa/ep/contentView.do?contentType=GSA_OVERVIEW&contentId=8062&noc=T.
[19] General Services Administration (July 2008), *Assessing Green Building Performance: A Post Occupancy Evaluation of 12 GSA Buildings, available at* http://www.gsa.gov/gsa/cm_attachments/GSA_DOCUMENT/GSA_WBDG_Report_Final_R2-p-q5Q_0Z5RDZ-i34K-pR.pdf.

and derived 63 percent of materials through regional manufacturing within a 500-mile radius, among other green features.

- ***EPA Region 8 Office, Denver, Colorado:*** Leased by GSA and occupied by EPA, the Region 8 office achieved LEED Gold in 2007 under LEED for New Construction. The building, which earned an Energy Star label, has reduced water consumption by 36 percent through water-saving technologies, makes use of green power, diverted more than 75 percent of construction waste through recycling, and both minimizes heat island effect and manages stormwater through a 20,000 square foot green roof.

Green building efforts stand to become an even-greater focus at GSA through the work of GSA's Office of Federal High-Performance Green Buildings, which was authorized by the Energy Independence and Security Act of 2007 to both coordinate and help to define best practices for the green building activities of federal agencies. This office, coupled with the $5.5 billion received by GSA through the American Recovery and Reinvestment Act (ARRA), promises to support significant environmental and energy-saving improvements to federal buildings. Indeed, in its report to Congress at the end of March, GSA documented how it would spend its recovery dollars, including more than $4.2 billion for high-performance green building activities and programs, spanning facilities across the country.[20]

Opportunities for Enhanced Performance

Energy Savings Performance Contracts

Owing to its vast and diverse portfolio, GSA enjoys a multitude of opportunities for sustainable building design and operations. In the past, however, GSA's ability to maximize such opportunities has been affected by limited funding to address building repairs and alterations. Recent funding made available through ARRA provides needed capital to undertake energy-saving and green improvements—an endeavor that can be leveraged to even greater ends through public-private partnerships.

With the support of the Department of Energy's Federal Management Program, GSA has utilized energy savings performance contracts to achieve significant gains in building energy efficiency.[21] Under this model, the agency enters a contract with an energy service company (ESCO), which finances the upfront cost of the desired improvements, including needed equipment. The balance is then repaid by the agency

[20] *See* General Services Administration, American Recovery and Reinvestment Act Spending Plan, *available at* http://www.gsa.gov/graphics/pbs/American_Recovery_and_Reinvestment_Act_2009.pdf.

[21] *See*, e.g., General Services Administration, The Impact of the Credit Crisis on GSA's Capital Program (Testimony of David L. Winstead, Commissioner of the Public Buildings Service before the House Subcommittee on Economic Development, Public Buildings, and Emergency Management, Committee on Transportation and Infrastructure (July 29, 2008) *available at* http://www.gsa.gov/Portal/gsa/ep/contentView.do?contentType=GSA_BASIC&contentId=24771&noc=T; Department of Energy, Federal Energy Management Program, Awarded Energy Savings Performance Contracts, *available at* http://www1.eere.energy.gov/femp/financing/espcs_awardedcontracts.html.

throughout the contract period using the energy and other savings that are generated by the project. By providing upfront financing that can be combined with other measures undertaken by the agency, performance contracting offers the federal government a means of broadening both the scope and depth of its facility-related projects.

Most commonly used to finance water and energy improvements, performance contracting is gaining popularity as a means of supporting green improvements. Unlike traditional performance contracting, which frequently targets isolated opportunities, "green performance contracting" draws upon an integrated approach encompassing energy- and water-saving measures as well as features designed to improve indoor health and environmental quality. Green performance contracting may even be used to cover the cost of green roof retrofits, and the installation of systems to manage stormwater or other external environmental pollutants. Green performance contracting also may involve the installation of advanced meters. Advanced meters enable building owners and operators to view in "real time" a building's energy and water consumption and also allow for peak demand reductions, reducing capacity shortages in strained utility service territories. In addition to enabling dramatic operational savings, advanced metering performs a critical educational role--helping to raise awareness among building occupants and operators about both the need and opportunities for reducing energy and water consumption.

By accounting for the interaction between building systems, materials, and operational measures, green performance contracting can deliver maximum building performance. Combining this model with third-party verification, such as that provided by LEED for Existing Buildings: Operations and Maintenance, can ensure that buildings are both sustainable and achieve optimal cost reductions.

Power Purchasing Agreements

Under current authority, GSA may enter into contracts for public utility services for a period of ten years. Absent changes to the length of contracts, however, GSA does not have the flexibility to enter into energy agreements with renewable power developers, who often require longer contract periods to deliver increased capacity. Allowing GSA to enter into contracts for renewable energy utility services for longer periods would enable GSA to benefit from continuous, local power and would help to insulate the agency from fluctuations in energy costs. Such a change also would assist GSA's compliance with the Energy Policy Act of 2005, which requires federal agencies to purchase increasing percentages of renewable energy, up to 7.5% by 2013.

Free-standing legislation introduced in the House of Representatives this year would allow GSA to extend the length of renewable energy contracts to up to 30 years. Similar language is contained in the draft energy and climate legislation currently under consideration in the House. USGBC recommends the adoption of such policies as a powerful means of jumpstarting the renewable energy sector and leveraging the significant purchasing power of the federal government.

Cost-Effective Strategies for GSA Facilities

In March 2009, GSA's Public Buildings Service released a report highlighting seven cost-effective strategies for improving the energy and overall performance of federal buildings.[22] Developed by the agency's Applied Research Program and based on GSA's Workplace Performance Survey of more than 6,000 federal workers in 22 buildings, the report highlights specific measures that can increase both energy savings and user satisfaction. The report points to seven strategies in particular that can help to deliver desired savings, including: temperature adjustments for summer months; routine replacement of HVAC filters; consolidation and reduction of printers and copiers; use of LCD monitors; upgrades to lighting and improved access to daylighting; and upgrades to windows. GSA estimates that implementation of these strategies throughout its portfolio can deliver energy savings in the order of more than 500 million kilowatt hours each year.

USGBC applauds GSA's ongoing leadership in conducting research on improved federal building performance and recommends that consistent funding be provided to GSA to ensure the continuation and implementation of this valuable work.

[22] General Services Administration, *Energy Savings and Performance Gains in GSA Buildings* (March 2009), *available at* http://www.gsa.gov/graphics/pbs/GSA_SevenStrategies_090327screen.pdf.

About U.S. Green Building Council

The Washington, D.C.-based U.S. Green Building Council is committed to a prosperous and sustainable future for our nation through cost-efficient and energy saving green buildings.

With a membership comprising 78 local chapters, more than 20,000 member companies and organizations, and more than 80,000 LEED Accredited Professionals, the U.S. Green Building Council is the driving-force of an industry that is projected to soar to $60 billion by 2010. The U.S. Green Building Council leads an unlikely constituency of builders and environmentalists, corporations and nonprofit organizations, elected officials and concerned citizens, and teachers and students.

Buildings in the United States are responsible for 38% of CO_2 emissions, 39% of energy consumption and 15% of GDP, making green building a source of significant economic and environmental opportunity. Greater building efficiency can meet 85% of future U.S. demand for energy, and a national commitment to green building has the potential to generate 2.5 million American jobs.

About the LEED® Green Building Program

The U.S. Green Building Council's LEED rating system is the nationally recognized program for the design, construction and operation of green buildings. Every business day, $500 million worth of construction enters the LEED pipeline. LEED has been applied to more than 20,000 projects in all 50 states in and 91 countries, covering more than 4.5 billion square feet of development.

By using less energy, LEED Certified buildings save money for families, business and taxpayers; reduce greenhouse gas emissions; and contribute to a healthier environment for residents, workers and the larger community.

Doug Gatlin
Vice-President, Market Development

As the Vice President for Market Development at the U.S. Green Building Council, Doug Gatlin has oversight for deploying the family of LEED rating systems in all the major commercial market segments and for managing overall customer relations for LEED and the Council's new pilot initiative, the Portfolio Program.

Doug has 16 years experience in energy and environmental policy and has worked on climate change response strategies and voluntary pollution prevention programs for most of his career. He has authored publications on climate change mitigation strategies, energy efficiency program design, and energy efficiency project financing.

Prior to joining USGBC, Doug worked at the US EPA for nearly 10 years. For most of his tenure there, he served as Team Leader for the ENERGY STAR Commercial Buildings program, spearheading numerous activities including the launch of the first vertical sector marketing strategy, a new public sector program for governments, K-12 schools and universities, an energy efficiency financing initiative, and the launch of new partnership program with utilities. From 1992-1996, Doug served as a project manager at the Washington, DC based Climate Institute, where he managed the Energy Smart Cities campaign and helped the U.S. Department of Energy launch the Rebuild America program.

Doug holds a Bachelor's in political science from Duke University and a Master's in public policy from Georgetown University. He lives with his wife and two children in Silver Spring, MD.

Senate Environment and Public Works Committee Hearing, April 22, 2009
Doug Gatlin, USGBC, Responses to Follow-Up Questions for Written Submission

Response to Senator Thomas R. Carper's Question:

1. As you know, the federal government is the nation's single largest energy consumer. In recent years, a range of policies has been implemented to reduce costs and save energy, including energy intensity targets, alternative project financing, efficient procurement requirements, and a variety of training and technical assistance. How can we expand or refine these policies and programs to maximize efficiency and cost savings?

Beyond those recommendations enumerated in our testimony, we support incentives for water efficiency and the expansion of power purchasing authority, as provided for by legislation recently introduced in Congress, including:

- H.R.175, Rep. Schiff (on the extension of length of contracts for renewable energy sources and associated services); and
- H.R.2368, Rep. Holt (the Water Advanced Technologies for Efficient Resource Use Act of 2009).

Response to Senator James M. Inhofe's Questions:

1. *The primary reason for the GSA's adoption of design rating systems and certification labels like yours has been the assumption of longer term performance benefits afterwards. To what extent do you make claims about or guarantee the performance expectations of the buildings you certify? What sorts of performance claims do you make generally?*

   The LEED Green Building Rating System is a voluntary, consensus-based, market-driven green building rating system based on existing, proven technology. It evaluates environmental performance from a whole building perspective over a building's lifecycle, providing a definitive benchmark for what constitutes a "green building." It is a performance-oriented system where credits are earned for satisfying criteria designed to address specific environmental impacts inherent in the design, construction and operations and maintenance of buildings. USGBC ensures that certified buildings have met the criteria of the LEED system. Studies have consistently shown increased performance in LEED certified buildings.

2. *Have there been any third party studies of the actual performance against those claims? Or have you or your supporting organizations done any studies? Can you describe those studies as well as other studies that may have been critical?*

   There have been a number of third party studies that have looked at the benefits of LEED buildings. These studies focused on a variety of benefits including energy performance, financial, and health. Some of the primary studies, and their main conclusions include the following:

- **GSA Post-Occupancy Evaluation:**[1] Recently, GSA performed a detailed evaluation of 12 of its sustainably designed buildings, post-occupancy, and discovered that these 12, when considered jointly and compared to the national average:
  - produced 33% fewer carbon emissions;
  - used 26% less energy;
  - used 3% less domestic water; and
  - reported 27% higher satisfaction among occupants.

  Within the group of 12, two of the buildings were LEED Gold, and those buildings:
  - consumed 34% less energy;
  - used 54% less domestic water than the national average; and
  - reported 34% higher satisfaction among occupants.

- New Buildings Institute (NBI) study:[2]
  Energy Use Intensity (EUI) - For all 121 LEED buildings (included in study), the median measured EUI was 69 kBtu/sf, 24% below (better than) national average for all commercial building stock, as determined through a comparison to the Commercial Buildings Energy Consumption Survey (CBECS) compiled by the Energy Information Administration. Comparisons by building activity type showed similar relationships. For offices, the single most common type, LEED EUIs averaged 33% below (better than) CBECS. The median measured EUI performance increased with certification level:
  - CBECS average – 91
  - Certified – 67
  - Silver – 62
  - Gold/Platinum – 51

  Energy Star Ratings – The average Energy Star rating of LEED buildings (included in the study) was 68 (meaning better than 68% of similar buildings), compared with a median rating of 50 for the complete national building stock. Nearly half of LEED buildings had Energy Star ratings of at least 75, meeting the qualification level for an EPA-certified Energy Star building.
  Measured Performance in Relation to Modeling - Measured energy savings for the buildings in this study average 28% compared to code baselines, close to the average 25% savings predicted by energy modeling in the LEED submittals. Program-wide, energy modeling turns out to be a good predictor of *average* building energy performance for the sample. However, as with the other metrics in the study and common to statistical analysis, there is variability among the individual results that make up the average savings.
  The NBI study indicates further study is needed due to a large degree of variability between predicted and measured performance, but on average, the study stated that LEED buildings are delivering anticipated savings. Each of three views of building

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[1] General Services Administration, Public Buildings Service, *Assessing Green Building Performance: A Post Occupancy Evaluation of 12 GSA Buildings (July 2008),* available at http://www.gsa.gov/gsa/cm_attachments/GSA_DOCUMENT/GSA_WBDG_Report_Final_R2-p-q5Q_0Z5RDZ-i34K-pR.pdf.
[2] *Energy Performance of LEED® for New Construction Buildings.* New Buildings Institute. March 2008.

performance show average LEED energy use 25-30% better than the national average--a level similar to that anticipated by modeling. Average savings increase for the higher LEED levels, with Gold/Platinum buildings approaching the interim goal of Architecture 2030.

- **Does Green Pay Off?**[3] – Provides comparison data on Energy Star and LEED-certified buildings vs. non-Energy Star or non–LEED-certified office property from the entire United States using the CoStar database. High-level conclusions:
  - Tenant demand for green space is fairly new and not without its limits, but positive rent differentials do exist.
  - Even without higher rents, higher occupancy rates and faster absorption were observed, which translates into higher values that almost certainly exceed the marginal costs to go green.
  - For those who have developed some experience in LEED certification and/or Energy Star ratings and planned with experts early in the process of new construction or existing building conversion, the costs to go green can be quite modest.

- **Doing Well by Doing Good? Green Office Buildings**[4] - Provides credible evidence on the economic value of the certification of "green buildings" in the commercial sector. High-level conclusions:
  - Systematic evidence that rents for green offices are about 2% percent higher than rents for comparable buildings located nearby.
  - Effective rents, i.e., rents adjusted for the occupancy levels in office buildings, are about 6% percent higher in green buildings than in comparable office buildings nearby.
  - Occupancy rates for LEED properties are 5.4% higher than peers (90.03% vs. 84.66% in 2009 Q1)
  - Direct rental rates for LEED properties are $9.06 higher than peers ($38.86 vs. 29.80 in 2009 Q1)
  - Sales of LEED Class A office buildings are $65.90/sf higher than peers ($472.94 vs. $407.04 in 2008)

3. *Currently LEED buildings are not re-certified based on performance data. Do you have plans in upcoming products to examine performance of buildings as criteria for continuing certification?*

LEED addresses the complete life cycle of the building and sets high performance targets for the design and construction phase during which a building utilizes the LEED for New Construction rating system as well as the ongoing operations and maintenance phase during which a building utilizes the LEED for Existing Buildings: Operations & Maintenance rating system. In order for a building to performance throughout its lifecycle the building must be designed, constructed and operated with high performance green criteria in mind. The LEED for Existing Building

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[3] *Does Green Pay Off?* Nonn Miller, Jay Spivey and Andy Florance. July 2008

[4] *Doing Well by Doing Good? Green Office Buildings.* Piet Eicholtz, Nils Kok, John M. Quigley. http://repositories.cdlib.org/iber/bphup/working_papers/W08-001/

Operations & Maintenance rating system certifies existing buildings based on verifiable performance data such as utility costs. Projects that used the LEED for New Construction rating system are encouraged and incentivized to use LEED for Existing Buildings: Operations & Maintenance by waiving the registration fee. In addition, existing building certification is valid for 5 years, at which point projects must re-certify. This helps to ensure—through measurement—sustained, high performance. To encourage projects to re-certify, the re-certification fee is reduced by 50%.

In addition to incentivizing re-certification under LEED for Existing Buildings: Operations & Maintenance, LEED 2009 now requires that all certified projects must commit to sharing with USGBC all available actual whole-project energy and water usage data for a period of at least 5 years.

4. *How many LEED buildings are also Energy Star certified?*

Both LEED and the Energy Star program use building performance data to track the energy use of a building throughout its lifecycle. An Energy Star score of an existing building is part of the certification under LEED for Existing Buildings: Operations & Maintenance. Indeed, buildings pursuing such certification are required to obtain an Energy Star score of 69 or above.

Given that the majority of LEED certified buildings are new construction and such buildings would not have applied for Energy Star until later in their life cycles (i.e. after submitting for LEED New Construction certification), we are unable to provide a precise number.

5. *How much does it cost to certify a building to the LEED Silver standard? Please include a separate cost break out for costs associated with hiring a LEED AP consultant to assist in the process of achieving certification of a typical office building, as well as additional costs for green or sustainable upgrades. Average costs for different types of buildings is sufficient.*

The LEED certification fee schedule is currently $0.035/sf (minimum of $1,750 and maximum of $17,500) for Design & Construction certification reviews and $0.025/sf (minimum of $1,250 and maximum of $12,500) for Existing Building certification reviews. These certification fees represent approximately 0.02% of the prevailing building construction costs of $200/sf.

LEED does not require that a project use or employ a LEED Accredited Professional (LEED AP) or a consultant. Having a LEED AP on the project team is an optional credit within the LEED rating system.

Per additional costs for green, a 2007 study by Davis Langdon concluded that "....there is no significant difference in average cost for green buildings as compared to non-green buildings."[5]

6. *How much money does USGBC net as a result of the certification of a building?*

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[5] Davis Langdon (2007), *The Cost of Green Revisited,* available at http://www.davislangdon.com/upload/images/publications/USA/The%20Cost%20of%20Green%20Revisited.pdf.

USGBC, a nonprofit organization, established the certification fee structure with the intent of covering the cost of reviewing certification submittals, and USGBC has historically offered certification at or below the cost to USGBC to certify projects.

7. *In your testimony you discussed common improvements to building systems such as advanced meters and better education of building operators. What does a building gain from getting LEED for Existing Buildings Operations and Maintenance that they don't get from going alone?*

LEED certification offers an independent, third-party verification that the building project meets the highest green building and performance measures. This is a benchmark indicating that performance thresholds are fully implemented and the expected performance levels are met. In an existing building this includes verified energy performance, verified water savings, and verification of green practices such as healthy indoor air quality, green cleaning, and waste diversion, most commonly through recycling. Implementing an integrated, systems-oriented approach to green project design, development and operations, such as the process required for LEED certification, can yield synergies and improve the overall performance of a building.

8. *You discussed the barriers that exist for greening in buildings when tenants and landlords aren't sharing the benefits. Do you see this as a problem with GSA owned buildings and their federal tenants? What is GSA doing to help incentives agencies to go green? Has GSA explored ways to pass the savings gained from energy efficiency measures on to the agencies? What are your recommendations for GSA and agencies to better address these issues?*

GSA has consistently delivered high performance green buildings for its federal tenants. Since 2003, the agency has used the LEED rating system to promote greater environmental performance of those buildings. In addition, as of 2008, GSA began requiring LEED certification for all build-to-suit leased space for its tenants.

GSA's plans for the American Reinvestment and Recovery Act funding include expanding practices such as smart metering, advanced controls, and re-commissioning buildings, which give tenant agencies control over their own utility performance and the utility bills they pay. This encourages changes in their operations and adds incentives for the tenant to save energy, water and money. More sophisticated building design practices, such as the use of multiple, smaller systems and split systems to enable zone control for large buildings, are currently used by some buildings within GSA's portfolio of buildings, and these practices should be expanded.

In addition, the building market, including GSA tenants and those who provide buildings, require education in green building practices to assist tenants, building owners, and building providers in understanding their role in building performance and how they can contribute to attaining a high-performance green building that reduces their environmental impact.

9. *Is there anything that the committee should consider in drafting new legislation on greening of federal buildings?*

Please refer to the response to Sen. Carper's Question 1.

Senator BOXER. Thank you.
Mr. Burt.

STATEMENT OF LANE BURT, ENERGY POLICY ANALYST, NATURAL RESOURCES DEFENSE COUNCIL

Mr. BURT. Thank you, Madam Chair, Senator Inhofe, and members of the Committee. Thank you for inviting me to testify on energy efficiency in public buildings. My name is Lane Burt and I am an Energy Policy Analyst with the Natural Resources Defense Council. I am NRDC's principal advocate for Federal policies that promote building and equipment efficiency.

The topic of discussion today is extremely timely as we continue to discuss how to reduce global warming pollution while contributing to our economic recovery. Energy efficiency can do both of these things. Energy efficiency is the fastest, cleanest and cheapest energy resource that we have and it can help us fight global climate change and reduce our addiction to oil and revitalize our economy.

The opportunity for energy efficiency in our buildings is tremendous. U.S. buildings are the largest single source of global warming pollution in the United States and the site of countless opportunities for efficiency improvements.

I would like to call your attention to this chart on the left—your right, excuse me—that NRDC has developed from the 2007 study by McKinsey and Company, detailing the cost and scope of reducing global warming pollution. The column on the far left, highlighted in red, represents building efficiency. The building efficiency measures not only have the largest potential emission reductions of any option, but they also have net negative costs, making money over time.

The conclusion is clear: building efficiency makes sense no matter when or why it is being considered. In the context of global climate change, building efficiency is imperative.

As the owner of a huge portfolio of buildings, the Federal Government has a vital role to play in reducing emissions from the buildings sector. We can cut emissions and keep future taxpayer dollars from being unnecessarily wasted on energy if we pursue efficiency opportunities. The GSA, as the Federal Government's landlord, should lead the charge for all Federal agencies on increasing energy efficiency.

Improving commercial buildings is faster and results in larger savings per building than retrofits in the residential sector, making this sector ideal for near-term investment. Federal facilities are nearly three times the size of the average commercial building, making the opportunity even greater.

Reducing costs to taxpayers is important, however there are additional benefits to be had as the GSA is an ideal laboratory for cutting edge building improvements that could generate even greater savings in the private sector. Agencies can utilize emerging technologies and design strategies, thereby increasing their market penetration and helping to bring down the price.

Water efficiency is also vital, as the economic consequences of shortages demonstrate that water is more than an environmental issue. To maximize energy and water savings in the Federal facili-

ties and lead the private sector, the GSA and all Federal agencies should prioritize efficiency improvements with their recovery funds. GSA has already demonstrated impressive improvements in complying with the requirements of the Energy Independence and Security Act of 2007 and they should continue this progress with the use of ARRA funds.

Specifically, we suggest that GSA release savings targets for energy, water and emissions in each project and document their success in meeting those targets. Documenting the savings in every building is the best way to oversee the progress of the agency, identify problems, and demonstrate success.

The GSA should also create a strategy for attaining all the remaining cost-effective energy efficiencies in their facilities, share best practices with State and local governments and the private sector, and share its most effective building energy management strategies across agencies to encourage further improvements.

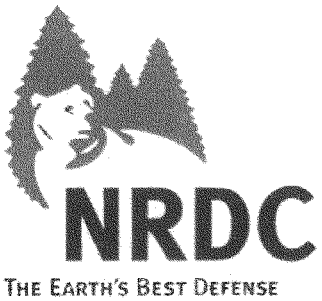
There are also opportunities for GSA to lead by utilizing new tools. NRDC has developed, with stakeholders from all aspects of commercial real estate, an energy efficiency lease that seeks to properly allocate the costs and benefits of efficiency improvements between owners, tenants and brokers. This is intended to address the market barrier of split incentives where the owner cannot profit from efficiency improvements because the tenants pay the energy bills. The GSA and other agencies should offer this lease structure to its building tenants, while requesting this structure of building owners in spaces it leases.

The Federal tax deduction for energy efficient commercial buildings can also be utilized by Federal facilities because it contains an option to assign the deduction to the designer or engineer responsible for the improvements. GSA should consider utilizing the deduction in all projects.

In conclusion, Federal facilities should lead by pursuing all cost-effective energy efficiency measures to reduce the energy costs of these facilities. We welcome the Committee's leadership on Federal building energy efficiency and I thank you for allowing me to present these views.

This concludes my testimony.

[The prepared statement of Mr. Burt follows:]



Testimony of Lane Burt,
Energy Policy Analyst
Natural Resources Defense Council

Before the Senate Committee on Environment and Public Works

Hearing on:
Oversight of the GSA and Energy Efficiency in Public Buildings

April 22, 2009

Summary

The building sector is the largest source of global warming pollution in the United States, accounting for roughly one-third of greenhouse gas emissions. Fortunately, buildings also offer the quickest and most cost-effective opportunity to reduce global warming pollution while yielding direct economic benefits by saving consumers money and boosting U.S. industry. Efficiency retrofits of existing buildings can generate dramatic savings using technology that exists today. The federal government owns nearly 2 billion square feet of commercial space, representing billions of dollars in energy savings that could be generated for taxpayers from retrofits. To make these savings real, the U.S. General Services Administration (GSA) and all federal agencies should prioritize efficiency improvements with their renovation funds, especially those provided in the American Recovery and Reinvestment Act (ARRA). This investment would yield more than just direct taxpayer benefits, as the GSA is an ideal laboratory for cutting edge building improvements that could enable the private commercial building sector to make dramatic reductions in global warming pollution.

The continued existence of tremendous opportunities for energy savings in buildings reflects the significant barriers to pursuing building efficiency. Building owners and occupants have not taken advantage of efficiency opportunities, even when it is in their best interest to do so, despite the growing acknowledgement and demonstration of the potential benefits. This effect can be traced to the existence of market barriers that discourage energy efficiency, such as split incentives, lack of consumer awareness, and problematic treatment of energy efficiency by the financial sector.

Overcoming these barriers to efficiency will not be easy. It will take well-designed policies to induce a market transformation, where energy efficiency would be appropriately valued by all parties. This transformation will not occur without leadership from early adopters of advanced technologies and methods. The federal government needs to lead by example and play this role to the greatest extent possible.

In the American Recovery and Reinvestment Act (ARRA) of 2009, Congress provided the GSA with the opportunity to demonstrate leadership in its facilities by allocating $4.5 billion dollars to the GSA for the "greening" of existing facilities. This tremendous investment of public dollars is a great opportunity for GSA to return at least twice as much in savings to taxpayers. Congress should work to ensure that the agency is successful in this endeavor. As the first step, GSA should reaffirm its commitment to prioritizing efficiency in every project that receives ARRA funding and communicate the savings of every retrofit to Congress and the public. Documenting the amount of energy and water saved in every building is the best way to oversee the progress of the agency, identify problems, and demonstrate success. The GSA should also create a strategy for attaining all the remaining cost effective energy efficiency in their facilities, share best practices with state and local governments and the private sector, and also share their most effective building energy management strategies within the agency to encourage further improvements.

There are also opportunities for GSA to lead on advanced energy efficiency by utilizing new tools and continuing to take advantage of existing programs. NRDC has developed, with the US Green Building Council (USGBC) and stakeholders from all aspects of commercial real estate, an energy efficiency lease that seeks to properly allocate the costs and benefits of efficiency improvements between owners, tenants, and brokers, thereby addressing the market barrier of split incentives. The GSA and other agencies should offer this lease structure to its building tenants while requesting this structure of building owners in spaces it leases.

GSA will not be able to take advantage of all the efficiency opportunities in its thousands of buildings with the funding in ARRA and should therefore consider other avenues for undertaking retrofits. The Energy Service Performance Contract (ESPC) is one such tool for improving efficiency without up-front funding. federal tax deduction for energy efficient commercial buildings can also be utilized and will be available through 2013 with its extension in the Emergency Economic Stabilization Act of 2008. The provision contains an assignability option that would allow federal agencies to assign the deduction to the designer or engineer responsible for the improvements. The deduction should be used in all projects for the redesign of lighting systems, at minimum, to attain more efficient designs at lower cost.

Strong federal leadership is required to begin achieving the savings possible in buildings, and especially in commercial buildings. All efficiency measures that are cost-effective over an extended period should be pursued in federal buildings to reduce the operating costs of these facilities. The GSA, as the federal government's landlord, should lead the charge for all federal agencies on increasing energy efficiency. We welcome the Committee's leadership on building energy efficiency, which will help ensure federal funds are used well and reduce the total energy bill for federal buildings.

Introduction

Senator Boxer, Senator Inhofe and Members of the Committee, thank you for inviting me to testify on "Oversight of the GSA and Energy Efficiency in Public Buildings." My name is Lane Burt and I am an Energy Policy Analyst with the Natural Resources Defense Council (NRDC). NRDC is a non-profit organization dedicated to the protection of our environment and the prosperity of future generations. NRDC has over 1.2 million members and online activists and employs over 350 lawyers, scientists, and other professionals. I am a mechanical engineer by training, a LEED accredited professional (Leadership in Energy and Environmental Design), and am NRDC's principal advocate for federal policies promoting buildings and equipment efficiency.

To avoid the worst effects of global climate change, end our addiction to oil, and revitalize our economy, we must use energy more efficiently. Energy efficiency is the fastest, cleanest, and cheapest energy source we have and must be treated as such. The most cost-effective efficiency opportunities are in the building sector, which is the largest source of global warming pollution in the United States, accounting for roughly one-third of U.S. global warming pollution.[1] As the owner of an immense number of buildings, the federal government has a vital role to play in reducing emissions from the building sector. Reducing energy consumption in federal facilities will cut emissions and keep future taxpayers dollars from being unnecessarily wasted on energy. The GSA, as the federal government's landlord, should lead the charge for all federal agencies on increasing energy efficiency.

Building Efficiency Opportunities

A 2007 study by McKinsey and Co., sponsored by NRDC and other business, industry, and utility organizations, found that most building energy efficiency measures using existing technology make money over time, reducing the cost of a cap on emissions. The study found that annual savings of $33 billion per year are achievable from cumulative building sector efficiency improvements, with even greater savings resulting from more aggressive policies.[2] The chart in Figure 1 was developed from this study and shows the cost and scope of the policy options available to achieve the potential global warming pollution reductions it identified. The measures to the left have a negative cost over time, meaning they make money. Building efficiency (highlighted in red) is not only the most cost effective option, but also has the largest potential for reductions. Transportation and industrial efficiency follow buildings as net negative cost options.

[1] Energy Information Administration (2008). "Emissions of Greenhouse Gases in the US 2007 – Overview." <http://www.eia.doe.gov/oiaf/1605/ggrpt/>

[2] McKinsey and Company (2007). "Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?" sponsored by DTE Energy, Environmental Defense, Honeywell, National Grid, NRDC, PG&E, and Shell and available for download at www.mckinsey.com/clientservice/ccsi/greenhousegas.asp

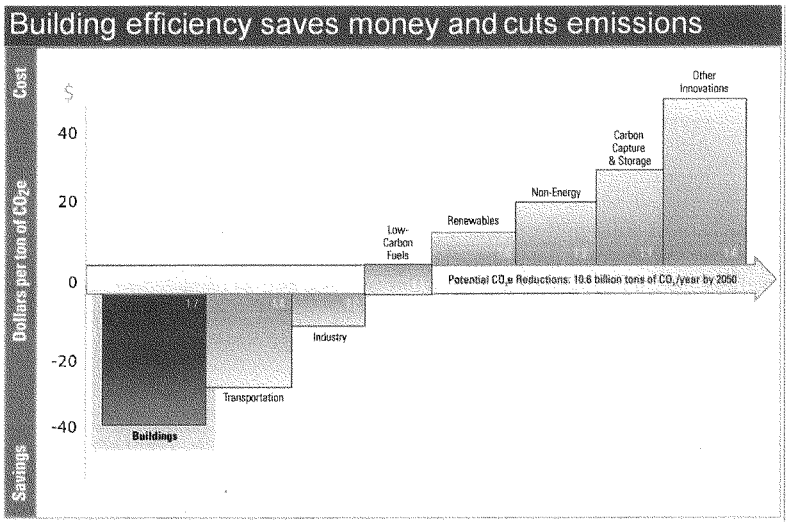


Figure 1: The cost of reducing greenhouse gas emissions

The vast majority of building energy efficiency opportunities can be realized through market uptake of efficient products and the retrofitting of the existing building stock. Based on this conclusion, NRDC advocates for policies that encourage building efficiency measures, including codes and standards for buildings and equipment, incentives for exceptionally efficient buildings and equipment, building energy labeling, and energy efficiency financing.

Barriers Prevent Efficiency Improvements

Energy efficiency opportunities for buildings are often ignored despite their undeniable benefits. This failure of the market can be traced to several effects, including:

- Split incentives - The individual who pays the energy bills is often not the individual who makes decisions about the efficiency of the building systems. For example, the landlord who does not pay the energy bills will not benefit from investing in more efficient equipment. Similarly, a home builder may only purchase the cheapest and least efficient equipment as the builder is not concerned with the home buyer's cost to operate that equipment.
- Lack of consumer knowledge about when and how to pursue efficiency – Many building owners have no idea how efficient their building is or how much energy it should be using. Even if they were to find out, they may not know what measures to take to reduce energy use, or how to make the improvements.
- Problematic treatment of energy efficiency by the financial sector – The cost to operate a facility is not taken into account in the loan underwriting process. This results in the false assumption that all buildings will cost the consumer or

occupant roughly the same amount to operate. This assumption may also discourage building owners from making improvements if they are not certain they will own the building for an extended period, as the final price may not reflect their investment. Further, loans that are granted based on future energy savings may be assessed as risky because the structure is new to lenders and the risk profile is not established, despite the nearly certain returns that efficiency improvements can provide.

These barriers are significant and ingrained. A robust set of policies and tools are necessary to overcome them and allow efficiency to be valued appropriately. Federal facilities have a unique role to play in this process, as they can become early adopters of advanced efficiency measures, thereby speeding market acceptance of efficiency measures while reducing energy costs to the federal government.

The Role of Federal Buildings

According to the Energy Information Administration (EIA), the federal government owns 46,000 buildings comprising almost 2 billion square feet of space - nearly 3 percent of all commercial space in the United States.[3] Because of this significant market share, the federal government is exceptionally well-positioned to transform the commercial building market through its actions. Nearly 4 percent of offices and healthcare facilities are federally owned, while 13 percent of all service buildings are federal property. NRDC analysis of EIA's commercial building data indicates that with a 30 percent reduction in the energy consumption of federal facilities, annual savings of at least $1.3 billion dollars are possible at today's energy prices. Global warming pollution could be reduced by over 7 million metric tons per year, equivalent to removing almost one and a half million cars from the road. These savings are direct only and do not account for additional savings that could be generated in the private sector as a result of lessons learned from federal leadership

The savings possible in federal facilities and all commercial facilities can be achieved in the near future because of the structure of the commercial building sector. Commercial buildings consume less total energy than residential buildings, but the sector has the potential for larger near-term reductions in energy consumption. The sheer number of residential buildings spread across the country will require a great expansion of the residential efficiency industry in order to achieve the potential cost-effective reductions in this sector, and this expansion will take time. Commercial buildings can provide larger energy savings per project and require less time and labor in total to retrofit. Federal facilities, which are almost three times as large as the average commercial building, are an even greater opportunity.

Even though the savings in commercial buildings may be achieved more quickly than residential buildings, they are often more technically challenging. This further enhances the value of federal facilities providing leadership to the rest of the buildings sector.

[3] Commercial Building Energy Consumption Survey (CBECS) 2003

Federal buildings could be used to demonstrate advanced techniques, designs, and technologies. The stable nature of federal ownership also supports a longer-term approach for the evaluation of energy saving technologies – a luxury that the private sector does not have because it typically ignores paybacks of greater than 3 years. Congress has already provided agencies with the necessary authority to make longer term decisions by adjusting the life cycle considered for building improvements to 40 years from 25 in the Energy Independence and Security Act (EISA) of 2007. This is one of several recent changes that have led to improvements in the federal building stock and this progress should be built upon.

Progress in Federal Facilities

Many agencies have already begun to pursue efficiency opportunities in response to the Energy Independence and Security Act (EISA) of 2007 and Executive Order 13423. The Order requires an annual 3 percent reduction and a 30 percent reduction by 2015 of energy use per square foot in federal facilities compared to a 2003 baseline. Water consumption is also to be reduced 2 percent annually. EISA added a requirement for all new and renovated federal facilities to reduce energy consumption from fossil fuel sources 55 percent by 2010 and 100 percent by 2030. Many agencies have worked to meet these requirements and should be commended for doing so. GSA is one of these agencies, having exceeded the goal of reducing energy consumption 9 percent in 2008 with a reduction of 10.3 percent.

This progress in GSA and in all agencies must be continued. A report by the Government Accountability Office (GAO) in October of 2008 documented GSA's movement towards satisfying the requirements of EISA. Of particular importance in this report is the progress towards designation of energy managers in each of GSA's 8,600 buildings. GSA was attempting to complete designations by November 2008 and maintaining an energy manager in every facility should be a priority. Experience in the Environmental Protection Agency's Energy Star program has demonstrated that many buildings may attain low or no cost energy use reductions of up to 30 percent. These savings are not possible without educated and motivated individuals who understand and can respond to specific buildings. These managers will also be extremely valuable to the identification of future efficiency measures that may eventually receive federal funds from the Recovery bill or other sources.

Provisions in the American Recovery and Reinvestment Act

The American Recovery and Reinvestment Act (ARRA) enacted earlier this year provided GSA with $4.5 billion dollars "to convert GSA facilities to High-Performance Green Buildings." This represents a tremendous investment of tax dollars and an equally large opportunity for a return on that investment if used properly. These funds could potentially leverage two or more times as much in avoided energy expenditures, and transparency is needed to ensure that this potential is achieved. Given the nature of the investment, oversight need not be expensive or an impediment to the GSA. The agency should document the reductions in energy and water consumption in each project so that

the success can be determined, prepare a plan for the attainment of all remaining cost effective energy efficiency in their buildings, and share best practices and lessons learned with state and local governments as well as the private sector.

Recommendations for Documenting Improvements

Prioritize Efficiency
The definition of High Performance Green Building in EISA is very broad and covers all aspects of a "green" building. No guidance on how to prioritize the different aspects is given, nor is any particular measure emphasized. It is therefore extremely important that GSA not only utilize the funds in a way that meets the definition but that it also prioritizes efficiency in all decisions regarding ARRA funding.

Improving energy efficiency is the first priority for "greening" an existing building. Energy efficiency measures pay for themselves quickly and reduce the need for future tax dollars. If pursued on a large scale, these measures can benefit the private sector through the increased market penetration and commoditization of more efficient products, technologies, and processes. Building-related emissions of greenhouse gasses are reduced as a result of efficiency retrofits and energy demand growth is controlled, thereby avoiding the need for new power generation and all the associated infrastructure costs.

Water efficiency must also be prioritized. A building is typically retrofitted or renovated once every 20 to 30 years, and the opportunity to reduce the water use of a building must be taken advantage of at this time. Water efficiency measures are not the primary goal of most retrofits, as water bills are very low; however, the societal value of water efficiency is extremely high. Significant amounts of energy are used to collect, distribute, and treat clean water and wastewater to acceptable standards. This energy consumption soars in the dry Southwest, reaching to 19 percent of all electricity consumed in California.[4] Water is also becoming increasingly scarce in these parts of the country. The costs associated with water shortages and the economic consequences to all sectors (such as farming, power generation, or tourism) of these shortages must be avoided. Water is a precious resource that must be used efficiently and it is most cost effective to retrofit water systems during a comprehensive renovation or efficiency retrofit.

Document Performance
To demonstrate its progress in energy and water efficiency improvements, GSA should provide performance targets for every retrofit, in terms of energy and water savings. The agency should be evaluated based on the ambitiousness of these targets and their success in meeting them. These targets should be aggressive so poor investments of recovery funds would be discouraged. Each individual building will, of course, be different, so we also recommend that GSA reduce total energy consumption of the buildings being retrofit by at least 30 percent compared to the building's previous state and water consumption by the same.

[4] NRDC Water Facts. < http://www.nrdc.org/water/files/energywater.pdf>

GSA should document improvements in efficiency after the retrofit and publicly disclose this information in a report and on its website. Retrofits that squander the opportunity to reduce future energy costs will then be clear to all parties. There may be legitimate reasons for lower than expected performance, and GSA can explain should this occur. Similarly, exceptional performance will be rewarded with additional attention.

GSA is required by EISA to benchmark the energy use in its facilities using the Energy Star Portfolio Manager tool developed by the Environmental Protection Agency (EPA), and the agency should publicly disclose this data for each facility. The benchmarking tool utilizes energy bill data and building characteristics to make a comparison of the building to its peers. The building is given a score of the percentile of buildings in which it performs, and 75 or above is awarded the Energy Star designation. The disclosure recommendation applies to all federal agencies, as this action will encouraging federal facility managers to operate their buildings efficiently and allow for easy identification of opportunities for improvement.

The benchmarking of retrofitted facilities will also be extremely useful for the facility managers of the individual projects. Good building managers become even more important after a retrofit, as the most sophisticated and efficient buildings will waste energy if not maintained and operated correctly. It is important that GSA understand the value of good energy managers and seek to identify those that excel in this capacity. Education and the sharing of best practices should occur across federal facilities to encourage the operation of facilities at peak performance levels.

Plan to Attain All Cost Effective Energy Efficiency and Share Best practices
In recent conversations with GSA leadership, the agency has shown an understanding of efficiency issues and the intent to take advantage of all opportunities. What is needed in the coming year is a systematic strategy to deploy all cost-effective energy efficiency measures in every building. This strategy should not be technology specific, rather it should focus on implementing baseline efficiency improvements to all the buildings that require it, the process for testing new technologies and communicating results across the agency, as well as the identification and sharing of building operations strategies developed by the agency's best managers. It is likely that GSA already has strategies in many of these areas but this information needs to be shared. The models would be extremely useful to state and local government in their public buildings as well as in the private sector. GSA should provide Congress, other agencies, and the public with a report outlining this efficiency deployment strategy for their existing facilities.

GSA should also develop a blueprint for pursuing efficiency opportunities in other areas where the agency is leading and will develop expertise, like performance contracting, facility management, integrated design, product procurement, and energy-efficient leasing. State and local governments benefit from leadership in all of these areas and GSA can help them avoid mistakes that are costly in dollars and CO2 emissions. The private sector would also benefit from the existence of best practices. This is an essential

element in scaling efficiency and capturing the large associated economic, climate, health and security benefits over the next decade.

Additional Tools

In addition to the disclosure of retrofit information and the sharing of best practices, there are other policies and newly developed tools that can be used by GSA and all federal agencies to make the investments in ARRA more effective. New and existing options, like the Energy Efficiency Lease, the Commercial Buildings Tax Deduction, and the Energy Service Performance Contract should be deployed when possible.

The Energy Efficiency Lease

NRDC has partnered with the USGBC and commercial building owners, tenants, brokers, and government officials to develop an Energy Efficiency (EE) Lease concept. The EE Lease is designed to address the market barrier of split incentives, where the party making decisions about the energy efficiency of the building systems will not benefit from investing in energy efficiency. In the commercial sector, this barrier takes the form of standard leasing practices that share operating and capital expense responsibilities between landlord and tenant, diminishing the attractiveness of the investment. This results in a failure to pursue efficiency, even in the face of rising energy prices and other pressures to improve the sustainability of buildings.

The EE Lease provides a set of guidelines that specifically document how to address common problems in the leasing of commercial space, including:

- Capital recovery that allows all savings generated by a retrofit to be used to pay for it.
- Benchmarking of energy use on a building-wide basis.
- Efficiency standards for equipment and systems replacements.
- Regular systems analyses and recalibration.
- Sub-metering wherever possible; and a greater sharing of energy consumption data between landlord and tenant.

Both landlord and tenant stand to benefit from these guidelines. The tenant is provided with an improved space, better and more reliable equipment, more information about their energy use and that of the entire building, and the possibility of decreased rent resulting from their own operational changes and that of their fellow tenants. The landlord similarly benefits from recovery of retrofit costs, greater information on tenant energy use, and tenants that are educated and aware of their energy use.

The potential for GSA and other federal agencies to speed the market penetration of the EE Lease is tremendous. The ownership statistics for federal and public buildings mentioned previously, when combined with the amount of space leased by government entities (GSA alone owns or leases more than 354 million square feet of space), represent a market share that would be impossible to ignore. GSA and other agencies should utilize these guidelines in leasing structures that they own and request the structure of

owners of buildings they are leasing. GSA could increase familiarity with the leasing concept through its interactions with the private sector and help reduce one of the most significant market barriers to energy efficiency in commercial buildings to the private sector. Large scale adoption of these principles could pave the way for the private sector to redistribute funds away from wasted energy to more productive uses.

The Federal Tax Deduction for Efficient Commercial Buildings

Another tool that may be useful to GSA is the federal tax deduction for energy efficient commercial buildings. The deduction was originally enacted in the Energy Policy Act of 2005 and extended in the Emergency Economic Stabilization Act of 2008 through 2013. This policy includes an option for a GSA or other federal agency to assign the deduction to a third party, usually the engineer, architect, or designer that achieves the performance targets of the credits.

The performance requirement of the deduction is a reduction in energy consumption to 50% below the ASHRAE 90.1-2001 model energy code with partial deductions available for qualifying improvements in building envelope, mechanical systems, or lighting systems. While some of these targets may be out of reach in the retrofit of an existing building, the lighting deduction is often attained in practice and should be targeted in GSA retrofits. There are also several proposals in Congress to increase the amount of the deduction, which would make it an even more valuable and usable option for federal agencies.

The Energy Service Performance Contract

A policy that has been utilized by GSA to finance a retrofit is the Energy Service Performance Contract (ESPC). These contracts involve little or no up-front cost to an agency because an Energy Services Company (ESCO) provides an energy audit of the facility, designs the retrofit, and guarantees a certain level of energy savings to the owner. The agency and ESCO then sign a contract, dividing the future savings between the parties so that the agency assumes no additional cost while the ESCO is paid for the retrofit. The retrofit is then performed and the agency retains all energy savings once the contract terms have been met. The Utility Energy Services Contract may also be an option, in which the utility plays the role of the ESCO. According to the Federal Energy Management Program, ESPCs have generated $7.1 billion in savings across 19 agencies from an investment of $2.3 billion dollars.[5]

The ESPC is an important tool for a federal agency or the party responsible for any large public building to increase efficiency without up-front costs; however they are not substitutes for general retrofit funds. Because of the tremendous number of federal buildings, this financing strategy is inadequate to reach all of the energy efficiency opportunities. Agencies that have the funds should continue to utilize them for retrofits, as the savings to the agency will be much greater than when the entire cost of the project is financed in an ESPC; however, when funding is not available, GSA and other agencies should continue to make use of ESPCs.

[5] Federal Energy Management Program. "Super ESPCs – Just the Facts." 2008

Conclusion

The potential economic and environmental benefits of improving energy efficiency in public buildings are immense – at least $1.3 billion dollars annually in energy savings for taxpayers are possible. The funding for GSA in ARRA can help begin to tap this potential, but only if it is effectively used to pursue energy and water efficiency. The most simple and effective way to achieve this goal is by GSA setting targets for energy and water efficiency in buildings retrofitted with ARRA funds and providing Congress and the public with the energy and water savings achieved from its retrofits. GSA should also develop a strategy for attaining all cost effective energy efficiency in every facility that they own and share this strategy openly with Congress, other agencies, state and local governments, and the private sector.

GSA should also utilize the other tools at their disposal to further their pursuit of efficiency. The newly developed Energy Efficiency Lease guidelines, the federal tax deduction for energy efficient commercial buildings, and the Energy Services Performance Contract are all useful tools to taking on this tremendous challenge and opportunity.

This concludes my testimony. Thank you for the opportunity to speak on these important issues. I would be happy to answer any questions you may have.

Questions for Burt

Questions from:
Senator Thomas R. Carper

1. As you know, the federal government is the nation's single largest energy consumer. In recent years, a range of policies has been implemented to reduce costs and save energy, including energy intensity targets, alternative project financing, efficient procurement requirements, and a variety of training and technical assistance. How can we expand or refine these policies and programs to maximize efficiency and cost savings?

These recently implemented policies have all been extremely helpful in allowing federal agencies to reduce their energy consumption. They have helped educate the agencies and move them up the learning curve. For example, GSA has exceeded the goals of the Energy Independence and Security Act of 2007 (EISA) by reducing energy use by 10.3 percent from their 2003 baseline and both the agency and Congress should celebrate this success.

In the future, it would be most effective to direct the agencies to utilize the knowledge gained in meeting the goals of EISA to pursue all cost effective energy efficiency in every federal facility in the country. Efficiency opportunities that are not taken advantage of represent wasted tax dollars and unnecessary emissions.

Legislation directing all agencies to produce and submit to Congress a report that identifies all cost effective efficiency opportunities and provide a plan for attaining those reductions would jumpstart this process. If more resources are necessary this could be reported as well. Additional federal investment in energy efficiency will help the economy grow and decrease government spending in the long run.

Congress should define "all cost effective energy efficiency" and instruct the agencies to consider all costs and benefits including,

- Electricity, natural gas, water, and other resources saved;
- Savings from avoided energy supply costs;
- Savings from avoided capacity costs;
- Program costs (overhead and installation) incurred by the agency;
- Incremental measure cost (paid by the agency).

Savings over time should be evaluated over the life of the building or system based on projected energy cost escalation and by discounting the savings at the cost of money to the federal government (the interest rate on government bonds).

As the agencies continue to learn and succeed in energy efficiency, the lessons will be translated to the private sector where even larger savings will be generated.

Senator James M. Inhofe

1. You discussed the barriers that exist for greening in buildings when tenants and landlords aren't sharing the benefits. Do you see this as a problem with GSA owned buildings and their federal tenants? What is GSA doing to help incentivize agencies to go

green? Has GSA explored ways to pass the savings gained from energy efficiency measures on to the agencies? What are your recommendations for GSA and agencies to better address these issues?

This issue is most certainly still present in GSA owned buildings, albeit in varied forms. The funding for GSA and the leasing agency originate from different sources, meaning there will be conflict over who spends money and for what purpose. There may also be issues within either agency as to capital versus operational expenses. GSA needs to identify these issues and address them individually on a case by case basis.

A concrete example of one such issue can be found in most GSA spaces, where the tenants are not separately metered. This means that data on the energy use of individual tenant agencies is not available to allocate the benefits of efficiency improvements resulting from tenant behavior. It is similarly difficult to identify wasteful behavior. This acts as a disincentive to agencies who would consider efficiency improvements within their space to comply with the federal requirements because they will be forced to share the cost reductions with all the tenants when the rent is adjusted.

GSA could alleviate this disincentive by helping agencies install meters and meet their federal requirements to do so while utilizing the savings to recoup initial investment. Similarly GSA could begin coordinating whole building retrofits with tenant agencies (likely resulting in greater energy savings than individual space retrofits) and then committing to properly allocating the benefits of efficiency in proportion to tenant investment. The Energy Efficiency Lease guidelines mentioned in my testimony are an excellent starting point for creating the system by which these benefits can be allocated.

Market barriers other than split incentives are also present in GSA facilities, as GSA operates as a traditional landlord to agencies and is therefore subject to the same or similar constraints. For example, GSA must still guarantee a certain mechanical capacity in terms of watts per square foot that can be handled by the HVAC system in each space. meaning most systems are intentionally oversized and running below peak efficiency points. Utilizing correctly sized equipment and then planning for additional capacity if necessary is much more cost effective and saves energy. GSA is exploring ways to address this issue with its tenants and should continue to work towards a solution.

GSA must lead the tenant agencies in planning and executing efficiency retrofits and attempting to address market barriers. To put it plainly, GSA should "learn by doing" and determine the procedures and protocols that most effectively reduce consumption in their buildings through retrofits and operational improvements. Tools like the Energy Efficiency Lease can provide guidance, but the experience in implementation is priceless. To this point, if each agency had a plan to obtain all cost effective energy efficiency in their facilities, GSA could simply act as a retrofit administrator in its facilities and help agencies invest and coordinate whole building retrofits for deep efficiency improvements.

2. With so many Green Building Standards or Rating Systems in addition to LEED in operation (Green Globes for New Construction, (a Rating System) Green Globes for

Continual Improvement of Existing Buildings (a Rating System), EPA Energy Star Target Finder (a Energy Rating System for New Buildings), EPA Energy Star Portfolio Manager (a Energy Rating System for Existing Buildings), CHPS -- Collaborative for High Performance Schools (a Rating System for Schools), ICC-700 National Green Building Standard (an American National Standards Institute (ANSI), consensus process Rating System for New Residential Buildings (developed by the International Codes Council)), and with so many Green Building Standards or Rating Systems in addition to LEED about to be completed (such as: GBI/ANSI for New Construction (a new version of the Green Globes rating system developed using the ANSI consensus process - due to be completed by the end of 2009), ASHRAE 189P Standard for the Design of High Performance Green Buildings (an ANSI consensus process Standard - due to be completed by the beginning of2010), California's Green Building Standard (a statewide Standard which will have two performance levels for energy compliance - due to be completed by August 2009)), it is clear there is significant interest in building green. Why do you think so many systems have developed?

Different systems have been developed for different reasons. Some have been developed because a market niche was perceived. Others may have been developed in order to compete with existing standards, to provide more or less rigorous alternatives. For the most part, the different systems are not direct competitors.

The underlying differences in the building sector are the fundamental reason for the existence of so many standards. Lines are first drawn between residential and commercial, energy efficiency and "green" attributes, and then between new and existing buildings. These are then further divided by building type, especially in commercial. There is also a distinction between exceptional performance standards (like LEED, Green Globes, Energy Star) and standards written in code language (as many of the under development standards will be).

It is also worth noting that most of the efficiency and "green" systems are harmonized. For example the Energy Star tools are wrapped into LEED. In future cases, all parties will likely work toward harmonization. We are currently seeing coordination in the commercial buildings area between the USGBC, ASHRAE, EPA Energy Star, and DOE on harmonizing and simplifying methods for rating energy use.

Is NRDC working with the development of any of the other systems?

NRDC has participated in a variety of ways with the development of LEED. Our staff has and continues to contribute to various technical and steering committees convened by the U.S. Green Building Council. We comment during public comment periods on new or revised LEED rating systems, and we are a voting member in the approval of all rating systems. We particularly support the third-party verification aspect of LEED certification. We are also working on the coordination of various new and existing rating systems.

Do you think the increased competition is leading to better rating systems?

Increased competition can lead to better rating systems, or it can be a case of "bad money driving out good." For example, if the certification process in a certain rating system is significantly simpler and cheaper than its competitors and at least as effective, then other rating systems will be forced to improve and streamline. But if the system is cheaper and easier but less accurate or more subject to manipulation, competition could undermine the credibility of ratings.

The more important question is whether increased competition leads to better buildings. If the competing rating systems differ on substance, this will be shown in the buildings themselves. Inconsistent determination of energy savings, various component certification systems (such as sustainable wood products or the definition of local), and differing baseline standards can all lead to market confusion and average buildings claiming to be "green." Improper weighting of various categories (energy, water, air quality, materials, etc) can also skew a rating system and a building.

The market is not always able to differentiate between rating systems that have a credible verification process and those that are essentially "self-certifying." This is a key aspect to any green building label, and so to the extent that credible verification processes are eroded, you may have streamlined rating systems, but you won't get better buildings. Federal policy should foster competition between entities that operate credible verification processes, and use science based determinations for energy and water savings as well as component certifications.

3. Once the basic "low hanging fruit" of energy efficiency (lighting replacement, HVAC upgrades, better insulation) has been met, where are the next, most cost-effective, changes to make?

The best case scenario for improving a building is to take advantage of all the improvements mentioned (lighting, mechanical systems, and building envelope) during a whole building retrofit. In this scenario, the building is basically re-engineered to be more efficient and can take advantage of efficiency opportunities in the interactions between the systems that would not be available if only a lighting or HVAC improvement were to be pursued. Basically, the building itself is optimized rather than individual components. For example, if the lighting and building envelope systems are improved at the same time it is very likely that the mechanical system can be downsized as a result of reduced load. This helps the owner as smaller systems are less expensive and cuts the consumption as a mechanical system that is sized appropriately will operate at its peak efficiency point more often than one that is oversized.

Many building owners may think that they have taken advantage of the low hanging fruit but they may not have considered the benefits of a whole building retrofit. Doing so will allow them to identify the next steps to take to maximize energy and dollar savings.

Additional opportunities that fit the category of "low hanging fruit" are available by making sure the building is operated correctly. Even a building with the most efficient

deign can waste significant energy with poor operation. In most cases operational improvements can be made at no or low cost to the owner and good facility energy managers can pay for themselves many times over. This could be the next step after an efficiency improvement or retrofit or even before.

In more practical terms, an owner that has taken advantage of the "low hanging fruit" has likely found all improvements of 3 years simple payback or less. From there the owner could expand to the life cycle cost minimum point when considering the maximum time period that the owner is comfortable with. Individual measures could be considered but a whole building retrofit should also be evaluated as a single option.

Also, the definition of "low hanging" has often been applied only the cost of the retrofit and not to the level of thought or effort. Often deeper retrofits than cost less and save more than conventional ones are foregone because the building owner or manager does not want to put the effort into specifying or designing something better. This is not only a waste of money, both of investment cost and operating cost, but it retards innovation and competition.

4. What are the most important things that should be considered when selecting a green rating system?

From a building perspective, it is important that the categories, and points, if appropriate, be weighted according to scientific determination of environmental impact. In other words, you want rating systems that reward the most important improvements in performance rather than those that may, intentionally or not, encourage less worthy expenditures, thereby shifting investment away from higher impact improvements. USGBC has done an excellent job of re-weighting their credits within LEED utilizing life cycle assessment of impacts and they have committed to continuing this improvement.

From a policy perspective, the verification process for green building attributes is vital. Federal policy decisions will direct public and private investment and therefore this should be a major consideration. Assuming competing rating systems cover the same building niche and have scientifically determined rating criteria, then the system with the most credible and dependable verification procedure should be specified to protect public investment and prevent fraud and waste.

5. Is there anything that the committee should consider in drafting new legislation on greening of federal buildings?

In terms of rating system considerations, the two factors mentioned previously (credits/points awarded in proportion to environmental impact and credible verification processes) should be included in any future legislation.

Additionally, it would be extremely helpful for Congress to direct the agencies to identify all remaining cost effective energy efficiency opportunities and create a plan for attaining

those reductions. This could take the form of a report to Congress that would also include recommendation for additional resources that may be necessary.

Congress should define "all cost effective energy efficiency" and instruct the agencies to consider all costs and benefits including,

- natural gas/water and other resources saved;
- savings from avoided supply costs;
- savings from avoided capacity costs;
- program costs (overhead and installation) incurred by the agency;
- incremental measure cost (paid by the agency).

Each cost effective energy efficiency opportunity that remains represents wasted tax dollars and unnecessary emissions.

Senator BOXER. Thanks, Mr. Burt.
Dr. Bryan.

STATEMENT OF HARVEY BRYAN, PROFESSOR, SCHOOL OF ARCHITECTURE AND LANDSCAPE ARCHITECTURE, SCHOOL OF SUSTAINABILITY, ARIZONA STATE UNIVERSITY

Mr. BRYAN. Chairman Boxer, Ranking Member Inhofe and Members of the Committee, thank you for this opportunity to honor Earth Day by participating in this hearing on behalf of the Green Building Initiative or GBI, and the Green Globes rating system.

I am a founding member of the GBI Board and Chairman of the Energy Committee. My background is included in the written submittal.

I am a specialist in energy issues and served on the ASHRAE Committee responsible for developing the 90.1 national energy standard. While currently active in the development of Green Globes, I have also been active in the U.S. Green Building Council. I am a LEED-accredited professional, and helped shepherd several buildings through the LEED process, and was founding member and was board member of the Arizona USGBC chapter.

As an active member of the Green Buildings community, I chose to support the development of the Green Globes system in the United States because I believe strongly that the marketplace needs multiple tools and approaches to achieve high-performance buildings.

GBI commends the Committee for creating this opportunity to testify about GSA and energy efficient issues, and we are honored to be on this panel.

GSA has certainly been a leader in applying green building practices and has made considerable progress. There are many lessons to be gained from this experience. We also understand that the Committee is interested in ensuring that dollars spent on energy efficiency through the stimulus package results in measured savings. To this end, we would like to address two primary topics.

First, one of our greatest challenges is that many buildings designed to be energy efficient fall short once operational. GSA has many successes to its credit, but it is not immune to this fact. A key to solving this problem will be to shift the mind set of people who design, construct and operate buildings so that form follows function and performance, and become fundamental considerations from initial concept through design, construction and operations.

The second issue is measuring and specifically the fact of measuring buildings before and after they undergo renovations must be a priority. To this end, the Green Globes system is a good example of how practical and affordable tools can play that important role.

Regarding the first issue of performance shortfalls, the answer is better information, tools and education. Whether planning for a new or major retrofit, decisions should be based on the best performance data available. This is the area where we as an industry have fallen short. We rely too heavily on benchmarking to code. For instance, GSA has, as I understand, an arsenal of data available on the energy performance of its standard building pipes and has conducted baseline research on occupant comfort in many of the

buildings. And so this should be used as the primary data base, rather than building better than code.

It is worthwhile to note that innovative States such as California have created new building performance data bases to facilitate more accurate prediction because it is important to have accurate historical performance data. In fact, the Department of Energy's commercial building energy consumption survey should receive more funds for investment.

With regard to education and training, portfolio managers need tools to create baselines and interpret these results and prioritize improvements. For many building managers, this type of evaluation requires new tools.

Unfortunately, GSA has, in conjunction with DOE, has recently written a policy that calls for the use of only one rating system, LEED, for all Federal buildings that seek green building certification for either major retrofit or new construction. This approach not only supports a federally mandated sole source contract with one organization, the USGBC, the owner of the LEED system, but also stifles benefits and competition, which there are many.

Because of the affordability and ease of use, Green Globes has been used to evaluate a number of public and private sector buildings. Federal agencies such as DHHS, Interior, Veterans Affairs and State Department have used Green Globes.

In conclusion, GBI applauds GSA's leadership in applying green building technology and practices. We hope that the important part of the agency's plan will be to measure before and after performance of buildings. We encourage Congress to examine public policy in regards to new laws encouraging benchmarking tools such as CBECS data base.

Last, we ask the Committee to give direction to GSA to support the use of multiple rating systems and private sector solutions to encourage competition in the marketplace.

Thank you for this opportunity today.

[The prepared statement of Mr. Bryan follows:]

GREEN BUILDING INITIATIVE
www.thegbi.org

April 19, 2005

Oversight of the GSA and Energy Efficiency in Public Buildings

Green Building Initiative Testimony to the

Senate Committee on Environment and Public Works

Chairman Boxer, Ranking Member Inhofe, and Members of the Committee, thank you for the opportunity to honor Earth Day by participating in this hearing on behalf of the Green Building Initiative, or GBI, and the Green Globes® rating system. I am a founding member of the GBI board and chair of its energy committee. My background is included in the written submission, but I am a specialist in energy issues, and served on the ASHRAE committee responsible for developing the 90.1 National Energy Standard. As an active member of the sustainability community, I chose to support development of Green Globes in the US because I believe strongly that the marketplace—including both the public and private sectors—needs multiple tools and approaches to achieve its high performance goals.

GBI commends the committee for creating this opportunity to testify about GSA and energy efficiency issues—and we are proud to be on this panel next to some of the most accomplished leaders in the world of green building and sustainability. GSA has certainly been a leader in applying green building practices and has made considerable progress. There are many lessons to be gained from its experience.

We also understand that the committee is interested in ensuring that dollars spent on energy efficiency, through the stimulus package and in general, result in measured savings. To that end, we'd like to address two primary topics.

1. First, one of our greatest challenges is that many buildings designed to be energy efficient fall short once operational. GSA has many successes to its credit but is not immune to this fact. A key to solving this problem will be to shift the mindset of people who design, construct and operate buildings so that form follows function and performance goals—which should include occupant comfort as well as energy and water efficiency—become fundamental considerations from initial concept through design, construction, operations, and renovation.

2. The second issue is measurement—and specifically, the fact that measuring buildings before and after they undergo renovation must be a priority. To that end, the GBI's Green Globes system, which is still fairly new in the US, is a good example of how practical and affordable tools can play an important role.

Regarding the first issue of performance shortfalls, the answer is better information, tools and education.

- Whether planning for design or major renovations, decisions should be based on the best performance data available. This is an area where we as an industry fall short. We rely too heavily on benchmarking to codes.

- For instance, GSA has—as I understand it—an arsenal of data available on the energy performance of its standard building types, and has conducted baseline research on the occupant comfort in many of its buildings.

Instead of designing to perform "better than code", we hope that GSA will begin benchmarking using its historical performance data.

- It's worthwhile to note that innovative states, such as California, are creating new building performance databanks to facilitate more accurate predictions. Because of the importance of having accurate historical performance data, existing national databanks such as the Department of Energy's Commercial Buildings Energy Consumption Survey (or CBECS) database should receive more of our investment dollars.

- With regard to education and training, portfolio managers need tools to create baselines, interpret the results, and prioritize improvements. For many building managers, these types of evaluations represent new ground. Tools such as Green Globes could be used to evaluate buildings that receive stimulus money.

Having laid out some of the challenges that GSA and other portfolio managers face, I'd like to say that NGOs—some of whom are on this panel—and the private sector are working to address many of these issues. If Congress and federal agencies support renewed investment in data collection as well as healthy competition in the market, we are confident that the data available to us will improve, as will the standards, rating systems, tools, education, and even codes themselves. Unfortunately, some agencies still write policies that focus on LEED only, which tends to stifle the benefits of competition—of which there are many.

While Green Globes is widely used in Canada on both public and private buildings, it was at first quite novel here. It takes a slightly different approach in that more than a third of its points are weighted in energy and buildings must be at least 25% more efficient than average before earning any points for energy consumption. Green Globes is also integrated with ENERGY STAR. This was a fundamental decision made by GBI's technical committee to benchmark against the best performance data available by climate, building type and operational characteristics—and we believe it's key to ensuring that buildings perform as predicted.

GBI is also the first organization to take a commercial building rating system through a third-party codified ANSI consensus process—and is on track to release the first American National Standard for commercial green buildings later this year. This work has resulted in many innovations in the areas of carbon metrics and cradle-to-grave evaluation of building assemblies and carbon emissions. GBI also uses highly qualified and credentialed individuals to conduct third-party assessments and is the first and only organization to require on-site review of commercial buildings prior to awarding a Green Globes certification.

Because of its affordability and ease of use, Green Globes is being used to evaluate a growing number of public and private sector buildings.

- Federal agencies such as DHHS, Interior, Veterans Affairs and at the State Department are using Green Globes to create baselines and improve performance. Two GSA regional offices are also using Green Globes on a number of existing buildings within their portfolios. One is an EPA Regional Headquarters office in Chicago that we understand the GSA intends to dual certify using Green Globes and LEED.

- Higher education institutions like Arizona State University, Drexel University, and the University of Arkansas are also using Green Globes, as are state and local governments.

- In the private sector, a growing list of corporations and notable buildings—such as the Empire State Building—are choosing Green Globes because of their need for tools that are both credible and cost effective.

In conclusion:

- GBI applauds GSA's leadership in applying green building technologies and practices. We hope that an important part of the agency's plan will be to measure the before and after performance of buildings that receive stimulus money and that projections will be based on historical performance data.
- We encourage Congress to examine public policies to ensure that new laws encourage benchmarking against existing data and to increase investment in data collection efforts like DOE's CBECS database.
- Lastly, we ask that GSA and other agencies encourage competition in the marketplace by using and supporting multiple rating systems and private sector solutions.

Thank you for the opportunity to be here today.

Green Building Initiative Background and Relevant Information

The Green Building Initiative (GBI) is a 501(c)(3) non-profit education organization based in Portland, Oregon. It was established to accelerate the adoption of sustainable design and construction practices by promoting credible and practical approaches to green building for both residential and commercial construction.

Harvey Bryan, who testified on April 22, 2009 before the Senate Energy and Natural Resources Committee, is a professor in the School of Architecture & Landscape Architecture and the School of Sustainability at Arizona State University, and serves on the GBI Board of Directors. His bio appears at the end of this submission. The GBI Board is an independent, multi-stakeholder group comprised of construction professionals, product manufacturers, non-profit organizations, university officials, and other interested third parties. Each board member is allocated one vote to guide the GBI, ensuring an equal balance of influence. For a list of additional board members, please visit the board page of the GBI Web site.

In terms of funding, GBI has benefited from the support of a core group of industries that are committed to advancing the green building movement by creating a variety of credible options for design and building professionals. Since its inception, GBI has also worked tirelessly to diversify its financial base through membership, training and other initiatives. A complete list of funders can be found on the members and supporters page of the GBI Web site.

Having long recognized the power of collaboration, GBI has sought to foster relationships with a variety of organizations related to the built environment with the goal of helping to accelerate the acceptance of sustainable design and construction in the marketplace. To this end, GBI has a formal partnership with the US Environmental Protection Agency's ENERGY STAR® program, as well as Memorandums of Understanding with the following organizations:

- American Institute of Architects (AIA)
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- Associated General Contractors of America (AGC)
- Building Owners and Managers Association (BOMA)
- National Association of Home Builders (NAHB)

GBI has also established collaborative relationships with, among others:

- Alliance to Save Energy (ASE)
- Architecture 2030
- Sustainable Buildings Industry Council (SBIC)

GBI Mission

The GBI is committed to accelerating the adoption of green building practices by offering credible and practical tools that make green design, management and assessment more accessible to a wider population of builders and designers.

Residential Buildings – For residential construction, GBI has a unique strategic partnership with the NAHB. Since the inception of the NAHB Model Green Home Building Guidelines in January 2005, GBI has worked to promote them with Home Builder Associations (HBAs) across the country and, where desired, to help HBAs use them as the basis for their own local programs. Among our services, GBI provides technical assistance, promotional and marketing support, hosts educational seminars and conducts market research.

With the release of the National Green Building Standard for residential construction—which the NAHB developed in cooperation with the International Code Council through a formal process overseen by the American National Standards Institute (ANSI)—the GBI role has evolved into the promotion of both the standard and its related green building program, NAHB Green.

To date, GBI has secured partnerships with 52 HBAs across the US, enabling us to directly educate more than 60,000 home builders with regard to green building and related offerings of the NAHB.

Commercial Buildings – For the non-residential market, GBI owns the rights to promote and distribute Green Globes®—a highly innovative green management tool that features an assessment protocol, rating system and guide for integrating environmentally friendly design into commercial buildings. It features modules for New Construction (Green Globes-NC) and the Continual Improvement of Existing Buildings (Green Globes-CIEB) and facilitates recognition of completed projects through third-party assessment.

Green Globes is successful because it is rigorous, yet easy to use and affordable. Due to its unique, Web-based platform, the detailed information and references users need to design energy-efficient, healthier and environmentally sensitive buildings are embedded in the tool, enabling it to provide relevant information as required.

Innovation and Competition

When GBI was established in late 2004, there were no green building rating systems with the specific objective of supporting mainstream design and building professionals. This is at the core of both NAHB Green and the Green Globes system and is fundamental to encouraging energy efficiency and other green building practices on the broad scale that is clearly necessary.

Of primary importance, having more than one rating system supports the diversity of buildings, design and building professionals, and budgets. It also creates an atmosphere of healthy competition, which does for green building what it has done in countless other areas—drives improvements, lowers costs and benefits the ultimate consumer, which in this case is our shared environment.

In the last four years, for example, GBI:

- Became the first green building organization to be accredited as a Standards Developing Organization (SDO) by the American National Standards Institute (ANSI),
- Embarked on a process to establish Green Globes as the first ANSI standard for commercial green building, which will be completed this year,

- Introduced Green Globes-CIEB to strengthen the link between sustainable design objectives and actual building performance,

- Developed the first tool for integrating life cycle assessment (LCA)—widely considered to be the most effective way to compare the environmental impacts of building materials and assemblies—into a green rating system, and

- Chose to advance the green movement as a whole by supporting the development of a generic version of its LCA tool—the ATHENA® *EcoCalculator for Assemblies*—which is available free of charge from the ATHENA Institute (www.athenasmi.ca).

As evidenced by these highlights, GBI's offerings have evolved as new opportunities have arisen to help mainstream practitioners accelerate their adoption of green building practices. Our goal is for green building to become the norm and, while GBI has arguably become a leading voice in the movement, we are committed to remaining nimble and continuing our role as an agent of positive change.

Green Globes – History and Credentials

Originally developed in Canada, the Green Globes environmental assessment and rating system represents more than a dozen years of research and refinement by a wide range of prominent international organizations and experts.

The genesis of the system was the Building Research Establishment Environmental Assessment Method (BREEAM), which has been used to certify close to 100,000 buildings in the UK and was brought to Canada in 1996 in cooperation with ECD Energy and Environment. Pioneers of this project included Jiri Skopek, John Doggart and Roger Baldwin, who were the principal authors of the BREEAM Canada document.

In 1996, the Canadian Standards Association (CSA) published BREEAM Canada for Existing Buildings. More than 35 individuals participated in its development, including representatives from the following organizations:

Bell Canada
Carrier
Canadian Construction Research Board
Canadian Standards Association
ECE Group
Environment Canada
Environmental Planning Institute of Canada
Halozone, Inc.
International Council for Local Environmental
Initiatives
Natural Resources Canada
National Research Council
Ontario Hydro
Ontario Realty Corporation
Tescor Energy Services, Inc.
University of Toronto

In 1999, ECD Energy and Environment worked with TerraChoice, the agency that administers the Government of Canada's Environmental Choice program, to develop a more streamlined, question-based tool, which was introduced as the BREEAM Green Leaf eco-rating program. This program led to the development of Green Leaf for Municipal Buildings with the Federation of Canadian Municipalities later that year.

In 2000, BREEAM Green Leaf took another leap forward in its evolution, becoming an online assessment and rating tool under the name Green Globes for Existing Buildings. Also that year, BREEAM Green Leaf for the Design of New Buildings was developed for the Department of National Defense and Public Works and Government Services Canada.

In 2002, Green Globes for Existing Buildings was introduced online in the United Kingdom as the Global Environmental Method (GEM). Work also began to adapt BREEAM Green Leaf for the Design of New Buildings into the online Green Globes for New Buildings. Participants in this process included representatives from:

Arizona State University
Besto Group
Building Owners and Manufacturers Association of Canada
Canadian Construction Association
Canadian Standards Association
Department of National Defense
DST Group
Elia Sterling Associates
Energy Profiles
GWL Realty
MCMP Architects
Natural Resources Canada
Public Works and Government Services Canada
Stewart Energy
TerraChoice
The Athena Institute

In 2004, Green Globes for Existing Buildings was adopted by BOMA Canada under the name *Go Green Comprehensive* (now *Go Green Plus*). Since then, the Canadian federal government has adopted *Go Green Plus* as a green management tool for its portfolio of more than 500 existing buildings. It is also integral to the Ontario Power Authority's program for energy retrofits, and is used by most major property management firms.

Green Globes and the Green Building Initiative

In 2004, GBI acquired the rights to distribute Green Globes for New Construction in the United States. In adapting the system, the only changes made were those necessary to make the system appropriate for the US market (e.g., converting units of measurement and integration with the ENERGY STAR program).

Since then, GBI has committed itself to ensuring that Green Globes continues to reflect best practices and ongoing advances in research and technology. To that end, the GBI sought and received accreditation as an ANSI standards developer and began the consensus-based process of establishing Green Globes as the first ANSI standard for commercial green building. As part of the process, GBI established a technical committee and subcommittees featuring more than 75 building science experts, including representatives from four federal agencies, states, municipalities, universities and leading construction firms, as well as building owners. A complete list is available on the GBI Web site.

As part of the ANSI process, GBI relinquished control of the Green Globes tool to the technical committee, or consensus body, which is determining the final standard. This is the first time an organization has committed its commercial building rating system to further development through ANSI's third-party codified, consensus-based committee process, which represents the ideals of balance, transparency and public input. As of this writing, the proposed standard has undergone two public comment periods and, once finalized, is expected to include a number of improvements.

For example:

- In the energy section, the proposed standard uses carbon dioxide (CO_2) as the basis for calculating the performance path instead of the previous kBtus per square foot per year of energy consumed, which will require the calculation of CO_2 equivalent. This is particularly important in the context of climate change and the need to consider buildings in terms of their total carbon footprint.

- The proposed standard is the first green building rating system to fully integrate life cycle assessment (LCA).

  The green building movement is experiencing a fundamental shift in the way it approaches sustainable design, away from a prescriptive methodology—whereby materials are assumed to have environmental benefits based on rapid renewability, recycled content or other attributes—toward one that emphasizes measurable performance. LCA is a means to this end because it allows the impartial comparison of materials, assemblies and even whole buildings, from cradle-to-grave, in terms of quantifiable impact indicators such as embodied energy and global warming potential.

  LCA is widely accepted in the environmental research community as one of the best ways to assess building sustainability, but its use has been limited by the perception that it is too complex or time consuming for mainstream practitioners. To remedy this, GBI commissioned a tool that provides instant LCA results for hundreds of building assemblies, making it more accessible than ever before.

  Although developed for integration into Green Globes, GBI recognized the tool's importance to the broader sustainable design community and supported the development of a generic version, the ATHENA® *EcoCalculator for Assemblies*, which is available free of charge from the Athena Web site (www.athenasmi.ca). GBI encourages the use of this tool among other green building organizations and universities, and at all levels of government.

- The proposed standard incorporates a calculator that allows users to project water consumption of new buildings based on their designs. As with other elements of building sustainability, water use has a significant impact on energy consumption.

Green Globes and Energy Efficiency

The Green Globes system is unique in a number of ways that directly impact energy efficiency.

- Green Globes relies on information from the US EPA's ENERGY STAR program and, as such, uses data generated through the Department of Energy's Commercial Buildings Energy Consumption Survey (or CBECS). CBECS provides data on actual building performance by building type, which is the first step in determining how to achieve a building that performs significantly better than average.

- More than a third of Green Globes' point system is weighted to energy efficiency. To receive points under energy performance, a building must be compared to an average building using the ENERGY STAR system. Only those buildings projected to perform in the top 25% of buildings nationwide are eligible for points in this category.

- The two modules of Green Globes seamlessly connect new building design to existing building performance. Certification with Green Globes-NC is just the first step to achieving a truly green structure. Green Globes-CIEB has an important role to play in incentivizing the ongoing measurement and monitoring of building performance—as re-certification every three years is necessary to ensure that a building is in fact being managed in a manner that maintains the integrity of its initial assessment.

- As indicated above, changes to Green Globes made as part of the ANSI process include a shift in the way it calculates energy efficiency from kBtus per square foot to carbon dioxide equivalent and the integration of a tool that provides LCA results for hundreds of common building assemblies. Both are important in the context of climate change for determining and improving a building's energy efficiency as well as its overall carbon footprint.

- Because of its low cost, Green Globes is appealing to budget-sensitive projects such as those that utilize public funds or those that may not otherwise be considered in a green building context.

Using Green Globes for New Construction

Although many green building tools claim to be Web-enabled, this is typically limited to providing online information and templates. Green Globes' use of Web tools is far more complex and offers a fully interactive experience.

Once an online questionnaire is completed, the system generates a point score and project design highlights. The report generated includes an educational component, which emphasizes sustainability attributes of the building and provides detailed suggestions for improvements that should reduce the building's overall environmental impact. This is supported by links to further information regarding best design practices and standards or specific information on building systems and materials. Links are

selected to provide educational information, government references, NGOs, and industry research relevant to each stage of project delivery and to help users achieve a higher performance design and thus higher Green Globes score.

In Green Globes-NC, projects are awarded up to 1,000 points based on their performance in seven areas of assessment:

1. **Project Management – 50 Points**

   The Green Globes system places an emphasis on integrated design, an approach that encourages multi-disciplinary collaboration from the earliest stages of a project while also considering the interaction between elements related to sustainability. Most decisions that influence a building's performance (such as siting, orientation, form, construction and building services) are made at the start of the project and yet it's common, even for experienced designers, to focus on environmental performance late in the process, adding expensive technologies after key decisions have been made. This is costly as well as ineffective.

   To ensure that all of the relevant players are involved, the system tailors questionnaires so that input from team members is captured in an interactive manner, even on those issues which may at first appear to fall outside their mandate. For example, while site design and landscaping may come under the purview of the landscape designers, the questionnaire prompts the electrical engineer to get involved with design issues such as outdoor lighting or security. Thus the Green Globes format promotes design teamwork and prevents a situation where, despite strong individual resources, the combined effort falls short.

   Also included under project management are environmental purchasing, commissioning, and emergency response.

2. **Site – 115 Points**

   Building sites are evaluated based on the development area (including site selection, development density and site remediation), ecological impacts (ecological integrity, biodiversity, air and water quality, microclimate, habitat, and fauna and flora), watershed features (such as site grading, storm water management, pervious cover and rainwater capture), and site ecology enhancement.

3. **Energy – 360 Points**

   To simplify the process of energy performance targeting, Green Globes-NC directs users to the Web interface used for the ENERGY STAR Target Finder software, which helps to generate a realistic energy consumption target. As a result, an aggressive energy performance goal can be set—with points awarded for design and operations strategies that result in a significant reduction in energy consumption—as compared to actual performance data from real buildings.

   As previously stated, Green Globes is the only green rating system to use energy data generated through the US Department of Energy's Commercial Buildings Energy Consumption Survey

(CBECS), which is widely considered to be the most accurate and reliable source of energy benchmarking information.

In addition to overall consumption, projects are evaluated based on the objectives of reduced energy demand (through space optimization, microclimatic response to site, daylighting, envelope design and metering), integration of "right sized" energy-efficient systems, on-site renewable energy sources, and access to energy-efficient transportation.

4. **Water – 100 Points**

Projects receive points for overall water efficiency as well as specific water conservation features (such as sub-metering, efficiency of cooling towers and irrigation strategies), and on-site treatment (of grey water and waste water).

5. **Resources – 100 Points**

The resources section covers building materials and solid waste. It includes points for materials with low environmental impact (based on life cycle assessment), minimal consumption and depletion of resources (with an emphasis on materials that are re-used, recycled, bio-based and, in the case of wood products, certified as having come from sustainable sources), the re-use of existing structures, building durability, adaptability and disassembly, and the reduction, re-use and recycling of waste.

6. **Emissions, Effluents and Other Impacts – 75 Points**

Points in this section are awarded in six categories, including air emissions, ozone depletion and global warming, protection of waterways and impact on municipal waste water treatment facilities, minimization of land and water pollution (and the associated risk to occupants' health and the local environment), integrated pest management, and the storage of hazardous materials.

7. **Indoor Environment – 200 Points**

According to the US EPA, indoor air can be up to 10 times more polluted than outdoor air, even in cities where the quality of outdoor air is poor. This has obvious health implications, but the consequences are also economic. A study by Lawrence Berkeley National Laboratory found that improving indoor air at work could save US businesses up to $58 billion in lost sick time each year, with another $200 billion earned in increased worker performance.

This section evaluates the quality of the indoor environment based on the effectiveness of the ventilation system, the source control of indoor pollutants, lighting design and the integration of lighting systems, thermal comfort and acoustic comfort.

Projects that achieve a score of 35% or more become eligible for a Green Globes rating of one, two, three or four globes, as follows:

One Globe:	35-54%
Two Globes:	55-69%
Three Globes:	70-84%
Four Globes:	85-100%

However, buildings cannot be promoted as having achieved a Green Globes rating until the information submitted has been assessed by a qualified third party.

The Green Globes third-party assessment process features a rigorous two-stage approach. Stage I can be initiated by the design team as soon as the Construction Documents questionnaire is finalized. The completed questionnaire is assessed against the documentation generated throughout the design process and, once complete, the design team receives a Certificate of Achievement. However, a final rating cannot be achieved until after Stage II, which occurs post-construction and includes an on-site inspection by a qualified assessor. This stage can be initiated as soon as construction is complete.

The GBI currently oversees a network of Green Globes-trained assessors comprised primarily of licensed architects and engineers with significant experience in building sciences and sustainability issues. However, to accommodate increasing demand and further strengthen our third-party assessment program, GBI is working in cooperation with CSA America, Inc., a leading developer of standards and codes, to develop an independently accredited Green Globes Personnel Certification Program. CSA America is developing the program on behalf of GBI for assessors using the Green Globes system to verify achievements in the design and operation of green buildings. It is the industry's first independently administered certification program for third-party assessors of green buildings.

Green Globes for Continual Improvement of Existing Buildings

Considering that the United States is home to more than 100 million buildings, the need to improve the performance of existing structures is a necessary prerequisite for widespread energy efficiency. The missing element—until last year when GBI introduced Green Globes-CIEB—was a practical and affordable way to measure and monitor performance on an ongoing basis.

Green Globes-CIEB allows users to create a baseline of their building's performance, evaluate interventions, plan for improvements, and monitor success—all within a holistic framework that also addresses physical and human elements such as material use and indoor environment.

As in Green Globes-NC, energy is the most significant area of assessment within Green Globes-CIEB. A combined focus on energy use, building features and management helps to pinpoint where performance is lacking and what corrective action is required. The system uses the ENERGY STAR Portfolio Manager to determine a consumption target for each building type and, where appropriate, buildings must meet a minimum performance target of 75% based on the comparable ENERGY STAR building.

US Market Acceptance

To date, 47 buildings have successfully achieved Green Globes third-party certifications across the United States, and 41 buildings are at some stage in the certification process. Another 152 buildings are registered with Green Globes-NC and 265 buildings are registered with Green Globes-CIEB.

Green Globes has also been formally recognized by the public and private sectors including the following:

- Eighteen states have included Green Globes in green building legislation, regulation or executive order, including: Arkansas, Connecticut, Florida, Hawaii, Illinois, Indiana, Kentucky, Minnesota, New Jersey, New York, North Carolina, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Virginia and Wisconsin.

- Green Globes is included in insurance packages offered for green buildings by Aon Corporation, Fireman's Fund Insurance Company and Liberty Mutual.

- Several federal agencies—including the Department of Health and Human Services (piloting Green Globes on the NIH building in Maryland and an Indian Health Services building in Arizona) and the Department of the Interior (piloting Green Globes on a building in New Mexico) are not only using the Green Globes tools but have also included Green Globes in their formal sustainability policies. The Department of Veterans Affairs, State Department and two GSA regional offices are also actively using Green Globes.

- To date, thirty-five federal government buildings have been registered to use Green Globes and are at some stage in the assessment process. This includes 10 Green Globes-CIEB registrations from the US Government Services Administration (GSA) Region 9 (San Francisco), three Green Globes-CIEB registrations and one Green Globes-NC registration from GSA Region 5 (Chicago), 21 Green Globes-CIEB registrations from the US Department of Veterans Affairs and one Green Globes-CIEB registration from the US Department of State.

- Since the launch of Green Globes-CIEB, some of the largest corporations and real estate companies in the country have chosen to use it for their existing building portfolios, including the USAA Real Estate Company, which plans to use Green Globes-CIEB to assess up to 20 buildings; Tishman Speyer-Chicago, which is gearing up to assess 12 buildings; Capital One, which recently certified nine buildings at its Richmond, Va. headquarters and has begun the process of certifying its Washington DC-area facility in McLean, Va.; and the Carol Woods Retirement Community, which used the tool to assess and improve the environmental performance of 10 buildings at its Chapel Hill, NC facility.

The Potential of Green Building Rating Systems to Accelerate Building Efficiency

In addition to the specifics associated with Green Globes, green building rating systems in general help to accelerate progress toward energy efficiency in three important ways:

1. Rating systems define achievable goals beyond mandatory codes.

- A building must be approximately 25% more efficient than an average building built to the ASHRAE 90.1-2004 standard (or code) in order to achieve any points in the Green Globes section on energy performance.

2. Rating systems provide the means to measure progress against these goals.

   - For example, the Green Globes system rates on a 1000-point scale, with points awarded based on the building's performance against a broad range of environmental and energy metrics. Using the system helps building owners set priorities during the design process, measure outcomes once the building is operational, and plan for improvements.

3. Rating systems create a market dynamic that rewards those who go beyond mandatory codes. In the private sector, this includes incentives such as green insurance products and mortgages and there is a growing body of information supporting the marketing benefits of green building certification. However, this is equally important in the public sector where buildings that perform well serve as examples for others—both at a technical level, for those who manage the performance of buildings, and as a more general encouragement to the community to follow suit.

Conclusion

It is the GBI's view that substantially improving the energy efficiency of buildings one of the most important things Congress can do to address climate change and other impacts associated with energy consumption. We commend the Senate Committee for Environment and Public Works for seeking to use its oversight authority to achieve this goal, and thank you for the opportunity to contribute our testimony.

Speaker Biography

Dr. Harvey Bryan, Ph.D., FAIA, FASES
School of Architecture & Landscape Architecture
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Arizona State University

A recognized specialist in building technology, Dr. Bryan has authored more than 100 papers and articles on the relationship between technology and the design of high-performance buildings. He has served on the design faculties of the Massachusetts Institute of Technology (MIT), Harvard, and the University of California, Los Angeles (UCLA), where his research received support from numerous public and private sponsors. Dr. Bryan was a member of teams that received three Progressive Architecture Awards, co-chairman of the 1986 International Daylighting Conference, will be serving as chairman for the Solar 2010 Conference and was associate editor of the international journals, "Building and the Environment" and "Solar Energy."

Dr. Bryan is currently active in several professional and technical societies. He has served on the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) committee responsible for developing the 90.1 National Energy Standard and is presently serving on the ASHRAE committee responsible for developing "Proposed Standard 189.1P, Standard for the Design of High-Performance Green Buildings." He has a B.Arch. from Arizona State University, a M.Arch., M.S. and Ph.D. from the University of California, Berkeley, is a fellow of the American Institute of Architects, a fellow of the American Solar Energy Society as well as a Fulbright Fellow.

Dr. Bryan also serves on the GBI/ANSI technical committee responsible for developing Green Globes and establishing it as the first American National Standard for commercial green buildings.

Responses by Dr. Harvey Bryan following testimony on April 22, 2009.

Senator Thomas R. Carper

1. **As you know, the federal government is the nation's single largest energy consumer. In recent years, a range of policies has been implemented to reduce costs and save energy, including energy intensity targets, alternative project financing, efficient procurement requirements, and a variety of training and technical assistance. How can we expand or refine these policies and programs to maximize efficiency and cost savings?**

We believe that beginning to work on the accountability equation is the next worthwhile challenge. The federal government, like all building portfolio managers, needs to ensure that it has the proper tools in place to hold its decision makers and implementers accountable for achieving performance goals for each building. To have true accountability, outcomes must be linked to a person that has the ability to influence those outcomes. There should also be accountability at each phase of a building's life. The person being held accountable should be empowered to make and implement decisions including those which impact the budget. They should also be educated and trained to understand the consequences of their decisions.

Measuring the resources that are crossing the building boundary (i.e., energy and water metering) is critical to evaluating success or failure in meeting operational goals.

To determine how to refine the policies that impact accountability and ensure that we are measuring apples to apples, we need to seek the following information from GSA:

- Who is accountable for ultimate building energy and water performance?
- What is their educational background to make those decisions?
- What actual performance data is being measured and what were the assumptions used? How can you ensure we are comparing apples to apples (projected assumptions versus actual performance assumptions)? What actual portfolio data is each building being compared to and were the assumptions the same?
- How are the accountable persons applying lessons learned from actual portfolio energy performance data to ongoing operations and design/construction of new buildings?
- What are the standards for continuous accountability?

Senator James M. Inhofe

1. At the hearing, many barriers were discussed that exist for greening in buildings when tenants and landlords aren't sharing the benefits. Do you see this as a problem with GSA owned buildings and their federal tenants? What is GSA doing to help incentivize agencies to go green? Has GSA explored ways to pass the savings gained from energy efficiency measures on to the agencies? What are your recommendations for GSA and

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agencies to better address these issues?

If it is accepted that the desired benefits from green buildings are healthy buildings and more efficiently operated buildings then the tenants and owners both benefit. However, where there is tension between the two parties the benefits of green building are often looked at too narrowly and measured by only one attribute ($ saved).

The other item we would like to comment on here is that other agencies have reported that they have been told by GSA that they can use only LEED to determine whether a building is "green" and we believe that it is inappropriate for a federal agency to be advocating for and dictating use of one private brand or label.

Generally speaking, we would encourage transparency among the agencies. The agencies are balancing many different priorities from security through safety and meeting overall requirements for the facility, not to mention achieving the federal agencies' Guiding Principles requirements and any agency-specific design and operation requirements. If agencies are given as much information and control as possible, they will be best able to manage their operations to achieve their overall goals.

Also, if agencies are able to choose the best tools for their individual needs to arrive at overall performance goals, whether that means Green Globes, LEED, or other rating systems or tools, the government and overall market will be better served.

2. Has GBI worked with GSA and GSA tenants? What was that experience like? Is there demand from GSA or federal agencies for alternative green systems to LEED?

3. What are the most important things that should be considered when selecting a green rating system?

4. You have worked with both LEED and GBI. What concerns you about the government picking one system over another? How are these two systems different?

We would like to answer these three questions together. We would like to stress that we believe it is WRONG for the federal government to view green building rating systems as an ultimate goal or as a definition of a high performing building. As stated previously, GSA and the other agencies are accountable to the federal MOU and Guiding Principles (generic performance and process oriented goals), Executive Order, the P100, and their own agencies' specific design and operational guidance documents. Rating systems should be a means to an end...to make achieving their goals simpler.

When we lean toward using the rating system with a third-party assessment process attached—and both Green Globes and LEED provide well rounded services to support agency efforts—we should be thinking about these as tools in our toolkits. But we should NOT expect them to be the sole definition of performance measurement. While to have accountability, it is important to also have incentives, we must remember that the ultimate goal is not achieved when one earns a plaque on the wall.

Therefore, GSA and the federal government should not call for the use of any one rating system or require certification as a blanket requirement. If general performance goals are set, the individual agencies, regions,

and departments that are held accountable should be encouraged to pilot and use a variety of rating systems and tools to help them achieve their functional, operational, and sustainability goals.

GBI has worked with both GSA regions, a number of Veterans Affairs buildings, and the State Department and Green Globes® is written into the formal policies of the Dept. of Interior and Dept. of Health & Human Services. GBI has heard from a number of federal agencies and GSA regional staff that they welcome the opportunity to use an alternative to LEED. Some within GSA also report that they feel hampered in their desire to select an alternative because of headquarters' overt endorsement and sole sourcing of the LEED rating system.

We would encourage Congress to direct the agencies to keep their written policies (online endorsements, P100s, procurement policies, RFPs, etc.) open to allow the use of "nationally recognized rating systems." Further, we believe that the most important considerations in selecting a rating system is whether it is user friendly, educational, cost effective, developed in a third-party codified consensus process, and if it supports the needs of those ultimately responsible for benchmarking, analyzing, and reporting on each individual building's functional, operational, and sustainability performance.

We would direct Congress to the University of Minnesota study conducted that was completed in September 2006 which compares both LEED and Green Globes as well as to a paper I co-wrote and published by the Sustainable Buildings 2008 Conference, Melbourne, Australia, September 2008 where 7 buildings that were dual certified were analyzed for similarities and differences in the rating systems. In conclusion, the differences in the systems are more in process and technical emphasis and competition between these two systems will continue to drive innovation and cost efficiencies.

5. Currently, we are in a period of "greening" where there is a lot of "low hanging fruit" to be had. Once the basic "low hanging fruit" of energy efficiency (lighting replacement, HVAC upgrades, better insulation) has been met, what are the next, most cost-effective, changes to make? What will the costs associated with these be? At what point will making savings in energy efficiency and performance of existing buildings outweigh the costs of the upgrades?

Your question about balancing energy containment versus other opportunities to reduce energy consumption is insightful. Ultimately, there will always be a minimum amount of energy used in any given building if it is to be occupied. That number if measured in kbtus and if based on current benchmarks is probably somewhere in the 25,000 to 30,000 kbtus/sq. ft/yr. You can be as efficient as possible on lighting and HVAC, etc., but you will still have electronics and other equipment that creates plug loads. Therefore, there is more than likely a baseline where we will have trouble reducing the consumption too much more below that figure. What I would look to next is how to reduce "energy waste". Typically a building is 50% efficient...consuming twice as much energy as it needs. There is a huge potential to go further by focusing on reducing waste.

Energy waste is tackled through thorough evaluation of the loads, capacities of systems that meet those loads, and the controllability by building management of those systems. The control systems will need to be transparent, simple to understand, and simple to operate. The complexity of systems today is untenable. By improving the control systems, we can significantly reduce energy waste.

Reducing the cost of this needed upgrade should be tackled by the entire industry and looked at as an opportunity for cost avoidance.

6. Given the considerable advances in green building products over the past 5 years do you think GSA should revisit their analysis in the 2006 Pacific National Lab study (with 2005 data) that they used to justify their decision on which green building system to use?

Please see my answer to #2,3,4 above. The 2006 study (based on 2005 data) was not in our opinion useful. It was overseen by the GSA staff that made the decision in the first place to sole source use of only one rating system. GBI would NOT recommend revisiting such a study. We believe that Congress should direct the federal agencies to keep their policies open to "nationally recognized rating systems" and let the individual teams—whether headquarters staff, regional staff, or paid consultants—determine which rating system will help them benchmark, analyze, and report on how they met design goals and performance outcomes. Competition should be encouraged and the 2006 study merely helped one agency orchestrate a selection process that was already pre-determined.

We believe that a more profitable use for federal monies would be to study the performance outcomes achieved by use of the stimulus package to upgrade existing structures and to develop a comprehensive lessons learned package for use by the entire industry. How were dollars used? What were the goals? Were the goals achieved? If so, how? If not, why not? Who was accountable and what can we learn from the decision-making process used?

7. Is there anything that the committee should consider in drafting new legislation on greening of federal buildings?

8. Is there any additional information you would like to convey to the committee on the topics of energy efficiency and greening of buildings?

Please consider the following recommendation to be answer for both #7 & #8. We greatly appreciate the opportunity to testify before this Committee and to share our expertise and thoughts on how to progressively move forward with our energy and environmental building performance goals.

We hope that Congress will:

- Avoid the appearance of sole-sourcing of rating systems in all current and future policies related to green building by mentioning all nationally recognized systems and future equivalents or by setting specific performance goals and avoiding mention of any brand names. A great example is H.R. 2187, The 21st Century Green High-Performing Public School Facility Act which mentions Green Globes, LEED, or an equivalent program. Another example is the American Clean Energy and Security Act of 2009 , H.R. 2454 which mentions "...recognized green building rating systems...". It is a move in the right direction to see legislation and regulatory policy that is neutral on the subject of rating systems.

- Direct the federal agencies to keep written policies open to all "nationally recognized rating systems" to ensure that headquarters, regional staff, and contractors have open and competitive processes by which to choose one or more rating system/certification process (or not to choose one).

- Continue to closely work with experts in the areas of building performance data collection, benchmarking, and accountability. Increasing funding for DOE's CBECS database and tools like EPA's Energy Star program (and continuing to improve the data and assumptions behind them) is a win-win for Congress and the nation's building industry.

Thank you

Senator BOXER. Thank you, sir.

I would like to say, of course we need to measure. That is absolutely essential. We want to make sure that when we spend a dollar, we get more than that over time, and that is something that I think everyone agrees with. Otherwise, we are wasting our time and money.

I wanted to announce here, and Senator Lautenberg you would be interested in this, Wal-Mart just put out a press release just now that to broaden their sustainability efforts, they are expanding their solar power program in California over the next 18 months at 10 to 20 additional Wal-Mart facilities. It is very exciting because we know the jobs that will go with this. They say increasing the use of solar is the right thing to do for the environment and makes tremendous business sense, especially in these economic conditions.

I think it is important to note a lot of my colleagues are saying this isn't the time to do anything. It is the opposite. When you move toward energy savings, it is going to be better for the economy, for job creation. And they say that they are committed to expanding their solar presence in California. I would say it is because California's laws are so incentivizing to putting in solar, wind and geothermal.

Mr. Gatlin, you mention in your testimony that GSA has adopted your organization's green building rating system, which I support. And it has set a goal for each project to receive at least the silver certification. Now, there are two higher certifications.

Is there any reason, and I would ask Mr. Burt the same, why we shouldn't shoot higher for a platinum or a gold?

Mr. GATLIN. Well, I will just say that the USGBC has attempted to set a benchmark target for green performance without being prescriptive in any way about what measures or pathways that organizations have to take. So we actually have four certification levels, including basic, silver, gold and platinum.

In a post-occupancy study that the New Buildings Institute conducted for us 2 years ago, they found almost a lockstep correlation of energy savings and the increased certification levels on LEED, with platinum buildings achieving typically 40 percent energy savings.

So given the principle that the savings will actually pay for the up-front investment, it in many cases is a good investment. I think that GSA is simply setting a target that they think is achievable, given that platinum buildings in many cases require an all-out effort to use all available new technologies and practices. So I think they would rather go broad and achievable, rather than set a target that may be only for a subset of their portfolio.

Senator BOXER. Mr. Burt, what is your feeling? If you are retrofitting, is it really too hard to get to the platinum, but we should have that for our new buildings? What is your feeling?

Mr. BURT. I think it is important to document which part of the different LEED categories we are emphasizing. So if we have an overall target of LEED silver, but a very aggressive target for energy and water savings, then you may find that eventually in constructing a new building or renovating a new building, you actually may certify higher than silver to a gold or platinum level, and you

have prioritized those measures which will provide the most return on investment.

Senator BOXER. That is not my question. Do you think that we should shoot for higher than silver in our efforts?

Mr. BURT. Yes. I think it is possible to shoot for higher than silver. I think there are precedents across the Country where different cities have pointed to LEED silver as a possible code target, which means that the enhanced performance should be above this bar.

Senator BOXER. And am I right in saying it is obviously easier to get to platinum if you are building a new building, because then you could—you don't have to go backward?

Mr. GATLIN. That is not necessarily the case. I would also just like to comment that we hope that GSA will embrace the LEED system for operations and maintenance. It is a benchmarking system for green operations and maintenance just as aggressively as they have embraced our system for design and construction.

Senator BOXER. Well, that is good.

Mr. GATLIN. There are just so many different paths to get there. We did have a case study of a building in California owned by the Adobe Company that was built to Title 24 California energy efficiency standards, had utility rebates, and yet they were still able to identify an additional $1 million in green investments. They have made that existing building platinum. It paid for itself in 10 months.

Senator BOXER. Wow. That is a fabulous, I know Adobe Systems.

Well, what I am going to do is hand the gavel to Senator Lautenberg. If he has to go, leave, then he can hand the gavel to Senator Merkley. And if Senator Merkley promises me, if another colleague comes, he stays for that, and then close it down. I don't know how long Senator Lautenberg can stay.

So I am going to hand the gavel over to you, Senator.

I want to thank this panel very much, all of you, for your sage words. We are going to move further. We are going to have a bill here ready for mark up on the 7th of next month. We are going to move even further because this is energy saving. This is savings in the pockets of taxpayers. So thank you very much.

Senator, here is the gavel.

Senator LAUTENBERG [presiding]. Thank you. I take the gavel without ceremony, Madam Chairman.

[Laughter.]

Senator LAUTENBERG. Thank you for this awesome responsibility.

One of the things that I see happening is that as we talk about product reductions in energy use, cleaner air emissions, et cetera, we still I think fail to have the public understand exactly what our mission is. When we talk about saving lives or saving quality of life, or permitting those who may be impaired with a respiratory disease, what it means.

I come on this sort of full boat because one of my grandchildren is asthmatic, and I know the trials that my daughter goes through to make sure that Alexander has, that she knows where the nearest clinic is when they go to emergency clinic, when they go for him to participate in an athletic event. And she is conscious of his

wheezing and the sensitivity of his ability to deal with these things.

I lost a sister to asthma in a sudden attack when she was 53 years old. Yes. And so I think the picture has to be even more clearly presented, that we are talking about, again, saving lives. And even as we talk about saving money, saving quality of life that permits people to go about the things they must do or enjoy doing.

And so I commend you all. I think you are on a mission of great importance to the human race. I believe that climate change is something compared to a plague, perhaps the 11th plague. The Old Testament lists 10 plagues. This is a plague if we don't take care of this, that could overcome mankind, humankind. And again, you are acting as good soldiers in this, and I really respect that your organizations are on the right track.

Isn't there a way of examining the emissions coming from the buildings that go beyond simply energy efficiency? How about the products that are used in building materials, more the kind of boards that are used so commonly—pressboard and other materials that in themselves, we talk about saving kids from materials that are plastics, that have a different metabolism when they are mixed with certain food products, et cetera.

So is there a concern about that? Mr. Burt, does your organization look to these things as well?

Mr. BURT. Certainly, that is an extremely important concern. I would say that in an existing building when you take a look at the materials that are in there, you need to make sure that all the materials and everything in the building is up to health and safety standards, and is a healthy environment for the occupants, and then go and invest in the energy efficiency and the water efficiency measures.

I would also point out that in the LEED rating system, there is a category for indoor environmental quality, which covers the off-gassing of chemicals and toxins from the products and also makes sure that there is adequate ventilation in the building.

Senator LAUTENBERG. And is there an official recognition of products now, an examination of these things, and perhaps a label that says yes, this meets a green standard? What do you think, Mr. Bryan?

Mr. BRYAN. Yes. There are several organizations that are now testing all products in the building industry for emissions. Green Seal and Green Guard are two organizations that are doing that. Both the Green Globes system and LEED also acknowledges those as protocols for use within the indoor air quality section.

Senator LAUTENBERG. Is the Green Globes, is that a lighting?

Mr. BRYAN. No. Green Globes is a system that I have been talking about which is sort of a parallel system to some of the other rating systems like LEED and other systems that are out there that are in the marketplace today.

Senator LAUTENBERG. I see. No, because immediately when you think of globe, you think of——

Mr. BRYAN. I understand.

Senator LAUTENBERG. Yes.

Mr. BRYAN. But again, Green Seal and Green Guard are two protocols, both systems used to acknowledge material impact. The

Green Globes system also does a material life cycle assessment calculation that actually does comparisons between products on both embedded energy, as well as impact to the air, water and disposal landfill. And so it is a very robust calculator that gives designers that information about the impact those materials have on the occupants of those buildings.

Senator LAUTENBERG. Is there interest in those using products—this is stepping outside the building opportunities—products that have to be dealt within trash disposal and so forth? All of these things combine to make a threatening environment. In this case, we are talking about something where we see an ability to control it. The Government, there is a lot of might that is included in the suggestion that the Government has a standard.

But when we look around, again I see this as the perhaps most important problem that mankind faces, and that is protecting an environment, protecting nature and its being when we see all of the—I am a tree hugger and have been for a long time. When you see what is happening with the disappearance of species, with things in the sea that are changing, and their ability to afford sea life nutrition and nourishment.

So we have a war on our hands that we must win. And so, once again I thank you for being here. The fact that we are light in attendance doesn't mean that we are light in interest. The record will be kept open for questions that will be conveyed to you, and please if you get these questions, answer as thoroughly and as quickly as you can.

With that, I go to the fact that Senator Merkley is in the last seat doesn't mean that his views or his knowledge is any different than those who are sitting up in the front.

Senator Merkley.

Senator MERKLEY [presiding]. Thank you very much, Senator.

I wanted to ask a question about carbon sequestration. It has been pointed out at various times that when you build buildings with wood, you are taking a significant amount of carbon and taking it out of cycle, if you will. I was just wondering if any of you from the LEED system or the Green Globes system can comment on how that calculates, or if it is a factor in how you evaluate buildings.

Mr. GATLIN. I am not sure that I can give you a specific estimate of the carbon sequestration of wood in buildings. We can certainly research that and provide that in follow up. But I would just mention that the committee that oversees our LEED rating system—again our products are all member-driven, consensus-based, and it is an open transparent system in the market—has spent the last year aligning the credit categories within the LEED rating system to the known environmental impacts and sort of the weighting between those environmental impacts.

So carbon emissions comes up as the most significant aspect of the certification simply because of the magnitude of the climate change. We are looking at not only the energy associated with operations of the building, but the energy that it took to create the materials in the buildings, life cycle assessment if you will.

So I do not have the specific figure on the carbon sequestration of wood, but it is within our Scientific Advisory Committee's goal

of aligning the credits as much as possible with the ultimate environmental impacts.

Senator MERKLEY. OK, thank you.

Mr. Burt or Bryan.

Mr. BRYAN. Yes. The Intergovernmental Climate on Climate Change has determined a 100-year life cycle for dealing with products. If wood products in a building has less than a 100-year life cycle, it is considered to be a closed loop. That means in its growth or absorption of CO_2, and its eventual decay, that it will be a closed system. If it has longer than 100 years, it has to be accounted for, at least in their system, and I think most of the environmental rating systems and system systems are assuming that protocol.

Wood looks very good generally when we do comparisons with other material for this reason. However, there are in larger buildings, you are dealing with structural issues and wood tends to have problems when you deal with multiple-story buildings because of the structural issues. Like for small buildings, wood is a very, very appropriate product. While we don't encourage any one material, when you go through the process very often those better materials from a carbon sequestering standpoint will shine.

Senator MERKLEY. OK. Second, and thank you for your answers. A second question I wanted to ask about is in terms of GSA and the enormous number of buildings and enormous number of rooftops that they have, is the GSA fully engaged in perhaps the type of contracts energy—savings contracts where, subcontracts, if you will, out the installation of the solar panels, and then you basically get them installed for free, if you will, and over time come to own them.

Has the GSA been proactive? Is there a tremendous amount more they can do? What is your sense of that?

Mr. GATLIN. I will take a quick crack at that. I believe that GSA has been proactive, especially using its construction funding and its modernization funding to expand the adoption of green roofs, either light-colored roofs or vegetative roof systems which not only have heat island reduction benefits, but also stormwater mitigation benefits.

I believe that with its existing stock, it has not moved aggressively yet to tap into the types of performance contracting vehicles that would allow them to take the savings stream from their utility bill payments and essentially front load them to some capital improvement efforts that could very well include those green roof upgrades.

I believe the Department of Energy has handled the Federal energy performance contracting specifications and has vehicles that are more than available to do that within GSA stock.

Senator MERKLEY. OK, great. Any other comments?

Mr. BURT. GSA has prioritized the rooftop photovoltaics with some of the limited scope projects that they have released for the recovery funding, but I wouldn't be able to speak to the financial vehicle for making that happen.

Senator MERKLEY. OK.

Mr. BRYAN. I think they are doing a very good job. I think on a couple of issues, I think all buildings should be what I call solar ready, even though they may not be putting on the system right

now; that they keep the stairwells, elevator shafts, things like that, from protruding into the, let's say, unobstructed portions of the roof; try to gang them along the northern side of the building. Also vents and other types of things, we have a lot of problems with our air filters and ventilation fume hoods, things like that.

Again, some buildings on my campus I know are completely inappropriate for solar, even though we have wonderful access in Arizona for solar energy, because of the design of the rooftop. And so I think we can develop some protocols to actually be solar ready and be available for solar in a few years if we can't do it right now.

Senator MERKLEY. I think my time is up, but Senator Whitehouse has arrived. No wait, Senator Udall has arrived. Sorry, looking right past you.

[Laughter.]

Senator UDALL. Thank you, Mr. Chairman. I appreciate it.

Thank you to the panel, and great having all of you here today.

I believe that one of the most productive things that the GSA could do to promote renewable energy would be to expand its efforts to install photovoltaic solar systems on the roofs of Federal buildings.

In regards to solar power, we have great technology and manufacturing ability in the U.S., but we need to expand the demand for it in order to bring down the cost. What should Congress and GSA do to encourage solar installation on Federal buildings?

Mr. GATLIN. One of the things that I mentioned in my testimony was extending the lifetime of renewable power contracts. Now, much of that will be for green-certified power through the grid, but there also are arrangements where the owner of the buildings can actually lease out the rooftop to the utility for the application of those.

I don't know specifically within the acquisitions legislation what, if anything, needs to be changed, but I do know that there was some discussion on the House side about extending the time of those power purchase agreements to go beyond the current 10-year cap and that will actually allow for more dedicated development of green energy resources for Federal buyers.

Mr. BURT. I think the extension of the power contracts period and the development of solar-ready buildings are both excellent ideas. I would also point out that it is important for GSA to make sure that they are doing the efficiency in the building as well so that a greater portion of the building's power can be provided by solar, either right away or eventually if they are solar-ready.

Mr. BRYAN. Yes, on my campus at Arizona State University, we put in only in about 9 months almost two megawatts of photovoltaics, and this year we are planning about eight more, so we will possibly by the end of the year 10 megawatts of installed power.

And we did notice a lot of the problems. We had some limitations on our State constitution about public-private contracts that we had to get around to extend our period to deal with some of these power purchasing requirements. And so we had to take some sort of creative, or creative sort of cuts at that. And as I was saying, I would assume the same kinds of restrictions and inertia that exists within some Federal laws that I would like to think could be

reviewed so we can take advantage of this third-party financing because it is very hard to get capital, particularly in State government, for any of these types of projects.

Senator UDALL. The GSA has decided to use LEED certification for its green building branding efforts, but we have been told that there are other significant green building certification standards. Should GSA choose one standard to allow a Federal building to be called green, to the exclusion of other equivalent standard-setting organizations?

Mr. GATLIN. Since both of us on either side of Mr. Burt represent the two standards, we will look to him to be an objective arbiter. But I would just say that within our LEED system, we have set up a new organization called the Green Building Certification Institute which will be equipped to scale up the certification to tens of thousands or even hundreds of thousands of buildings.

The demand for primarily LEED certification in the commercial building marketplace, both private and publicly owned, has grown exponentially since 2006, I think due to the realization not only of the cost savings and health benefits, but in many cases private buildings are simply worth more as an asset that are green-certified.

So I would say that our system, I believe our third party certification system is the most robust. It is the furthest along and most established, and now through the Green Building Certification Institute, we have 10 global certification bodies that will be expanding our capacity many-fold. All of them are very familiar with the ISO requirements for certification—International Standards Organization.

So through those partnerships, I think our certification institute is very well equipped to handle the market demand.

Mr. BRYAN. Much of my testimony addressed or sort of countered that with the attributes of the Green Globes system. However, there are I think about last time I counted, there are seven other systems in operation and three in the works. So why do we go with one? I don't understand that. A government should not be giving any system, no NGO, a sort of leg up on any other system until we really go to the market and really shake these systems down.

I think it is very important to take advantage of all the building inspectors out there. Over 100,000 building inspectors work for municipal governments. The International Code Council, which is a major body that develops building codes, have just completed the ICC 7000, which is the national green building standard. It is a residentially oriented standard, but that process is going to allow the training of building officials to do this inspection process in the field where they are in their own local jurisdictions.

Green building is not rocket science. You don't need any very highly specialized persons to do it. A well-trained building inspector who knows the industry, has been working in the industry for some time, can do these inspections.

Also, the State of California is developing their own green building standard. The ASHRAE 189 is developing a standard that will probably be introduced into the International Code Council process and be codified, so it actually could be then administered by building inspectors.

And the other aspect, Green Globes is web-based and all we need to expand is adding more service. We do have the third-party verification system in place, and that is being administered by the CSA America, which is an ISO certification organization.

So we have a third-party hands-off process of certifying the verifies for the Green Globes system. I just want to underline the need to incorporate many stakeholders that are already doing a very effective job in building the industry, try to bring them into the system, particular the building inspectors.

In doing green buildings, we are talking about thousands and thousands of buildings that we have to go through this process. We have to scale that up at a very high level of certification and verification, and we cannot do that by developing new organizations. We should use the existing manpower we have in the field.

Mr. BURT. The most important thing here is saving the energy and saving the water in the buildings, and verifying that this is done correctly. So it shouldn't be necessarily a question of which tool or this tool or that tool. We need to make sure that the tools we are using are actually resulting in the savings that we need to have.

I am not nearly as familiar with Green Globes as I am with LEED, and I can see that LEED does a very good job of that.

Senator UDALL. Thank you very much.

Senator MERKLEY. I wanted to follow up on Senator Udall's question. Why are so many organizations forming? The LEED organization existed and Green Globes has jumped in, and you mentioned that there are seven, and that there are three more forming. What is the impetus behind so many different groups jumping into this conversation about how to identify a green building, if you will?

Mr. BRYAN. Well, I think there is tremendous demand out there, and again, organizations like ASHRAE have been in place for a number of years. The International Code Council has been in place for a number of years. They know the industry very well, and they want to make sure they are positioned as sort of the ramp-up is happening, which I think is happening now, especially with the stimulus money and the various other activities going on nationally.

So these organizations I don't think have a hidden agenda. These are working. Both ASHRAE and ICC and Green Globes are working with the ANSI, the American National Standards Institute, consensus process. So these are open committee meetings that decide the various protocols for these documents. These are not closed activities being done by a member-only organization.

Senator MERKLEY. Let me frame the question a little bit differently. Is it primarily differences in ideology as you balance different environmental components that drive the proliferation of organizations? Or the issue of how you ramp up to meet the demand, if you will, to get certification through the pipeline, if you will? I will just expand that to anyone.

Mr. BURT. I think it is important to note that not all of the programs mentioned are actually direct competitors. They have arisen to occupy different niches in the green building industry. ASHRAE and ICC are putting things out in code language, which is slightly different from what LEED does, where it is an exceptional label,

basically. You are documenting that you are far above the code level.

There are also different systems that are focused on existing buildings and operations than are focused on new construction. So they are not all direct competitors.

Also, for example, EPA's portfolio manager is directly tied into many of the other programs, so there is a lot of communication going on across all the borders as well.

Mr. GATLIN. Senator, USGBC was set up as a member organization. Our members are companies, governments and institutional owners and managers of buildings. And we have been absolutely astonished that even while the construction market and other industries have had a significant downturn, that the growth in our membership has actually continued at a pace in excess of what it was in 2006 and 2007.

The fastest-growing source of our members is building contracting professionals. I just want to add that it has always been in our foundations and our bylaws to have a completely open, transparent process. The rating system is developed by the industry experts who populate our membership, the 20,000 companies and organizations, and also has to be balloted—any of those changes to the rating system have to be balloted by our membership and approved.

So we do not have a staff-driven rating system. We do not have a lobby interest-driven rating system. There is true balance across all sectors of the building industry.

Senator MERKLEY. Thank you.

Senator Udall.

Senator UDALL. Thank you, Chairman Merkley.

As you all know, the Congress put in place the Energy Independence and Security Act of 2007, which has specific targets in it that we have been talking about today, this 55 percent in 2010 and then 100 percent in 2030. I would be interested in your opinions that we could accelerate those targets. I mean, the way we are proceeding at this point and from your vantage point, do you think those could be accelerated or moved up?

Mr. GATLIN. It is our opinion that more can be done in the existing buildings arena from a green building perspective. The broad scope measures called I believe in Mr. Prouty's testimony, some of the generic measures that they are installing in buildings, are really the ticket there on the existing building side.

Through every financing means necessary, whether it is through appropriations or whether it is through third-party financing vehicles such as performance contracting, there is a significant amount of opportunity in the Federal sector.

And as was mentioned before, even when there has been a lighting or HVAC system upgrade within the last 10 years, there has been such technology innovation even within the last 5 to 10 years that there will be many more cost-effective upgrades to go back to some of those buildings that were upgraded as recently as 10 years ago.

Mr. BURT. I agree with what was just said. We can't necessarily predict when the technological innovations will happen. We are very confident that it will happen. So we have to be careful about

setting hard goals and deadlines too far out in the future because we don't know the exact timing.

That said, one thing I talked about in my testimony is the need for GSA to identify all the remaining cost-effective energy efficiency in the rest of the facilities and strategize how do we go about getting that. And I think if they did that, we would have a lot better sense of when it can be done, how it can be done, and how soon, and how much we can accelerate the process.

Mr. BRYAN. I also agree. However, I have seen in the industry in the past, from the private sector, is the first couple of years there seems to be a fairly good downward sloping that they are on a trajectory, beating the trajectory. That is because they are going at the low-hanging fruit, the easy things. Lighting, variable speed motors, things like that are easy things to do and retrofit. The harder things are re-glazing, reinsulation, large fit-out of large mechanical air conditioning systems. Those are the big ticket items.

So my recommendation is that we have to be diligent. We have to look to the long term. We have to have the resources there for the long term, the heavy lifting, and going beyond the low-hanging fruit as far as the conservation and efficiency efforts are concerned.

Senator UDALL. Thank you very much, and thank you, Chairman Merkley. I see we have been joined by Senator Klobuchar.

Senator KLOBUCHAR [presiding]. Thank you very much.

Thank you all for being here. We are doing a lot of work with green buildings in my State, the State of Minnesota. People don't always think of it as a solar State given how cold it is, but we are doing a lot with that, as well as wind and other things.

I just want to talk in more detail about the LEED certification process. I know you just mentioned that, Dr. Bryan. I have heard a lot about that from our people, the cost associated with it and potential improvements to it. Could you talk about the costs associated with it? How much you estimate it is? And what we could do to improve it?

Mr. BRYAN. Well, again, I was sort of countering the LEED system with another system that I felt is actually more cost effective because it is a much lower first entry cost into the system. It is web-based. It is very low cost, with ability to interact with the system. Documentation is minimum because we have onsite verification of a third party verifier.

So this reduces the cost. Much of the LEED cost is not the direct cost as far as paying for the system. It is the indirect cost of the documentation and a lot of the stuff you need to collect for submittal to get your certification.

And as I mentioned, the Green Globes system has an onsite third party reviewer that basically helps alleviate a lot of that stuff. The material still has to be there, but it is done onsite in a kind of a day-long walk through the building. When you see something you know it is in there, rather than just something in a specification that is submitted as a submittal.

So that is one of the major differences. So I think it is a little bit more cost effective for that reason.

Senator KLOBUCHAR. Anyone want to add anything?

Mr. GATLIN. Senator, if I may, representing the U.S. Green Building Council. We have had to make enhancements to our sys-

tem and also expand our contractor pool substantially, as there are now over 20,000 buildings in the pipeline. So that 20,000 buildings has scaled up dramatically from just fewer than 5,000 about 4 years ago.

Our fees for providing the certification essentially are just directly to cover the review expenses. It comes in at 3.5 cents per square foot, where typically the green building improvements yield a dollar or more per square foot in direct operating savings, and even indirect savings in many cases, as GSA showed in its post-occupancy study, a 13 percent reduction in maintenance costs down the line.

So they are fairly small. I think extremely small relative to the benefits. And I think what you don't get by simply referencing the rating system as opposed to pursuing certification is the added impetus to do it right once you know you are going to go through a third party review. And that has in many cases sort of flushed out some mistakes in the process that can go back and be corrected.

Senator KLOBUCHAR. You know, I hear it over and over again that they are not doing LEED because it is just too expensive. Maybe when you described it as three cents, that is probably the best way to describe it. For them, they are looking at how much of a cost it would be when they are trying to do the environmentally right thing, so on the margin it is maybe more expensive to build, and then they look at this LEED thing, so they don't do it. They go to ENERGY STAR or some other thing.

So that is what I am trying to grapple with here, because I think nearly every building that I have been to, except the few that did the LEEDs in our State, say we are not going to do it.

So I just think it is an issue. I have been surprised at how much it has come up when I have been out and about, really all over the Country.

The other thing I am trying to figure out as we try to push for more green buildings, more energy efficient buildings, what the factors are that make some metropolitan areas have more of them. I am asking this question very openly, not because I know the answer, but is it State laws? What is it, like Portland is No. 1; Minneapolis-St. Paul is number 25; Atlanta is No. 3. You know, what is the thing that makes incentives for more green buildings?

Mr. GATLIN. I think in Portland, in Chicago, and several cities around the Country, almost 50 cities—I am sorry, in almost 35 States and over 100 jurisdictions there are incentives. And those certainly helped in the early days. The early adopters were either in cities with incentives or where governments through their own took on an executive order mandate to have green buildings.

In Atlanta and in other cities, we have seen a really robust commercial market embrace LEED. There is increasing empirical studies, as well as evidence through broker transactions that green buildings, LEED-certified buildings, sell at higher transaction costs, actually have more attractive rental rates. So there is a market demand as well.

Senator KLOBUCHAR. Mr. Burt.

Mr. BURT. I think the incentives are very helpful, especially when they are structured in a way that they set a performance target and tell the industry to go do it, because then the industry re-

sponds. They learn how to do it, and they learn how to do it well. They bring the costs of doing it down so that we get a nice feedback cycle where we continue to learn about how to do the buildings.

I think it is also very helpful once the process has happened that the market then values those buildings greater because they realize this is a better building, it is a better space, and it is much better across the board. And that is how you get a continuing cycle of green building.

Senator KLOBUCHAR. Thank you.

Mr. BRYAN. As an educator, I think education is a major force. I know I am training the next generation of students who will be architects and engineers. They are really hungry for this information, and I know they are going to go out and do a good job because they are getting well trained. I think all our universities have courses on green buildings now, among all the architectural and construction schools and many of the engineering schools across the country. It is an exciting area.

I think also on the local level, again education by again professional organizations or their membership, the American Institute of Architects, ASHRAE, National Association of—all these organizations I think are doing a much more effective job than they did a few years ago on educating their membership to these issues.

As I mentioned before, it is not rocket science, but there is some good preparation and understanding, especially in the use of computer modeling, computer simulation. We have gotten in a lot of trouble, a number of people have been using tools, predicting performance and we have not seen that performance in reality, and that has given, I think, some of the systems a questionable—some of the systems have been put into question because of some poor consultants using some tools that they shouldn't have even had a driver's license before using a computer program like DOE–2 or one of those other programs out there.

So there is a lot we have to do in education to ramp up everybody's level of expertise.

Senator KLOBUCHAR. All right. Thank you.

All right. Well, that is a good end. I want to thank all of you for being here, and the hearing is adjourned.

[Whereupon, at 11:30 a.m. the committee was adjourned.]

[Additional statements submitted for the record follow:]

STATEMENT OF HON. BENJAMIN L. CARDIN, U.S. SENATOR FROM THE STATE OF MARYLAND

Madam Chairman, thank you.

Over the last 2 years we have heard testimony from a number of individuals. A little over a year ago, for example, we heard from Dr. Pachauri, and we are grateful that he has come back to provide us with a further update on the science of global warming.

I want to thank Chairman Boxer for her work in keeping the focus on sound science as this debate continues.

While the list of witnesses has included the occasional obligatory nay-sayer, we have seen a steady stream of scientists who have provided a remarkably consistent set of facts regarding:

- the state of the global climate system,
- projections on how the climate system is changing, and
- the likely impacts these changes will have on health and human welfare, agriculture, transportation systems, and important ecosystems like the Chesapeake Bay.

Much of the testimony has been informed by the latest, peer-reviewed science and represents a consensus of the scientific community on the nature of the climate system's warming, the causes for that warming, and the degree to which this warming will continue.

Climate change will likely have an impact on our Nation's treasure, the Chesapeake Bay. Possible impacts for the Chesapeake include increased sea-levels, lower dissolved oxygen levels, more precipitation, and changes in various species' abundance and migration patterns. Many species will deal with the interaction of several climate change effects, which could impact their ability to survive in the Bay region.

It is not only wildlife that are threatened by climate change—the EPA has found that increasing greenhouse gas concentrations pose a threat to human health due to a number of factors including more deaths attributed to heat and the increase in vector-borne diseases. In Baltimore, the EPA projects that a 3 degree Fahrenheit overall increase in air temperature could increase the heat-related death toll by 50 percent from 85 to 130 people annually.

The research upon which these findings are based is rooted in an extensive, careful analysis of past and present observations of the atmosphere and ocean coupled with advanced numerical predictive models.

The science record is remarkable in another key aspect. Time is not on our side. The scientific community consistently warns us that the longer we wait to take aggressive action to curb greenhouse gas emissions, the steeper the climb will be to meet our targets.

Thankfully, today we have not simply a strong scientific consensus on the issue. We also have an increasing body of evidence that our efforts to address climate change will result in a number of net positives for America and the world.

• Our national security is enhanced as we reduce our reliance on foreign sources of oil.

• Our economy will be recharged as we move to a sustainable energy system and the thousands of green jobs it will produce in solar, wind and bio-energy development and energy efficiency projects.

• And, lowering greenhouse gas pollution will almost certainly also result in a lowering of other air pollutants, meaning our citizens will be breathing cleaner air.

Thankfully, today we have both an Administration in the White House as well as the congressional leadership we will need to tackle this extraordinary challenge.

I look forward to hearing from today's witnesses and learning more about the latest climate science research.

And I look forward to using this hearing as a strong springboard for us as we confront one of the greatest challenges of our age. With your strong leadership, I look forward to drafting and passing a climate change bill this year. Let's get started.

Thank you, Madam Chairman.

STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Thank you, Madam Chairman, for holding this hearing. I am pleased to have the opportunity once again to discuss energy efficiency within our committee.

Using less to do more is a fundamental economic principle that American industry has practiced with great success. Its application has helped the United States rise in prosperity and, I believe, will be a key element of our economic recovery. Moreover, increased productivity in the form of energy efficiency and innovation—along with developing new domestic sources of energy and ensuring a diverse energy supply—are essential to strengthening our Nation's energy and financial security. For these reasons, it is important to pursue opportunities for energy efficiency and innovation in our public buildings.

While I was not a supporter of the Stimulus bill, it did contain some productive elements. For example, it provides an unprecedented opportunity for GSA to make investments in the existing stock of Federal buildings. It is extremely important that GSA's decisions make these buildings more energy efficient and that such improvements are cost-effective. It is also important that the choices GSA and other Federal agencies make to "go green" deliver measurable performance results.

It's my understanding that so-called "green" buildings don't always perform as intended. This raises serious concerns for me, and it also raises fundamental questions: What research still needs to be done on the actual benefits of green buildings? What standards and benchmarks are currently being used for various aspects of building design and certification? How can the Government make sure that we are spending money on the efforts that ensure we are meeting our energy goals and not creating unintended burdens on our taxpayers and communities?

I am concerned that GSA selected LEED as its only category of "green" building for new construction. I believe that the increased interest in green buildings and advances in technology in recent years have and are creating new building rating systems. These systems should be allowed to compete in the market and Government agencies should be able to determine which system meets their performance requirements. I do not think that GSA should be in the business of selecting one system over another. Additionally, we need to practice careful oversight to ensure that the best rating systems are being used in Government decisions.

I am pleased to have Dr. Harvey Bryan, Professor at the Arizona State University School of Architecture and Landscape Architecture with us today on behalf of the Green Building Initiative. He will share his expertise with us today and update us on what GBI has been doing since our last hearing. I am also looking forward to hearing from Acting Administrator Paul F. Prouty as well.

Thank you again, Madam Chairman, for this opportunity.

[Additional material submitted for the record follows:]

Testimony of Associated Builders and Contractors

U.S. Senate Committee on Environment and Public Works

Chairman Barbara Boxer and Ranking Member James Inhofe

Hearing on:

"Oversight of the GSA and Energy Efficiency in Public Buildings"

April 22, 2009

The Voice of the Merit Shop®

Associated Builders and Contractors (ABC) appreciates the opportunity to submit the following testimony for the official record.

We would like to thank the Committee Chairman, Barbara Boxer and Ranking Member, James Inhofe, as well as the members of the Senate Committee on Environment and Public Works for holding today's hearing entitled "Oversight of the GSA and Energy Efficiency in Public Buildings".

ABC is a national construction industry trade association representing more than 25,000 merit shop contractors, subcontractors, materials suppliers and construction-related firms within a network of 79 chapters throughout the United States and Guam. ABC member contractors employ more than 2.5 million skilled construction workers, whose training, skills, and experience span all of the twenty-plus skilled trades that comprise the construction industry. Moreover, the vast majority of our contractor members are classified as small businesses. Our diverse membership is bound by a shared commitment to the merit shop philosophy in the construction industry. This philosophy is based on the principles of full and open competition unfettered by the government, nondiscrimination based on labor affiliation, and the award of construction contracts to the lowest responsible bidder through open and competitive bidding. This process assures that taxpayers and consumers will receive the most for their construction dollar.

The purpose of our testimony is to bring to the attention of members of the Committee several areas of concern facing the construction industry as it pertains to U.S. General Services Administration (GSA).

Green Jobs

ABC member companies have been leaders in green construction since before this terminology came into fashion. In fact, ABC has been at the forefront of the green building movement since its inception. ABC member SIGAL Construction was a founding member of the U.S. Green Building Council (USGBC) as well as one of the authors of the Leadership in Energy and Environmental Design (LEED) rating system. ABC members continue leading the construction industry by utilizing sustainable construction methods and practices. According to Engineering News-Record in 2008, 53 of the Top 100 Green Contractors were ABC members generating close to $15 billion in revenue with more than 2,800 LEED APs on staff. (Attachment 1)

ABC chapters and member companies are actively engaged in training workers in a wide variety of skilled occupations and are constantly striving to keep pace with technology and innovation in order to make certain America has the skilled workforce it deserves, and that all American workers, regardless of union affiliation, enjoy equal opportunity of access to critical job training. However, the continued participation of open shop contractors, and the job opportunities for over 84 percent of the construction workforce they employ, in the booming green building market is threatened by the efforts of many in Washington, D.C. to exclude non-union companies and training providers from participating in new government funded green jobs training programs.

The Green Jobs Act, enacted as part of the "Energy Independence and Security Act of 2007" which was signed into law in December 2007, establishes National Energy Training Partnership Grants to fund training programs targeted at creating an efficient energy and renewable energy skilled workforce. Specifically, the Green Jobs Act would require any entity applying for these grants to partner with organized labor. The reality is that this language would bar the numerous open shop training programs from receiving this grant funding.

Organized labor makes up just 15.6 percent of the private construction workforce and likely represents a similar amount of work in the green building market. Given the desire to see a continued increase in the use of green building and green technology, it seems that limiting the ability to participate in green training to such a small percentage of the construction industry would make this growth difficult. If the green building market is going to continue to expand in the coming years as some groups predict, the participation of the open shop will be a crucial factor in ensuring there are enough skilled workers to meet the demand.

To that end, ABC, along with many other construction and business groups, strongly supports the "Green Jobs Improvement Act" soon to be introduced in the U.S. House of Representatives by Congressman John Kline which would amend the Workforce Investment Act to allow both union and open shop training providers access to the federally funded energy efficiency and renewable energy worker training programs. This bill would give all workers the opportunity to train in the ever increasing field of green construction and would not block certain training providers access simply because they choose not to be affiliated with organized labor.

The advances in the technology and skill involved in green building, and the benefits of their use, is indeed a welcome trend for contractors, skilled workers and the end user. It is our view that the most efficient path to encouraging this continued growth of this sector is by giving all training providers, regardless of union affiliation, access to federal training programs so that the greatest numbers of workers can be trained in green jobs. In today's tough economic times, especially in the construction industry, Members of Congress have a responsibility to provide all workers with training opportunities paid for by their tax dollars.

ABC looks forward to your continued efforts to promote green building opportunities for all contractors.

Union-Only Project Labor Agreements

President Obama's Executive Order 13502, signed February 6, 2009, encourages federal agencies and recipients of federal assistance to attach union-only requirements, known as project labor agreements (PLAs), to all construction projects exceeding $25 million. The order also repealed the Bush Executive Order 13202, which protected hundreds of billions of federal and federally funded construction projects from being subject to government mandated union-only PLA requirements since 2001. This Executive Order effectively forbids the over 84 percent of private construction who is not affiliated with organized labor from working on federal projects. Projects that are funded by their own tax dollars!

Equal opportunity and open competition in federal contracting is a critical issue to consider as the federal government explores various solutions, including significant infrastructure spending, to stimulate our ailing economy. Congress must ensure federal and federally funded infrastructure projects paid for by taxpayers are procured in a manner that is free from favoritism and discrimination while efficiently spending federal tax dollars. These interests would not be served if the Federal government were to require union-only requirements, commonly known as union-only PLAs, on federal construction projects.

A union-only PLA is a contract that requires a construction project to be awarded to contractors and subcontractors that agree to: recognize unions as the representatives of their employees on that jobsite; use the union hiring hall to obtain workers; pay union wages and benefits; obtain apprentices through union apprenticeship programs; and obey the union's restrictive work rules, job classifications and arbitration procedures.

Construction contracts subject to union-only PLAs almost always are awarded exclusively to unionized contractors and their all-union workforces. According to the most recent data from the U.S. Department of Labor's Bureau of Labor Statistics, only 15.6 percent of America's construction workforce belongs to a union. This means union-only PLAs would discriminate against more than eight out of 10 construction workers who otherwise would be eligible to work on construction projects if not for a union-only PLA.

This discrimination is particularly harmful to women and minority-owned construction businesses – whose workers traditionally have been under-represented in unions, mainly due to artificial and societal barriers in union membership and union apprenticeship and training programs. In fact, the National Black Chamber of Commerce, Women Construction Owners and Executives and National Association of Small Disadvantaged Businesses have all come out in opposition to mandating PLAs on federal projects.

In addition, construction projects subject to union-only PLAs stifle competition from non-union contractors and take away opportunity from their non-union employees unless they agree to the "union friendly" and inefficient terms and conditions of a typical PLA. A union-only PLA is a contract that requires a construction project to be awarded to contractors and subcontractors that agree to: recognize unions as the representatives of their employees on that jobsite; use the union hiring hall to obtain workers; obtain apprentices through union apprenticeship programs; and obey the union's restrictive work rules. While non-union contractors are permitted to bid on PLA projects, the reality is the contracts subject to PLAs end up being awarded almost exclusively to unionized contractors and their all-union workforces.

Moreover, several academic studies by the Beacon Hill Institute indicate PLAs increase the cost of school construction between 10 percent and 20 percent when compared to similar school construction projects not subject to a PLA. America can't afford to waste in excess of $30 billion in construction spending contained in the stimulus bill to reward special interests. Why should we build four schools, bridges, hospitals and wind farms for the price of five? That money is better served rebuilding America's crumbling infrastructure and putting all construction workers, not just union workers, back to work.

ABC fully supports the "Government Neutrality in Contracting Act," (S. 90) introduced by Senator David Vitter which would curb waste and end discrimination in the Federal government procurement process while ensuring taxpayer dollars are used responsibly. ABC urges members of the Committee to add their names as cosponsors to this important piece of legislation.

It is the duty of those elected to Congress to ensure taxpayer funded infrastructure projects are cost-effective and administered without favoritism or discrimination. These interests will not be served under President Obama's Executive Order 13502.

Davis-Bacon Act Expansion

Since the beginning of the 110th Congress we have seen a dramatic increase in the expansion of the arcane Davis-Bacon Act into areas of law where it has never before been seen. The Davis-Bacon Act is a Depression-era wage subsidy law enacted in 1931. In the 21st Century, especially in the new competitive global economy, it is essential to allow the free market system to determine wages.

Mandating Davis-Bacon Act prevailing wage requirements adversely affects small business access to construction performed under the program in which it is attached and inflates the costs of projects at the expense of the taxpayer. Moreover, reports consistently indicate Davis-Bacon wage rates are inaccurate and vulnerable to fraud.

Davis-Bacon has a negative impact on equal access to work opportunities. It prevents many qualified small and nonunion businesses from even bidding on publicly funded projects, because the complexities and inefficiencies in the Act make it nearly impossible for them to compete. This has a disproportionate impact on minority-owned businesses, which tend to be smaller and nonunion companies. The toll is real: one study estimates Davis-Bacon reduces the number of minority workers in the construction industry by 25,000 each year.

In addition, Davis-Bacon's flaws will cost taxpayers more to provide less. Davis-Bacon has been shown to increases public construction costs by anywhere from 5 to 38 percent above what the project would have cost in the private sector. According to the Congressional Budget Office (CBO), the Davis-Bacon Act already costs taxpayers more than $9.5 billion over the 2002 to 2011 period relative to the 2001 appropriations and $10.5 billion relative to 2001 appropriations adjusted for inflation. A more recent estimate, from the Beacon Hill Institute at Suffolk University in January, suggests Davis-Bacon costs taxpayers $8.6 billion per year.

Finally, federal authorities have concluded that Davis-Bacon wage rates are inaccurate. A series of audits by outside agencies, as well as the Department of Labor's (DOL) own Office of Inspector General (OIG), have revealed substantial inaccuracies in Davis-Bacon Act wage determinations and suggested that they are vulnerable to fraud. In fact, DOL's OIG released three reports highly critical of the wage determination program, with one report from 2004 finding errors in nearly 100 percent of the wage surveys reviewed. Expanding a wage determination process that has been proven to be flawed is unfair to the American taxpayer and American businesses.

Davis-Bacon's wage determination flaws harm the very employees the law was intended to protect. Research from the Heritage Foundation found that if it were not market forces, Tampa Bay area electricians would be "underpaid" by 38 percent under Davis-Bacon's system when compared to the more statistically sound wage determination method used by the Bureau of Labor Statistics (BLS). Recent academic research found that Davis-Bacon wages were substantially lower than BLS figures in 16 urban areas across the nation.

Moreover, the "American Recovery and Reinvestment Act of 2009" (ARRA) took the unprecedented step of requiring Davis-Bacon Act prevailing wages to be used on the entire project if $1 or more of ARRA funding is used on the project. This will undoubtedly create havoc on projects funded fully or in part by stimulus monies. In fact, there is a very real possibility that shovel ready projects will become un-shovel ready due to the Davis-Bacon Act being mandated on the project. For example, if a project is bid and the work is set to begin as soon as funding is procured and $1 dollar or more of project funding comes from the ARRA the entire project would have to be re-bid taking into account Davis-Bacon wage rates for that project. Thus, a shovel ready project would automatically become un-shovel ready because the entire bidding process would have to begin from scratch. This flies in the face of the intended purpose the "American Recovery and Reinvestment Act of 2009", putting workers back to work immediately. Congress acted without taking into account the ramifications of mandating Davis-Bacon Act prevailing wages on stimulus funding.

ABC calls on Congress to reform the Davis-Bacon Act and immediately halt its expansion into areas of the law where it has never before been used.

Complex Procurement Regime and "Buy American" Provisions

GSA, in its role on the Civilian Agency Acquisition Council (Council), is responsible for approving and finalizing changes and additions to the Federal Acquisition Regulation (FAR). On March 31, the Council published interim rules (rules which are issued as final regulations prior to public notice-and-comment procedures) implementing several provisions of the "American Recovery and Reinvestment Act of 2009" (ARRA).

Already a labyrinthine set of procedures, rules and requirements, the complexity of the FAR discourages businesses—especially small businesses—from participating in federal contract work. The interim rules for ARRA have created additional compliance and reporting layers to the federal procurement process. This will naturally be a further disincentive to participation in federal contracting.

For example, the new FAR rules contain "Buy American" provisions, requiring all iron, steel and manufactured goods used in the construction, alteration, maintenance or repair of public buildings or public works projects to be produced in the United States. This provision will add cumbersome restrictions to materials purchases, as well as complex reporting requirements to verify compliance. Granted, some exemptions have been provided—notably with regard to thresholds and unreasonable costs of domestic materials. However, simply trying to determine when these exemptions apply is enough to deter a small business contractor from

participating in federal contracting and bidding on stimulus projects, particularly due to the added time and resources (including staffing needs) this and other provisions necessitate.

Unreasonable Executive Compensation Reporting Requirements

In addition, the new FAR rules require the disclosure of the names and total compensation of a contractor's five most highly compensated officers if the contractor receives 80 percent or more of its annual gross revenues from federal contracts (and/or subcontracts) in the calendar year in which an ARRA-funded project is awarded. Included in reporting requirements are salary, bonus, stock options, change in pension value, earnings for services under non-equity incentive plans, and even severance and termination payments. The fact is that the intrusiveness of this reporting requirement stands to be a significant disincentive for bidding on ARRA-funded projects. Many honest contractors will turn away from federal bidding as a result of this provision, not because they intend to misappropriate federal funds, but because the requirement is unnecessarily invasive, due to the fact that reporting does not necessarily facilitate the tracking of ARRA funds.

Many of ABC's members are currently active in federal contracting, and many more would like to begin bidding federal work, particularly given the current private construction market. However, in order for this to occur, the procurement process needs to be easier for small businesses, rather than increasingly burdensome and confusing. To date, guidance documents for compliance with the new FAR rules have only been produced for contracting officers of federal agencies, and not for the actual contractors and businesses. Our national office has been inundated with calls and emails asking for additional guidance documents geared specifically to contractors. However, without further information from the administration, any attempt to create such resources for our members would be interpretations at best, and guesses at worst.

To be sure, the FAR rules, of which we have only touched on in this testimony, will create significant obstacles to the acquisition process, especially for small business contractors with no prior experience in federal contracting.

Again, thank you for holding today's hearing and we hope that by raising these concerns your Committee will work to alleviate the issues outlined above so that the construction industry can continue building America.

Attachment 1

According to Engineering News-Record in 2008, 53 of the Top 100 Green Contractors were ABC members generating close to $15 billion in revenue with more than 2,800 LEED APs on staff -
http://enr.construction.com/people/topLists/GreenCont/topGreenCont_1-50.asp.

Highlighted firms are ABC member companies:

RANK	FIRM	APs	07 GREEN REV	
2008	*ABC Members highlighted*	on staff	$MIL	% REV
1	The Turner Corp., New York, N.Y.	429	1805.05	19
2	Webcor Builders, San Mateo, Calif.			
3	Skanska USA Inc., Whitestone, N.Y.	164	1242.34	22
4	Bovis Lend Lease, New York, N.Y.	201	1075.5	20
5	Swinerton Inc., San Francisco, Calif.	195	1046	52
6	PCL Construction Enterprises Inc., Denver, Colo.	18	936.71	19
7	Clark Group, Bethesda, Md.	85	752.97	18
8	Hensel Phelps Construction Co., Greeley, Colo.	68	747.68	30
9	Gilbane Building Co., Providence, R.I.	186	651.87	22
10	The Haskell Co., Jacksonville, Fla.	17	562	79
11	Hunt Construction Group Inc., Scottsdale, Ariz.	25	527.32	26
12	L.F. Driscoll Co., Bala Cynwyd, Pa.			
13	Hoffman Corp., Portland, Ore.			
14	The Whiting-Turner Contracting Co., Baltimore, Md.			
15	Sundt Construction Inc., Tempe, Ariz.	74	440.3	49
16	Clayco Inc., St. Louis, Mo.			
17	The Weitz Co. LLC, Des Moines, Iowa	58	349.33	22
18	Austin Industries, Dallas, Texas	47	345.9	2
19	David E. Harvey Builders Inc., Houston, Texas	13	337	47
20	Holder Construction Co., Atlanta, Ga.			
21	Balfour Beatty Construction, Dallas, Texas	50	273.58	12
22	The Facility Group, Smyrna, Ga.			
23	B.L. Harbert International LLC, Birmingham, Ala.	5	267.1	63
24	JE Dunn Construction Group, Kansas City, Mo.	133	266.5	10
25	William A. Berry & Son Inc., Danvers, Mass.			
26	Caddell Construction Co. Inc., Montgomery, Ala.	4	256.54	74
27	Structure Tone, New York, N.Y.	140	248.43	7
28	Opus Group, Minnetonka, Minn.	92	225.3	12
29	FTR International Inc., Irvine, Calif.			
30	Stellar, Jacksonville, Fla.	25	199.9	36
31	HITT Contracting Inc., Fairfax, Va.	17	199.04	22
32	James G. Davis Construction Corp., Rockville, Md.			
33	Pepper Construction Group, Chicago, Ill.			
34	M.A. Mortenson Co., Minneapolis, Minn.			
35	Suffolk Construction Co. Inc., Boston, Mass.	56	170.06	15
36	DPR Construction Inc., Redwood City, Calif.	211	167.22	11
37	Linbeck, Houston, Texas			
38	Hathaway Dinwiddie Construction, San Francisco, Calif.			
39	Messer Construction, Cincinnati, Ohio	11	146.5	22
40	TLT Construction Corp., Wakefield, Mass.			
41	The Walsh Group, Portland, Ore.	20	136.5	52
42	The Walsh Group Ltd., Chicago, Ill.	44	135.47	4
43	Barton Malow Co., Southfield, Mich.	40	133.24	9
44	Okland Construction Co. Inc., Salt Lake City, Utah			
45	McCarthy Holdings Inc., St. Louis, Mo.			
46	Power Construction Co. LLC, Schaumburg, Ill.			

47	Andersen Construction Co., Portland, Ore.			
48	Duke Construction, Indianapolis, Ind.			
49	Grunley Construction Co. Inc., Rockville, Md.	9	109.06	41
50	Lauth Construction Group LLC, Indianapolis, Ind.			
51	Cox & Schepp Construction Inc., Charlotte, N.C.	8	105	50
52	Barnhart Inc., San Diego, Calif.			
53	Saunders Construction Inc., Centennial, Colo.			
54	Ryan Cos. US Inc., Minneapolis, Minn.	47	101.25	10
55	Pioneer General Contractors, Grand Rapids, Mich.			
56	Sellen Construction Co. Inc., Seattle, Wash.			
57	Bernards, San Fernando, Calif.			
58	BE&K Inc., Birmingham, Ala.	22	79.48	5
59	Kraus-Anderson Construction Co., Minneapolis, Minn.			
60	Lusardi Construction Co., San Marcos, Calif.	0	77	25
61	Consigli Construction Co. Inc., Milford, Mass.			
62	The Yates Cos. Inc., Philadelphia, Miss.	25	75.2	4
63	C.W. Driver, Pasadena, Calif.	18	75.01	13
64	Hall Building Corp., Farmingdale, N.J.			
65	New South Construction Co., Atlanta, Ga.	7	73.8	47
66	McGough Construction, St. Paul, Minn.			
67	Mascaro Construction Co. LP, Pittsburgh, Pa.			
68	Forrester Construction Co., Rockville, Md.	40	70	26
69	Lease Crutcher Lewis, Seattle, Wash.			
70	Reno Contracting Inc., San Diego, Calif.	11	66.16	30
71	Rockford Construction Co., Grand Rapids, Mich.	6	63.73	18
72	The Boldt Co., Appleton, Wis.			
73	P.J. Dick-Trumbull-Lindy, West Miflin, Pa.			
74	Shawmut Design and Construction, Boston, Mass.			
75	The Korte Co., Highland, Ill.			
76	Brasfield & Gorrie LLC, Birmingham, Ala.	7	49.72	2
77	O & G Industries Inc., Torrington, Conn.			
78	INTECH Construction Inc., Philadelphia, Pa.			
79	CORE Construction Group, Morton, Ill.	20	48.4	9
80	Manhattan Construction Co., Tulsa, Okla.	15	43.7	4
81	Continental Building Systems, Columbus, Ohio			
82	XL Construction Corp., Milpitas, Calif.			
83	Workstage, Grand Rapids, Mich.			
84	Adolfson & Peterson Constr., Minneapolis, Minn.	48	40.4	5
85	Butz Enterprises Inc., Allentown, Pa.			
86	JM Olson Corp., St. Clair Shores, Mich.			
87	Davis Constructors & Engineers Inc., Anchorage, Alaska			
88	IMC Construction, Malvern, Pa.			
89	Hoar Construction LLC, Birmingham, Ala.	15	35.4	7
90	Nabholz Construction Corp., Conway, Ariz.	10	34.2	8
91	Tarlton Corp., St. Louis, Mo.			
92	Harper Construction Co. Inc., San Diego, Calif.	5	31.6	23
93	Creative Contractors Inc., Clearwater, Fla.	4	31.12	
94	F.A. Wilhelm Construction Co. Inc., Indianapolis, Ind.			
95	Moss & Associates LLC, Fort Lauderdale, Fla.	26	28.9	4
96	Coakley & Williams Construction, Gaithersburg, Md.	8	24.5	9
97	Elkins Constructors Inc., Jacksonville, Fla.	6	20.87	9
98	Weis Builders Inc., Minneapolis, Minn.	15	20.79	4
99	Sahara Inc., West Bountiful, Utah	4	20.6	23
100	Gray Construction, Lexington, Ky.	5	19.46	4
		2809	**$14,990,700,000**	

AMERICAN FOREST & PAPER ASSOCIATION

GROWING WITH AMERICA SINCE 1861

American Forest & Paper Association (AF&PA)
Statement Submitted for the Record

U.S. Senate Committee on Environment and Public Works
Hearing on Oversight of the GSA and Energy Efficiency in Public Buildings

April 22, 2009

The American Forest & Paper Association (AF&PA) appreciates this opportunity to present the forest products industry's views regarding recommendations for reducing energy consumption in buildings. AF&PA is the national trade association of the forest products industry, representing manufacturers of wood products, pulp, paper, and packaging and forest landowners. Our companies make products essential for everyday life from renewable and recyclable resources that sustain the environment.

The forest products industry accounts for approximately 6 percent of the total U.S. manufacturing GDP, putting it on par with the automotive and plastics industries. The industry produces $200 billion in products annually and employs more than 1 million people earning $54 billion in annual payroll. The industry is among the top 10 manufacturing sector employers in 48 states.

That said, the current economic downturn, especially the housing market, has had a disproportionate impact on the forest products industry. Since 2006, the industry has lost more than 250,000 jobs—19 percent of our workforce. These jobs are critical for the survival of the rural communities where our facilities are often located.

AF&PA and its members are committed to reducing the environmental impact of buildings by encouraging energy-efficient, environmentally responsible choices during the design and construction process. Use of green building ratings systems is one of the most effective means to achieve both energy efficiency, and overall environmental responsibility. Below we summarize the positive attributes of wood building materials and green building rating systems, as well as a few concerns about the inadequacies of some systems.

Energy and Environmental Benefits of Wood Products

AF&PA recognizes that the environmental impact of buildings is significant. Construction and operation of residential and commercial buildings account for nearly 40 percent of all greenhouse gas (GHG) emissions in the U.S. In particular, the more than 500,000 federally-owned and leased buildings often consume more energy than

non-governmental buildings and require billions of dollars in energy costs. It is critical that efforts to address climate change through green building construction recognize the positive environmental benefits of wood construction materials.

It has been shown that the use of wood building materials can help mitigate the climate change impact of building construction. The Consortium for Research on Renewable Industrial Materials (CORRIM), a non-profit academic research consortium, undertook a study evaluating the energy and environmental impact of leading building materials. The study concluded that the use of wood-framing in buildings resulted in the generation of 26 percent fewer CO_2 emissions than for comparable steel-frame buildings, and 31 percent fewer than for concrete-frame buildings. Also, the study found that manufacturing wood framing used at least 16 percent less energy than producing steel or concrete frames, and had other environmental benefits, as well.

In addition, the ability of wood products to store carbon is recognized internationally by climate scientists and policymakers, including the most recent guidelines from the Intergovernmental Panel on Climate Change. Nearly one-third of carbon sequestered in forests becomes sequestered in the products made from them. Wood building materials can store carbon for their useful life keeping it out of the atmosphere for decades or even centuries. The EPA estimates that the amount of carbon in wood and paper products is equivalent to removing over 100 million tons of carbon dioxide from the atmosphere every year. This is equivalent to eliminating the carbon dioxide emissions from 18 million passenger cars – 13 percent of all passenger cars on the road in the U.S.

Wood Products, "Green" Buildings, and Rating Systems

Wood is among the most energy-efficient and environmentally friendly of all building materials. It is less energy and carbon intensive to produce than competing materials like steel and concrete. Among other positive environmental characteristics, wood products store huge amounts of carbon, contributing to the reduction of CO_2 in the atmosphere. Wood products are a vital component of sound architectural design and construction, while providing inherent energy-saving performance. Wood buildings are readily adapted to reuse or can be deconstructed and individual products reused in new construction. Lastly, wood is a renewable resource, a characteristic of unparalleled environmental value. Accordingly, the emergence over the last decade of green building rating systems that do not fully recognize the environmental benefits provided by the use of wood products are fundamentally flawed.

Notably, we e believe green building rating systems should equally recognize all credible sustainable forestry certification programs in the U.S. To do otherwise would unfairly discriminate against the use of wood, drive up the cost of a very limited supply of compliant products, and favor the use of non-wood products that have much higher environmental impacts. Appropriate rating systems should provide equal credit to all programs that meet a commonly accepted set of objective criteria, including globally-

recognized sustainable forestry programs, such as the Sustainable Forestry Initiative® (SFI) program or the American Tree Farm System®. They should also include life cycle assessment (LCA). It is critical that rating systems be grounded in objective, scientific criteria based on life cycle impacts. LCA provides objective criteria so that a rating system or standard yields consistent results through appropriate thresholds and baselines, and allows for the comparison of buildings in different locations on equal terms.

It is also important that green building rating systems be developed in a consensus process that meets the spirit of the American National Standards Institute (ANSI) Essential Requirements[1] or OMB Circular A119. Development of a standard under a recognized consensus process provides transparency and ensures the opportunity for meaningful participation by all groups that will be affected. A true consensus process also has procedures to ensure balance, consideration of dissenting views, and appeals procedures. ANSI is the coordinator of the U.S. standards process and provides strict objective requirements for accreditation of those processes. A credible rating system must be developed using a process that embodies the elements of consensus as defined by ANSI.

Government entities should only adopt green building policies that recognize the energy-saving attributes of wood, are inclusive of forest certification programs, are based on sound science, including LCA, and have been developed in a consensus process. AF&PA and its members will continue to work with all interested parties to create and promote green building rating systems that meet the above criteria.

Specific Green Building Rating System Concerns

The U.S. forest products industry has been working for several years to assure that green building rating systems provide appropriate recognition for the positive environmental attributes of wood building materials, and follow recognized standard development procedures that assure fair treatment for all stakeholders. Unfortunately, the U.S. Green Building Council (USGBC) has failed, so far, to incorporate this recognition into its Leadership in Energy and Environmental Design (LEED) green building rating system.

One of our primary concerns with the LEED program is its failure to recognize all credible, sustainable forestry certification programs in its certified wood credit. LEED only provides credit to builders using forest products certified by the Forest Stewardship Council (FSC). No credit is awarded for wood products produced by companies independently third-party certified to the SFI® program standard or the American Tree

[1] *ANSI Essential Requirements: Due process requirements for American National Standards (http://publicaa.ansi.org/sites/apdl/Documents/Standards%20Activities/American%20National%20Standards/Procedures,%20Guides,%20and%20Forms/2008%20ANSI%20Essential%20Requirements/2008%20ANSI%20Essential%20Requirements%20031108.pdf)*

Farm System® (ATFS) – the two largest sustainable forest management systems in the U.S., and both accredited by PEFC, a third-party international group. These two programs account for over 100 million acres of forestland, yet are unable to qualify for points under the LEED rating system. Since FSC has fewer acres certified in North America than the SFI or ATFS propgrams, the LEED point structure forces builders to either eliminate wood products from their designs, or if they nonetheless use wood, they must largely import their wood from overseas to receive LEED credit for certified forest products.

Also, the LEED rating system does not recognize the positive attributes of renewable wood products. For instance, LEED provides credit for using "rapidly renewable materials," which LEED arbitrarily defines as products originating from plants grown and harvested in a 10-year cycle. U.S.-based construction lumber does not qualify for this credit since domestic timber is grown and harvested on a longer rotation. The credit, thus, benefits exotic crops such as bamboo from overseas or wheatgrass. This suggests that under LEED it would be "greener" to deforest an area of native trees that are being sustainably managed and replace it with a plantation crop of an invasive species like bamboo or wheatgrass. This is an outcome that would have negative consequences for the environment.

And, it should be noted that,all existing versions of LEED were not developed in a consensus process open to all interested parties. Our industry specifically asked to participate and was rebuffed. The process USGBC used to create and maintain these LEED versions did not meet generally accepted criteria for development of consensus standards. While USGBC has since obtained accreditation from ANSI as a green building Standards Developing Organization, USGBC has not developed any existing edition of LEED through an ANSI-accredited process.

Building Energy Performance

Some building codes and a number of green building rating systems rely on an American Society of Heating, Refrigeration, and Air Conditioning Engineers standard, ASHRAE 90.1, to determine minimum building energy performance, while others recognize other state-of-the-art energy codes. Since 1999, ASHRAE 90.1 has unfairly required greater energy performance for building envelopes constructed from wood than for those constructed of other materials. As a result, wood buildings quickly become economically uncompetitive due to these more restrictive provisions. Energy codes will only be effective when equal performance is demanded from all building materials. Further, LEED relies entirely on ASHRAE 90.1 to determine energy efficiency and, in the process, not only discriminates against wood products, but gives preferential treatment to steel and concrete, which are permitted to underperform buildings constructed with wood. Providing users with options in choosing rating systems will also help to mitigate these energy performance penalties imposed by LEED. The Department of Energy should continue to review and revise the energy performance requirements in the codes and standards it references for this purpose.

Legislation and Regulation Should Recognize Multiple Rating Systems

As the Committee is aware, several new green building rating systems have been developed and entered the marketplace in the past few years. Growing demand for building "green" is attracting competition in the green building marketplace. We believe this competition is healthy and will result in a rapid increase in the number of green buildings in the U.S., as well as improvements in the rating systems themselves.

As Congress and federal agencies continue to explore this issue and contemplate policy options, we recommend they avoid policies that may stifle competitive forces that are driving the green building rating system movement. We encourage Congress and federal agencies to explore and evaluate the full range of systems now available in the marketplace beyond t LEED. Legislation should not pick winners and losers in the constantly-evolving green building marketplace, particularly as these rating systems are private-sector products. Furthermore, the competition between existing systems, when fostered by federal policies, provides powerful incentives for all of them to continuously improve.

Solely including references to the LEED rating system prevents other credible systems, such as the Green Globes® and National Green Building Standard™ rating systems, from contributing to legislative and regulatory goals. Green Globes is currently concluding its third-party ANSI consensus process, and is being used by a number of public and private entities, including eighteen states, several federal agencies (totaling 35 buildings), private insurance carriers, and large corporations. The National Green Building Standard was approved by ANSI in January 2009, and is being used by home builders and communities across the nation. Unlike LEED, these two standards have undergone the rigors of a nationally-recognized voluntary consensus process approved by ANSI.

Conclusion

AF&PA appreciates this opportunity to present its views to the Committee regarding the design and construction of green buildings. The forest products industry strongly supports the construction of environmentally-friendly and energy-efficient green buildings. Wood products can contribute greatly towards building green if treated appropriately in rating systems and energy codes. It is, therefore, important that legislation and regulation promoting green buildings not specify one rating system, but rather make all credible systems eligible to participate in its provisions. AF&PA and our member companies look forward to working with the Committee, others in Congress, and federal agencies on this important set of issues.

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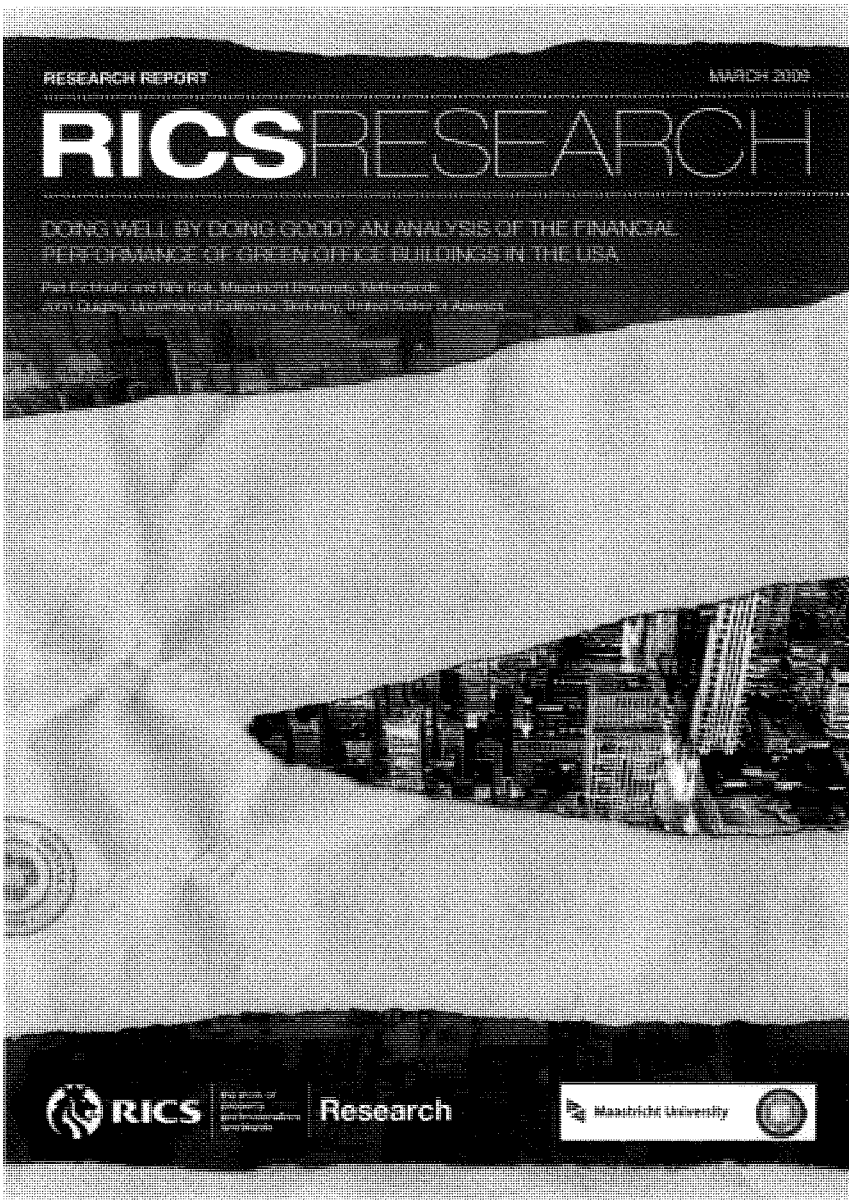
RESEARCH REPORT
MARCH 2009
RICSRESEARCH
DOING WELL BY DOING GOOD? AN ANALYSIS OF THE FINANCIAL PERFORMANCE OF GREEN OFFICE BUILDINGS IN THE USA
RICS
Research
Maastricht University

About the authors

Piet Eichholtz

Piet Eichholtz is Professor of Real Estate and Finance and chair of the Finance Department at Maastricht University in the Netherlands. He teaches courses in Finance, and in Real Estate Finance and Investments. He has provided extensive services to public society, mainly through board memberships of industry organizations in the property sector, but also as an advisor to various government agencies. For example, he was a special property advisor to the UN Good Offices Mission on Cyprus. His academic work has resulted in a great number of publications, both in the Netherlands and internationally. Most of his work examines real estate markets, with a focus on international investment, portfolio management and housing markets. Key issues on his research agenda for the coming years are sustainable real estate and the effects of demographics on real estate markets After having gained practical experience at the ABP and NIB Capital, he started Global Property Research, an international consultancy firm specialized in property companies, which was acquired by Kempen & Co in 2001. After leaving Kempen in 2004, he became co-founder of Finance Ideas, a financial consultancy company. He is currently a non-executive board member at IPD Holding, a member of the Advisory Boards of Redevco and the RO Group, of the Investment Committees of Blue Sky Group and Servatius, and of the Housing Scenario Group of Bouwfonds.

Nils Kok

Nils Kok currently works as an assistant professor in Finance and Real Estate at Maastricht University, the Netherlands. He recently finished his PhD at Maastricht University, for which he received the 2009 Best Thesis Award of the French Social Investment Forum. His main research focus is on sustainability issues in the real estate sector, concentrating on the economics of "green" buildings. In addition, his research interests includes issues such as transparency of global property markets, property investment and demographics. He was the co-author of an influential report proposing a pan-European property fund structure. Besides his work at Maastricht University, he is an executive teacher at the Amsterdam School of Real Estate and the Amsterdam Institute of Finance. He is a contributing member of various real estate and market networks, communicates his ideas and findings in the international arena as a frequent speaker on academic and industry conferences.

John Quigley

John Quigley is the I. Donald Terner Distinguished Professor at the University of California, Berkeley, where he holds professorial appointments in the Department of Economics, the Haas School of Business, and the Goldman School of Public Policy. He has served as Chairman of Berkeley's Department of Economics and as Chair of Berkeley's Academic Senate. He is an expert on issues in public finance and taxation, and on real estate, mortgage and financial markets. He is the author of more than a dozen books and scores of scientific and professional publications. He served as President of the American Real Estate and Urban Economics Association, Vice President of the Association for Public Policy and Management, and he is currently President of the North American Regional Science Association. He has received many forms of recognition for his scholarly contributions, most recently an honorary degree from the Royal Institute of Technology, awarded last year.

This report describes a research project aimed at assessing the financial performance of 'green' office buildings in the United States of America, carried out by Piet Eichholtz and Nils Kok of Maastricht University, the Netherlands, and John Quigley of the University of California, Berkeley, United States of America. It is in two parts. First, there is a non-technical summary of the work, which gives the background to the work, an overview of the research and the main results. This is then followed by the researchers' full technical paper, which gives the detailed specification of the research methodology and the complete results.

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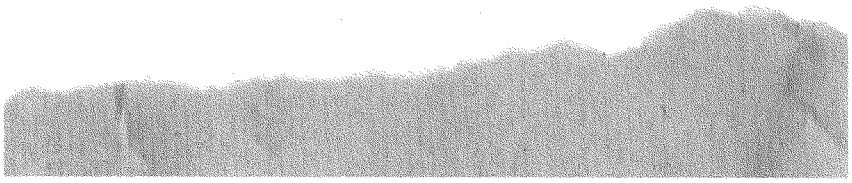

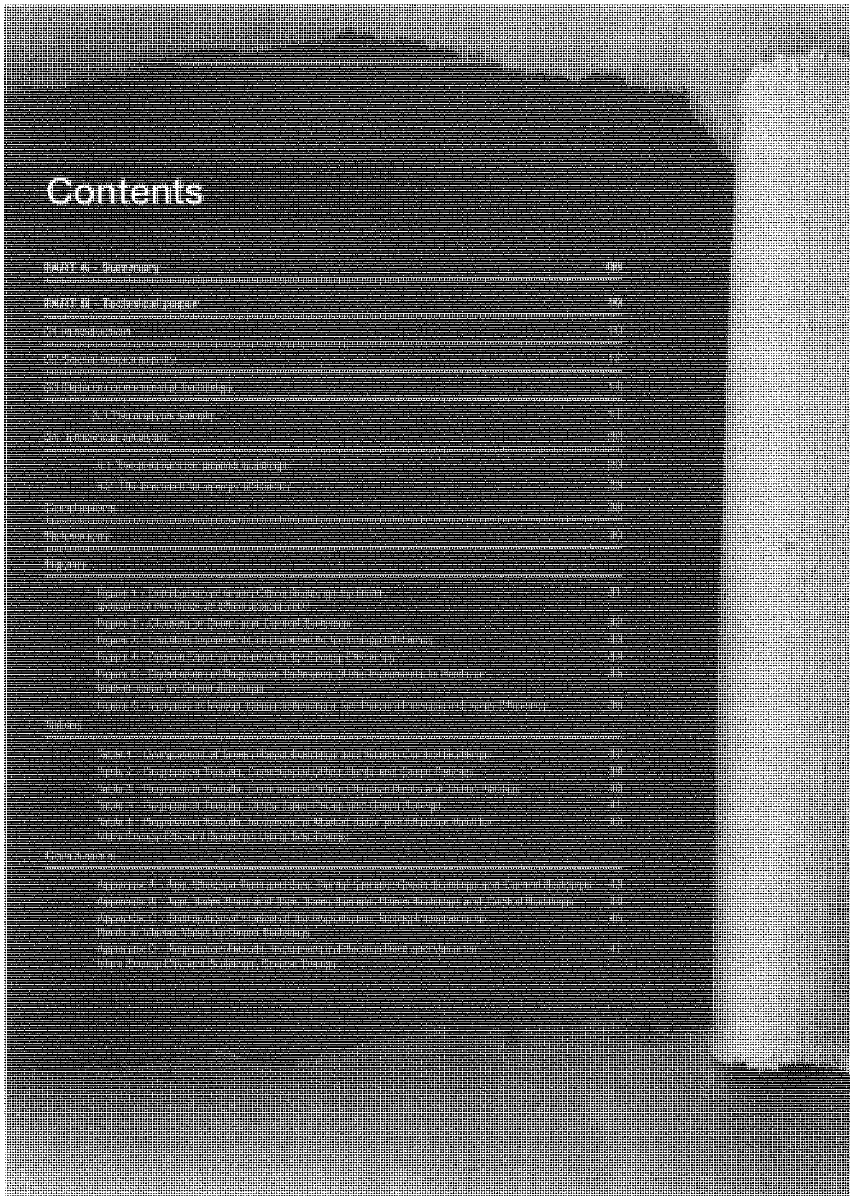
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PART A - Summary

PART B - Technical paper

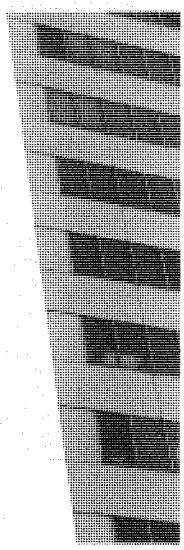
Part A Summary

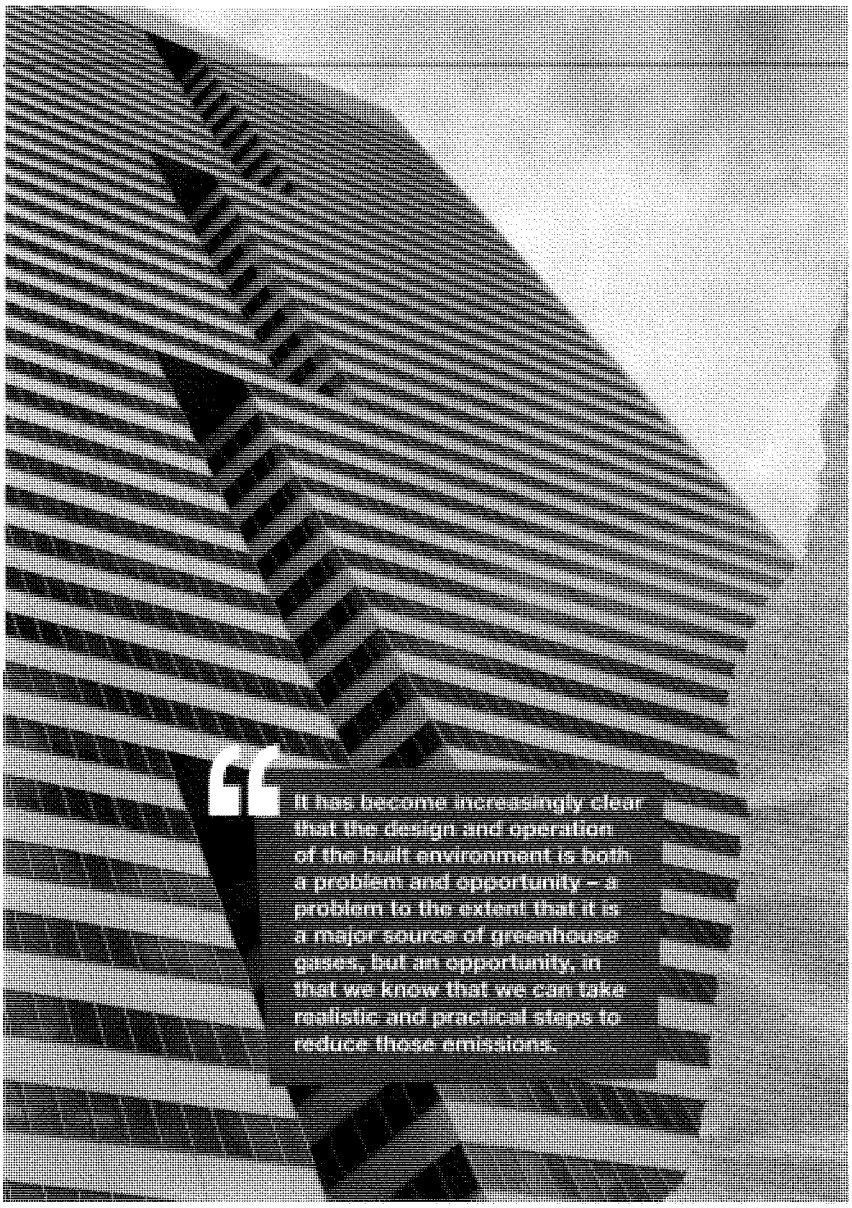
When the opportunity arose in April 2008 for the Royal Institution of Chartered Surveyors (RICS) to help support a global research programme being developed by Piet Eichholtz and Nils Kok of Maastricht University, and John Quigley of the University of California, Berkeley, into the financial performance of 'green' office buildings, it was one that we welcomed and valued. To be able to work with researchers to examine in a rigorous and impartial manner whether there was a financial premium attached to 'green' buildings is central to the aims and aspirations of RICS.

It has become increasingly clear that the design and operation of the built environment is both a problem and opportunity – a problem to the extent that it is a major source of greenhouse gases, but an opportunity, in that we know that we can take realistic and practical steps to reduce those emissions. Awareness of this fact is growing. The increasing emphasis on "green rating" systems for buildings - initiated by both government and industry - gives witness to this development. In general, these ratings assess the energy footprint of buildings, and they may provide owners and occupants with a solid yardstick for measuring the energy efficiency and sustainability of properties. However, the use of these ratings has so far been limited, and the global diffusion of rating systems is relatively slow. Moreover, both real estate developers and institutional investors are understandably uncertain about how far to go in implementing environmental investments, since the economic rationale for the development of sustainable buildings is based almost entirely on anecdotal evidence.

Alongside this, we have been seeing an increasing trend in the corporate sector to engage with and take on board corporate social responsibility (CSR) as a way of informing business decisions. It has been suggested that companies that embrace CSR may be able to out-perform others for a number of reasons, such as improved corporate reputation, less pressure of regulation, and improved profitability through lower input costs and higher employee productivity. In terms of how this relates to real estate investment, it may have an impact through:

- The impact on the construction process in terms of materials used and processes adopted
- 'Green' buildings having a longer economic life
- Enhanced employee productivity as a result of improved internal environmental quality
- Improved corporate image through occupying 'green' buildings

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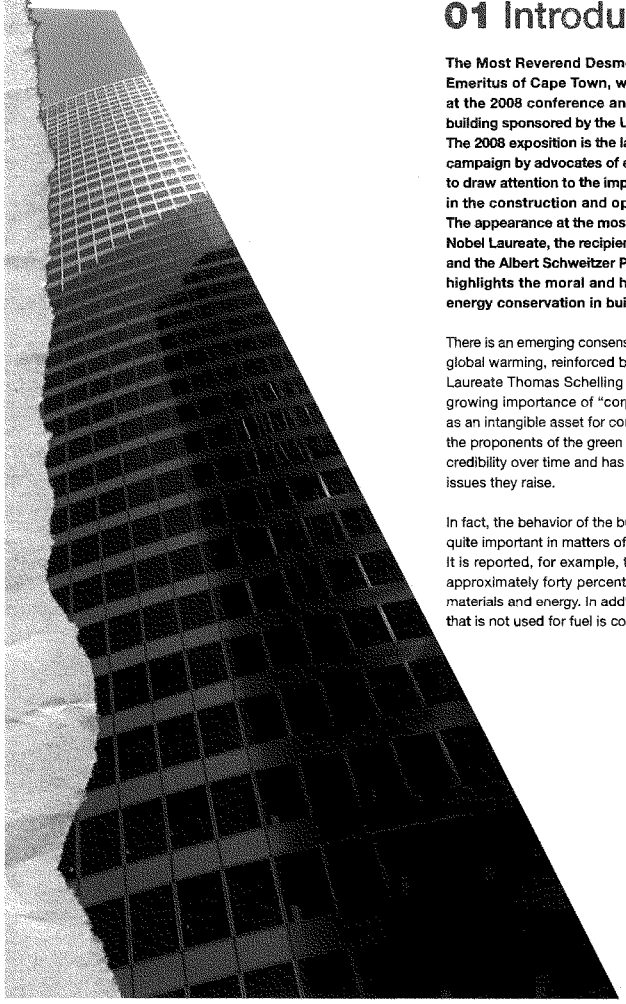
It has become increasingly clear that the design and operation of the built environment is both a problem and opportunity – a problem to the extent that it is a major source of greenhouse gases, but an opportunity, in that we know that we can take realistic and practical steps to reduce those emissions.

Summary

Upgrading the average non-'green' building to a 'green' one would increase its capital value by some $5.5 million

Part B Technical paper



01 Introduction

The Most Reverend Desmond Tutu, Archbishop Emeritus of Cape Town, was the keynote speaker at the 2008 conference and exposition on green building sponsored by the U.S. Green Building Council. The 2008 exposition is the latest in the decade-long campaign by advocates of environmental conservation to draw attention to the imperative of "sustainability" in the construction and operation of buildings. The appearance at the most recent exposition by the Nobel Laureate, the recipient of the Gandhi Peace Prize, and the Albert Schweitzer Prize for Humanitarianism, highlights the moral and humanitarian aspects of energy conservation in buildings.

There is an emerging consensus on the consequences of global warming, reinforced by academics such as Nobel Laureate Thomas Schelling (1992). Together with the growing importance of "corporate social responsibility" as an intangible asset for competitive firms, this has given the proponents of the green building movement increased credibility over time and has increased the salience of the issues they raise.

In fact, the behavior of the building sector is potentially quite important in matters of environmental sustainability. It is reported, for example, that buildings account for approximately forty percent of the consumption of raw materials and energy. In addition, 55 percent of the wood that is not used for fuel is consumed in construction.

Overall, buildings and their associated construction activity account for at least thirty percent of world greenhouse gas emissions (RICS, 2005). And once a building is constructed, the energy consumption associated with it continues. The impact of energy costs directly affects the bottom-line of tenants and building owners. Energy represents thirty percent of operating expenses in a typical office building; this is the single largest and most manageable operating expense in the provision of office space.

Thus the design and operation of real estate can play an important role in energy conservation in advanced societies. Awareness of this fact is growing. The increasing emphasis on "green rating" systems for buildings - initiated by both government and industry - gives witness to this development. In general, these ratings assess the energy footprint of buildings, and they may provide owners and occupants with a solid yardstick for measuring the energy efficiency and sustainability of properties. However, the use of these ratings has so far been limited, and the global diffusion of rating systems is relatively slow. Moreover, both real estate developers and institutional investors are understandably uncertain about how far to go in implementing environmental investments, since the economic rationale for the development of sustainable buildings is based almost entirely on anecdotal evidence. This contrasts with a growing body of evidence on the profitability of incorporating eco-efficiency measures in strategic management and investment decision-making (Margolis and Walsh, 2003).

This paper provides the first systematic analysis of the impact of environmentally-sustainable building practices upon economic outcomes measured in the marketplace. We concentrate on commercial property and investigate the relationship between investments in energy efficiency in design and construction and the rents, effective rents, and selling prices commanded by these properties. We analyze a large sample of buildings, some of which have been certified as more energy efficient by independent and impartial rating services.

We assemble a national sample of U.S. office buildings which have been evaluated for energy efficiency by one of two leading agencies. For each building, we identify a control sample of nearby office buildings. For some 10,000 subject and control buildings, we relate contract rents, effective rents and selling prices to a set of objective hedonic characteristics of buildings, holding constant the locational characters of properties. We find that buildings with a "green rating" command rental rates that are roughly three percent higher per square foot than otherwise identical buildings – controlling for the quality and the specific location of office buildings. Premiums in effective rents, i.e., rents adjusted for building occupancy levels, are even higher – above six percent. Selling prices of green buildings are higher by about 16 percent.

Beyond the average price or rental premium, our methodology also permits us to estimate the increment for each "green building" relative to the control buildings in its immediate geographic neighborhood. We find, for example, that the relative premium for "green buildings" is higher, *ceteris paribus*, in places where the economic premium for location is lower. That is, the percent increase in rent or value for a green building is systematically greater in smaller or lower-cost regions or in less expensive parts of metropolitan areas.

For some 500 buildings which have been certified as energy efficient by the Energy Star program, we obtained the engineering estimates of thermal efficiency which were submitted in the certification process. Within this population of certified "green buildings," we find that variations in effective rent and market value are systematically related to the energy efficiency of buildings. This suggests that the increment to rent or value attributable to its certification as "green" reflects more than an intangible labeling effect.

Section 2 provides a brief review of the emerging literature on corporate social responsibility and its relationship to environmentally sustainable buildings. In Section 3 we discuss the sources of ratings for the environmental aspects of buildings, and we describe the data used in our analysis, a unique body of micro data on the economic and hedonic characteristics of office buildings. We also discuss the engineering data made available to us by the U.S. Environmental Protection Agency. Section 4 presents our methodology and empirical results. Section 5 is a brief conclusion.

02 Social responsibility

"Corporate social responsibility" (CSR, Waddock and Graves, 1997) has become a normative standard that describes firms' choices about inputs (e.g., the source of raw materials), internal processes (e.g., the treatment of employees), and publicity (e.g., community relations). Judgments about the social responsibility of private firms have become an investment criterion for some investors, and it is estimated that $2.7 trillion is currently allocated to "socially-screened" portfolios in the United States alone (Social Investment Forum, 2007). However, the economic rationale for investing in companies or investment funds that rank high in corporate social performance is a matter of debate, and there is no consensus about the financial performance of these investments (Margolis and Walsh, 2003).

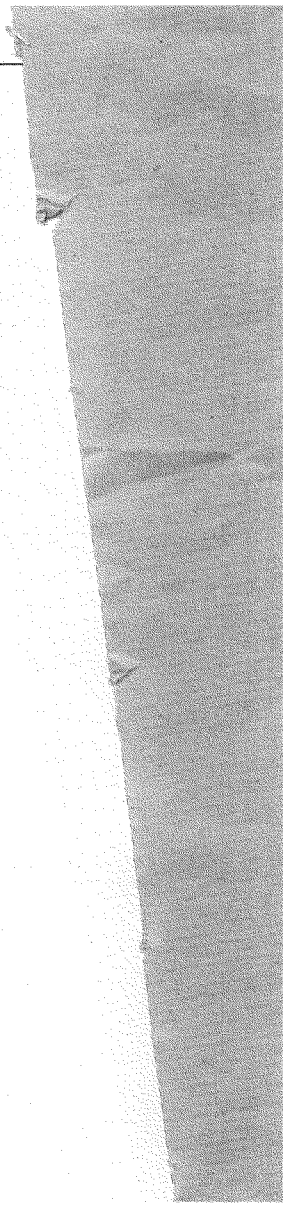
Companies with well-defined and aggressive CSR policies might be able to outperform others for several reasons: improved corporate reputation (Turban and Greening, 1997), less intrusion from activists and governmental organizations (Baron, 2001, Lyon and Maxwell, 2006), reduced threat of regulation (Maxwell et al., 2000), and improved profitability through lower input costs and higher employee productivity. The latter two represent the most tangible elements of corporate social responsibility.

In the real estate sector, these issues of eco-efficiency are confounded with straightforward capital budgeting decisions involving choices between the levels and types of initial investment and consequent operating inputs chosen to maximize investor returns. In this context, the investment in green buildings could lead to economic benefits in several distinct ways.

First, investments at the time of construction or renovation may: save current resources expended on energy, water and waste disposal; decrease other operating costs; insure against future energy price increases; and simultaneously decrease greenhouse gas emissions. The financial benefits of energy savings and waste reduction are measurable, but existing empirical studies focus on environmental consequences rather than financial performance. For example, Khanna and Damon (1999) study how reductions in releases of chemicals influence financial performance in the chemical industry; they find that firms that reduce the release of toxic chemicals suffer losses in the short run, but gain in the long run. For real estate, the evidence on energy savings in green buildings is typically based upon engineering studies of energy usage. There seems to be a consensus that a variety of capital expenditures improving energy efficiency in property are cost-effective at reasonable interest rates, given current and projected energy costs.

Second, an improved indoor environmental quality in green buildings might result in higher employee productivity. But while energy and waste savings can be measured fairly precisely, the relation between employee productivity and building design or operation is far more complicated. The financial impact of healthier and more comfortable green buildings is hard to assess, in part because the cost of poor indoor environmental quality (for example, lower productivity and higher absenteeism) may simply be hidden. However, there is popular discussion of the putative health and productivity costs that are imposed by poor indoor environmental quality in commercial buildings (http://www.epa.gov/iaq). In reliance upon this, tenants may be willing to pay a higher rent for buildings in which indoor environmental quality is better.

Third, locating corporate activities in a green building can positively affect the corporate image of tenants. Leasing space in a green building may send a concrete signal of social awareness, and of the superior social responsibility of tenants. This may be important for some firms, and it may be a determinant of corporate reputation (Frombrun and Shanley, 1990). Favorable reputations may enable firms to charge premium prices (Klein and Leffler, 1981), to attract a better workforce (Turban and Greening, 1997), and to attract investors (Milgrom and Roberts, 1986). As a result, tenants may be willing to pay higher rents for green buildings.



Fourth, sustainable buildings might have longer economic lives – due to less depreciation – and lower volatility in market value – due to less environmental and marketability risk – leading to reduced risk premiums and higher valuations of the properties. Orlitzky and Benjamin (2001) address the relation between corporate social performance and risk, and argue that the better a firm's social reputation, the lower its total market risk. If this relationship holds for the real estate sector, building green may result in a lower cost of capital and higher building valuation. So, even if green buildings did not command higher spot rents, they could still be valued higher.

Economists are quick to point out that many of these advantages could be obtained if energy inputs were appropriately priced (to reflect their social and environmental costs). Appropriate investments in energy efficiency would minimize life-cycle costs discounted at market rates, maximize developer returns, and correctly economize on energy costs (Quigley, 1985, 1991). But to the extent that productivity, corporate image, and intangible or hard-to-measure returns are important, simple adjustments of input prices are just that – too simple.

If the economic benefits of green building for commercial property are indeed reflected in tenants' willingness to pay premiums on net rent for green spaces or in lower risk premiums for green buildings, this would enable investors to offset the higher initial investment required for sustainable buildings, or even to command higher risk-adjusted returns. However, for real estate investors, hard evidence on the financial performance of green buildings is limited and consists mainly of industry-initiated case studies. An example is the report for California's Sustainable Building Task Force (2003) on the costs and financial benefits of green buildings. For a sample of 33 California buildings with green ratings, it was concluded that the financial benefits of green design were ten times as large as the incremental outlays to finance those green investments. However, the sources of the financial benefits identified in this case study are diverse, hard to quantify, and they were not verified by market transactions. To persuade real estate developers and investors in the global marketplace of the benefits of "eco-investment," the payoff from investment in green buildings needs to be identified in that same marketplace.

03 Data on commercial buildings

In the USA, there are two major programs that encourage the development of energy-efficient and sustainable buildings through systems of ratings to designate and publicize exemplary buildings. The Energy Star program is jointly sponsored by two Federal agencies, the U.S. Environmental Protection Agency, and the U.S. Department of Energy. Energy Star began in 1992 as a voluntary labeling program designed to identify and promote energy-efficient products in order to reduce greenhouse gas emissions. Energy Star labels were first applied to computers and computer equipment and were later extended to office equipment, to residential heating and cooling equipment, and to major appliances. The Energy Star label was extended to new homes in 1993 and has been promoted as an efficient way for consumers to identify builders as well as buildings constructed using energy-efficient methods. The Energy Star label is marketed as an indication of lower ownership costs, better energy performance, and higher home resale values. The label is also marketed as an indication of better environmental protection, and the Energy Star website for new homes stresses that "your home can be a greater source of pollution than your car." The Energy Star label was extended to non-residential buildings in 1995.

Non-residential buildings can receive an Energy Star certification if the site energy use, the source energy use, and the greenhouse gas emissions of the building, as certified by a professional engineer, achieve certain specified benchmark levels. The benchmark is chosen so that the label is awarded to the top quarter of all comparable buildings, ranked in terms of energy efficiency. The Energy Star label is marketed as a commitment to conservation and environmental stewardship. But it is also touted as a vehicle for reducing building costs and for demonstrating superior management skill. Indeed, the Energy Star website draws attention to the relationship between energy conservation in buildings and other indicia of good "corporate governance."

As of October 2008, 5,709 buildings in the U.S. had been awarded the Energy Star designation, including 2,230 office buildings.

The U.S. Green Building Council (USGBC), a private non-profit organization, has developed the LEED ("Leadership in Energy and Environmental Design") green building rating system to encourage the "adoption of sustainable green building and development practices." Since adoption in 1999, separate standards have been applied to new buildings and to existing structures. The requirements for certification of LEED buildings are substantially more complex than those for the award of an Energy Star rating, and additional points in the certification process are awarded for such factors as "site selection," "brownfield redevelopment," and the availability of "bicycle storage and changing rooms," as well as energy performance.

It is claimed that LEED-certified buildings have lower operating costs and increased asset values and provide healthier and safer environments for occupants. It is also noted that the award of a LEED designation "demonstrate[s] an owner's commitment to environmental stewardship and social responsibility."

Data on commercial buildings

As of October 2008, there were 1,703 buildings certified by the LEED Program of the USGBC[3]. Energy-Star-rated buildings and LEED-rated buildings are identified by street address on the websites of Energy Star and the USGBC respectively. We matched the addresses of the rated buildings in these two programs as of September 2007 to the office buildings identified in the archives maintained by the CoStar Group. The CoStar service and the data files maintained by CoStar are advertised as "the most complete source of commercial real estate information in the U.S." The CoStar Group maintains an extensive micro database of approximately 332,000 U.S. commercial buildings, their locations, and hedonic characteristics, as well as the current tenancy and rental terms for the buildings. A separate file is maintained of the recent sales of commercial buildings. Our match yielded 1,360 green office buildings which could be identified in CoStar, of which 286 were certified by LEED, 1,045 were certified by Energy Star, and 29 were certified by both LEED and Energy Star[4].

Figure 1 provides a geographic summary of our match between the Energy Star-certified commercial office buildings, the LEED-certified buildings, and the universe of commercial buildings identified in CoStar. The figure reports the number of certified commercial office buildings in each state, as well as an estimate of the fraction of office space in each state which has been rated for environmental sustainability[5]. About four percent of U.S. office building space is green-labeled. As the map indicates, in some states – notably Texas, Washington, and Minnesota – more than five percent of office buildings are rated. The incidence of green office space is almost nine percent in California – 122 million square feet of office space are labeled. In a large number of states, however, only a small fraction of office space is certified by Energy Star or the USGBC. Apart from California, states with extreme temperatures are apparently more likely to have rated office buildings.

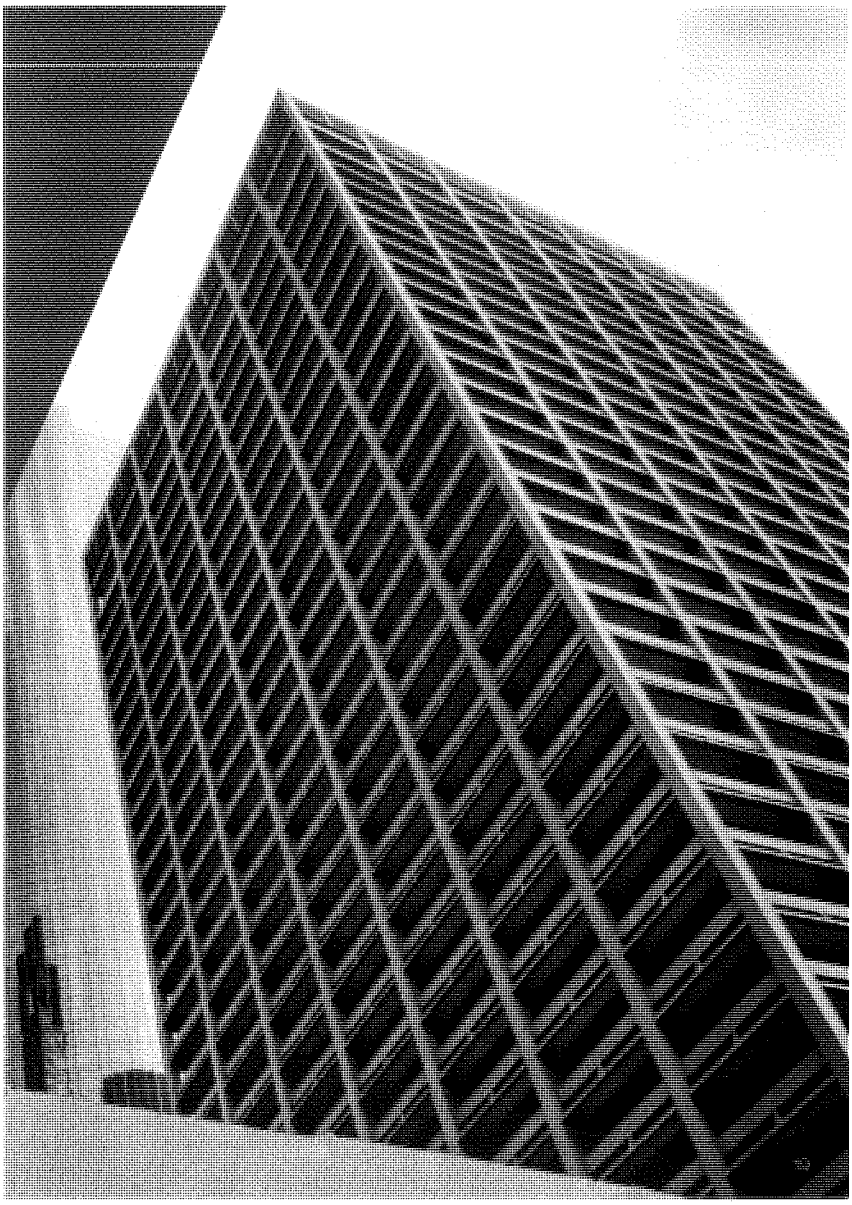
3.1 The analysis sample

Of the 1,360 rated buildings identified in the CoStar database, current information about building characteristics and monthly rents were available for 694 buildings. In addition, 199 of these buildings were sold between 2004 and 2007[6]. To investigate the effect of energy efficiency on the rents and values of commercial buildings, we matched each of the rated buildings in this sample to nearby commercial buildings in the same market. Based upon the latitude and longitude of each rated building, we used GIS techniques to identify all other office buildings in the CoStar database within a radius of one quarter mile. In this way, we created 893 (i.e., 694 plus 199) clusters of nearby office buildings. Each small cluster – 0.2 square miles – contains one rated building and at least one non-rated nearby building. On average, each cluster contains about 12 buildings. There are 8,182 commercial office buildings in the sample of green buildings and control buildings with rental data, and there are 1,816 buildings in the sample of buildings which have been sold.

Figure 2 illustrates the research design - designated clusters of nearby properties. For the green building pictured in Chicago, the map indicates that there are 41 non-green office buildings within the surrounding 0.2 square miles. For the green building in Houston, there are six nearby non-green buildings, while for the green building in Columbus, there is only one non-green building within a quarter of a mile.

[3]The USGBC does not release the composition of its LEED-rated buildings, so the exact number of commercial office buildings with USGBC ratings is not available.
[4]In the September 2007 version of the CoStar database, green rated buildings are separately identified. However, in matching the Energy Star and LEED-certified buildings by street address, we discovered that about a quarter of the buildings certified by Energy Star and LEED had not been recorded in the CoStar database.
[5]Ratios based upon the CoStar data probably overstate the fraction of green office space in the U.S. inventory, since CoStar's coverage of smaller and older office buildings is less complete.
[6]We choose this interval, 2004 – 2007, in part, because the formula for rating office buildings was unchanged throughout the period.

Data on commercial buildings



04 Empirical analysis

4.1 The premium for labeled buildings

To investigate how the commercial mortgage interest rate premium for green and net zero carbon buildings varies with the energy performance of the building, we use the standard valuation framework for commercial real estate. This provides a conceptually robust framework and the typical available explanatory variables in mortgage and property datasets. Accordingly, we model the natural logarithm of the mortgage interest rate spread for building i in location c at time t as a function of the building's energy performance, other building characteristics, loan characteristics, and borrower characteristics. Equation (1) is the hedonic model we estimate using ordinary least squares (OLS) with location and time fixed effects. Equation (2) is the same model but with location-specific time fixed effects.

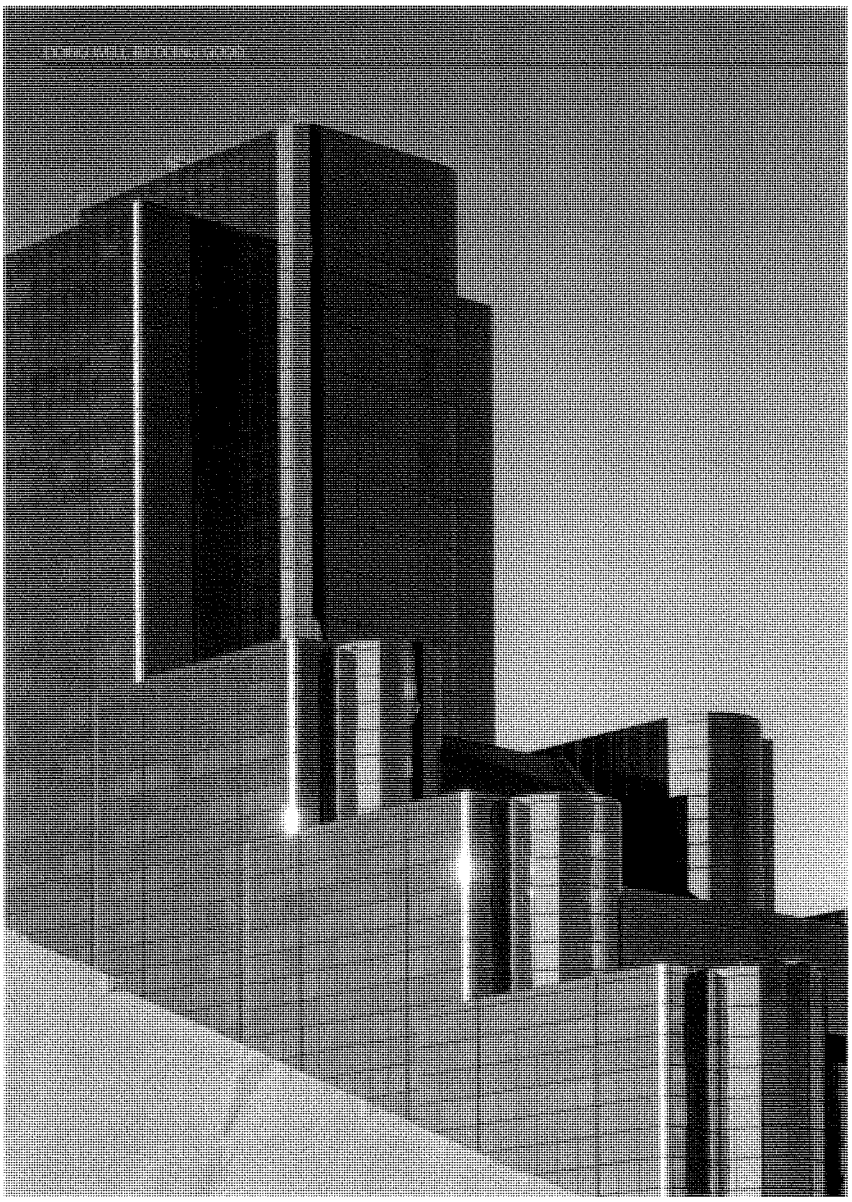
$$\ln(y_{ict}) = \alpha + \beta_1 EE_i + \sum_k \gamma_k x_{ik} + \ln(\varepsilon_{ict}) \quad (1)$$

$$\ln(y_{ict}) = \alpha + \beta_1 EE_i + \sum_k \gamma_k x_{ik} + \sum_c \delta_c (t \times \mathbb{1}_c) + \ln(\varepsilon_{ict}) \quad (2)$$

In the formulations represented by equation (1) and (2), the dependent variable is the logarithm of the spread per mortgage loan, y_{ict}, in commercial real estate building i in location c at the origination of the loan t. The dependent variable is the logarithm of the spread over the underlying benchmark rate, which is typically a swap rate or government bond yield. The spread is the contract interest rate minus the benchmark rate. EE_i is a dummy variable for whether building i is labeled as energy efficient or net zero carbon. x_{ik} is a vector of k explanatory variables for building i. The variables include building characteristics, loan characteristics, and borrower characteristics. ε_{ict} is the error term. α, β_1, γ_k, and δ_c are coefficients to be estimated. $\mathbb{1}_c$ is a dummy variable with a value of 1 if building i is located in location c and 0 otherwise. $t \times \mathbb{1}_c$ is the interaction between the time of origination and location. Equation (2) includes location-specific time fixed effects, which control for unobserved heterogeneity in the spread that varies by location and time. For example, if the spread in a location is affected by the local economy, then the location-specific time fixed effects will control for this. Equation (2) is our preferred specification.

Table 2 presents the main results for the energy efficient premium for mortgage interest rate spreads. Each column represents a different model specification and some combination of the buildings. Results are presented for ordinary least squares regressions estimated by maximum likelihood. Panel A presents the results for energy efficient buildings, and Panel B presents the results for net zero carbon buildings. Column (1) reports a basic model with no fixed effects and no control variables. Column (2) reports a model with location fixed effects and no control variables. Column (3) reports a model with location fixed effects and control variables for the property, loan, and borrower characteristics. Column (4) reports a model with location-specific time fixed effects and control variables for the property, loan, and borrower characteristics. Column (5) reports a model with location-specific time fixed effects and control variables for the property, loan, and borrower characteristics, but the dependent variable is the logarithm of the contract interest rate instead of the logarithm of the spread. Column (6) reports a model with location-specific time fixed effects and control variables for the property, loan, and borrower characteristics, but the dependent variable is the logarithm of the spread over the underlying benchmark rate, which is typically a swap rate or government bond yield. Column (7) reports a model with location-specific time fixed effects and control variables for the property, loan, and borrower characteristics, but the dependent variable is the logarithm of the spread over the underlying benchmark rate, which is typically a swap rate or government bond yield. Column (8) reports a model with location-specific time fixed effects and control variables for the property, loan, and borrower characteristics, but the dependent variable is the logarithm of the spread over the underlying benchmark rate, which is typically a swap rate or government bond yield.

[illegible]



Empirical analysis

The distribution of green-rated buildings is not random within urban areas in the U.S. and if this is not taken into account explicitly, statistical analyses can be highly misleading[13]. Figure 3 illustrates this point. It presents the joint frequency distribution of the dummy variables estimated for each cluster and the dummy variables estimated for the premium for the green building in that cluster. (These are the coefficients estimated in equation 1b.) This relationship is presented separately for the premium in effective rents and in market values.
An inverse relationship between any cluster premium and its associated green premium is clearly apparent. The correlation coefficient between cluster and green increments is significantly different from zero at the one percent level. This suggests that the premium for a green building, relative to nearby buildings, tends to be larger in smaller markets and regions and in the more peripheral parts of larger metropolitan areas, where location rents are lower. Apparently, a green label for a building adds less in value at a prime location, but it serves as an important signal in an otherwise lower-quality location.

Figure 4 reports the joint frequency distribution of the rent and value increments for green buildings and a measure of demand for energy – the number of "degree days" in the locations in which these green buildings are placed[14]. The figure reports a positive but weak relationship between the estimated rent and value increments for green building and a measure of the climatic conditions surrounding each of the buildings. This suggests that an energy-efficient building is more valuable in regions with more extreme climates, where heating and cooling is likely to be a larger part of total cost of occupancy. This is explored below.

4.2 The premium for energy efficiency

As demonstrated in the previous section, there is a statistically significant and rather large premium in rent and market value for green labeled buildings. The statistical analysis does not identify the source of this premium, or the extent to which the signal about energy efficiency is important relative to the other potential signals provided by a building of sufficient quality to earn a label. But the estimated premiums do vary within the stock of Energy-Star labeled buildings – most of which are certified to be in the top quarter of comparable buildings in terms of energy efficiency.

Figure 5 presents the distribution of the rent and value premiums for each of the 694 green buildings in the rental sample and the 199 green buildings which were sold between 2004 and 2007. Figures 5A, B, and C report the distribution of the premium in rent per square foot, effective rent per square foot, and in selling price. These figures are based upon the regressions reported in column (5) of Tables 3, 4 and 5 respectively. The figure indicates that the values of the estimated premiums vary across buildings, and in at least a few cases, the estimated effects are negative. However, a simple t-test indicates that the probability that the mean rent or value premium is negative for this sample of buildings is miniscule[15]. Appendix C reports the distribution of the t-ratios for the increments to rent and value (from the regression in columns (5) in Tables 2, 3 and 4). Each t-ratio is a test of the hypothesis that the estimated regression coefficient is different from the coefficient reported for rated buildings as a group (reported in column (4) in Tables 2, 3 or 4). As the figures show, a substantial fraction of the estimated individual premiums are indeed significantly different from the mean premium[16].

The rent premium associated with the label on any building represents the joint effects of the engineering efficiency of the building together with other unmeasured, but presumably important, attributes of the building. The fact that the estimated premiums are different from each other suggests that systematic variations in the thermal properties of buildings – even among certified green buildings – may be reflected in economic performance.

[13] *Results from additional specifications and specifications that do not identify specific clusters are available on request (or online at http://urbanpolicy.berkeley.edu).*
[14] *Degree days measure the deviation from a temperature of 65 degrees during a year. For each day with an average temperature lower or higher than 65 degrees, the degree day is the difference between that average temperature and 65 degrees. Data are available by CBSA (www.ncdc.noaa.gov).*
[15] *For rents, the probability is 0.0007. For effective rents, it is 0.0000, and for selling prices the probability that the mean value premium for green buildings is smaller than zero is 0.0000.*
[16] *For rent, 52 percent of the estimated increments are significantly different from 0.028, for effective rent, 45 percent of the estimated increments are significantly different from 0.064, and for transaction values, 38 percent of the estimated increments are significantly different from 0.167.*

Empirical analysis

For 494 buildings that have been certified as energy efficient by the Energy Star program, we obtained detailed data on energy efficiency as reported by a licensed engineer in the application for certification in the program. More specifically, we have the underlying raw data on energy use as submitted and verified by building owners in the Statement of Energy Performance (SEP) submitted to the EPA as a part of the certification process.

The energy use of a building is measured in two ways: site energy use and source energy use. Site energy use is the amount of heat and electricity consumed by a building as reflected in utility bills, converted into the standard energy measure, British Thermal Units (BTU) per square foot. This represents the most salient cost of energy use for building owners and occupiers. The site energy use may include a combination of purchases of primary energy (e.g., fuel oil) and secondary forms of energy (e.g., heat from a district steam system). The source energy of a building incorporates all transmission, delivery, and production losses for both primary and secondary energy used in the building. This facilitates a more complete comparison of gross energy use associated with buildings[17].

To account for the influence of climatic conditions on energy use, we standardize the energy consumption of each Energy-Star-rated building by the total number of degree days in the CBSA in which it is located. Presumably, more energy is needed for the heating of buildings in metropolitan areas with more heating degree days, and more energy is needed for the cooling of buildings in cities with more cooling degree days.

In this part of the analysis, we seek to distinguish the effects of the energy-saving aspect of the rating from the intangible effects of the label itself. These latter effects may arise from the reputational or marketing benefits of the labeled building or from other unmeasured aspects of quality in rated buildings.

Our statistical models utilize data on the thermal properties of the subsample of rated buildings and the climate conditions of the clusters in which they are located. The most straightforward of these takes the form:

(2a)

$$\hat{\delta}_n = \alpha + \Theta_j Z_{jn} + \eta_n^*$$

The dependent variable $\hat{\delta}_n$, is the estimate from equation (1b) of the increment to rent commanded by the green building in cluster n, relative to the control buildings in that cluster, holding constant the hedonic characteristics of the buildings. Z_{jn} is a vector of the thermal and climatic attributes j of the building n. As before, the Greek letters α and Θ_j denote estimated coefficients, and η_n is an error term. Note that the dependent variable is a regression estimate obtained from equation (1b), often with considerable error. Thus equation (2a) is appropriately estimated by generalized least-squares, incorporating the variance-covariance matrix of the parameters estimated in equation (1b). See Hanushek (1974).

As an alternative, we also report estimates of the following form:

(2b)

$$\hat{\varepsilon}_{in}^* = \alpha + \Theta_j Z_{jn} + \eta_{in}^{**}$$

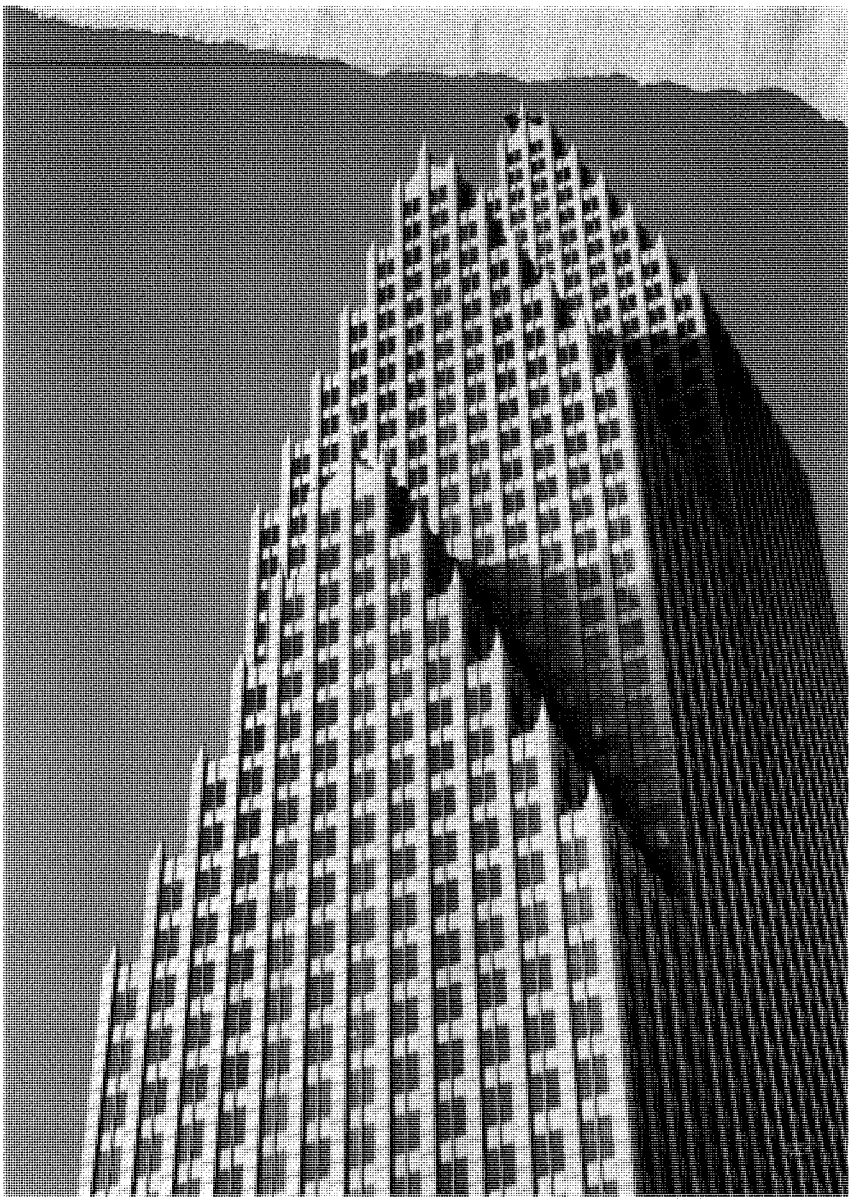
In this formulation the dependent variable, $\hat{\varepsilon}_{in}^*$, is the residual from equation (1a). It is the increment to rent commanded by the specific green building i that is not attributable to its hedonic characteristics, or to the average premium estimated for a green building, or to its location in a specific cluster. Presumably, this increment reflects energy efficiency as well as random error.

Finally, we report estimates of the following form:

(2c)

$$logR_{in} - \hat{\gamma}_n = \alpha + \beta X_i + \Theta_j Z_{jn} + \eta_{in}^{***}$$

[17] For details, see www.energystar.gov/index.cfm?c=evaluate_performance.bus_benchmark_comm_bldgs



Empirical analysis

In this formulation, we rely upon the location rent increment estimated for each cluster in equation (1a) using the entire sample of green buildings and control buildings. The dependent variable is the natural logarithm of the rent commanded by green building i in cluster n minus the estimated location rent increment for other buildings in cluster n as estimated in equation 1a.

Table 5 presants estimates of models explaining the variation in the increment in rent and market values as a function of the site energy consumption of an office building. Recall, "site energy" measures energy usage as reflected in the utility bills of the building owners or tenants. We estimate models (2a), (2b), and (2c) in several variants. We report energy usage in BTUs per square foot of gross space per degree day. More energy efficient buildings are those that use fewer BTUs per square foot per degree day. We also distinguish between BTU usage per cooling degree day and BTU usage per heating degree day, reflecting the usage of air conditioning and heating systems.

Panel A reports the increment to market value associated with energy efficiency for the 120 buildings which were sold and for which we were able to match SEP records and CoStar data. There is a clear inverse relationship between market value and energy usage. Within the sample of certified buildings which have been sold, a ten percent decrease in site energy use per degree day leads to an increase in market value of approximately two percent, over and above the average label premium of sixteen percent. These results are statistically significant using models 2a and 2b.

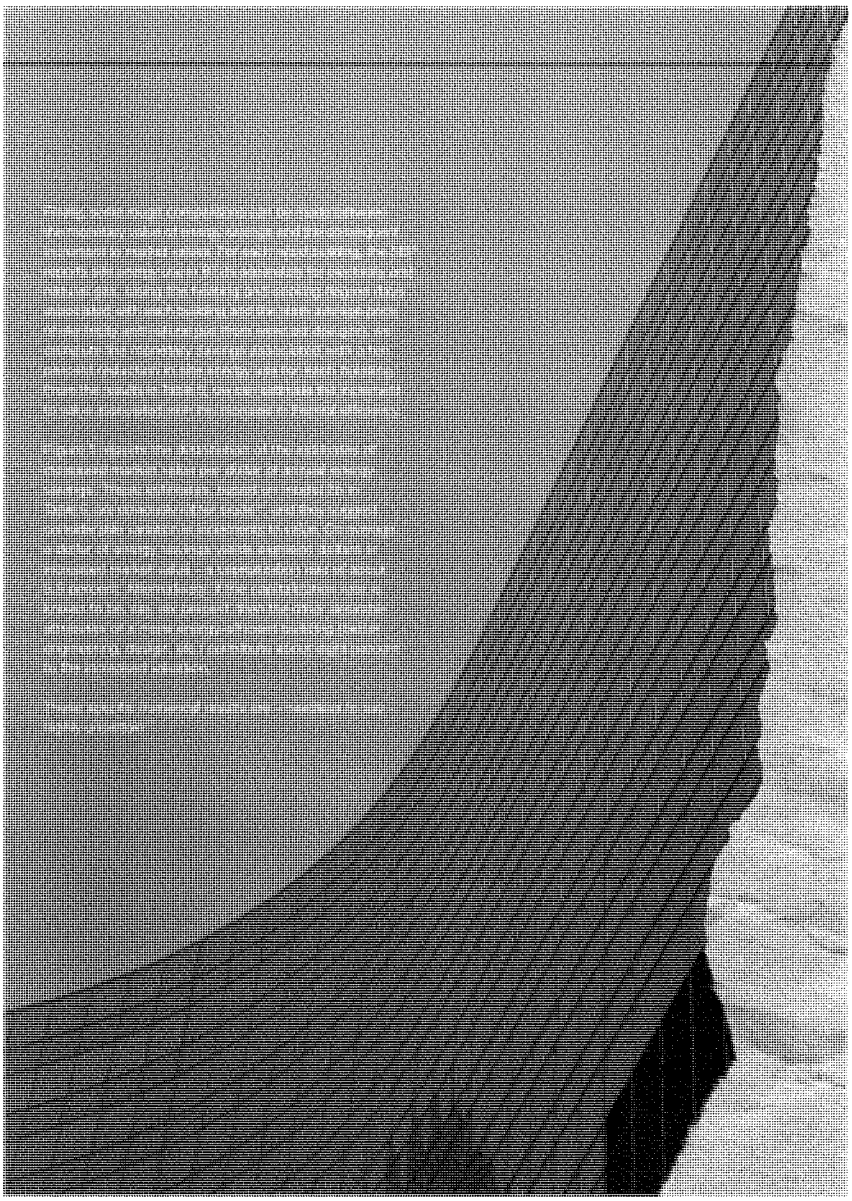
As noted in Table 1, for 39 of the buildings in the sample of 694 green buildings, leases require the tenants to pay separately for utilities. (These are called "net rent contracts.") For 27 of these buildings, we were able to obtain the SEP and the site energy use of the office building. In panel B of Table 5, we report models relating the increment in rents paid by tenants in these buildings as a function of the same measures of energy efficiency. The table reports estimates of the importance of variables measuring energy usage for these buildings in models which also include the energy usage in other rental buildings. The results indicate that tenants with net rental contracts are willing to pay higher rents for more energy efficient buildings, especially office buildings that use less energy per square foot to heat buildings in cold weather. A ten percent decrease in the energy consumption in a building is associated with an increase in the rent increment of approximately twenty basis points, over and above the six percent premium for a labeled building[18]. The sample sizes are quite small, and the precision of some of these estimates is questionable. Nevertheless, it certainly appears that: when tenants in office buildings pay their own utilities, and when they have chosen to pay a premium for tenancy in rated green buildings, they are nevertheless still willing to pay higher rents for more energy efficient buildings[19].

[17] *This calculation is based on the average site energy use, which is 64 BTU per sq.ft., with a standard deviation of 15 BTUs per sq.ft., the average number of heating degree days, which is 2737 per annum and the average number of cooling degree days, which is 1415 per annum.*

[18] *As noted in Appendix D, when source energy is used in the analysis (reflecting total energy use, rather than energy reflected in utility bills), the results are consistent.*

[19] *Not the least because more than forty percent of the sample is from California, and thus the same energy costs are reported.*

[20] *But for completeness, we report that the analogous calculations for rental buildings yields a capitalization rate of 6.3 percent (based on 27 net rental buildings).*



05 Conclusions

References

Baron, D.P. "Private Politics, Corporate Social Responsibility, and Integrated Strategy." *Journal of Economics & Management Strategy*, 2001, 10(1), pp. 7-45.

Bollinger, C.R.; Ihlanfeldt, K.R. and Bowes, D.R. "Spatial Variation in Office Rents within the Atlanta Region." *Urban Studies*, 1998, 35(7), pp. 1097-118.

California's Sustainable Building Taskforce. *The Costs and Financial Benefits of Green Buildings*, Qctober 2003.

Frombrun, C. and Shanley, M. "What's in a Name? Reputation Building and Corporate Strategy." *The Academy of Management Journal*, 1990, 33(2), pp. 233-58.

Glascock, J. L.; Johanian, S. and Sirmans, C.F. "An Analysis of Office Market Rents." *AREUEA Journal*, 1990, 18, pp. 105-19.

Gunnelin, A. and Söderberg, B. "Term Structures in the Office Rental Market in Stockholm." *Journal of Real Estate Finance and Economics*, 2003, 26(2-3), pp. 241-65.

Hanushek, E., "Efficient Estimators for Regressing Regression Coefficients," *American Statistician*, 28(2), 1974, pp. 66-67.

Khanna, M. and Damon, L.A. "EPA's Voluntary 33/50 Program: Impact on Toxic Releases and Economic Performance of Firms." *Journal of Environmental Economics and Management*, 1999, 37(1), pp. 1-25.

Klein, B. and Leffler, K.B. "The Role of Market Forces in Assuring Contractual Performance." *The Journal of Political Economy*, 1981, 89(4), pp. 615-41.

Lyon, T.P. and Maxwell, J.W. "Greenwash: Corporate Environmental Disclosure under Threat of Audit." Ross School of Business, University of Michigan, 2006, 1-39.

Maxwell, J.W.; Lyon, T.P. and Hackett, S.C. "Self-Regulation and Social Welfare: The Political Economy of Corporate Environmentalism." *Journal of Law and Economics*, 2000, 43(2), pp. 583-617.

Milgrom, P. and Roberts, J. "Price and Advertising Signals of Product Quality." *Journal of Political Economy*, 1986, 94(4), pp. 796-821.

Orlitzky, M. and Benjamin, J.D. "Corporate Social Performance and Firm Risk: A Meta-Analytic Review." *Business and Society*, 40(4), 2001, pp. 369-396.

Öven, V.A. and Pekdemir, D. "Office Rent Determinants Utilising Factor Analysis - a Case Study for Istanbul." *Journal of Real Estate Finance and Economics*, 2006, 33(1), pp. 51-73.

Quigley, J.M., "The Production of Housing Services and the Derived Demand for Residential Energy." *The RAND Journal of Economics*, 15(4), 1985: 555-567.

Quigley, J.M., "Market Induced and Government Mandated Energy Conservation in the Housing Market: Econometric Evidence from the U.S." *Review of Urban and Regional Development Studies*, 3(1), 1991: 28-38.

RICS, Royal Institution of Chartered Surveyors, *Green Value*, London and Vancouver, 2005.

Rosen, K. "Toward a Model of the Office Building Sector." *AREUEA Journal*, 1984, 12, pp. 261-69.

Schelling, T.S. "Some Economics of Global Warming." *American Economic Review*, 1992, 82(1), pp. 1-14.

Sivitanidou, R. "Urban Spatial Variations in Office-Commercial Rents." *Journal of Urban Economics*, 1995, 38(1), pp. 23-49.

Sivitanidou, R. "Do Office-Commercial Firms Value Access to Service Employment Centers? A Hedonic Value Analysis within Polycentric Los Angeles." *Journal of Urban Economics*, 1996, 40(2), pp. 125-49.

Social Investment Forum. *2007 Report on Socially Responsible Investing Trends in the United States*, Washington, D.C., 2007.

Turban, D.B. and Greening, D.W. "Corporate Social Performance and Organizational Attractiveness to Prospective Employees." *Academy of Management Journal*, 1997, 40(3), pp. 658-72.

Waddock, S.A. and Graves, S.B. "The Corporate Social Performance-Financial Performance Link." *Strategic Management Journal*, 1997, 18(4), pp. 303-19.

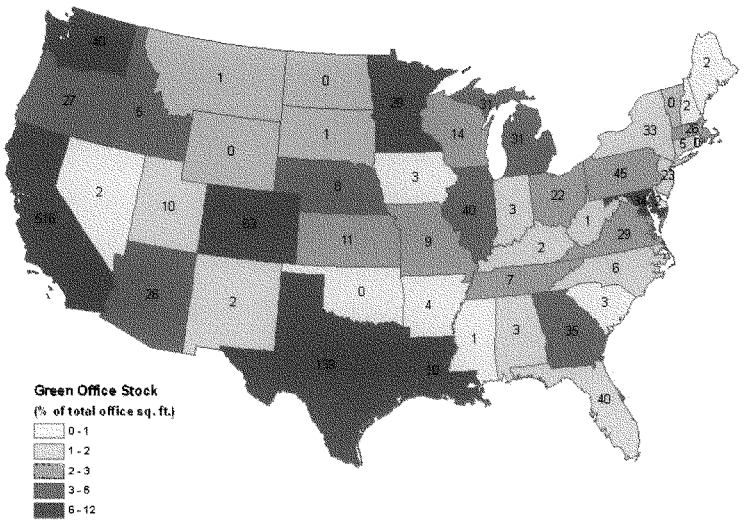
Webb, R.B. and Fisher, J.D. "Development of an Effective Rent Index for the Chicago CBD." *Journal of Urban Economics*, 1996, 39, pp. 1-19.

Wheaton, W.C. and Torto, R. "Office Rent Indices and Their Behavior over Time." *Journal of Urban Economics*, 1994, 35, pp. 121-39.

White, H.. "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." *Econometrica*, 1980, 48(4), pp. 817-38.

Figures

Figure 1 - Distribution of Green Office Buildings by State (percent of the stock of office space) 2007

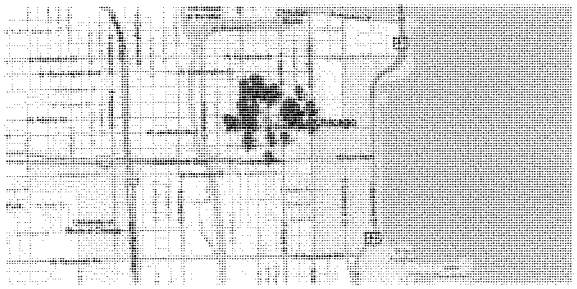


Source: Costar and authors' calculations.

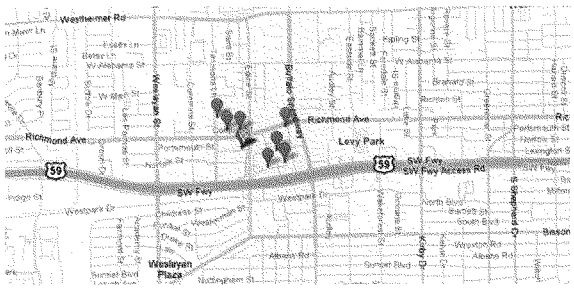
Note: Number in each state represents the number of green buildings in that state.

Figure 2 - Clusters of Green and Control Buildings

A. Chicago, IL



B. Houston, TX



C. Columbus, OH

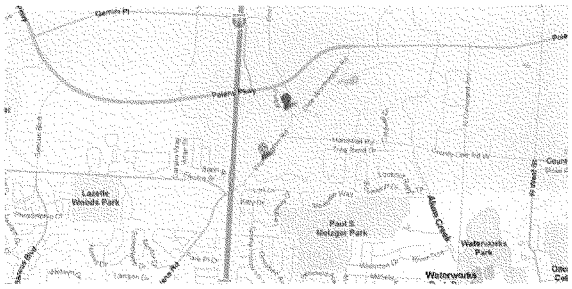


Figure 3 - Location Increments vs Increments for Energy Efficiency

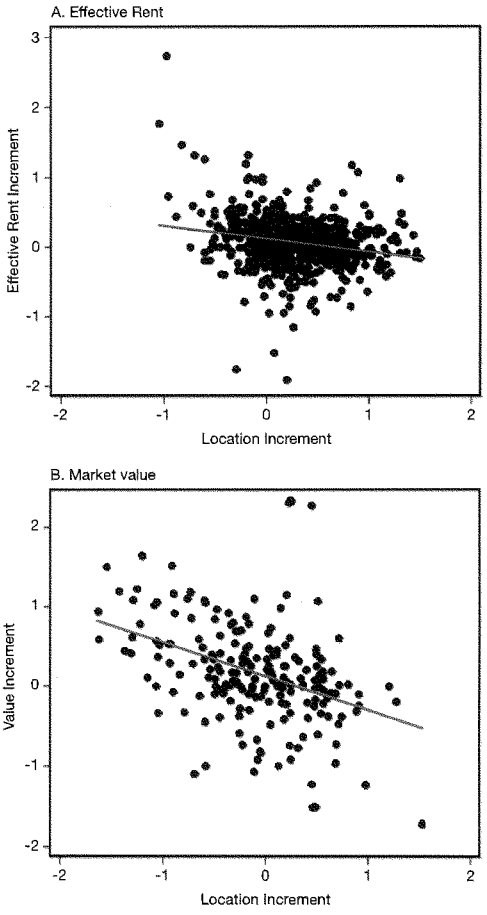


Figure 4 - Degree Days vs Increments for Energy Efficiency

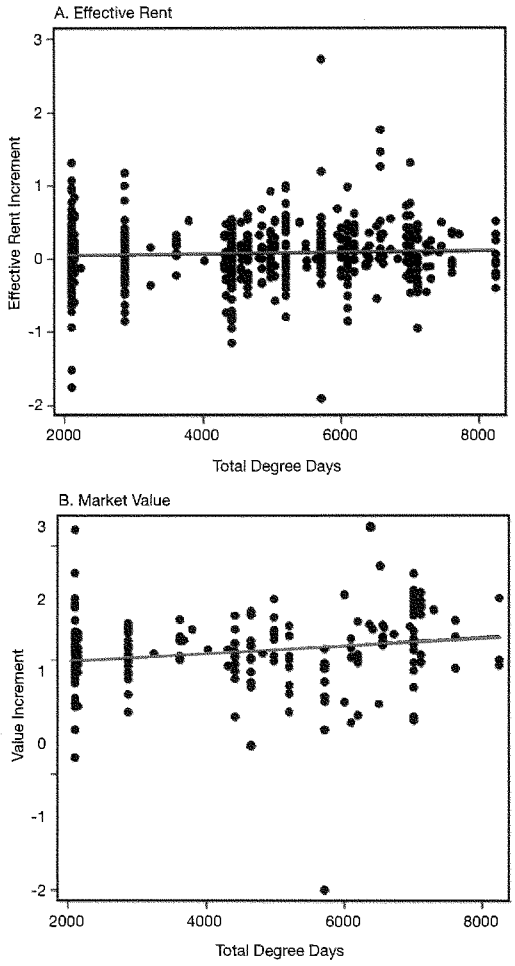


Figure 5 - Distribution of Regression Estimates of the Increments to Rents or Market Value for Green Buildings

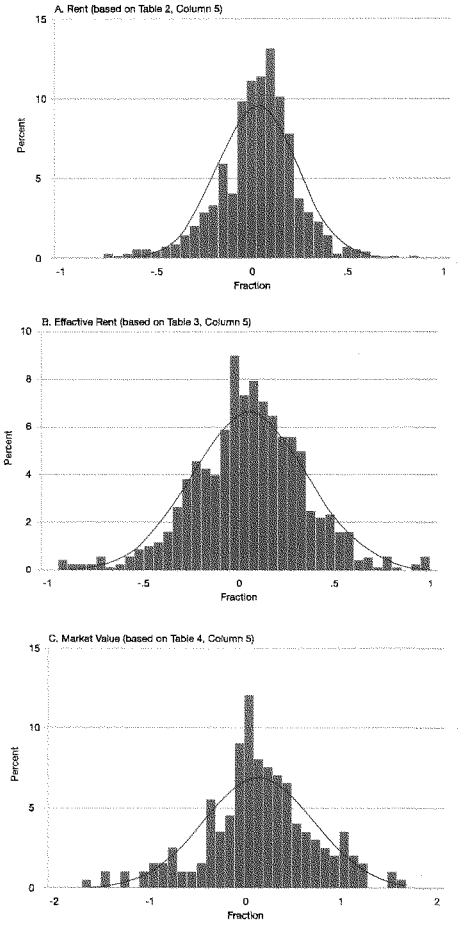
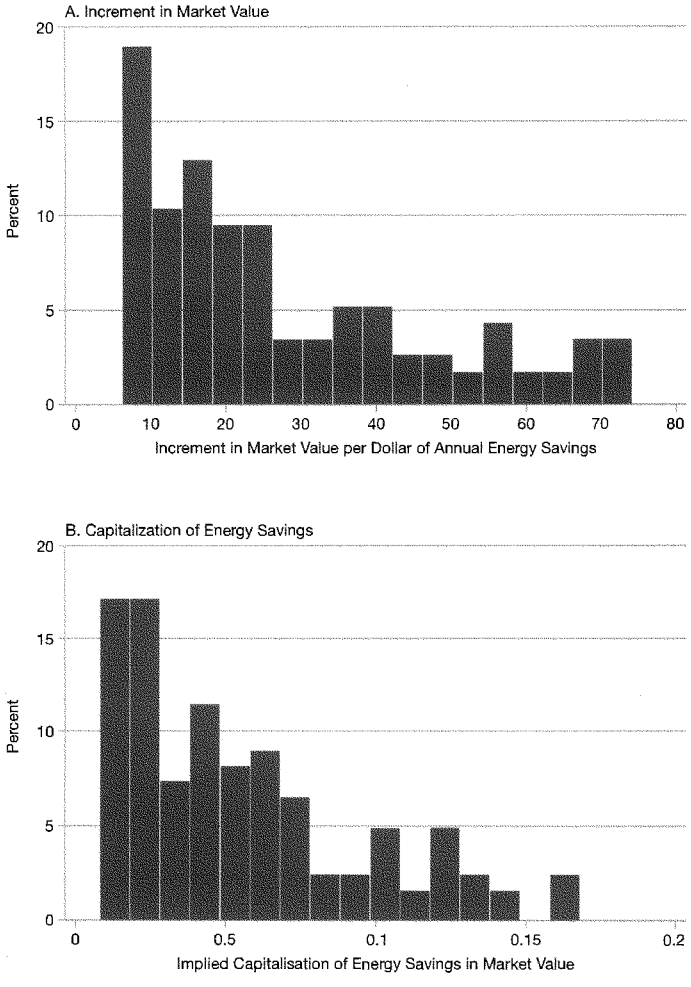


Figure 6 - Increase in Market Values following a Ten Percent Increase in Energy Efficiency



Tables

Table 1 Comparison of Green-Rated Buildings and Nearby Control Buildings. Rental Sample and Sales Sample (standard deviations in parentheses)

	Rental Sample		Sales Sample	
	Green Buildings	Control Buildings	Green Buildings	Control Buildings
Sample Size	694	7,488	199	1,617
Asking Rent (dollars/sq. ft.)	29.84	28.14		
	(12.98)	(15.60)		
Effective Rent* (dollars/sq. ft.)	26.83	23.51		
	(13.00)	(16.11)		
Sales Price (dollars/sq. ft.)			269.22	248.89
			(165.70)	(255.49)
Net Rent Contract** (percent)	5.76	3.15		
	(23.32)	(17.47)		
Size (thousands sq. ft.)	324.08	218.69	368.33	159.12
	(288.92)	(293.67)	(287.86)	(257.50)
Occupancy Rate (percent)	89.12	81.53		
	(12.76)	(22.73)		
Stories (number)	15.31	13.07	16.47	10.35
	(13.26)	(12.11)	(12.76)	(10.50)
Stories (percent)				
Low (<10)	46.25	53.49	44.12	63.33
	(49.90)	(49.88)	(49.77)	(48.21)
Medium (10-20)	26.66	25.25	33.04	21.34
	(44.25)	(43.46)	(42.21)	(40.98)
High (>20)	27.08	21.27	22.84	15.34
	(44.47)	(40.93)	(47.08)	(36.05)
Age (years)	23.85	49.45	24.64	60.36
	(15.57)	(32.50)	(16.40)	(35.61)
Age (percent)				
Less than 10 years	14.27	4.87	16.18	4.14
	(35.00)	(21.53)	(36.91)	(19.94)
10 to 20 years	24.06	9.40	21.08	5.43
	(42.78)	(29.19)	(40.89)	(24.54)
21 to 30 years	43.37	25.13	42.16	20.22
	(49.59)	(43.38)	(49.50)	(40.18)
31 to 40 years	11.10	13.25	11.76	8.63
	(31.43)	(33.90)	(32.30)	(27.95)
Over 40 years	7.20	47.34	8.82	60.67
	(25.88)	(49.93)	(28.43)	(48.86)

Tables

Table 1 Comparison of Green-Rated Buildings and Nearby Control Buildings. Rental Sample and Sales Sample (standard deviations in parentheses) - continued

	Rental Sample		Sales Sample	
Sample Size	Green Buildings	Control Buildings Control Buildings	Green Buildings 199	Control Buildings 1,617
Building Class				
A	79.39 (40.48)	34.94 (47.68)	80.39 (39.80)	22.26 (41.61)
B	19.45 (39.61)	48.78 (49.99)	19.12 (39.42)	53.12 (49.92)
C	1.15 (10.68)	16.28 (36.92)	0.49 (7.00)	24.56 (43.05)
On-Site Amenities*** (percent)	71.76 (45.05)	49.22 (50.00)	78.43 (41.23)	49.41 (50.01)
Renovated Bldg. (percent)	21.04 (40.79)	36.51 (48.67)	25.49 (43.69)	45.70 (49.83)
Employment Growth (percent)	3.48 (9.52)	3.10 (7.96)	3.40 (3.23)	2.50 (3.63)
Year of Sale (percent)				
2004			15.08 (35.87)	18.99 (39.23)
2005			22.61 (41.94)	26.28 (44.03)
2006			26.63 (44.32)	30.67 (46.13)
2007			35.68 (48.03)	23.87 (42.64)

Notes:

The control sample consists of all commercial office buildings within a 0.25 mile radius of each rated building for which comparable data are available. All observations are as of September 2007.

* Effective Rent equals the Asking Rent multiplied by the Occupancy Rate.

** Net Rent Contracts require tenants to pay separately for utilities.

*** One or more of the following amenities are available on-site: banking, convenience store, dry cleaner, exercise facilities, food court, food service, mail room, restaurant, retail shops, vending areas, fitness center.

Table 2 Regression Results. Commercial Office Rents and Green Ratings (dependent variable: logarithm of rent per square foot)

	(1)	(2)	(3)	(4)	(5)
Green Rating (1 = yes)	0.035 [0.009]***		0.033 [0.009]***	0.028 [0.009]***	
Energy Star (1 = yes)		0.033 [0.009]***			
LEED (1 = yes)		0.052 [0.036]			
Building Size (millions of sq. ft.)	0.113 [0.019]***	0.113 [0.019]***	0.102 [0.019]***	0.111 [0.021]***	0.111 [0.023]***
Fraction Occupied	0.020 [0.016]	0.020 [0.016]	0.020 [0.016]	0.011 [0.016]	0.004 [0.017]
Building Class:					
Class A (1 = yes)	0.231 [0.012]***	0.231 [0.012]***	0.192 [0.014]***	0.173 [0.015]***	0.173 [0.017]***
Class B (1 = yes)	0.101 [0.011]***	0.101 [0.011]***	0.092 [0.011]***	0.083 [0.011]***	0.082 [0.012]***
Net Contract (1 = yes)	-0.047 [0.013]***	-0.047 [0.013]***	-0.050 [0.013]***	-0.051 [0.013]***	-0.057 [0.014]***
Employment Growth (fraction)	0.608 [0.171]***	0.608 [0.171]***	0.613 [0.167]***	0.609 [0.169]***	0.574 [0.054]***
Age:					
< 10 years			0.118 [0.016]***	0.131 [0.017]***	0.132 [0.019]***
10 – 20 years			0.079 [0.014]***	0.085 [0.014]***	0.083 [0.015]***
20 – 30 years			0.047 [0.013]***	0.049 [0.013]***	0.049 [0.014]***
30 – 40 years			0.043 [0.011]***	0.044 [0.011]***	0.044 [0.012]***
Renovated (1 = yes)			-0.005 [0.009]	-0.006 [0.009]	-0.010 [0.010]
Stories:					
Intermediate (1 = yes)				0.009 [0.009]	0.008 [0.010]
High (1 = yes)				0.029 [0.014]**	0.032 [0.016]**
Amenities (1 = yes)				0.047 [0.007]***	0.054 [0.008]***
Constant	2.741 [0.113]***	2.742 [0.114]***	2.718 [0.126]***	2.725 [0.127]***	2.564 [0.022]***
Sample Size	8182	8182	8182	8182	8182
R^2	0.71	0.71	0.72	0.72	0.74
Adj R^2	0.69	0.69	0.69	0.69	0.68

Notes:

Each regression also includes 694 dummy variables, one for each locational cluster. Regression (5) also includes an additional 694 dummy variables, one for each green building in the sample.

Standard errors are in brackets. Significance at the 0.10, 0.05, and 0.01 levels are indicated by *, **, and ***, respectively.

Tables

Table 3 Regression Results, Commercial Office Rents and Green Ratings (dependent variable: logarithm of effective rent per square foot)

	(1)	(2)	(3)	(4)	(5)
Green Rating (1 = yes)	0.100 [0.016]***		0.062 [0.024]***	0.064 [0.023]***	
Energy Star (1 = yes)		0.100 [0.016]***			
LEED (1 = yes)		0.094 [0.052]*			
Building Size (millions of sq. ft.)	0.261 [0.028]***	0.261 [0.028]***	0.235 [0.027]***	0.189 [0.027]***	0.193 [0.030]***
Building Class:					
Class A (1 = yes)	0.408 [0.028]***	0.408 [0.028]***	0.340 [0.029]***	0.229 [0.030]***	0.226 [0.033]***
Class B (1 = yes)	0.226 [0.027]***	0.226 [0.027]***	0.203 [0.027]***	0.152 [0.026]***	0.149 [0.028]***
Net Contract (1 = yes)	0.015 [0.024]	0.014 [0.024]	0.010 [0.024]	0.009 [0.024]	0.016 [0.026]
Employment Growth (fraction)	0.765 [0.312]**	0.756 [0.322]**	0.773 [0.293]**	0.682 [0.308]**	0.468 [0.421]
Age:					
< 10 years			0.134 [0.045]***	0.177 [0.044]***	0.149 [0.054]***
10 – 20 years			0.141 [0.025]***	0.146 [0.025]***	0.150 [0.028]***
20 – 30 years			0.113 [0.023]***	0.112 [0.023]***	0.128 [0.025]***
30 – 40 years			0.097 [0.018]***	0.090 [0.018]***	0.089 [0.020]***
Renovated (1 = yes)			0.019 [0.018]	0.016 [0.018]	0.022 [0.019]
Stories:					
Intermediate (1 = yes)				0.145 [0.021]***	0.156 [0.024]***
High (1 = yes)				0.088 [0.026]***	0.090 [0.029]***
Amenities (1=yes)				0.116 [0.015]***	0.124 [0.016]***
Constant	2.151 [0.029]***	2.158 [0.059]***	2.093 [0.050]***	2.187 [0.050]***	2.299 [0.060]***
Sample Size	8182	8182	8182	8182	8182
R^2	0.47	0.47	0.47	0.48	0.51
Adj R^2	0.42	0.42	0.42	0.43	0.41

Notes:

Each regression also includes 694 dummy variables, one for each locational cluster. Regression (5) also includes an additional 694 dummy variables, one for each green building in the sample.

Standard errors are in brackets. Significance at the 0.10, 0.05, and 0.01 levels are indicated by *, **, and ***, respectively.

Table 4 Regression Results. Office Sales Prices and Green Ratings 2004 – 2007 (dependent variable: sales price in dollars/sq. ft.)

	(1)	(2)	(3)	(4)	(5)
Green Rating (1 = yes)	0.168		0.158	0.165	
	[0.057]***		[0.052]***	[0.062]***	
Energy Star (1 = yes)		0.191			
		[0.052]***			
LEED (1 = yes)		0.113			
		[0.172]			
Building Size (millions of sq. ft.	0.171	0.167	0.104	0.200	0.192
	[0.090]*	[0.089]*	[0.089]	[0.168]*	[0.128]
Building Class:					
Class Aa (1 = yes)	0.164	0.161	0.032	0.104	0.143
	[0.066]**	[0.066]**	[0.075]	[0.064]	[0.099]
Class B (1 = yes)	-0.188	-0.187	-0.216	-0.184	-0.183
	[0.051]***	[0.051]***	[0.057]***	[0.058]***	[0.064]***
Employment Growth (trailing	0.005	0.005	0.004	0.005	0.005
	[0.004]	[0.004]	[0.005]	[0.003]	[0.005]
Age:					
< 10 years			0.201	0.207	0.161
			[0.149]	[0.147]	[0.207]
10 - 20 years			0.196	0.224	0.226
			[0.099]*	[0.100]**	[0.124]*
20 - 30 years			0.248	0.276	0.288
			[0.070]***	[0.070]***	[0.081]***
30 - 40 years			0.226	0.251	0.261
			[0.073]***	[0.075]***	[0.090]***
Renovated (1 = yes)			0.096	0.087	0.071
			[0.046]**	[0.046]*	[0.053]
Stories:					
High (1 = yes)				0.185	0.232
				[0.092]**	[0.113]**
Intermediate (1 = yes)				0.180	0.189
				[0.057]***	[0.067]***
Amenities (1=yes)				0.043	0.048
				[0.049]	[0.058]
Year of sale:					
2006 (1 = yes)	0.015	0.017	0.021	0.016	0.048
	[0.060]	[0.060]	[0.060]	[0.060]	[0.071]
2005 (1 = yes)	-0.040	-0.039	-0.039	-0.048	-0.034
	[0.056]	[0.056]	[0.056]	[0.055]	[0.065]
2004 (1 = yes)	-0.177	-0.175	-0.173	-0.200	-0.174
	[0.067]***	[0.067]***	[0.067]**	[0.067]***	[0.078]**
Constant	5.314	5.317	5.269	5.406	5.401
	[0.091]***	[0.091]***	[0.151]***	[0.160]***	[0.226]***
Sample Size	1816	1816	1816	1816	1816
R^2	0.43	0.43	0.44	0.44	0.49
Adj R^2	0.35	0.35	0.36	0.37	0.34

Notes: Each regression also includes 199 dummy variables, one for each locational cluster.

Regression (5) also includes an additional 199 dummy variables, one for each green building in the sample.

Standard errors are in brackets. Significance at the 0.10, 0.05, and 0.01 levels are indicated by *, **, and ***, respectively.

Tables

Table 5 Regression Results. Increment in Market Value and Effective Rent for More Energy Efficient Buildings Using Site Energy

Panel A. Value Increments	Model 2a		Model 2b		Model 2c	
Site Energy Consumption						
Per Degree Day	-10.540 [4.859]**		-9.805 [3.922]**		-6.083 [4.397]	
Per Degree Day (heating)		-4.954 [1.906]**		-4.189 [1.952]**		-2.970 [1.969]
Per Degree Day (cooling		-0.492 [0.303]		-0.442 [0.247]*		-0.504 [0.909]
Constant	0.332 [0.095]***	0.362 [0.098]***	0.302 [0.086]***	0.309 [0.090]***	5.623 [0.296]***	5.637 [0.251]***
Sample Size	120	120	120	120	120	120
R²	0.04	0.06	0.05	0.06	0.31	0.33
Adj R²	0.03	0.05	0.04	0.04	0.20	0.22

Panel B. Rent Increment	Model 2a		Model 2b		Model 2c	
Site Energy Consumption						
Per Degree Day*Net	0.707 [4.693]		0.539 [3.221]		7.636 [9.256]	
Per Degree Day (heating)*Net	-0.240 [0.282]		-0.197 [0.025]***		-0.236 [2.067]***	
Per Degree Day (cooling)*Net	-0.063 [0.381]		-0.196 [0.238]		-0.395 [0.244]	
Constant	0.028 [0.015]*	0.027 [0.015]*	0.053 [0.013]***	0.053 [0.013]***	2.705 [0.149]***	2.692 [0.154]***
Sample Size	449	449	449	449	449	449
R²	0.00	0.00	0.00	0.00	0.23	0.24
Adj R²	0.00	0.00	0.00	0.00	0.21	0.21

Notes:

Energy consumption is measured in BTUs per square foot of gross space. See www.energystar.gov/index.cfm?c=evaluate_performance.bus_benchmark_comm_bldgs

In panel B, the specification includes the variables measuring site energy consumption as well as the interaction between site energy consumption and buildings with net rent contracts.

Standard errors are in brackets. Significance at the 0.10, 0.05, and 0.01 levels are indicated by *, **, and ***, respectively.

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STATEMENT OF
THE INDEPENDENT ELECTRICAL CONTRACTORS

BEFORE THE
SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ON
"OVERSIGHT OF THE GSA AND ENERGY EFFICIENCY IN PUBLIC BUILDINGS

The Independent Electrical Contractors (IEC) and its 2,700 electrical contractor members would like to thank the Committee for holding today's hearing on "Oversight of the GSA and Energy Efficiency in Public Buildings."

While the witnesses testifying before your panel will likely focus on the value of "greening" the large number of buildings that the federal government owns or leases, IEC would like to point out the limited economic, real-world impact these efforts will have due to restrictive policies that are being implemented by the current administration.

First, Executive Order (EO) 13502, signed by President Barack Obama on February 6, 2009, authorizes and encourages the use of union-only project labor agreements (PLAs) on federal construction contracts totaling $25 million or more. This order also included PLAs on smaller contracts that are determined to be "related" to those in excess of the $25 million threshhold.

A union-only PLA is a contract that requires a construction project to be awarded to contractors and subcontractors that agree to the following terms: (1) recognize unions as the representatives of their employees on that jobsite; (2) use the union hiring hall to obtain workers; (3) obtain apprentices through union apprenticeship programs; and (4) obey the union's work rules and job classifications.

Union-only PLAs discriminate against merit shop contractors, and their employees (which represents 84 percent of the construction workforce, according to the U.S. Bureau of Labor Statistics), by effectively denying them the opportunity to bid on contracts that are funded with their own tax dollars.

President Obama justified Executive Order 13502 by citing non-fact based concerns about efficiency in contract completion and avoiding labor disputes. However, it bears stating an obvious reality that counters these straw man arguments; namely, that a previous executive order, mandating federal neutrality in government contracting, was in effect for almost eight years (2001-2009) until overturned by President Obama's order. During that time, none of President Obama's stated concerns, stated in EO 13502, had a negative impact on federal construction contracts.

IEC members are not asking for special treatment or set asides. Our contractors are proud of both their work product and their employees, and are more than happy to compete for any job on the market. Unfortunately, the specter of EO 13502, which would exclude merit shop contractors and their employees from federal work, means that any real-time economic benefit related to "greening" federal buildings will be limited to a very small segment of our industry.

We strongly encourage the Committee, and the Congress, to pass S. 90, which would overturn EO 13502 by mandating government neutrality in federal contracting.

Next, the archaic and inefficient Davis-Bacon Act prevailing wage rates that apply to federal construction are a barrier to small businesses competing for these contracts. As an organization with two-thirds of its membership employing 10 or fewer individuals, IEC members are especially sensitive to the bureaucratic red tape that accompanies Davis-Bacon.

The inaccurate and wasteful system currently employed to calculate the "prevailing wage rate" relies on data collected through a survey process that relies on voluntary participation by the respective industries and labor organizations. Unfortunately, the survey process is such that the "prevailing wage rate" is almost always reflective the local union's collective bargaining agreement rather than the true market rate. Importantly, this means that the local union's worker classifications, and thus its works rules, are also reflected in the Davis-Bacon rate.

Thus, a small business owner must understand the details of a local collective bargaining agreement and apply that to their business in order to comply with the law.

A series of audits by outside agencies, as well as the U.S. Department of Labor's (DOL) own Office of Inspector General (OIG). These audits have revealed substantial inaccuracies in Davis-Bacon Act wage determinations and suggested that they are vulnerable to fraud. In fact, DOL's OIG released three reports highly critical of the wage determination program, with one report from 2004 finding errors in nearly 100 percent of the wage surveys reviewed.

The Davis-Bacon Act's inefficiencies are not only discriminatory, but also are costly to the U.S. taxpayers. Davis-Bacon has been shown to increase public construction costs by anywhere from 5 to 38 percent above what the project would have cost in the private sector. According to the Congressional Budget Office, the Davis-Bacon Act already costs taxpayers more than $9.5 billion over the 2002 to 2011 period relative to the 2001 appropriations and $10.5 billion relative to 2001 appropriations adjusted for inflation. A more recent estimate, from the Beacon Hill Institute at Suffolk University in January, suggests Davis-Bacon costs taxpayers $8.6 billion per year.

As the General Services Administration (GSA) and Congress proceed with the "greening" of federal buildings, IEC strongly encourages the repeal of Davis-Bacon and the use of a more accurate and less costly federal prevailing wage rate.

Finally, IEC cannot comment on the issue of "green" construction without noting the negative impact that the Green Jobs Act (Title X of P.L. 110-140) could have on the skilled training of the men and women who will work these "green jobs."

The Green Jobs Act establishes training grants to fund training programs targeted at creating an efficient energy and renewable energy skilled workforce. Specifically, the Green Jobs Act would require any entity wanting to apply for these grants to partner with a labor organization in order to be eligible for funding. The reality is that this language would bar the numerous merit shop training programs from receiving this grant funding.

Through its DOL certified, chapter-based training programs, IEC trains thousands of apprentice electricians every year, along with providing continuing education for contractors and journeymen, while constantly striving to keep pace with technology and innovation in order to make certain America has the skilled workforce it deserves. IEC contractors recognize the growing market force of green buildings and are adapting their training methods to prepare workers for this expanding segment of the construction industry.

IEC strongly supports the concept of green jobs training in order to meets the growing demand within the marketplace. However, the continued participation of IEC members and all merit shop contractors, and the job opportunities for the 84 percent of the construction workforce they employ, is threatened by the requirements contained within the Green Jobs Act.

Given the stated desire to see a continued increase in the use of green building and green technology, it seems that limiting the ability to participate in green training to the 16 percent of the market that belongs to a union would make this growth difficult. If the green building market is going to continue to expand, even double in the coming years as some groups predict, participation of the merit shop will be a crucial factor in ensuring there are enough skilled workers to meet the demand. The advances in the technology and skill involved in green building, and the benefits of their use, is indeed a welcome trend for contractors, skilled workers and the end user. It is our view that the most efficient path to encouraging the continued growth of this sector is through open competition rather than policies that favor a special interest group over the majority of an industry.

Limiting the ability of a vast majority of the construction workforce to participate in green job training will increase the costs of constructing new green buildings by limiting the competition for the contracts.

IEC encourages this Committee to support passage of the *Green Jobs Improvement Act*, which would promote open competition for these federal funds by removing the restrictive mandate that a training program partner with a labor order to be eligible for a taxpayer funded program.

Again, I would like to thank the Committee for accepting IEC's statement for the record as part of this hearing. We stand ready to work with Congress and the GSA to make federal office space as energy efficient as possible, and we remain hopeful that our contractor members will be given the opportunity to compete for these opportunities.

Testimony from the
National Association of Home Builders

United States Senate
Committee on Environment & Public Works

"Oversight of the GSA and Energy Efficiency in Public Buildings"

April 22, 2009

Written Statement

Overview

On behalf of the 200,000 members of the National Association of Home Builders (NAHB), we appreciate the opportunity to provide testimony on the oversight of the U.S. General Services Administration (GSA) and energy efficiency in public buildings. While most NAHB members do not construct federal buildings, the impact of buildings belonging to and constructed by GSA on the building sector as a whole directly affects our industry. NAHB members are affected by the overall performance of GSA buildings as all buildings are responsible for some measure of energy and resource use, as well as greenhouse gas emissions. As our industry moves forward with a rigorous green building program, the National Green Building Standard™ - the first and only green standard approved by the American National Standards Institute (ANSI) – and promoting energy efficiency improvements in both new and existing homes, it will be important for the nation's biggest landlord, i.e., GSA, to have sound policies on energy efficiency, sustainability, and green building.

The policies and procedures promoted and supported by GSA on energy efficiency, sustainability, and green building are relevant and important precursors for other types of development, including residential. General support for improved energy, resource, and water efficiency in public buildings coincides with many of the green building advances that the housing industry has voluntarily implemented over the last 30 years. However, one potential area of concern is with the GSA's endorsement and support for specific green rating systems over criteria-based or benchmarked targets for green building. NAHB supports a holistic approach to green building that is based on actual performance of homes and buildings, rather than promoting specific, or privately-developed and managed green rating systems, particularly for government-owned and funded property.

Energy Efficiency and Green Building

The energy performance of newer homes and buildings has dramatically improved over the last decade. Since the introduction of national model energy codes and standards in the early 1990s, energy consumption has dropped and efficiency has increased. As the Energy Information Administration (EIA) reports, homes built between 1991 and 2001 consumed only about 2.5% of total U.S. energy consumption in 2001, while homes built before 1991 consumed 17.1%.[i] Additionally, the growing momentum of the green building movement in the 1990s began delivering more sustainable buildings that both conserved energy and natural resources.

In 2005, Congress passed the *Energy Policy Act* (P.L.109-58) that provided additional incentives for building efficiency under Sections 25C, 25D, 179D, and 45L of the Internal Revenue Code. These incentives further pushed efficiency thresholds beyond code minimums (up to 50%) to promote the construction of super-efficient homes and commercial buildings. The same law also established a grant program to improve the energy efficiency of State and locally-owned public buildings by 30% - for both new construction and renovated existing buildings (Section 125).

Also in 2005, NAHB released the first set of national green building benchmarks for residential construction called *The National Green Home Building Guidelines* (the Guidelines). The Guidelines, developed by many stakeholders in the building industry – i.e., builders, suppliers, manufacturers, and government officials – served to improve not only energy efficiency, but also resource efficiency and indoor environmental quality as part of the design and construction of new homes.

As greater emphasis on the design and performance of new buildings continues to enhance energy savings and consumption reductions for new stock, fewer resources and focus is continually afforded to the energy lost in existing buildings and older, less efficient structures. While it seems easier to control the efficiency of buildings *before* construction through various regulatory measures, the government risks losing out on the most substantial energy savings if policies are focused inordinately on newer, more efficient buildings.

Developing a Legitimate National Consensus Standard

The challenges of addressing efficiency improvements in both new and existing construction at the same time was answered by NAHB with the development of the first nationally-applied green building standard approved by the American National Standards Institute (ANSI). Working off of the success of the Guidelines, NAHB convened a stakeholder group [see Appendix A – Consensus Committee] in 2007 to begin development of a rigorous set of green benchmarks for single and multifamily construction, renovation, and site development that holds impartial integrity through its approval by an unaffiliated third-party accreditation authority like ANSI.

The Consensus Committee convened several public meetings, negotiated countless proposals, and reviewed thousands of public comments to produce a set of criteria that preserves environmental quality, saves energy and natural resources, and supports affordability metrics that could apply to every price-point and building type in the residential market. The finished product was approved by ANSI on January 29, 2009 and is currently the only national green building standard for any construction category that has earned ANSI's seal of approval.

The importance of gaining integrity through third-party approval by groups like ANSI is to protect against undue private or corporate influence, to align with federal laws that govern recognition of technical standards by government agencies, and to ensure that such standards are updated and improved on a regular schedule. These safeguards ensure that one interest holds no greater weight over others in developing product design specifications or techniques and that neither industry nor public interest groups supersede government and enforcement officials' authority in setting benchmarks.

For instance, standards approved by ANSI have to meet strict balance requirements during development to include equal representation by stakeholder groups – public interest (nonprofit), industry and government, essentially those entities that develop criteria, those regulated by it, and those enforcing it. If the government supported and used only green criteria established entirely by interest groups or unaffiliated corporations, for example, it would effectively stifle any input from industry or government officials that ultimately bear the regulatory costs and burdens of enforcement.

In order to clarify confusion over the potential proliferation of privately-developed systems, Congress passed legislation to specify how government agencies should recognize voluntary consensus standards in the marketplace with the passage of the National Technology Transfer Act of 1995 (P.L.104-113). This law provides:

> *(1) In general.--Except as provided in paragraph (3) of this subsection, all Federal agencies and departments shall use technical standards that are developed or adopted by voluntary consensus standards bodies, using such technical standards as a means to carry out policy objectives or activities determined by the agencies and departments.*

(2) Consultation; participation.--In carrying out paragraph (1) of this subsection, Federal agencies and departments shall consult with voluntary, private sector, consensus standards bodies and shall, when such participation is in the public interest and is compatible with agency and departmental missions, authorities, priorities, and budget resources, participate with such bodies in the development of technical standards.

The law is clear that greater weight be given to those standards that have undergone development by consensus bodies, particularly those in which the federal government participates, and for which approval by consensus standards bodies has been granted.

Lastly, one of the most important aspects of the ANSI-approved standard is that it must be regularly updated with schedules for including ongoing technological advancements. This consistent improvement inclusion protects the standard from ever lagging behind technology and provides that its benchmarks will accommodate continued evolution in construction practice and design, which is particularly important in the rapidly-changing green movement.

The combined gains in energy efficiency and green for new buildings continue to shine despite reports of the energy consumption stats of the building sector as a whole. Because of its largess, government property owned and built under GSA plays a major role in the impact on buildings generally. Similarly, the principles and policies embraced by GSA to improve efficiency and implement green for GSA buildings also impacts development and construction of other buildings not owned or leased directly by the federal government.

As an industry that has made great strides to help initiate the development of the first-ever ANSI-approved consensus standard on green, the housing industry is deeply committed to embracing technology advancement and flexibility in pushing the next generation of buildings. It is our hope that GSA shares the same commitment and does not stifle growing innovation or adopt measures that counter current federal laws designed to promote voluntary consensus standards in lieu of privately-developed rating tools.

Oversight and Implementation of the *American Recovery and Reinvestment Act (ARRA)*

The provisions set forth in the ARRA covering high performance building, green, and green jobs have implications for the residential construction industry. The provisions of the ARRA generally cover public, commercial buildings and schools, but the approach and direction taken with respect to implementing rating systems and training related to such construction runs counter to housing industry efforts on green. Thus, the actions taken by GSA in implementing the ARRA will be critically important because of its potential to set precedents for non-government related contracting, building, and training in green and green jobs.

If the goal is ultimately to save energy, with the supplementary benefit of producing jobs and training in the efficiency and green construction industries, then the policies embraced in ARRA with respect to green are rather exclusionary and may not accomplish this goal. For example, not only does the requirement for a privately-developed and managed green rating system apply to the school construction provisions under the Act (and in practice applies to the High Performance Green Building provisions), but also the training and workforce development procurement in the ARRA to promote this work is also limited to industries with affiliation to specific labor organizations.

NAHB, through its workforce and development arm – the Home Builders Institute (HBI) – has been providing training and workforce development in residential construction for 30 years. Furthermore, HBI's main program, Job Corps, is the nation's largest and oldest residential education program for training at-risk youth to provide hands-on skill acquisition in the trades and in preparing youth for employability. The Job Corps partnership with the U.S. Department of Labor places more than 2,000 young people annually in construction jobs. With the new Job Corps Green Curriculum program, these future construction professionals are getting the training necessary to build the high performing green buildings of the future.

To be sure, NAHB is training and preparing not only the current generation of builders to construct new and retrofit old homes and buildings for efficiency, but also the next generation of builders and professionals. The provisions in the ARRA are limited such that many successful programs and workforce training in the green and efficiency field would not be funded or promoted, despite the fact that they can deliver results towards the ARRA goals of efficiency promotion and high performance green building.

Lastly, the requirements in the general provisions of the ARRA for Davis-Bacon prevailing wages to be paid on all construction projects will potentially be limiting for a number of green and efficiency projects. For example, the Department of Energy (DOE)'s Weatherization Program, which has typically never been subject to Davis-Bacon prevailing wage requirements, would now be required to use the wage payments on the new infusion of $6 billion provided through ARRA.

With respect to public buildings, the costs of certification fees and commissioning for use of private rating systems and their affiliated professionals extend well beyond the hard material costs of improving efficiency in these buildings. For instance, with limited resources and many buildings to address, the money from ARRA should be used for actual construction costs and materials fees and not for paperwork and professional fees associated with some of the rating systems through which have been required under these types of public construction programs.

Ultimately, NAHB hopes to see the most robust approach to efficiency and green building under GSA and for every building. This includes providing training development and resources to *every* eligible professional that is doing the necessary efficiency work, as well as not saddling such programs with extraneous fees and paperwork that saves zero energy and ultimately threatens the long term viability of efforts to truly improve efficiency in public buildings – and *all* buildings.

Conclusion

Embracing a robust energy efficiency and green building policy that accommodates new and existing buildings is the most appropriate way for the government to realize efficiency gains in all building types, both in public buildings and beyond. The programs and policies embraced by the GSA will be templates for future construction types, even outside of the scope of federal construction projects.

While providing resources to efficiency and green projects under GSA through the ARRA appears to be an appropriate policy direction, the implications of the accompanying requirements could negatively impact a number of successful programs outside the scope of public buildings. Because of the limited scope of the ARRA with respect to green and promoting greater efficiency in public buildings, NAHB is concerned that such limitations will be similarly placed on private development in the future, as state and/or local governments attempt to model policies after the federal government.

Therefore, it is incredibly important that GSA's implementation of energy efficiency and green building policies be open and flexible to allow for technological innovations that will continue to push sustainable building above and beyond current practices. The current policy of GSA to embrace a specific green rating system, developed by a private interest group, will limit its ability to respond to changing construction advances and to include improvements in building materials. This will have implications for other types of construction and NAHB hopes that policies can be promoted at GSA to avoid exclusionary rating systems and instead embrace green building and energy efficiency performance as a metric of compliance.

[i] U.S. Department of Energy, Energy Information Administration. *Residential Energy Consumption Survey*, 2005.

Appendix A

Consensus Committee on the
National Green Building Standard™

Representatives from the following organizations, companies, and government offices participated in the development of the criteria as approved by the American National Standards Institute (ANSI) for the ICC-700 2008 National Green Building Standard™:

American Forest & Paper Association
American Gas Association
American Institute of Architects
Bowen Collins and Associates, Consulting Engineers
Brick Industry Association
Build Green New Mexico
Building Owners and Managers Association (BOMA) International
Building Quality
City of Dearborn, Michigan, Department of Building & Safety
City of Denton, Texas, County Building Inspections
City of Keene, New Hampshire
City of Rio Rancho, New Mexico
City of St. Paul, Minnesota
City of Scottsdale, Arizona
CNIC Housing – Commander, Navy Installation Command, U.S. Navy
ConSol
Edison Electric Institute
Fairfax County, Virginia, Department of Public Works
Gas Appliance Manufacturers Association (GAMA)
Green Builder, LLC
Green Building Initiative, Portland, Oregon
Green Built Michigan (Lansing)
Gypsum Association
K. Hovnanian Homes/Landover Group
Manufactured Housing Institute
NAHB Land Development Committee
National Multi Housing Council
North American Insulation Manufacturers Association
Plastic Pipe and Fittings Association
Plumbing Manufacturers Institute
Portland Cement Association
State of California, Department of Housing and Community Development
Steel Framing Alliance
Sustainable Buildings Institute
Town of Parker, Colorado
United States Environmental Protection Agency
United States Department of Energy
U.S. Green Building Council
Veridian Homes
Village of Arlington Heights, Illinois
Whirlpool Corporation
Winchester Homes, Inc.

TESTIMONY OF ANTHONY PICARAZZI
ADMINISTRATOR
NATIONAL ENERGY MANAGEMENT INSTITUTE

SUBMITTED TO
THE U.S. SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

APRIL 22, 2009

Madam Chairman, thank you for the opportunity to submit this testimony to the record. I represent the National Energy Management Institute (NEMI), which is a non-profit partnership between the Sheet Metal Workers International Association (SMWIA) and the Sheet Metal and Air Conditioning Contractors National Association (SMACNA). NEMI has long been a trailblazer in the areas of energy retrofit, clean rooms, indoor air quality, and Performance Information Procurement Systems (PIPS), or more commonly know as Best Value Contracting (BVC). We have been recognized as an authority on improving indoor air environments by Congress and the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) and truly understand the importance of improving heating, ventilating, and air conditioning (HVAC) to achieve energy efficiency, reduce the carbon footprint of buildings, and maintaining or improving indoor air quality (IAQ).

We now appreciate the opportunity to weigh-in on this important public hearing into how the General Services Administration (GSA) plans to undertake energy efficiency projects in public buildings.

Our members were pleased when the 110th Congress passed the Energy Independence and Security Act of 2007 (EISA) (P.L. 110-140). Among other things, EISA put new focus on the importance of energy savings in government and public

institutions, including requiring agencies to move towards high-performance green building standards for all types of federal facilities. Our members were further pleased when this Congress recently passed the American Recovery and Reinvestment Act of 2009 (ARRA) (P.L. 111-5) which will now provide a new and unprecedented level of financial muscle towards achieving true energy efficiency and modernization of federal facilities under the direction of GSA and its Office of Federal High-Performance Green Buildings.

Moving forward, it is critically important that we seek to achieve the optimal energy and environmental improvements, while also adopting the best practices and technology. This will guarantee that federal facility construction and retrofit projects are completed with the highest quality results to optimize HVAC performance, indoor air quality, energy efficiency, and reliability, while also ensuring projects are completed correctly, on-time, on-budget, and provide the necessary quality assurance.

1. **Critical Importance of HVAC Systems for Energy Efficiency & Health**

As an organization representing over 150,000 skilled crafts persons in the unionized sheet metal industry throughout the United States, Canada, Australia, and Brazil, NEMI understands the critical importance of HVAC systems and IAQ in regards to health, energy efficiency, and cost savings. While a building may be designed to be sustainable and/or "green", an unhealthy HVAC system will lead to an unhealthy indoor environment that, in the long-term, will be detrimental to the building's dwellers and result in significant costs in energy and maintenance to the building's owners.

A viable energy future requires finding a way to reduce energy consumption in our existing buildings while improving productivity and occupant health. According to

the Environmental and Protection Agency (EPA) "a growing body of scientific evidence has indicated that the air within homes and other buildings can be more seriously polluted than the outdoor air in even the largest and most industrialized cities..."[1] For many people, theses health risks may be even greater due to their exposure to indoor, rather than outdoor, pollutants. Thus, as many Americans spend a vast majority of their time inside buildings, control of IAQ becomes a critical national health priority.

HVAC standard improvements are also critical national energy priorities. Forty percent of America's energy is consumed for power, light, and to heat, cool, and ventilate our homes, schools, shops, and businesses, accounting for forty-one percent of our country's carbon emissions. Improving IAQ and energy efficiency are often placed at opposite ends of the building management spectrum. This is often due to the current practice of increasing the rates of ventilation (outdoor air) into a building to dilute the indoor air contaminants and to achieve acceptable occupant responses. These increased ventilation rates require more energy to heat, cool, and dehumidify the supply air to occupied spaces, especially in cold, hot, or humid climates. Control of IAQ through air cleaning technologies reduces the demand for dilution ventilation and its resultant energy impact. Thus, optimal IAQ and good energy management are not mutually exclusive. In fact, combining the two concerns can result in a synergistic relationship that can create buildings that will operate both healthfully and efficiently. We hope that as public policy shifts towards reducing emissions and energy consumption, equal focus is placed on the performance and health of buildings. This must be an important part of the government's decisionmaking with regards to the success of new federal building energy retrofit and construction projects.

[1] U.S. EPA/Office of Air and Radiation, Office of Radiation and Indoor Air Website

Decades of commercial and institutional renovation and recommisioning work performed by skilled labor and contractors have yielded two critical findings: First, standardized protocols should be developed to deliver desired results; and second, skilled labor and experienced contractors performing the complexities of renovation and recommissioning work more assuredly yields on-time and under-budget results, as well as increases the quality of delivery of what was specified in the design. These two important issues unquestionably apply to HVAC contractors and technicians, who are asked to perform building assessments to reduce energy consumption or improve indoor air quality for building occupants.

As GSA moves forward to implement these federal greening programs authorized by the EISA and funded in the ARRA, we hope that significant attention will be paid to adopting the best possible practices and technologies, while at the same time achieving energy and environmental improvements.

2. **Highest Building HVAC Standardized Protocols Should Be Required**

New federal building retrofit and construction programs should focus on standardized protocols to ensure projects are completed with the highest quality results to optimize HVAC performance, indoor air quality, energy efficiency, and reliability – all of which are goals articulated by Congress and the President in enacting the ARRA. As noted earlier, a strong body of evidence from both Government and private sources suggest that additional standards in HVAC and duct work would drastically reduce costs, improve American's healthcare and improve the environmental footprint of Government buildings.

NEMI established the Testing, Adjusting, and Balancing Bureau (TABB), which is an organization made up of HVAC industry professionals, in recognition of the need for ensuring that HVAC systems function at the highest standards and greatest efficiency and effectiveness at every stage. TABB is a comprehensive approach to HVAC testing, adjusting and balancing, as well as maintaining the life safety systems (fire smoke dampers, atrium exhaust, and stair well pressurization in a building fire condition). This approach also ensures the integrity of system design, installation, commissioning, operation, maintenance, and recommissioning, which also provides for the education and training for supervisors, technicians, and contractors.

TABB implements the HVAC testing, adjusting, and balancing of technician, supervisor, and contractor certification program for SMWIA and SMACNA, which ensures that HVAC systems operate at the highest standards, with the best energy efficiency, and ventilation effectiveness at every stage of an indoor environmental retrofit or new building construction. TABB is the first certification program to bring together all components of the complex HVAC industry and is recognized as the state-of-the-art testing, adjusting, and balancing program that assures building energy service companies and owners that their HVAC systems meet the design specifications, are energy efficient, and aid in providing healthy indoor quality. TABB has also established its own 10-point green building policy to assure that systems in green buildings are performing to design objectives and optimum system performance for sustainability.

TABB was accredited by the American National Standards Institute (ANSI) on December 10, 2008 after an exhaustive 2 year process. As such, TABB is currently the only HVAC systems testing, adjusting, and balancing certification program with this seal,

which is recognized in more than 150 countries as the symbol of the highest standard of integrity and performance. As part of this certification, TABB conforms to ISO/IEC 17024 – determining that TABB structure and systems adequately maintain confidentiality, objectivity, and impartiality in awarding or withdrawing certifications among participating companies and individual practitioners. ANSI accreditation also requires that all parties at interest are able to participate in the organization's operation, that a balance of interest is achieved and maintained, that no single interest predominates, and all TABB governing decisions and operating rules remain free of conflicts of interest. TABB certified commissioning agents have been adopted by the U.S. Army, Navy, and Air Force.

3. **Right Skilled HVAC Technicians and Contractors Should Be Required**

It is readily apparent that well trained, experienced, and certified workers perform better. Quality training can form the backbone of the quality assurance for these best practices standards and protocols. Skilled technicians that undergo extensive classroom, field, and apprentice training consistently provide the desired economic and energy efficiency results that the government now seeks. Therefore, we recommend that all HVAC trades working on GSA or other federal building construction and green retrofit programs are required to participate in a Class A Apprenticeship program that is currently registered with the U.S. Department of Labor (DOL) or state apprenticeship agency and has graduated apprentices to journeyperson status for at least three of the past five years.

In the case of sheet metal workers and SMACNA contractors, Class A apprenticeship program participation is essential. It usually takes between 4 – 5 years of both classroom and apprentice training to become a skilled sheet metal/HVAC

technician. Apprenticeship provides comprehensive instruction in sheet metal fabrication and installation, commercial heating, HVAC installation and maintenance, welding, testing, balancing, commissioning, and recommissioning of building systems. The advantage of incorporating skilled labor standards into retrofit project specifications has already been demonstrated. The complexity in understanding and executing successful HVAC system energy efficiency upgrade projects depends on completing the project correctly, on time and on budget. The key to ensuring this, however, is to use the most qualified HVAC technicians and contractors.

The HVAC industry has long recognized that holistic HVAC system training was essential to improve quality, and thus founded TABB in 2001. Industry professionals joined together to develop a comprehensive approach to HVAC system design, installation, commissioning, operation, maintenance and recommissioning education and training for technicians, supervisors, and contractors. Today, TABB certification standards are designed to ensure that TABB-certified technicians, supervisors, and contractors are competent, reliable, and qualified professionals. TABB technicians are trained through one of the 137 Local Joint Apprenticeship and Training Committee (JATC) training programs throughout the U.S. with support from the International Training Institute (ITI) of the SMWIA. TABB contractors are members of the SMACNA and are held to the very latest and highest standards available to the HVAC industry, bringing unmatched resources to guarantee quality of work. Furthermore, TABB certified contractors are trained, equipped, and capable of carrying out the 10-point green building process to ensure that systems in green buildings are performing according to design objectives and optimum system performance for sustainability.

Along with being the only ANSI-accredited HVAC systems standards, TABB is also the only ANSI-approved performance training and certification exam that includes training standards, instrumentation, and uniform methodology. TABB training is also certified as part of the DOL National Apprenticeship Program, in accordance with the basic standards of apprenticeship established by the Secretary of Labor.

As GSA moves forward to implement federal green facility construction and retrofit programs in accordance with EISA and ARRA, it is critically important that the agency seeks to achieve the optimal energy and environmental improvements, while also adopting the best practices and technology. Specifically, NEMI recommends that GSA ensures that:

(1) HVAC testing and balancing is conducted by ANSI-accredited technicians and supervisors;

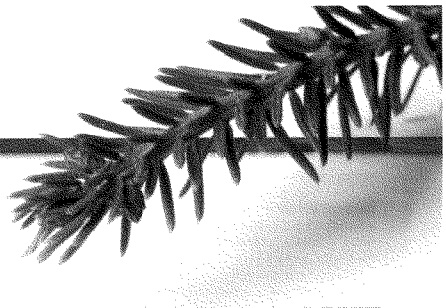
(2) Performance testing of all HVAC systems and equipment is conducted by ANSI-accredited technicians and supervisors;

(3) All building projects meet the GSA Facilities Standards for the Public Buildings Service (P100-2005) requirements and ANSI-accredited SMACNA HVAC Duct Construction & HVAC Air Duct Leakage Standards; and

(4) HVAC trades working on federal building construction and retrofits participate in a Class-A Apprenticeship Program that is currently registered with the Department of Labor (DOL).

These measures will guarantee that federal facility construction and retrofit projects are completed with the highest quality results to optimize HVAC performance, indoor air quality, energy efficiency, and reliability, while also ensuring projects are completed correctly, on-time, on-budget, and provide the necessary quality assurance.

SUSTAINABLE FORESTRY INITIATIVE
Good for you. Good for our forests.℠

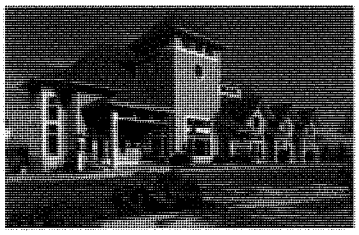


Build Green with SFI®-Certified Wood

Wood from well-managed forests certified to the Sustainable Forestry Initiative® (SFI®) Standard is an excellent environmental choice for any new construction or renovation. Wood is renewable and grows naturally, fueled by solar energy.

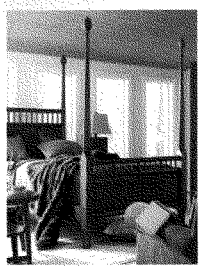
Managed, certified forests provice a range of benefits to mitigate climate change, in addition to storing carbon. SFI-certified forests are maintained in a healthy state so they can absorb more carbon and are less susceptible to wildfire, insects and disease.

SFI certification gives the added assurance that wood products come from responsibly managed forests. A growing number of buyers — whether institutional, commercial or individual — want to know they are sourcing products from well-managed forests. As one of the largest forest certification standards in the world, the SFI program is well positioned to meet this growing demand.



Examples of building with SFI: Blakely Hall (left) in Issaquah, WA received certification under the Green Globes rating system and used SFI-certified products such as timber trusses from Port Blakely Tree Farms.

Harden Furniture (right), which features numerous SFI-certified products, earned Silver Exemplary status under the Sustainable Furniture Council's certification program.



Green Building Rating Programs that Recognize SFI-Certified Products
Green building has become mainstream. It is attracting consumer demand and being embraced by planners, designers, architects, builders and customers.

USGBC and LEED
The new draft forest certification credit language in the LEED rating tools opens up the forest certification credit to any forest certification standard that the U.S. Green Building Council recognizes as conforming to its forest certification benchmarks. The SFI program will be given the chance to show it conforms to those benchmarks when LEED is ready to assess forest certification programs later this year.

The SFI Standard is a North American-based forest certification program with comprehensive, transparent, science-based requirements that give customers the assurance that the products they purchase come from responsibly managed and legal sources as defined by rigorous and auditable objectives, performance measures and indicators. The SFI Standard integrates the perpetual growing of trees with the protection of wildlife, plants, soil and water quality. SFI program participants practice responsible forestry on the lands they manage, and influence millions of additional acres through the training of loggers, foresters and family forest landowners in best management practices. The SFI program is overseen by an independent Board of Directors that equally represents social, environmental and economic forestry stakeholders.

With over 160 million acres (65 million hectares) independently third-party certified to the SFI Standard across the United States and Canada, it's easy to find SFI-certified products for your next green building project.

Visit our searchable product database at http://www.certifiedwoodsearch.org/sfiprogram/
to find SFI-certified products for your next green building project.

SFI-certified products are recognized by many leading green building rating programs in the United States, Canada and overseas. By specifying SFI-certified products you can achieve credit and recognition under the following programs:

Commercial Building in the United States
The Green Building Initiative's (GBI) Green Globes™ green building assessment and rating system: The Green Globes system promotes building practices that result in energy-efficient, healthier and environmentally sustainable buildings. You can earn points under Green Globes based on the "proportion of solid lumber, engineered wood, and other wood-based products [which] originate from sustainable sources that are a third-party certified sustainable forestry program such as ... the Sustainable Forestry Initiative." In the United States, Green Globes is overseen by the non-profit GBI, and the New Construction module forms the basis of its Proposed American National Standard for the design and construction of commercial buildings. Learn more at www.thegbi.org.

Commercial Building in Canada
In January 2009, Public Works and Government Services Canada stated that wood used in its projects must be certified to one of three programs operating in Canada, including SFI, noting that they all "are effective in improving the sustainable management of Canada's forestry resources."

For new buildings, Green Globes Canada operates the Green Globes Design environmental assessment criteria and tools. The criteria require that builders "use lumber and timber panel products which originate from certified and sustainable sources (certified...[to] the ... SFI (Sustainable Forestry Initiative))." Learn more at www.greenglobes.com.

BOMA Canada operates Green Globes under the brand name Go Green Plus for existing commercial buildings. For more information, visit www.bomagogreen.com. For new buildings, Green Globes Canada operates the Green Globes Design environmental assessment criteria and tools. The criteria require that builders "use lumber and timber panel products which originate from certified and sustainable sources (certified...[to] the ... SFI (Sustainable Forestry Initiative))." Learn more at www.greenglobes.com.

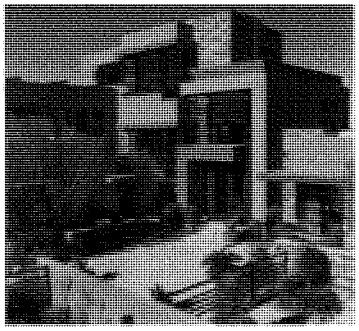
Residential Building in the United States
The National Green Building Standard, the first green building rating system to be approved by the American National Standards Institute (ANSI), offers several resources and tools to help the building community and homeowners learn how to build green. As part of the stringent process required by ANSI, the International Code Council (ICC) and National Association of Home Builders (NAHB) gathered a representative consensus committee including builders, architects, product manufacturers, regulators and environmental experts. The committee's work was administered by the NAHB Research Center, an ANSI-accredited standards developer. The new standard, known as ANSI ICC 700-2008, applies to all residential construction work in the United States. Section 606.2 Wood Products gives credit for "wood or wood based products certified to the requirements of one of the following recognized product programs" including the SFI program. Learn more at www.nahbgreen.org or contact your local homebuilder association.

Residential Building in Canada
The Built Green Society of Canada is an emerging rating program in Canada for residential buildings. Their checklist requires that "wood must come from a sustainably harvested source with certification from ... the Sustainable Forestry Initiative." Built Green™ is a voluntary program that promotes "green" building practices to reduce the impact that building has on the environment. Learn more at www.builtgreencanada.ca.

Commercial Building in the UK
The Building Research Establishment (BRE) oversees commercial UK green building programs under the BRE Environmental Assessment Method (BREEAM). BRE also worked with the Communities and Local Government (CLG) to create The Code for Sustainable Homes for new residential construction in England. The Building Research Establishment recognizes multiple forestry certification standards, including SFI. To learn more, visit www.breeam.org.

Everyday, more programs and governments are recognizing SFI products through green building rating programs. These include:

- SFI-certified products are recognized under government procurement policies around the world including the United States, Japan and the UK.
- The proposed ASHRAE/USGBC/IESNA Proposed Standard 189.1P, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings.
- Many state, provincial, and local green building policies recognize green building rating programs that include points for, or recognition of, SFI-certified products.



***NAHB's ShowcaseGreen Home** at the International Builder's Show in Las Vegas Nevada in 2009 featured Sierra Pacific Industries' windows framed in SFI-certified wood. Photo by Erin O'Boyle/Courtesy of the Portland Cement Association.*

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April 21, 2009

UNITED STATES GREEN BUILDING COUNCIL, LEED AND CERTIFIED WOOD

With the growing interest in sustainable construction practices in North America, and an increase in awareness of the various green building programs & standards and their development, questions continue to arise about the current state of the green building industry, and how forestry certification is impacted by this trend.

- **LEED is changing** –The existing LEED green building rating tools only recognize FSC for the forest certification credit; however, the **new draft** forest certification credit language in the LEED rating tools strikes out the FSC exclusive text and opens up the forest certification credit to any forest certification standard that USGBC recognizes as conforming to its forest certification benchmarks. SFI will be given the chance to show it conforms to those benchmarks when LEED is ready to assess these later in 2009.

"The wood products sector is the only building material sector that has voluntarily taken on and is subject to third-party environmental certification."

WHAT ARE THE DIFFERENT LEED GREEN BUILDING RATING SYSTEMS?

There are several LEED green building rating systems including LEED for New Construction, Existing Buildings, Commercial Interiors, Core & Shell, Schools, Retail, Healthcare, Homes, and Neighborhood Development. Generally speaking, most inquiries are interested in LEED for New Construction (LEED NC). However, given the use of forest products in home construction, there is an expectation that many builders will be taking a serious look at LEED for Homes.

HOW IS FOREST CERTIFICATION ADDRESSED IN THE LEED STANDARD?

The forest certification credit appears in the LEED rating tools under Materials & Resources (MR). Under *MR Credit 7: Certified Wood,* the USGBC has exclusively recognized FSC since its inception in 2000. That's changing. For almost two years now, USGBC has been engaged in an open and public process to revise the MR Credit 7. The latest draft has struck the FSC language and opens it up to any forest certification standard that USGBC recognizes as conforming to its forest certification benchmarks.

WHAT ARE THE PROPOSED CHANGES FOR THE MR CREDIT 7?

The new credit proposal sets benchmarks/criteria against which SFI and other certification programs including FSC would be evaluated. It is important to know that the forest certification credit (MR Credit 7) is undergoing a separate development process and will be balloted outside of the LEED 2009 Rating System as a single credit. As a clarification, LEED 2009 will contain the previous version of this credit until the revised credit is approved by USGBC membership. Once the revised forest certification credit is approved it will apply to all of the LEED rating tools.

What has changed at SFI?

The fact that SFI is part of the revision process, and being considered for inclusion in future LEED releases speaks to the validity and credibility of the SFI program. Becoming a fully independent program in January 2007 has driven our rapid growth. The designers and builders who want to build to a particular program, such as LEED, can do so with or without the use of FSC certified wood, and many do.

CAN A LEED BUILDING USE SFI WOOD?

Yes - builders and architects around the continent can build a LEED building with SFI wood! The reason for this is that just one point is actually available under certified wood credit out of a possible 69 in LEED-NC v2.2 (and a total of 110 points in the revised structure of LEED-NC v3). Many projects forgo this point and build with their preferred supply. In practicality, rating systems can become an exercise in numbers: a point lost for not using FSC wood could be gained from installing a bike storage rack and showering facilities, following SS Credit 4.2.

"SFI Inc encourages inclusivity in green building programs because the reality is that 90% of the world's forests are not certified to any system. Rewarding the leaders in this field will promote uptake of certification and strengthen the supply chain and improve forest management globally."

WHY IS IT IN USGBC'S INTEREST TO RECOGNIZE SFI?

We believe that USGBC recognition of SFI is a win for everybody - for SFI, for USGBC, for builders and architects and for the forests of North America. With FSC exclusivity and a failure to recognize all credible certification standards, the USGBC (LEED rating tools) risk losing market acceptance to other inclusive green building systems such as Green Globes, the ANSI National Green Building Standard and the National Association of Home Builders (NAHB) Guidelines and their state-level green building programs that are being developed as an alternative to LEED. After all, only 10% of the world's forests are certified, by accepting all credible forest certification systems, USGBC still maintains its commitment to sustainability but at the same time increases supply options thereby supporting the building community in its efforts to build sustainably.

WHAT GREEN BUILDING PROGRAMS RECOGNIZE SFI IN NORTH AMERICA?

Right here in your own backyard there are both commercial and residential green building rating tools that can be used that recognize a variety of credible forest certification standards, including SFI. On the residential side, ANSI's recently released National Green Building Standard (ANSI/ICC 700-2008) recognizes SFI as well as other credible certification programs in US projects. On the commercial side, The Green Building Initiative's Green Globes program recognizes SFI in Canada and in the US.

WHAT CAN YOU TELL ME ABOUT THE NATIONAL GREEN BUILDING STANDARD?

The National Green Building Standard is the first to be approved by the American National Standards Institute (ANSI). Now known as ANSI/ICC 700-2008, the standard – a joint effort between the International Code Council (ICC) and the National Association of Home Builders (NAHB) – applies to all residential construction work in the United States. It gives credits for wood and wood-based materials and products certified to all credible third-party forest certification programs, including the SFI program.

The approval of ANSI/ICC 700-2008 in early 2009 followed a stringent process involving an inclusive and representative consensus committee made up of builders, architects, product manufacturers, regulators and environmental experts. The committee deliberated the content of the standard for more than a year, held four public hearings, and evaluated more than 2,000 comments. For further information, visit http://www.nahbgreen.org/Guidelines/ansistandard.aspx. What's most interesting is that this is a recent ANSI standard with the latest thinking, and that latest thinking shows equal recognition for SFI and FSC. SFI Inc. is confident that USGBC through its revision process will move in this direction. However, until that process is finalized, USGBC risks losing market share to programs that say yes to certified wood in North America.

WHAT ELSE CAN YOU TELL ME ABOUT GREEN GLOBES RATING TOOL FOR COMMERCIAL BUILDINGS?

Based in Portland, Oregon, the **Green Building Initiative (GBI) Green Globes** national commercial green building rating program has recognized SFI from inception of the program in the US, as well as its Canadian counterpart and program founder, **Green Globes Canada.** The Green Globes system, which is web-based and cost effective, promotes a range of building practices that result in energy-efficient and healthier buildings. Learn more about the GBI and Green Globes at www.thegbi.org.

WHAT DO GOVERNMENT AGENCIES THINK ABOUT GREEN BUILDING?

While there are green building programs and government agencies the world over that recognize SFI - from the UK to Japan - there is also an increased interest in federal, state, provincial and local government initiatives in green building. Some government agencies recognize LEED only, others recognize LEED and Green Globes and others still take their own path and recognize the need for the use of wood in green building and recognize SFI alongside FSC and other credible certification standards.

- Officials in the state of Maine have been directed to buy wood or paper products that come from forests 3rd party certified by ATF, FSC or SFI.
- California governor Arnold Schwarzenegger vetoed a bill that would require builders to reach a LEED "gold" rating for commercial buildings greater than 50,000 sq. feet. The Governor said "... if implemented provisions in this bill would create a bias for certain building materials over others without a clear benefit. For instance, the use of California wood building construction materials is highly discouraged in favor of foreign grown bamboo and wheatgrass."
- The governors of Minnesota and Washington have sent letters to the USGBC saying a more inclusive approach to forest certification standards has the potential to include more forest products from family forest owners in their states, and other small forest parcels. Minnesota Governor Tim Pawlenty said "With only 10 percent of forests certified globally, choosing one program over another does not encourage forest certification efforts or improve markets for certified forest products."
- In January 2009, Public Works and Government Services Canada stated that wood used in its projects must be certified to one of the three programs operating in Canada, including SFI, noting that they all "are effective in improving the sustainable management of Canada's forestry resources."

WHAT HAS PRESIDENT OBAMA PUT FORWARD ON GREEN BUILDING?

President Barack Obama's federal stimulus bill says a percentage of recovery funds must be used for work performed in accordance with green building standards that include Green Globes, which give credits for wood and wood-based materials and products certified to credible certification programs such as the SFI program.

The American Recovery and Reinvestment Act dated Jan 15, 2009 and signed by President Obama on February 17, 2009 states: *"A percentage of recovery funds used for educatian facility construction and renovation (currently 25%) must be used for work performed in accordance with a green building standard such as LEED, Energy Stor, or Green Globes."*

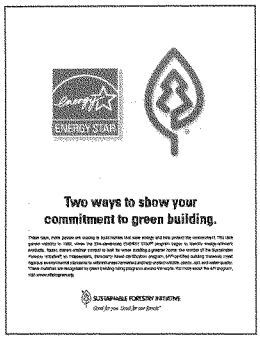
It is noteworthy that even before Obama came to power, the United States Government Services Agency's (GSA) Solicitation for Offers requirement SFO Section 7.4 Wood Products (revised August, 2008) states: *"For all new installations of wood products, the Lessor is encouraged to use independently certified forest products. For information on certification ond certified wood products, refer to the Forest Certification Resource Center, the Forest Stewardship Council United States, or the Sustainable Forestry Initiative."*

Swinging with SFI Fun fact:

There's a new swing set outside the Oval Office – and it's made with redwood from northern California forests certified to the SFI Standard. President Barack Obama and his wife Michelle bought the swing set as a surprise gift for their daughters Malia and Sasha.

TELL ME MORE ABOUT SFI AND ENERGY STAR?

SFI Inc. believes that there are many ways to show an organization's commitment to green building. One of the most widespread ways is through Energy Star and another way that organizations are increasingly aware of is SFI.



In fact, some market research confirms that there is a real recognition and respect for Energy Star as well as SFI and that is why we decided to undertake a co-branding strategy and feature the SFI label alongside the Energy Star label. A study by Terrachoice Environmental marketing polled 336 customers and 91% felt that green-washing is a problem that needs to be address. 72% of the respondents agreed that eco-labels help purchasing decisions and the majority also felt that having a choice of eco labels was important. The Energy Star and the SFI Label were included in purchasers' top ten most used eco-labels.

Our new ad campaign features messaging that delivers on the promise of the SFI standard, and our recently re-designed website features a variety of timely and relevant content, including examples of advertising like the Energy Star ad. It is our vision that the SFI brand be held in similar regard as the ENERGY-STAR brand. In fact, we think we are headed in the right direction with other independent research that showed SFI's growing recognition not just amongst large buyers but also across consumers. A recent survey by GfK Roper Public Affairs & Yale of 3000 consumers across North America found that consumers believe it is important or essential to have eco-labels that describe the environmental impacts caused by the manufacture, use and disposal of products. Of 10 eco-labels tested in the US, SFI had the highest familiarity rating of any forest certification program (SFI 19%, FSC 12%.)

THE SFI TEAM

At SFI, our team is growing, as are our capabilities. We are in the process of developing a Green Build Tool Kit which will include a PowerPoint presentation, key messages on green building, a brochure, and a series of FAQs. We value your insight and would like to hear from you on what you'd like to see in this kit. To learn more, visit us at www.sfiprogram.org.

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Study of the effects on employment of public aid to renewable energy sources

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DRAFT: BIBLIOGRAPHY PENDING

Study of the effects on employment of public aid to renewable energy sources

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EXECUTIVE SUMMARY: LESSONS FROM THE SPANISH RENEWABLES BUBBLE

Europe's current policy and strategy for supporting the so-called "green jobs" or renewable energy dates back to 1997, and has become one of the principal justifications for U.S. "green jobs" proposals. Yet an examination of Europe's experience reveals these policies to be terribly economically counterproductive.

This study is important for several reasons. First is that the Spanish experience is considered a leading example to be followed by many policy advocates and politicians. This study marks the very first time a critical analysis of the actual performance and impact has been made. Most important, it demonstrates that the Spanish/EU-style "green jobs" agenda now being promoted in the U.S. in fact destroys jobs, detailing this in terms of jobs destroyed per job created and the net destruction per installed MW.

The study's results demonstrate how such "green jobs" policy clearly hinders Spain's way out of the current economic crisis, even while U.S. politicians insist that rushing into such a scheme will ease their own emergence from the turmoil.

The following are key points from the study:

1. As President Obama correctly remarked, Spain provides a reference for the establishment of government aid to renewable energy. No other country has given such broad support to the construction and production of electricity through renewable sources. The arguments for Spain's and Europe's "green jobs" schemes are the same arguments now made in the U.S., principally that massive public support would produce large numbers of green jobs. The question that this paper answers is "at what price?"

2. Optimistically treating European Commission partially funded data[1], we find that for every renewable energy job that the State manages to finance, Spain's experience cited by President Obama as a model reveals with high confidence, by two different methods, that the U.S. should expect a loss of at least 2.2 jobs on average, or about 9 jobs lost for every 4 created, to which we have to add those jobs that non-subsidized investments with the same resources would have created.

[1] The MITRE project was partially funded by DG TREN (Energy & Transport) of the European Commission under the Altener programme.

3. Therefore, while it is not possible to directly translate Spain's experience with exactitude to claim that the U.S. would lose at least 6.6 million to 11 million jobs, as a direct consequence were it to actually create 3 to 5 million "green jobs" as promised (in addition to the jobs lost due to the opportunity cost of private capital employed in renewable energy), the study clearly reveals the tendency that the U.S. should expect such an outcome.

4. At minimum, therefore, the study's evaluation of the Spanish model cited as one for the U.S. to replicate in quick pursuit of "green jobs" serves a note of caution, that the reality is far from what has typically been presented, and that such schemes also offer considerable employment consequences and implications for emerging from the economic crisis.

5. Despite its hyper-aggressive (expensive and extensive) "green jobs" policies it appears that Spain likely has created a surprisingly low number of jobs, two-thirds of which came in construction, fabrication and installation, one quarter in administrative positions, marketing and projects engineering, and just one out of ten jobs has been created at the more permanent level of actual operation and maintenance of the renewable sources of electricity.

6. This came at great financial cost as well as cost in terms of jobs destroyed elsewhere in the economy.

7. The study calculates that since 2000 Spain spent €571,138 to create each "green job", including subsidies of more than €1 million per wind industry job.

8. The study calculates that the programs creating those jobs also resulted in the destruction of nearly 110,000 jobs elsewhere in the economy, or 2.2 jobs destroyed for every "green job" created.

9. Principally, these jobs were lost in metallurgy, non-metallic mining and food processing, beverage and tobacco.

10. Each "green" megawatt installed destroys 5.28 jobs on average elsewhere in the economy: 8.99 by photovoltaics, 4.27 by wind energy, 5.05 by mini-hydro.

11. These costs do not appear to be unique to Spain's approach but instead are largely inherent in schemes to promote renewable energy sources.

12. The total over-cost – the amount paid over the cost that would result from buying the electricity generated by the renewable power plants at the market price - that has been incurred from 2000 to 2008 (adjusting by 4% and calculating its net present value [NPV] in 2008), amounts to 7,918.54 million Euros (appx. $10 billion USD)

13. The total subsidy spent and committed (NPV adjusted by 4%) to these three renewable sources amounts to 28,671 million euros ($36 billion USD).

14. The price of a comprehensive energy rate (paid by the end consumer) in Spain would have to be increased 31% to being to repay the historic debt generated

by this rate deficit mainly produced by the subsidies to renewables, according to Spain's energy regulator.

15. Spanish citizens must therefore cope with either an increase of electricity rates or increased taxes (and public deficit), as will the U.S. if it follows Spain's model.

16. The high cost of electricity due to the green job policy tends to drive the relatively most energy-intensive companies and industries away, seeking areas where costs are lower. The example of Acerinox is just such a case.

17. The study offers a caution against a certain form of green energy mandate. Minimum guaranteed prices generate surpluses that are difficult to manage. In Spain's case, the minimum electricity prices for renewable-generated electricity, far above market prices, wasted a vast amount of capital that could have been otherwise economically allocated in other sectors. Arbitrary, state-established price systems inherent in "green energy" schemes leave the subsidized renewable industry hanging by a very weak thread and, it appears, doomed to dramatic adjustments that will include massive unemployment, loss of capital, dismantlement of productive facilities and perpetuation of inefficient ones.

18. These schemes create serious "bubble" potential, as Spain is now discovering. The most paradigmatic bubble case can be found in the photovoltaic industry. Even with subsidy schemes leaving the mean sale price of electricity generated from solar photovoltaic power 7 times higher than the mean price of the pool, solar failed even to reach 1% of Spain's total electricity production in 2008.

19. The energy future has been jeopardized by the current state of wind or photovoltaic technology (more expensive and less efficient than conventional energy sources). These policies will leave Spain saddled with and further artificially perpetuating obsolete fixed assets, far less productive than cutting-edge technologies, the soaring rates for which soon-to-be obsolete assets the government has committed to maintain at high levels during their lifetime.

20. The regulator should consider whether citizens and companies need expensive and inefficient energy – a factor of production usable in virtually every human project- or affordable energy to help overcome the economic crisis instead.

21. The Spanish system also jeopardizes conventional electricity facilities, which are the first to deal with the electricity tariff deficit that the State owes them.

22. Renewable technologies remained the beneficiaries of new credit while others began to struggle, though this was solely due to subsidies, mandates and related programs. As soon as subsequent programmatic changes take effect which became necessary due to "unsustainable" solar growth its credit will also cease.

23. This proves that the only way for the "renewables" sector - which was never feasible by itself on the basis of consumer demand - to be "countercyclical" in crisis periods is also via government subsidies. These schemes create a bubble, which is boosted as soon as investors find in "renewables" one of the few profitable sectors while when fleeing other investments. Yet it is axiomatic, as

we are seeing now, that when crisis arises, the Government cannot afford this growing subsidy cost either, and finally must penalize the artificial renewable industries which then face collapse.

24. Renewables consume enormous taxpayer resources. In Spain, the average annuity payable to renewables is equivalent to 4.35% of all VAT collected, 3.45% of the household income tax, or 5.6% of the corporate income tax for 2007.

CHAPTER 1. THE ORIGIN OF GOVERNMENT SUPPORT TO RENEWABLE ENERGY SOURCES AND THE PHILOSOPHY OF GREEN JOB CREATION

I. The green job philosophy

On January 16th, 2009, president-elect Barack Obama visited an Ohio business that manufactures components for wind power generators. Under the watchful eyes of both factory workers and the press, Obama assured, amid deepening unemployment and the onset of one of the gravest economic crises in recent history, that renewable energy "can create millions of additional jobs and entire new industries."[2]

The president then defended his energy subsidy package by citing examples from other countries: "And think of what's happening in countries like Spain, Germany and Japan, where they're making real investments in renewable energy. They're surging ahead of us, poised to take the lead in these new industries."

But the benefits, according to Barack Obama, will only be achieved "if we act right now." The president expressed awareness that certain indicators suggest that "half of the wind projects planned for 2009 could wind up being abandoned because of the economic downturn". If that were to happen, he said, "think about all the businesses that wouldn't come to be, all the jobs that wouldn't be created, all the clean energy we wouldn't produce."

The president is surely motivated by concern over the social pariah of unemployment, and every president seeking to work on behalf of his country must make often difficult decisions driven by a desire for the economy to generate employment. Furthermore, Obama correctly states the problem in *counterfactual*[3] terms. Of importance, as the French economist Frédéric Bastiat said, is not just what is seen but also what is unseen.

[2] Speech by president Obama at a wind turbine plant in Bedford Heights, Ohio: http://www.cbsnews.com/blogs/2009/01/16/politics/politicalhotsheet/entry4727659.shtml.

[3] Counterfactual analysis in economic science refers to the study of comparative courses of observable action (after their occurrence) against alternate courses of action that are not seen because the choice of action prevents their taking place. For more on counterfactual analysis in economic science, see Hülsmann's, "Facts and Counterfactuals in Economic Law", JLS Vol. 17, no. 1, pp. 57-102.

When we spend money to build a fast food restaurant instead of solar panels, the cost of this course of action is all of the panels that were never built and all of the jobs in that industry that were never created. Similarly, if the government decides to spend taxpayer money on windmills or solar panels, their unseen cost would be all the hamburgers not cooked or any other productive activity that would no longer take place as a result of the state directing resources to windmills or solar panels. Policymakers must recognize that because of government action, other jobs are not created.

Of course other studies including by U.S. academics have also noted several related impacts, for example:

- Raising energy costs kills. According to a Johns Hopkins study, replacing three-fourths of U.S. coal-based energy with higher priced energy would lead to 150,000 extra premature deaths annually in the U.S. alone (Harvey Brenner , "Health Benefits of Low Cost Energy: An Econometric Case Study," Environmental Manager, November 2005).

- Reducing emissions, a major rationale for "green jobs" or renewables regimes, hits the poorest hardest. According to the recent report by the Congressional Budget Office, a cap-and-trade system aimed at reducing greenhouse gas emissions by just 15% will cost the poorest quintile 3% of their annual household income, while benefiting the richest quintile ("Trade-Offs in Allocating Allowances for CO2 Emissions", U.S. Congressional Budget Office, Economic and Budget Issue Brief, April 25, 2007).

- Raising energy costs loses jobs. According to a Penn State University study, replacing two-thirds of U.S. coal-based energy with higher-priced energy such as renewables, if possible, would cost almost 3 million jobs, and perhaps more than 4 million (Rose, A.Z., and Wei, D., "The Economic Impact of Coal Utilization and Displacement in the Continental United States, 2015," Pennsylvania State University, July 2006)

The latter point is the principal focus of this study, an analysis that quantifies actual net job creation in renewable energy resulting from government aid, to the detriment of alternate uses.[4] In other words, we attempt to identify how many unseen jobs are lost for each one created – those that are *seen* - thanks to government aid to green energy.

II. The European tradition of government aid to create "green jobs"

Europe's current policy and strategy for the support of so-called renewable energy dates to 1997. On November 26th of that year, the European Commission presented

[4] We also note the publication, as this report was being finalized, of an assessment questioning the assumptions, findings and methodologies of the prevalent projections of "green jobs" schemes. Morriss, Andrew P., Bogart, William T., Dorchak, Andrew and Meiners, Roger E.,Green Jobs Myths (March 12, 2009). U Illinois Law & Economics Research Paper No. LE09-001.

the White Paper "for a Community Strategy and Action Plan" titled "Energy for the future: renewable sources of energy[5]." In presenting this European aid scheme barely five days before the Kyoto conference (*Third Conference of the Parties to the United Nations Framework Convention on Climate Change*), where the signing of a CO2 rationing accord had already been foreseen, the European Union wanted to get ahead of events and opt for a transformation of its energy model in order to reach the then-stated goal of reducing its greenhouse gas emissions by 2010 to 15% below1990 levels[6].

The White Paper's starting point is that renewable energy sources "are currently unevenly and insufficiently exploited in the European Union."[7] At the time, those forms of energy production comprised less than 6% of the entire consumption of energy. The document established the ambitious goal of transforming the state of affairs through an artificial stimulus such that by 2010 the EU would have doubled the contribution of renewables to achieve nearly 12% of the union's energy consumption. If we realize that in 1997 the funding to renewables to achieve 6% of its energy production already included large hydroelectric producers, and that hydro energy had little room to grow due to environmental issues, we quickly understand just how ambitious this project is.

That is to say that, taking into account certain, often material geographic and economic distinctions, Europe had already implemented, at some cost, a "green jobs" agenda like that now proposed in the U.S., and sought to increase it further.

The familiar argument in favor of political action to support the massive development of renewable energy, as now popularized by president Barack Obama, had already been made: "*Development of renewable energy sources can actively contribute to job creation, predominantly among the small and medium sized enterprises which are so central to the Community economic fabric, and indeed themselves form the majority in the various renewable energy sectors. Deployment of renewables can be a key feature in regional development with the aim of achieving greater social and economic cohesion within the Community.*"[8]

Thus, in 1997 the creation of jobs in the "renewables" industry emerged as one of the main justifications and focal points of the plan. The authors of the report estimated that between 500,000-900,000 new jobs would be created. The White Paper states that "*while it is not possible to reach any hard conclusions as is the likely cumulative level of job creation which would derive from investments in the various forms of renewable energy sources, it is quite clear that a pro-active move towards such energy sources will lead to significant new employment opportunities.*"[9] What the White Paper does not clarify is the relationship between the new job opportunities that "*would derive from investments in the various forms of renewable energy sources*" and those that would not be created or that would be destroyed in other parts of the economy precisely because the funding diverted to renewable energy.

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[5] http://ec.europa.eu/energy/library/599fi_en.pdf

[6] COM (97) 196 final, 14 May 1997, "The Energy Dimension of Climate Change" y COM (97) 481 final, 1 October 1997, "Climate Change - The EU Approach to Kyoto".

[7] http://ec.europa.eu/energy/library/599fi_en.pdf, p.4.

[8] http://ec.europa.eu/energy/library/599fi_en.pdf, p.4.

[9] http://ec.europa.eu/energy/library/599fi_en.pdf ,p. 13.

III. Europe moves to create new employment opportunities

On September 27th, 2001, under the policies and recommendation of the White Paper, the European Union approved Directive 2001/77/CE of the European Parliament and of the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market[10].

Already aware of the requirements of the Kyoto Protocol, the European Union launched the development of renewable energy by aiming for "the global indicative target of 12% of gross domestic energy consumption by 2010" through the use of renewable sources of energy, as part of which an objective for the electricity sector is added later on that year, a "22.1% indicative share of electricity produced from renewable energy sources."[11] Already at its inception, the directive states that, beyond its environmental objective, the proposal "can also create local employment."

That same year the *Monitoring and Modeling Initiative on Targets for Renewable Energy* (MITRE) project was set out by the European Commission "to confirm the view that the European Union renewable energy targets [were] achievable, and to inform key policy and decision makers of the economic (employment) benefits of a proactive renewable strategy in order to meet the targets."[12] The project ran for two years and its main conclusion was a projected net employment growth in the European Union of 950,000 jobs under current policies, and up to 1,660,000 under the Advanced Renewable Strategy (ARS) of meeting 22.1% share of electricity produced from renewable energy sources by 2010. The authors of this study led by Energy for Sustainable Development (ESD) Ltd., a global market leader in the provision of low carbon energy and sustainable development solutions, concluded that "a more pro-active encouragement of renewable gives rise to significant employment gains."[13]

On January 10th, 2007, the Commission presented an energy and climate policy package the expected repercussions of which were far from modest. According to the Commission itself using language of the sort now employed in the U.S., the package would "set the pace for a new global industrial revolution." At the European summit in March, 2007, an agreement was adopted mandating certain EU-wide binding targets that the Commission would attempt to implement, to achieve 20% of total energy consumption in the European Union by 2020. In November of the same year the Commission released its "Strategic Energy Technology Plan" and in January of 2008 the Commission proposed a directive that included objectives for each country, so that the common goal of the plan could be reached.[14] During the March 2008 European

[10] http://eur-lex.europa.eu/Notice.do?mode=dbl&lang=en&lng1=en,es&lng2=bg,cs,da,de,el,en,es,et,fi,fr,hu,it,lt,lv,mt,nl,pl,pt,ro,sk,sl,sv,&val=261327:cs&page=1&hwords=

[11] Directive 2001/77/CE, art. 3.

[12] Monitoring & Modelling Initiative on the Targets for Renewable Energy (MITRE). 'Meeting the targets and putting renewables to work,' Flier. http://mitre.energyprojects.net/.

[13] Monitoring & Modelling Initiative on the Targets for Renewable Energy (MITRE). 'Meeting the targets and putting renewables to work'. http://mitre.energyprojects.net/main.asp?Show=F, p.13.

[14] http://ec.europa.eu/energy/climate_actions/doc/2008_res_directive_en.pdf.

Union summit, an agreement was reached to adopt an energy and climate measure package by the end 2008 which would replace the measures from the 2001 directive. In September the package passed the Industry Committee of the European Parliament with almost unanimous support, and on December 17th this new directive was approved, substituting for the measures and objectives from the 2001 directive.

According to the new directive, each member state must implement its own share of renewable energy so that the European Union can achieve, by 2020, the goal of going from a total of 8.5% (in 2005) renewable energy to 20%. Each country of the Union thereby promised to increase its share of renewable energy production by at least 5.5% from 2005 levels, calculating the rest of the increase based on gross domestic product. Spain's objective requires moving from an 8.7% renewable energy level in 2005 to 20% by 2020.

The directive's explanatory memorandum highlights the argued benefits of the job creation in knowledge-based industries. The document reiterates the thesis that the "promotion of investments in energy efficiency, renewable energy and new technologies contributes to Europe's strategy for knowledge and employment."

The creation of green jobs would this time become the proposal's principal rationale. On January 23rd 2008, the very same day that the Commission proposed the package in the new directive, Commission President José Manuel Barroso said that the proposal would be "an opportunity that should create thousands of new businesses and millions of jobs in Europe. We must grasp that opportunity." The same idea was repeated, albeit with different tones, by various political leaders, giving fodder to a press release by the Commission that captured comments by its members under the title, "Boosting jobs and growth by meeting our climate change commitments."[15]

Not everyone, however, succumbed to the Commission's euphoria for the directive's job–creation potential. The same day, the European Trade Union Confederation (ETUC) sent out a release recognizing the important step taken by the Commission but warned of the necessity to guarantee European jobs in a globalized world. That is to say that the union syndicate saw the potential risk of employment destruction due to the package's "green energy" requirements and other measures, and thus clamored for the passing of a "compensation mechanism" to guarantee employment to Europeans in the heavy industry sector.

The release recommended that the "Globalisation Adjustment Fund be enlarged so as to limit the negative consequences for workers of measures to combat climate change."[16] The jobs negatively affected would not be new green jobs, of course, but the less visible ones that would be destroyed due to mandates, loss of competitiveness, and reallocation of resources. The ETUC could have gone further still if only it had, like Obama, considered in its statement those positions that simply would cease to be created in other industries.

[15] http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/80&format=HTML&aged=0&language=EN&guiLanguage=en.
[16] http://www.etuc.org/a/4505.

This same confederacy of European unions again declared its bittersweet impression over "the objectives of reducing greenhouse gas emissions by 20% and increasing the share of renewable energy to 20%" after the December 12 confirmation by the European Council. ETUC welcomed the agreement while also "regretting the lack of accompaniment measures for workers affected by the consequences." Furthermore, the organization doubts, given the current circumstances, the "EU's financial capacity to invest sufficiently in the 27 countries to reduce CO_2 emissions and promote renewable energy sources."[17]

IV. Background to Case Study: Policies in Spain

As Obama correctly remarked (and we will study in the next section), Spain provides a reference for the establishment of government aid to renewable energy. Indeed, the special regime,[18] under which renewable energy is juridically differentiated, has been regulated in Spain since 1980 when Law 80/1980 on Energy Conservation was enacted.

Royal Decree 2366/1994 was published in December of 1994. It dealt with electrical production by hydroelectric installations and with cogeneration and other installations that make use of sources of renewable energy; this decree constitutes an initial feed-in tariff scheme (which has the effect of artificially increasing the price paid for electricity produced by renewables) for production with renewable sources. Over the years, Royal Decrees[19] and laws would continue to emerge, and with them, government support to these kinds of energy production.

Royal Decree 436/2004[20] was approved in March of 2004, establishing the methodology for updating and systematizing the legislative and economic system of electric energy production under the special regime. The rule renewed and strengthened public assistance to renewable energy with above-market premiums of up to 575% for solar photovoltaic plants and up to 90% for wind-based electric installations. During the 2004 general election campaign the socialist candidate, José Luis Rodríguez Zapatero, promised "a reorientation of the energy model (...) towards one that is more centralized, more diversified and safe, less wasteful and also more solidary" (meaning it requires payment by many into a system "for the common good" from which they achieve little benefit). It was a change in energy policy that would take place—and this is paramount—"built on all renewables, and in particular, solar energy."[21] As we shall see in the next sections, the government's zeal to impel renewable energy led to strong growth in the industry and in related employment.

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[17] http://www.etuc.org/a/5667.

[18] "The generation activity in Special Regime includes the electric energy generation from power plants up to 50 MW which make use of renewable energies or wastes as primary energy, and those such as cogeneration that involve the utilization of high efficiency and energy saving technologies". Ministerio de Industria, Turismo y Comercio, at http://www.mityc.es/energia/electricidad/RegimenEspecial/Paginas/Index.aspx.

[19] Executive order formally sanctioned by the King (typical in monarchical countries, such as Spain).

[20] http://www.cne.es/cne/doc/legislacion/(36)RD436_2004.pdf.

[21] See http://www.energias-renovables.com/paginas/Contenidosecciones.asp?ID=14&Cod=4335&Tipo=historico&Nombre=Noticias.

The Royal Decree currently in place is 661/2007[22], which establishes the methodology for updating and systematizing the legislative and economic regime of electric energy production under the special regime. The new method continues to heavily support renewable energy. Wind energy producers, for example, received €73.22/MWh (appx. $92 USD per MWh), which could be anywhere between 136% and 209% of the market price at the time. This is relevant because it does appear that such price-hiking subsidy is necessary to make renewable technologies in a sense viable.

Soon after approving this new Royal Decree, Prime Minister Zapatero defended the change from the existing energy model to his energy model "of the future"—which Spain would lead, using language similar to that now employed in the U.S. — and correlated his efforts in the promotion of renewables with the creation of a high volume of jobs in the renewable energy sector. History would partially prove him right. The question we address is "at what price?"

[22] With the exception of the remuneration as well as part of the administrative procedures in force for solar photovoltaic plants for installations subsequent to the deadline for the retribution according to the Royal Decree 661/2007, which is currently regulated in those regards by the Royal Decree 1578/2008. http://www.cne.es/cne/doc/legislacion/RD_661-2007-RE.pdf.

CHAPTER 2. THE SPANISH RENEWABLES BUBBLE

I. Introduction. Wind and photovoltaic energy

This section will study two paradigmatic cases in Spain: wind energy and photovoltaic solar energy.[23]

The boom in renewable energy is the result of the confluence of two factors that have reinforced each other in recent years.

I.1. Support to renewable energy

In order to enhance renewable energy sources in Spain, the Government promoted legislation the main goal of which is to reach 12% penetration by these sources in the Spanish energy market and 20% of electric production in 2010. There are primarily two mechanisms:

- Setting regulated rates or highly subsided premiums as compared with a mean reference rate, with the clear objective of attracting investment to the relevant sector. In addition, electricity retailers are forced to buy all the electricity generated by renewable sources, which eventually implies that, unlike other forms of production, the sale of renewables' output is guaranteed and hence so is the return on the investment.
- Incentives: ICO (Instituto de Crédito Oficial) credits and IDAE (Instituto para la Diversificación y Ahorro de la Energía) aid, to which subsidies from the Spanish regions (Comunidades Autónomas) are added.

I.2. Economic cycle

The second case is the economic cycle itself, which has clearly propelled the establishment of these technologies in Spain. We shall analyze how interest rates (from the European Central Bank) and the ease with which credit is granted affects Spain along the cycle, as well as the volume of credit that the electric industry receives, particularly through September of 2008, when the photovoltaic industry burst its bubble.

[23] The thermoelectric solar energy is residual in Spain. The only plant (11 MW) was installed in 2008.

II. The retributive framework for wind energy

To achieve the goal of having 12% of primary energy originated from renewable energy, the Renewable Energy Plan (PER) 2005-2010 establishes that in 2010, 20,155MW of wind power (capacity) must be installed.

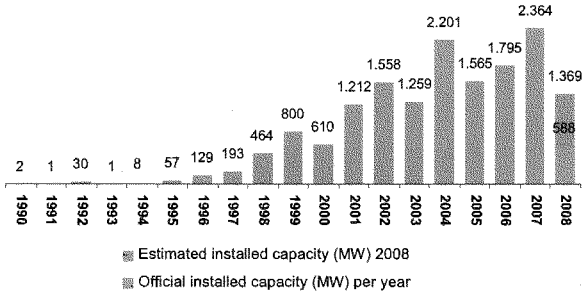
Table 1.- Expected wind energy installation growth in Spain according to PER 2005-2010

	2005	2006	2007	2008	2009	2010	TOTAL 2005-2010
POTENCIA EOLICA ANUAL (MW)	1800	2000	2200	2200	2000	1800	12000

Source: Renewable energy plan 2005-2010.

Spain's National Energy Commission (CNE) estimates that through December of 2008 there might have been as much as 15,617 MW installed, although only 14,836 MW are officially accounted for.

Figure 1.- Installed wind power by year (1990-2008)



Source: CNE[24], own elaboration.

The rate of development of this technology has remained comparatively quite calm (considerably more so than photovoltaic energy, which we shall mention later on). To attract investors and make it profitable against other forms of energy, it must remain subsidized. However, it has not experienced a bubble as intense as the one experienced by the photovoltaic industry, its annual rate of capacity increase being more in tune with PER's own forecasts for 2005-2010.

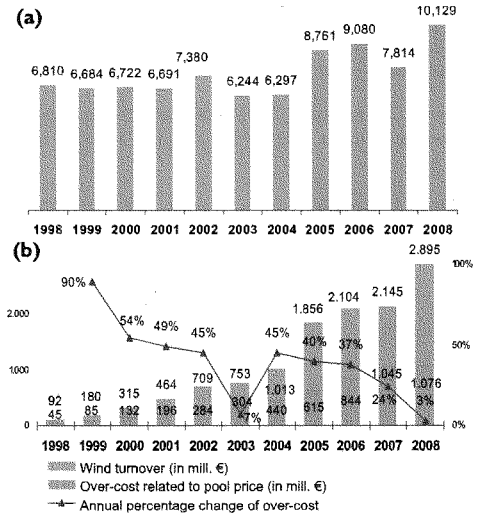
Spain has become the world's third-largest country for installed wind energy capacity.

[24] "Monthly Report on Energy Purchases from Special Regime". From http://www.cne.es/cne/Publicaciones?id_nodo=143&accion=1&soloUltimo=si&sldCat=10&keyword=&auditoria=F

The last eleven years have seen three different economic regimes relevant to wind: RD 2818/1998 (1998-2004), RD 436/2004 (2004-2006) and RD 661/2007 (since 2007).

The effect of the retributive framework on the wind farms has been to achieve sufficient stability in the development of the technology. By using estimated data on installed capacity, CNE projects that by the end of 2008, 77% of the 2010 objective was reached, leaving 40 months to reach the final goal of 20155 MW.

Figure 2.- (a) Average kWh price. (b) Total retribution and over-cost[25] (mill. €) of wind energy (1998-2008)



Source: CNE, own elaboration.

With regards to the objective that 20% of electric consumption originates from renewable sources by 2010, wind power is the source that contributes the most among the renewables, with 10.2% of electric consumption provided by wind[26] in 2008.

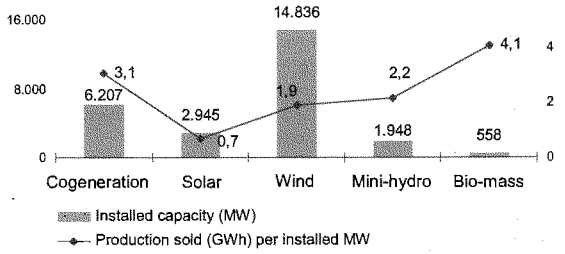
[25] This is the amount paid over the cost – because of the feed-in price system – that would result from buying the electricity generated by the renewable power plants at the market price (also named "pool price"), i.e., the over-cost is the result of multiplying the production by the difference between the average selling price of each technology and the average price of the market. Both the average selling price by technology and the average market price are from the cited CNE "Monthly Report on Energy Purchases from Special Regime." The average market price comes from the monthly settlement of the special regime's installations that take part in the electricity production market (made by OMEL-REE – Red Eléctrica Española).

[26] The total for renewable energy is 19% in 2008.

The expansion of this technology, however, has not been the result of economic efficiency but instead of the political pressure to develop it on a massive scale.

The success in the deployment of this energy source must be viewed with the perspective that, although twice as much wind has been installed as the second-leading *installed* "special regime" technology, cogeneration, the latter sells 3.1 GWh per installed MW while wind energy sells 1.7 GWh per MW installed. That is, cogeneration produces nearly twice the actual electricity per megawatt of capacity constructed.

Figure 3.- Official installed capacity (MW) and production (GWh) to installed MW ratio for technologies under the "special regime" (2008)



Source: CNE. CNE's official installed capacity data are shown for 2008, since these are the special regime power plants which have actually sold electricity during the cited year. As for the solar energy, we include the only thermoelectrical installation there is in Spain (an 11 MW plant which starts operating in 2008).

The sold-energy-to-installed-capacity ratio is even lower for solar energy, providing the least among all those technologies taken into consideration with 0.7 GWh sold per installed megawatt. Nonetheless, we can find a partial cause for this phenomenon in the fact that in 2008 alone 2253 megawatts have been officially installed; thereby, many of the plants have not been operating for a full year. The same ratio for solar energy in 2007 amounts to 0.71 GWh/MW.

Although in relative terms the wind bubble has not been as great as the one experienced by solar photovoltaic energy, it is worth noting that the 15617 MW installed is such a high amount that, in the middle of the economic crisis, it will necessarily represent a very significant portion of the electric deficit.[27]

Not without reason, RD 436/2004 was considered by the Secretary of Energy (November 2006[28]) as "unfortunate". The inclusion of the new Royal Decree of 2007 accomplished in part its objective (cut the percentage of over-cost), even though the

[27] The so-called rate deficit of the Spanish electric system is the result of fixed rates over electricity consumption which doesn't cover the cost of production, transportation and distribution, and rest of the costs of the electric system, especially those of the over-cost produced by governmental support of renewable energies.

[28] See http://www.eleconomista.es/empresas-finanzas/noticias/99679/11/06/Industria-fijara-un-tope-maximo-y-minimo-para-primas-de-la-eolica.html.

average regulated sale price increased to its highest levels. The accumulated rate deficit since 2000 is over 15,000 million Euros (appx. $18.9 billion USD) and it increased by 5,640 million Euros (appx. $7.14 billion USD) in just 2008, according to settlement information[29] from CNE (see figure 7).

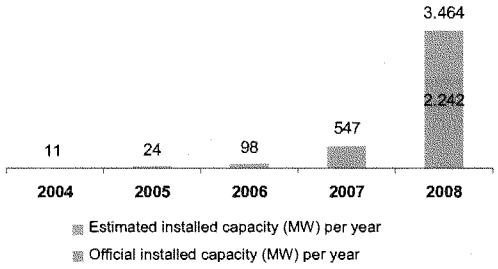
III. Retributive framework for photovoltaic solar energy: an unprecedented bubble, a reversal and the burst

The objectives laid out by PER 2005 for the development of the photovoltaic industry call for 371 MW of capacity by 2010. Solar photovoltaic energy would begin to be massively deployed in Spain from 2004 to 2008. Through that time, three economic regimes have come into effect; thanks to the appealing guaranteed retributions, these policies would massively encourage development of the industry, such as President Obama now speaks of. In 2008 Spain would become the second-largest country in installed capacity of solar energy, behind only Germany.

The three Royal Decrees are 436/2004 (2004-2006), RD 661/2007 (from June 2007 to September 2008) and RD 1578/2008 (starting on September 29th).

III.1. The increase in installed capacity of photovoltaic plants up to 100 kW

Figure 4.- Yearly growth of installed capacity (MW) of solar photovoltaic energy (reported and estimated) from 2004 to 2008.



Source: CNE[30].

RD 436/2004 took effect in 2004 when in Spain there were only 12 MW of installed capacity. The current retributive framework aims to considerably increase the

[29] "Liquidación provisional nº 13 de 2008", published in March, 2009. http://www.cne.es/cne/doc/publicaciones/IAP_Liqui_Mar09V2.pdf.

[30] "Monthly Report on Energy Purchases from Special Regime", See http://www.cne.es/cne/Publicaciones?id_nodo=143&accion=1&soloUltimo=si&sldCat=10&keyword=&auditoria=F

deployment of photovoltaic installations with the purpose of achieving the market penetration agreement with the European Union for the electricity (20%) and broader energy (12%) markets, all while giving preference to the smaller investors. To that end, a scheme of progressive regulated rates is established according to the size of the plant: 575% above the mean reference rate (TMR[31]) during the first 25 years of operation for plants up to 100 kW. Higher capacity plants, however, are penalized with a retribution over the TMR of "only" 300% in the first 25 years.

Nonetheless, as is common with such schemes this only emboldens craftiness. Indeed, in order to take advantage of the 575% over TMR, "solar farms" of various MW started to proliferate, motivated by businesses which ran these installations under several clients' names, usually assigning to teach one less than the 100kW limit. Thus, these firms could manage a big solar farm (for example, 10MW) connected by a series of transformers up to 100kW each.

In short, such artificial subsidy schemes encourage massive inefficiencies, which increase the "renewable" requirements' economic cost.

Not surprisingly, the annual growth rate of plants of up to 100 kW reached 122% both in 2004 and 2005, and 215% in 2006, with photovoltaic capacity going from 9 MW at the beginning of 2004 to 140 MW at the end of 2006. Regarding plants above 100 kW, these start out at 3 MW at the beginning of 2004 and end up with 5 MW in 2006. It is within this context that many a rent-seeker began to reel in such a juicy catch, from large family estates, venture capital and large corporations (Repsol, Iberdrola, Gamesa) to large financial institutions (BBVA, Banco Santander, La Caixa, CAM, Barclays, Deutsche Bank, etc.) willing to loan money to secure state-guaranteed returns.

III.2. The bubble: September 29th, 2007 through September 29th, 2008

RD 661/2007 took effect on June 1st 2007. This new directive aimed to create continuity and stability in the solar sector, even though the main difference it offered lies in the attempt to control an unintended consequence already caused by a previous regulation: the exorbitant development of the aforementioned "solar farms" and the dubious shadow of influences that they had cast.

The photovoltaic retributive framework then unlinks from the TMR retribution and, instead, a fixed reference price is set (whose 2007 initial value is published in the RD), and will be updated yearly against the consumer price index (CPI).

To seek greater professionalism in this sector, installations of more than 100 kW would no longer be intrinsically discouraged. Thus, those plants willing to welcome the regulated rate retributive framework and with capacity up to 100kW, would receive 44 c€/kWh for the first 25 years. Plants between 100kW and 10 MW would receive 41.75 cents per kilowatt-hour sold. Furthermore, both rates will be updated annually according to the CPI.

[31] That the Government used to set every year.

In September of 2007, the National Energy Commission[32] (CNE) certified that, as of information available through that August, 85% of the 371 MW goal towards 2010 had been reached. Furthermore, the CNE assured that the full objective could be attained by October 2007.

The announcement of the completion of 85% of the objective in 2007 immediately triggered the necessity to craft a new Royal Decree that would regulate rates and set operating conditions during a prescribed period of time, which was determined to be one year. The transitional period of one year was chosen to allow installations being built to have enough time to finish construction and come into operation (10 months on average), thereby taking advantage of the rates and regulations from RD 661/2007.

The draft[33] of the Royal Decree dated September 27th, 2007 revised the power objective that must be installed by 2010, increasing it to 1200MW. All installations beginning during the transitional period, once the new limit of 1200 MW was exceeded, would receive a non-subsidized retribution until the new RD took force, and with it, new rates.

The CNE would later ask to modify the draft and is finally able to require all installations which signed up before September 30th, 2008, to abide by the new retributive framework (decree 661), regardless of whether the goal of 1200 MW was met.

A period of uncertainty then arose in anticipation of the new regulation that would take effect one year after the transitional period (September 2008), which investors presumed would most likely prove to be less beneficial. Investors, thus, were motivated to rapidly install as much power as possible before September 29th, 2008, fearing that the upcoming regulation would be much worse.

Such is the source of the boom in the installation of new solar photovoltaic plants that, according to official records published by the CNE[34], through December of 2008, the scheme yielded over 2934 MW of solar photovoltaic power in place. However, according to CNE's own estimates[35], it could have realistically reached up to 4156 MW[36], which would mean that an 83.3% of the overall capacity was installed in 2008 alone.

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[32] According to CNE, reliable data of installed capacity in the case of photovoltaic technology is very inferior to that of the rest of renewable energy sources. Therefore, at n+1 (referring to month n), the official records only gather a 70.6% completion of real capacity.

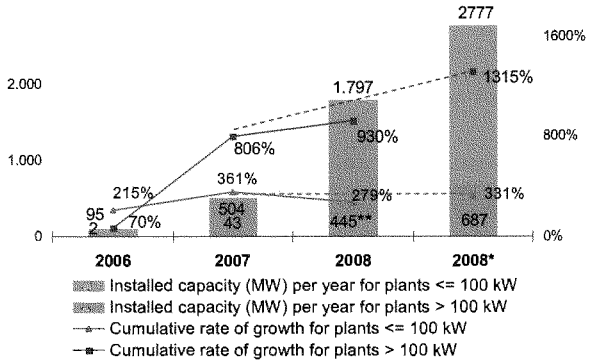
[33] Industry Secretary Joan Clos. http://www.mityc.es/NR/rdonlyres/CA88E8AD-B9D8-4829-9BA5-BE08D7F858B4/0/Propuesta_RD_fotovoltaica.pdf.

[34] Solar plants which are already billing to distributing companies.

[35] CNE takes into account the average delay in receiving the registry data of the installations in operation within a period. According to CNE, not until 9 months have passed since they start to measure the number of plants installed in a month that they have a reliability of a 95.8%.

[36] Available on the worksheet named "CumplimientoObjetivo" in the "Monthly Report on Energy Purchases from Special Regime" (Jan 2009 referred to Dec 2008).

Figure 5.- 2006-2008 yearly installation of solar photovoltaic power (in MW) by plant size and cumulative rate of growth



"2008*" refers to data extrapolated from the total potential amount of power estimated by the CNE in 2008. The "2008" column, however, represents the 2008 official installed capacity that the CNE accounts for at the beginning of 2009 (which is still incomplete).

** The first and only thermal solar plan is in Spain is brought online in 2008, with a capacity of 11 MW of power. The graph only takes into account photovoltaic solar energy and thus those 11 MW are not added to the official 445 MW seen above.

The new retributive framework extends the generosity of the regulated rates for larger installations: those above 100 kW and under 10 MW will enjoy for 2009 a regulated price of 44.5751 c€/kWh, and 47.0181 c€/kWh for those plants up to 100 kW. Moreover, the one-year grace period allows investors to install as much power as possible before it ends, thereby joining en masse photovoltaic plants in the 100 kW – 10 MW range.

The graph above shows the strong yearly growth in power plants above 100 kW capacity. According to official data, there was growth in solar capacity of 806% in 2007 and 903% in 2008. If we extrapolate from CNE's estimates, growth in 2008 could have reached as high as 1315%.

The attempt to encourage stability and "professionalism" in the industry by ensuring strong market penetration by specialized participants (especially to exploit higher capacity plants) in the production of photovoltaic energy, however, has not reaped the expected benefits. Instead, the energy industry witnessed the entrance of builders, real estate companies, hotel groups and even truck manufacturers.

The regulated tariffs are so generous that, by leveraging 70% of the cost, a 100 kW photovoltaic plant would yield internal rates of return of up to 17% in 2007.[37] To put

[37] Own estimate based on a turnkey project that had been settled in 2007 (RD 661/2007 retribution). Despite not being included here, we have used the estimation of a turnkey project (offered by Solar Fotovoltaicas Consulting corresponding to 2005 investment costs) to compare the approximate yield

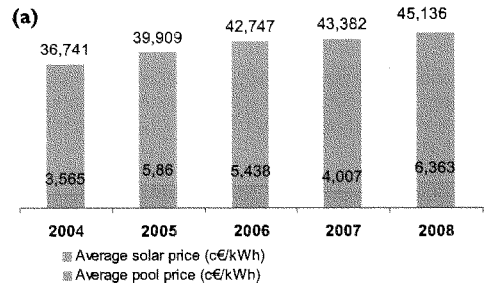
what this figure implies into perspective, let's compare it with a bond. Currently, a 30 year Spanish bond is yielding a return rate close to 5% per year. A solar plant investment would obtain 1,200 more basis points with a similar risk and guarantee (the one offered by Spanish Sate). Another way to understand the magnitude of this result is to calculate the earnings an investor initially endowing 100,000 euros would gather, reinvesting principal and interest yearly at the same 17% internal return rate. In 25 years, stemming from those 100,000 euros, the investment would become 5,065,782 euros.

Even the Photovoltaic Solar Industry Association (ASIF), through its president, Javier Anta, mentioned that, among other factors, "the ease of credit, a photovoltaic rate – the one from RD 661/07–, which was left high," have contributed such that the growth this produced in Spain's industry has absolutely exceeded all expectations and is now the world's number one photovoltaic market, even ahead of Germany."[38]

The latter factor is an important one for U.S. policymakers to consider as they expressly seek to replicate superficial tales of the European – and specifically Spanish – experience with renewable energy policy regimes by seeking to artificially force massive growth.

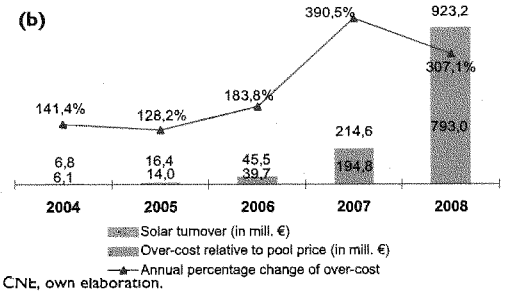
These two economic regimes commented on have guaranteed extremely high retributions far beyond the average market selling price (pool price). The regulated price has ranged between 6.8 and 10.9 times the mean market price from 2004 to 2008. As a result, over-cost has skyrocketed during this period because of the installed capacity boom explained above. It represented an 85.9% in 2008 and a 90.8% in 2007 of the retribution obtained by photovoltaic producers.

Figure 6.- (a) Average solar price vs. average pool price per kWh. (b) Total retribution and over-cost (mill. €) of solar energy (2004-2008)



under three different retribution frameworks. We are not even considering public aids, such as those offered by ICO-IDAE or local/regional institutions, which would have turned the internal returns higher.

[38] Statements can be found on Energías Renovables' website and other media. See: http://www.energias-renovables.com/paginas/Contenidosecciones.asp?ID=14&Cod=15756&Tipo=&Nombre=Noticias.

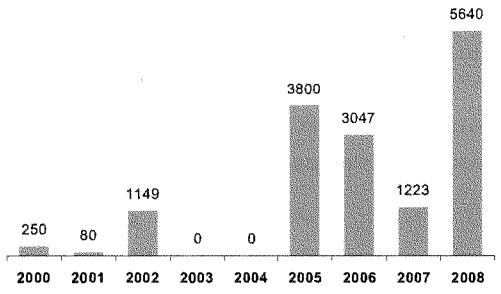


Source: CNE, own elaboration.

The spectacular increase in solar plant deployment has accentuated the 2008 rate deficit. However, it will do so even more intensely in 2009, at which point every plant that became operational in 2008 will by then have an entire year online, and also because many of them, operating under RD 661, will begin billing in 2009 (around 1222 MW, inferring from CNE estimates). For 2008, the mean sale price of electricity generated from solar photovoltaic power is 7 times higher than the mean price of the pool.[39]

Thus, the over-cost of photovoltaic production, which has to be somehow subsidized affecting the rate deficit, is and will continue to be enormous. The accumulated rate deficit from 2000 to 2008 is around 15,189 million Euros (based on provisional settlements published by CNE). Just in 2008, it has amounted to 5,640 million Euros (over a third of the total deficit). The estimated 500% growth in installed capacity in 2008 implies that the rate deficit could increase uncontrollably in coming years.

Figure 7.- 2000-2008 annual rate deficit (in millions of €)



Source: From 2000 to 2007, based on the document "El déficit de tarifa"[40], by "Energía y Sociedad". Rate deficit from 2008, source CNE: Settlement report for 2008[41].

[39] Electricity "market price" originated in the wholesale market.

[40] http://www.energiaysociedad.es/documentos/T3_Deficit_de_tarifas.pdf.

And after all of these economic efforts, solar energy failed even to reach 1% of Spain's total electricity production in 2008.

III.3. The looming collapse of the photovoltaic sector

It is in this context that the Royal Decree 1578/2008 of September 26th, 2008 (whose results we will not be able to analyze for a few more months) becomes effective and sets forth a very restrictive and arduous regulation on the photovoltaic industry. First of all, it will very much favor roof installations (on buildings) to the detriment of those on the ground because the recent "speculative" growth of photovoltaic has taken place in the latter form; fears of an increasing rate deficit has reined in a massive deployment of solar plants by producers foreign to the industry (according to the Ministry of Industry).

Secondly, it greatly decreases retributions to new installations, applying a reduction close to 30%, which especially affects the ground photovoltaic industry (the most developed so far).

Finally, a quota system is implemented to monitor the expansion of the industry. In 2009, a maximum of 400 MW of capacity will be the total allowed under the new regulated rates. To that amount, another 100 MW are allowed to avoid a sudden deceleration in the industry (plants installed in 2009 beyond the 500 MW limit shall see their subsidy reduced). Furthermore, plants within the quota policy will be penalized.

As we can see, the industry faces a substantial chance at failing if we take into consideration that, according to data estimated by the CNE, only 3464 MW have been installed in 2008. The Photovoltaic Industry Association (ASIF), in a press release of February 16th, 2009, estimates that there have been 15,000 job losses in the solar sector just a few months after RD 1578/2008 has taken effect.[42]

This reflects the boom/bust nature of the renewables industries, or any others which exist and subsist solely due to subsidies, mandates and similar regimes, which have been experienced to great effect and which must not be ignored by any country claiming a desire to replicate Europe's experience.

IV. The expansion of renewable energy and its link to the expansion of credit

The economic cycle has been the second factor helping the explosion of renewable energy in Spain.

The availability of low interest rates and easy credit that Spain enjoyed from 1998 until 2007 allowed credit-dependent industries to develop with great success. Renewable

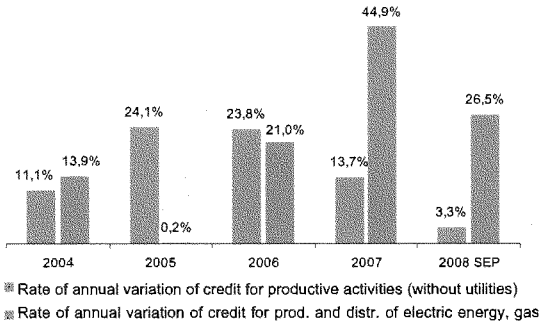
[41] "Liquidación provisional nº. 13 de 2008", published in March, 2009. http://www.cne.es/cne/doc/publicaciones/IAP_Liqui_Mar09V2.pdf.

[42] See ASIF's press release: http://www.asif.org/files/ASIF_Industria_prolonga_paralisis_Feb09.pdf.

energy was not an exception and they witnessed an enormous increase in plant deployment during those years.

However, as the credit bubble ballooned and with it, an economic bonanza, the seeds of reversal and crisis were being planted.

Figure 8.- Expansion in credit destined to finance the "production and distribution of electric energy, gas and water" and the rest of productive activity for 2004-2008.



Source: Statistical bulletin from the Bank of Spain. "Total créditos y total créditos dudosos a otros sectores residentes para financiar actividades productivas".

Note: As an approach to the credit assigned to renewable energy sources, we use the category measured by the Bank of Spain: "production and distribution of electric energy, water and gas".

The world begins to finally feel the credit crisis in the last half of 2007. From that point on, the other heavily leveraged industries collapse: real estate – a sector of notable overinvestment in Spain[43]– transportation, machinery, etc. Renewable energies, especially photovoltaics, however, remain one of the preferred outlets for credit concession during the past year-and-a-half. Thus, in 2007 and 2008, the growth of credit destined to the production and distribution of electric energy (and other utilities gas and water) skyrockets (see previous graph), while the rest of the productive sector of the economy diminishes its levels of leveraging in 2007 – more steeply by the second half, when signs appear that unequivocally show that the economic crisis has started in Spain – and ceases leveraging completely in 2008.

As we can see, the growth in photovoltaic power between the second half of 2007 and September of 2008 was enormous (up to several thousand MW according to either

[43] The residential houses started in Spain from 2004 to 2006 were 2,163,400 (Instituto Nacional de Estadística: "Estadísticas de la construcción"), on average more than 700,000 per year for a 45 million population. For comparative purposes, in the US, the number of started houses reached up to 1,716 millions in 2005 (US Census Bureau: "New residential construction"), which means the peak year of the real estate boom for 300 million people. In the US, comparing relative population, the equivalent of this overexpansion would be new residential houses started per year of 4,800,000.

estimates or official date from the CNE). This was a result of economic distortions brought about by their industry being a creature of government regulation.

Starting in October, between a more damaging retributive framework for photovoltaics and a banking liquidity crisis, we can foresee the evaporation of credit to this and other renewable sources as well.

CHAPTER 3. JOB CREATION IN THE WIND, MINI-HYDROELECTRIC AND PHOTOVOLTAIC INDUSTRY

I. Measuring job creation in Spain's wind, mini-hydroelectric and photovoltaic industries.

Having studied the Spanish policy of public assistance to renewables and the development of that sector, we now estimate the job creation attributable to the assistance provided said industry. The first problem that we face is that existing studies rely on sources that cannot be externally analyzed, such as interviews. Furthermore, those studies often include every contract as job creation when many of them, in fact the majority of them given that we are in an artificial bubble, are contracts for installation and manufacturing that would only be sustainable if we assume that the record rates of installing capacity during the last years were maintained. Thus, we will look at the installed power of the three main renewable electricity sources in Spain and estimate the related job creation according to the report of the Commission's *Monitoring and Modeling Initiative on Targets for Renewable Energy* (MITRE) project.

According to the latest version, at this writing, of the "Monthly Report on Energy Purchases from Special Regime"[44] (Jan 2009), the official and approximate data for installed capacity in Spain is as follows:

- Wind farms: 14,836 MW officially; 15,617 MW estimate.
- Mini-hydroelectric under 50 MW: 1,949 MW officially.
- Photovoltaic plants: 2,934 MW officially; 4,156 MW estimate.

Different criteria may be used to estimate the jobs created towards the installation of electric power in each one of the main sources of renewable production. After comparing the results according to the ratios (employment/MW) between projects produced to the Administration and commercial offerings by major developers and turnkey builders, the estimates from the IDAE (Instituto para la Diversificación y

[44] "Total annual retribution received by producers of the special regime in Spain, by technology" (chart 1.1).

Ahorro de la Energía)[45], and the estimates from MITRE, we opt to accept results from the latter, a European research group cited earlier.

The data used for MITRE's report for Spain assume a higher generation of jobs than revealed in the analyzed reports (which can be explained in part by the inclusion of indirect jobs included in the study financed by the European Commission), but lower than what are obtained by following the IDAE (which we have discarded for having overstated the amount of contracts that were actually formalized in the sector).

II. Estimate of the number of jobs created in wind power

We follow the data published in MITRE's report with regard to the total number of jobs created by wind energy production through 2010, that is, when the objectives of the EU's plan for 2010 should be completed. With its 14,836 MW installed and 28,579 GWh produced by the end of 2008 Spain, according to the report published for Spain by the European Commission (EC) titled "Complying with the objectives and putting renewables to work. Country Report, Spain,"[46] would be "close to" attaining the objectives for 2020 according to MITRE (current policies scenario). The goals are set at 15,614 installed MW and 37,558 generated GWh, which means, according to its estimates, the creation of 15,000 direct and indirect jobs. We accept that figure (that includes direct and indirect jobs) for the purposes of this study.

III. Estimate of the number of jobs created in mini-hydroelectric energy

According to the above-cited EC-financed report, "Meeting the targets and putting renewables to work,"[47] Spain should have created 4,700 jobs between 2000 and 2010 in the mini-hydroelectric sector. With 1,949 MW installed and 4,203 GWh produced towards the end of 2008, it would be far from achieving the 2010 objectives under MITRE's most conservative scenario (current policies scenario), which goals are set at 3,011 installed MW and 9,926 generated GWh. For the purposes of this study, we are going to assume that the objective had been attained in 2008 and that 4,700 direct and indirect jobs had been created[48] in 2000-2008 by mini-hydroelectric energy production.

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[45] IDAE is a public "Institute for the Diversification and Saving of Energy", currently dependent on the Ministry of Industry, Tourism and Commerce.

[46] Monitoring & Modelling Initiative on the Targets for Renewable Energy (MITRE). "Meeting the targets and putting renewables to work. Country Report: Spain" http://mitre.energyprojects.net/main.asp?Show=F. This project is part of the Alterner Programme (Directorate General for Transport and Energy. European Commission).

[47] Monitoring & Modelling Initiative on the Targets for Renewable Energy (MITRE). "Meeting the targets and putting renewables to work". http://mitre.energyprojects.net/main.asp?Show=F.

[48] We are being very generous in accepting such high job creation figures in this field since only two thirds of MITRE´s expected power capacity under the most conservative scenario has been reached.

IV. Estimate of the number of jobs created in solar photovoltaic energy

According to the most optimistic scenario (advanced renewable policy scenario) that MITRE manages for the photovoltaic industry, Spain, with 2,934 installed MW towards the end of 2008 and 2,065 produced GWh, would have achieved the 2020 goal of 1,818 installed MW but not the goal of 2,289 GWh produced. From the point of view of job creation, however, we will consider that those objectives had been accomplished and the number of jobs indicated in MITRE, 14,500 positions, have been created.[49]

V. Wind, mini-hydroelectric and photovoltaic premiums for the generation of electricity.

The current remunerative scheme for the energy produced under special regime establishes a premium over the marginal daily market price for each MWh produced by renewable energies, or a flat rate independent of the period of electricity generation. We have calculated the amount of the premiums that have been committed by the Spanish legislation (the subsidies NPV in 2008 have been calculated at 4%) with the assumption that since December 31st, 2008, there have not been any additional plants constructed and related employment holds steady. 10,951 million Euros would have been committed on wind energy in 2008, 1,173 in small hydroelectric and 8,629 million for photovoltaic generation.

Table 2.- Average price paid to the production of wind, photovoltaic and mini-hydro and over-cost with regard to the same production paid at average pool price in Spain (1998-2008)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
PHOTOVOLTAIC									
Production (in GWh)	1.4	2	4,64	9	18	40	106	454	2054
Capacity installed (in MW)	1	2	5,47	11	21	42	142	451	2934
Average selling price (in € / MWh)	226.58	248.96	285.36	308.25	366.92	399.04	427.44	434.71	451.36
WIND									
Production (in GWh)	4544	6925	9564	12063	15965	20955	23143	26789	28579
Capacity installed (in MW)	2060	3295	4580	6273	8152	10021	11845	12931	14836
Average selling price (in € / MWh)	67.31	66.96	73.89	62.44	62.94	87.59	92.16	79.07	101.29
MINI-HYDRO									

[49] Again, we are assuming a higher number of created jobs than in purity should be derived from the comparison between MITRE's Spanish Country Report and the actual development of the photovoltaic industry.

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Production (in GWh) less than 10 MW	2983								
Production (in GWh) over 10 MW	1015	4391	3895	5091	4678	3790	4144	4004	4203
Capacity installed (in MW) less than 10 MW	1013								
Capacity installed (in MW) over 10 MW	375	1459	1492	1606	1649	1712	1878	1882	1949
Average selling price (in € / MWh) less than 10 MW	69.72								
Average selling price (in € / MWh) over 10 MW	66.7	65.64	73.31	65.91	66.49	87.92	89.46	77.42	96.31

	2000	2001	2002	2003	2004	2005	2006	2007	2008	OVER-COST NPV @ 4%
AVERAGE POOL PRICE (in €/ MWh)	39.13	38.59	44.22	37.26	35.65	58.6	54.38	40.07	62.88	
OVER-COST PHOTOVOLTAIC (in M€) (1)	0.26	0.42	1.12	2.44	5.96	13.62	39.5	179.5	797.94	1054.88
OVER-COST WIND (in M€) (1)	128.05	196.46	283.76	303.75	435.68	607.49	874.34	1044.8	1097.7	5485.38
OVER-COST MINI-HYDRO (in M€) less than 10 MW (1)	91.25									
OVER-COST MINI-HYDRO (in M€) over 10 MW (1)	27.98	118.78	113.31	145.8	144.27	111.12	145.37	149.55	140.51	1378.28
TOTAL OVER-COST NPV@4 % (SPENT @ Dec 31st, 2008)										7918.54

Source: Own elaboration based on CNE's "Monthly Report on Energy Purchases from Special Regime."

(1) Calculated as the result of multiplying the production by the difference between the average selling price of each renewable technology and the average market price (pool price).

The above table shows the total over-cost that has been incurred from 2000 to 2008, calculating its net present value (NPV) at a 4% discount rate in 2008, which amounts to 7,918.54 Euros.

VI. Investment costs for photovoltaic, wind and mini-hydroelectric projects

To calculate the cost of investment in each of these sources we have used the standard cost for each one of these types of turnkey projects in the current market and applied it to the megawatt capacity installed between 2000 and 2008. Theoretically

speaking, we are dealing with the replacement value of these projects according to the current state of the art.

- Wind projects: 1.1 M€/MW[50].
- Photovoltaic projects: 5.5 M€/MW[51].
- Mini-hydroelectric projects: 1.71 M€/MW[52] (average)

VII. Conclusion

In table 3 we summarize the results achieved in terms of employment, subsidies and investment in the three main renewable industries. Since 2000, the renewable subsidies have created less than 50,200 jobs.[53] This amounts to 0.2% of Spain's workforce and 0.25% of Spain's employed workforce. We can see that the average subsidy per worker added in these three sources of renewable energies is more than half a million Euros (€571,138), ranging from €542,825 per worker added in or by the mini-hydro sector and two-thirds of a million Euros per worker added in or by the photovoltaic sector, to well over €1 million per worker added in or by the wind industry.

Table 3.- Subsidy and investment per worker

	Number of direct jobs	Number of indirect jobs (difference)	Total jobs	Total subsidy (spent and committed) in M€, NPV @ 4 %	Subsidy M€/ job	Total investment (in M €)	Investment (in M€)/job
WIND	6825	8.175	15000	16436.38	1.095758667	14723	0.981533333879
MINI-HYDRO	1475	3225	4700	2551.28	0.542825532	1067.04	0.227029728682
PHOTOVOLTAIC	14500	0	14500	9683.48	0.667826207	16131.5	1.112517241

[50] As an example, see: "The wind energy industry in Spain", by ICE. Economic bulletin, nº 2740, from September 23rd to September 29th 2002. http://www.revistasice.com/cmsrevistasICE/pdfs/BICE_2740_19-29__8A787D3F005521DDB8F16C9B13404D60.pdf.

[51] See the ASIF/APPA report "The role of photovoltaic energy in Spain", November, 2007. This is a conservative figure for turnkey projects because, for those installing two-axis solar tracking structure, prices revolve around 6.3 M€/MW and around 5.2 €/MW for fixed structure.

[52] Average cost calculated from the annual average operation of mini-hydroelectric Spanish plants in the past 8 years (2,556 hours) and considering that Spain, towards 31 December 2008 had 1,949 installed MW in 936 different locations. These figures bring about an average size per plant of 2.06MW, with an average installation cost between 1.45 M€/MW and 1.97 M€/MW, i.e., 1.71 M€/MW (average). This is the value that will be applied to the 624 installed MW from 2000 to 2008. See "Checklist para inversión y estudios de viabilidad en Mini hidráulica", report published by the European Commission.

[53] According to Instituto Sindical de Trabajo, Ambiente y Salud (ISTAS), the distribution of those green jobs is the following: 9.58% are jobs in maintenance and operation, 24% are jobs in administration, marketing and projects and 66.27% in construction, fabrication and installation. At this point has to be stated that it is a usual practice to include the complete productive chain of renewable production of electricity and compare the figures with the jobs created by the energy sector just at the energy companies. For this, see, for example, Asociación Empresarial Eólica, Estudio Macroeconómico del Sector Eólico en España, p. 33, footnote 7.

TOTAL	11491	19122	50200[54]	28671.14	0.571138247	31921.54	0.65887251

Source: Own elaboration based on the previous data (2000-2008).

[54] Included here are the 11,000 jobs lost due to support effects and the 5,000 jobs lost due to conventional displacement, in order to calculate the total number of jobs created. Once again, we are assigning the totality of these jobs only to the three renewable technologies and not proportionally to the jobs created to all of the renewable technologies and biofuels and thus we are counting a higher number of jobs that correspond to these technologies. The director of this study attempted to repeatedly contact the MITRE authors to separate the various categories, but there was no response.

CHAPTER 4. THE ECONOMICS OF ARTIFICIAL JOB CREATION: A CALCULATION OF THE COST OF GREEN JOBS ON THE REST OF PRODUCTIVE ACTIVITY

Public investment in renewable energy has job creation as one of its explicit goals, which, given the current economic crisis, suggests an intention of seeding a future recovery with "green job" subsidies. The problem with this plan is that the resources used to create "green jobs" must be obtained from elsewhere in the economy. Therefore, this type of policy tends to create not just a crowding-out effect but also a net destruction of capital insofar as the investment necessary must be subsidized to a great extent and this is carried out by absorbing or destroying capital from the rest of the economy.

The money spent by the government cannot, once committed to "green jobs", be consumed or invested by private parties and therefore the jobs that would depend on such consumption and investment will disappear or not be created.

Investment in green jobs will only prove convenient if the expense by the public sector is more efficient at generating wealth than the private sector. This would only be possible if public investment were able to be self-financing without having to resort to subsidies, i.e., without needing to absorb wealth generated by the rest of the economy in order to support a production that cannot be justified through the incurred incomes and costs. We have calculated that the total public subsidy in Spain, both spent and committed, totals 28,671 million Euros (€28.7 billion or appx. $37 billion USD), and sustains 50,200 jobs.

In order to know how many net jobs are destroyed by a green job program for each one that it is intended to create, we use two different methods: with the first, we compare the average amount of capital destruction (the subsidized part of the investment) necessary to create a green job against the average amount of capital that a job requires in the private sector; with the second, we compare the average annual productivity that the subsidy to each green job would have contributed to the economy had it not been consumed in such a way, with the average productivity of labor in the private sector that allows workers to remain employed.

I. Stock of capital per worker

The total amount of invested and promised money to guarantee the viability of renewable energy in Spain is as high as 28,671 million Euros, and, if we include the non-subsidized investment, up to 50,200 employees have been put to work.

This forcible loss of resources incurred by renewable energy programs must be compared with the average resources per worker allocated in the private sector. The parameter that most closely approximates it is the average stock of capital per worker, whose mean between 1995 and 2005 in Spain was 259,143 Euros.

Therefore, for every green job that is attempted to be created, there is a 2.2 destruction of the resources that on average the private sector employs per worker

$$\frac{Subdidy\_to\_renewables\_per\_worker}{Average\_capital\_per\_worker} = \frac{571{,}138}{259{,}143} = 2.2$$

This is to say that for every renewable energy job that the State manages to finance, we can be confident that on average 2.2 jobs will be destroyed, to which we have to add those jobs that the non-subsidized investment would have created.

II. The annual productivity of the expense

In this section, we shall compare the average annual productivity that the green job subsidy would have contributed to the economy had it not been consumed in public financing, with the average productivity in the private sector that allows them to keep their job, the latter being ultimately the measure which justifies the creation or preservation of that job.

In order to obtain the annual public consumption of resources devoted to renewable energy we calculate the average annuity value during the next 25 years of subsidies. Now, what should be the rate at which we discount the annuities? In a private enterprise, the adequate rate would be the ROA (return on assets) because this is the rate of additional return that we would have obtained over a year if we had allocated, in the private sector, the annual cost of renewables.

For an entire economy, the closest thing we have to an ROA is the relationship between the annual income of capital and the stock of capital in the economy, that is, a ratio of the annual return on that stock of capital.

In Spain, annual capital profitability has slowed in recent years and thus we will take the lowest rate available: 8.53% in 2005.[55] With this discount, the average annuity for the end of 2008 is €55,946 per worker.

[55] Own elaboration from National Accounting figures published by National Statistics Institute (INE) and the BBVA Research Foundation.

This figure must be compared with the annual average productivity per worker in the rest of the economy. We can obtain this data by dividing the total income of labor in the economy by the number of workers. Thus, the average productivity per worker, between 2003 and 2007, was 25,332 Euros[56].

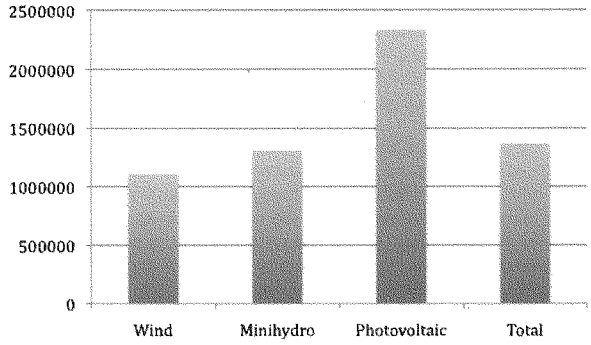
Thus, on average, the subsidized green job destroys the resources required to have created 2.2 jobs in the economy.

$$\frac{Annual\_subsidy\_to\_renewables\_per\_worker}{Average\_productivity\_per\_worker} = \frac{55{,}946}{25{,}332} = 2.2$$

Consequently, through the use of both methods we have reached a similar conclusion: for every green job, we can be highly confident that 2.2 jobs are destroyed elsewhere in the economy, to which we have to add those jobs that the non-subsidized investment would have created.

With that said, not all forms of energy sources are equally destructive, given that, to remain competitive, not all of them require the same amount of subsidy per megawatt. Our calculations, charted, reveal the following:

Figure 9.- Subsidy per MW (in €)



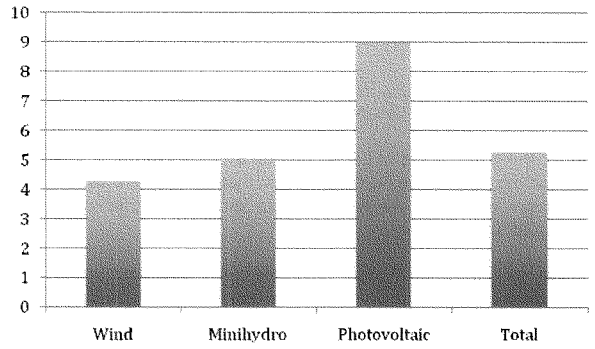
Source: Own elaboration.

We see that solar energy is significantly less competitive given that it requires more than twice the amount production of subsidy per megawatt compared to wind energy. By putting the per megawatt subsidy data in relation to the mean amount of capital resources, we obtain the number of jobs lost as a result of each kind of subsidized renewable energy source.

[56] Cuentas Nacionales, INE.

We achieve an identical result by relating the present value of an annuity of the sum of the committed amount with the annual productivity of labor:

Figure 10.- Employment destroyed per installed megawatt



Source: Own elaboration.

As we can see in figure 10, each renewable megawatt installed, on average (given Spain's breakdown of individual source contributions), destroys 5.28 jobs, compared with the 4.27 jobs destroyed per megawatt of wind energy, the 5.05 jobs destroyed per megawatt of mini-hydro and the 8.99 destroyed per megawatt of photovoltaic installed capacity as a result of "green jobs" mandates, subsidies and related regimes.

This result is important, since although solar energy may on paper appear to employ many workers (essentially in the plant's construction), the reality is that for the plant to work, it requires consumption of great amounts of capital that would have instead created many more jobs in other parts of the economy. Inversely, wind power, while still noxious in its economic impact when coercively introduced through state intervention, wastes far fewer resources per megawatt of installed capacity and thus does not destroy as many jobs in the rest of the economy.

This case is similar to the one that French economist Frédéric Bastiat denounced in his famous "Petition by the candle-makers," in which he ridicules the intentions of protectionist entrepreneurs by comparing them to candle-makers clamoring for the state to crowd-out the sun, which was competing with them unfairly when providing light. In their opinion, if the sun was barred from providing light, numerous jobs would be created in the candle manufacturing industry. Obviously, this is not so: precisely by not being able to profit from the sun's light we would be wasting scarce resources in the production of candles instead of producing other goods and services that would increase our wealth.

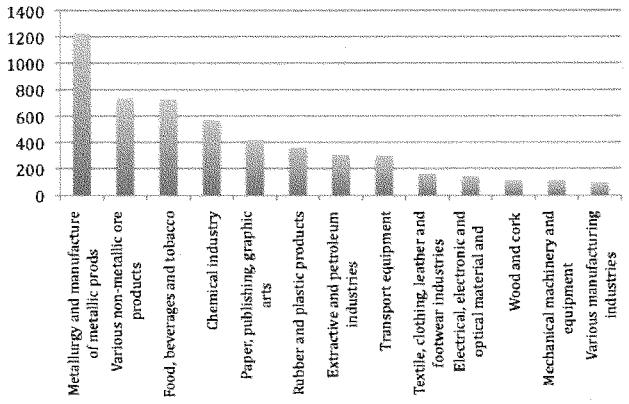
Finally, it is worth considering the distribution of the destroyed jobs across the economy. Obviously, the specific productive sectors affected will depend on how the government finances the subsidies to renewable energy. We can basically separate the

approaches intro three groups: increases in energy rates, increase in taxes or an increase in public debt.

The first method aims to correct the rate deficit, which in part is caused by the subsidies to the renewables, evidenced by a higher future electric cost. According to the National Energy Commission, the price of a comprehensive energy rate (paid by the end consumer) in Spain would have to be increased 31% to begin to repay the historic debt generated by this deficit.[57]

It is obvious that, if the rates were to increase by 31% — or by a lower percentage which, while it would not eliminate the deficit, it would reduce it—the energy intensive companies would suffer a very pronounced decline in their profitability and would have to reduce or eliminate operations in Spain. In our country, the sectors that consume the most energy are metallurgy, non-metallic mining and food processing, beverage and tobacco.

Figure 11.- Electricity consumption (in millions of €)



Source: INE (National Statistics Institute). From the Energy consumption survey (2007), table "Energy consumption by groups of activity and product consumed." (In this figure, the product shown is electricity).

From the groups above, it is worth highlighting that some of the most affected industries[58] would be producers of basic iron and steel products (in Spain, it consumed €470.77 million), basic chemical products (€382.13 million), plastics (€297.18 million), manufacture and first transformation of precious metals (€280.58 million) as well as producers of cement, lime and plaster (€202.22 million).

[57] See "Tarifas de acceso para 2009 y revisión de las tarifas integrales vigentes para el primer trimestre de 2009", CNE, November 7th 2008: http://www.cne.es/cne/doc/publicaciones/cne141_08.pdf

[58] Source: the most electricity-intensive industries pointed out here are taken from INE's Energy consumption survey (2007), table "Energy consumption by activity sectors and product consumed".

Unsurprisingly, the steel mills, the most electricity-intensive sector, have already been hurt by the high prices of electricity in Spain, exactly as the Acerinox example discussed below.

It is possible, of course, as it is indeed the case today in Spain, that the administration may try to prevent the most energy-intensive companies from leaving by bestowing upon them the privilege of paying a lower rate than the rest of the consumers pay. In Spain, it happens with the G4 rate, which is being taken advantage of by companies such as Arcelor Mittal, Asturiana de Zinc and Alcoa. But, as we have said, this privilege exacerbates the rate deficit, which, ultimately, must be financed through higher prices for the rest of non-privileged consumers or for the taxpayer.

And this leads us to the second possibility that we will mention to finance the rate deficit: an increase in taxation.

This method reduces the amount of income that consumers or businesses have available, reducing consumption and/or investment. For example, the average annuity payable to renewables is equivalent to 4.35% of all VAT collected, 3.45% of the household income tax, or 5.6% of the corporate income tax for 2007.[59] Regardless of whether the increase impacts consumption or investment more, the most affected sectors of the economy will be those with a greater pro-cyclical productions (such as automotive).

Finally, the subsidy to pay for "green jobs" or renewables could be financed by issuing public debt. This strategy poses a similar effect to the previous method but spread out over time (since it implies higher future taxes). However, debt has an additional effect: a restriction of present available credit that a business could use to refinance its debt or undertake new investments. Thus, employees of the most leveraged businesses or of investment projects that would need cheaper credit to be undertaken will suffer the costs of the renewables.

It is not possible to directly translate Spain's experience with similar exactitude or confidence, and claim that the U.S. should expect a loss of from 6.6 million to eleven million jobs as a direct consequence were the promise to create 3 to 5 million "green jobs" met (in addition to the jobs lost due to the opportunity cost of private capital employed in renewable energy), although the study clearly reveals that if President Obama would dedicate the massive resources needed to create those 3 to 5 million jobs, the U.S. should certainly expect its results to follow such a tendency.

At minimum, therefore, the study exposing the Spanish experience that President Obama cites as a model for the U.S. to replicate in quickly implementing "green jobs" programs serves as a note of caution that the reality far from what has typically been presented, and that such schemes offer considerable employment consequences and implications for emerging from the economic crisis.

[59] Own elaboration from Eurostat figures.

III. Spain's Self-inflicted Economic Wounds from "Green Jobs" Regimes

The late 90s already witnessed an energy leakage in Spain. As Jesús Lizcano Álvarez[60] put it, "Other substantial costs that can determine in some industries whether a relocation decision takes place can be energy costs, which –since they are higher in Spain than elsewhere nearby– along with other factor, have been crucial in cases such as the one of the Chemical company Hoeschst Ibérica, in its redirection of part of its investments abroad, or the case of Marcial Uchin, when deciding to build a steel mill in France, where energy costs are clearly competitive compared to Spain's."[61] Companies such as Sidenor have followed a similar path moving electric ovens to, e.g., France and other countries outside the EU, where energy prices are more competitive in the global market.

In April of 2004, the Mining-Metalurgy Federation of de CC.OO. strongly denounced the decision by the Grupo Celsa (parent company of Trefilerías Quijano, Global Steel Wire, Tycsa PSC, Tycsa Servicios, Laminaciones Arregui, Nervacero, Trefilerías Moreda, Celsa y Riviere) to close Trefilerías Quijano which, according to this union organization, was obeying a relocation policy as part of a plan to purchase a factory in Poland. However, the same union organization acknowledged the true culprit of these relocations when, in 2008, they warned that "we must take into account the profound impact that" an increase in energy costs "would have on the overall economy, and specifically, on industry and employment and families." The union perhaps would have obtained better results had they protested the European energy policy responsible for the loss of competitiveness in this sector, which has been zealously put into practice by the Spanish government.

Towards the end of 2006, UNESID (Unión de Empresas Siderúrgicas) warned that the process of liberalizing the electric market would lead to a relocation of a good portion of this industry due to the loss of competitiveness caused by high energy costs in Spain due to an energy policy closely linked to the promotion of renewable energy.

That same year, Ferroatlántica sounded the alarm. The company, the only producer of iron alloys in Spain, had an electric consumption of 2,300 Ghw in 2006 on Spanish soil and is the economic engine of the region of A Costa da Morte (Galicia). The continual increase in the cost of energy studied in this paper caused a change in the percentage of energy as a total cost of production in ferrosilicium from 37.1% in 1997 to 38.6% in 2000 and 43.2% in 2005. After years of installing efficient energy management measures, and increasing its productivity, in 2006 Ferroatlántica's factories had reached their productive capacity.

Because of that reality, the increases in energy prices had caused Ferroatlántica to lose competitiveness. The closing of the plants and their relocation to other countries such

[60] Professor of Accounting and Financial Economics at Universidad Autónoma de Madrid.
[61] Jesús Lizcano Ávarez. "Nuevas estrategias de contabilidad de gestión en las empresas multinacionales", Boletín AECA (Número Especial Congreso Sevilla), September 1995.

as France, where they already had a presence, is –according to the company- unstoppable.

The company stated that the challenge is clear: "only internationally competitive energy prices will allow us to support such a basic industry, not only because it belongs to a strategic sector, but also to support employment and generate wealth."

Gonzalo Urquijo, president of UNESID, has repeatedly shown his and the industry's concern about energy prices in Spain. In 2007, he denounced, before the Minister of Industry, that the electric rates had gone up 30% in two years, not to mention an increase of 85% in the price of natural gas. Urquijo remarked that "though the increase in prices has been absorbed in the last two years due to the strength of the demand, when consumption lowers this sector will find that the increase in prices has become permanent causing an unfavorable impact on its competitiveness." This is precisely what is happening in Spain, presently, where the metallurgy industry is facing its biggest loss in demand in its history.

Facing a grave situation, 18 energy intensive Spanish companies, representing sectors such as metallurgy, cement, chemicals, ceramics and gas, and operating more than 100 factories, formed in September of 2007 an association to attempt to lower the elevated price they pay for electricity and thus be able to compete with companies in other countries where the electric cost is not as cumbersome. These companies comprise 18% of the industrial electric consumption in Spain and 7% of the total demand in the Iberian Peninsula.

The goal of this union is twofold. On the one hand, it is to act as a central energy purchaser and, on the other, to attempt to receive from the administration special treatment allowing them to be exempted from paying the invoice incurred by the current energy policy. If they fail at this, shutting down and fleeing abroad will be unavoidable. The president of Asturiana de Zinc (one of Fortia´s members), Santiago Zaldumbide, has openly declared that his company will relocate if no alternative is found to paying such a high market price of electricity in Spain. In terms of labor costs, what is at risk if these 18 companies relocate are the 47,000 jobs that they create.

Before liberalizing the purchase of electricity by large consumers in July of 2008, the high-voltage regulated electric rate had been continually increasing, pushed by the burgeoning costs of electricity generation. Thus, between 1998 and 2008, the high-voltage rate increased by 40%. Last year, due to the change in rate, the large electricity consumers saw their electric price go up near 55%.

Further, the AEGE (Asociación de Empresas con Gran Consumo de Energía) has for some time warned about the same risks caused by Spain's energy policy. Its vice president, Javier Penacho, pointed out in May of 2008 that in a system such as the current one, "the reference price of energy is determined by the worst technology available on the market" and that this would "have grave consequences in matters of competitiveness, relocations and de-investments."

But perhaps the most telling example of the effects that we are studying, given its size, situation as a global enterprise, its Spanish origin and flexibility in managing its plants in

3 continents (and 4 soon), is that of the world's second-largest manufacturer of stainless steel, Acerinox.

Acerinox has already reduced or avoided extending its presence in Spain due to the high energy costs. Victoriano Muñoz, who led that company for 37 years, warned of the dangers of an electricity market distorted by such interventions in Spain as it would impose higher energy costs for industry. In April of 2002 he explained that the price of electricity for consumers had increased by 10.6% since the beginning of the decade, not to mention the related dozens of interruptions in the provision of that service.

A year later, the president of this leading stainless steel producer explained that in spite of good management and profits, important doubts had been cast about the company's operations as a result of the Kyoto agenda – a key part of which is a similar "green jobs" push – leading to possible relocation due to higher energy costs to nations that do not impose such regimes.

Consequently, when in 2004 Acerinox decided to increase the size and capacity of its operations it did so at plants in Kentucky (USA) and Columbia (South Africa), deciding to freeze its expansion plans in Spain, it cited the energy cost factor as influential. Consequently, green energy was to blame for the export of growth, meaning the transfer of hundreds of jobs from Spain to the USA and to South Africa.

In his last press appearance as CEO of Acerinox in July of 2008, Muñoz expressed regret and concern over the loss of competitiveness in the Spanish industry, which he blamed primarily on the continuous increase in energy prices. "We are going to have the highest prices in Europe," he said during his farewell, in which he once again urged removal of the barriers to construct nuclear plants as a way to achieve the Kyoto objectives, instead of the emphasis on renewable energy regimes that increase the price of electricity but not its reliability.

That final meeting with the press took place after Muñoz's last general shareholder meeting as president of Acerinox. In his remarks, he spoke of the loss of competitiveness in the Spanish industry due to a new 9.2% rise in actual cost per Kwh in 2006, the latest of many previous increases. However, this businessman, famous for his entrepreneurial spirit, commented that "we are afraid that the worst is yet to come," because, beyond the changes in regulated rates, "the continuous reduction of the hydroelectric and nuclear energy production share of the total Spanish electrical system."

Victoriano Muñoz associated Spain's ever-higher energy prices with the "green energy" policies enacted as a result of the Kyoto Protocol, even more than the "cap-and-trade" policy also adopted under Kyoto. Indeed, he explained that, although cap-and-trade had not yet directly harmed their bottom line, "indirectly, it affects [operations] very negatively through higher energy cost,"[62] That is, cap-and-trade's impact was first felt in

[62] Mr. Muñoz statements at Acerinox's annual reports and speeches at the General Shareholder Meetings (2002-2007) are downloadable at www.acerinox.es. His last press conference, that can be found at the following link: http://www.eleconomista.es/empresas-

the form of programs escalated in anticipation of the regime's implementation, in that cap-and-trade's goals spurred further "green jobs" schemes and deployment of renewable energy, the principal factor in the energy price spikes harming energy-intensive producers.

finanzas/noticias/229443/06/07/Acerinox-esta-estudiando-proyecto-en-India-con-japonesa-Nisshin-Steel-II.html

BIBLIOGRAPHY

Pending

APPENDIX

I. Data used to calculate the *green jobs* effects on the economy (chapter 4)

Table 4.- Working population

1995	12,590,000,000
1996	13,064,400,000
1997	13,534,500,000
1998	14,122,000,000
1999	14,959,800,000
2000	15,782,300,000
2001	16,348,200,000
2002	16,825,400,000
2003	17,559,700,000
2004	18,288,100,000
2005	19,314,300,000
2006	20,001,800,000
2007	20,476,900,000

Source: Encuesta de Población Activa, INE (National Statistics Institute).

Table 5.- Gross Domestic Product

	Current prices	Constant prices (2008)
1995	447,205,000,000	706,104,820,634
1996	473,855,000,000	723,171,461,227
1997	503,921,000,000	751,148,752,228
1998	539,493,000,000	784,711,285,453
1999	579,942,000,000	821,953,191,748
2000	630,263,000,000	863,460,310,000

	Current prices	Constant prices (2008)
2001	680,678,000,000	894,959,350,000
2002	729,206,000,000	919,160,979,486
2003	782,929,000,000	947,621,710,413
2004	841,042,000,000	978,578,949,814
2005	908,792,000,000	1,013,947,983,603
2006	982,303,000,000	1,053,379,393,251
2007	1,050,595,000,000	1,091,961,721,911

Source: Cuentas Económicas Anuales, INE.

Table 6.- Wages and Capital income contribution to GDP

	Wages	Capital Income
1995	48.8%	42.6%
1996	49.0%	42.3%
1997	49.7%	41.3%
1998	49.5%	41.1%
1999	49.5%	40.6%
2000	49.6%	40.5%
2001	49.2%	41.2%
2002	48.7%	41.6%
2003	48.4%	41.6%
2004	47.7%	41.9%
2005	47.4%	41.7%
2006	47.3%	41.6%
2007	47.3%	42.3%

Source: Cuentas Económicas Anuales, INE.

Table 7.- Capital stock in Spain

	Capital Stock at current prices (2000)	Capital stock at constant prices (2008)
1995	2,426,161,296,831	3,323,840,976,658
1996	2,506,625,116,773	3,434,076,409,979
1997	2,592,262,051,117	3,551,399,010,030

1998	2,690,725,341,078	3,686,293,717,277
1999	2,802,705,495,030	3,839,706,528,191
2000	2,924,158,951,252	4,006,097,763,215
2001	3,051,504,408,335	4,180,561,039,419
2002	3,182,072,654,259	4,359,439,536,335
2003	3,319,350,743,153	4,547,510,518,120
2004	3,462,101,036,701	4,743,078,420,280
2005	3,618,027,641,919	4,956,697,869,429

Source: "El stock y los servicios del capital en España y su distribución territorial (1964-2005). Nueva metodología", by BBVA Foundation and own elaboration based on INE's GDP deflator.

Table 8.- Average capital assignment per worker at constant prices (2008)

1995	264,006
1996	262,858
1997	262,396
1998	261,032
1999	256,668
2000	253,835
2001	255,720
2002	259,099
2003	258,974
2004	259,353
2005	256,634

Source: Own elaboration based on INE's and BBVA (Banco Bilbao Vizcaya Argentaria) Research Foundation's publications.

Table 9.- ROA

1995	9.05%
1996	8.91%
1997	8.74%
1998	8.75%
1999	8.69%
2000	8.73%
2001	8.82%
2002	8.77%
2003	8.67%

2004	8.64%
2005	8.53%

Source: Own elaboration based on INE's and BBVA Research Foundation's publications.

Table 10.- Average productivity per worker

1995	27,369
1996	27,124
1997	27,583
1998	27,505
1999	27,197
2000	27,136
2001	26,934
2002	26,605
2003	26,119
2004	25,524
2005	24,884
2006	24,910
2007	25,223

Source: Own elaboration based on INE's data.

Table 11.- Destroyed employment per renewable installed megawatt in Spain 2000-2008

Wind	4.27
Mini-hydro	5.05
Solar	12.7
Average	5.06

Source: Own elaboration.

Table 12.- Tax collections in Spain 2007 by category of tax imposed

VAT related taxes	64,434,000,000
Family income tax	81,299,000,000
Corporate income tax	50,065,000,000

Source: Eurostat.

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GREEN JOBS MYTHS

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Green Jobs Myths

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Abstract

A rapidly growing literature promises that a massive program of government mandates, subsidies, and forced technological interventions will reward the nation with an economy brimming with "green jobs." Not only will these jobs improve the environment, but they will be high paying, interesting, and provide collective rights. This literature is built on mythologies about economics, forecasting, and technology.

Myth: Everyone understands what a "green job" is.

Reality: No standard definition of a "green job" exists.

Myth: Creating green jobs will boost productive employment.

Reality: Green jobs estimates include huge numbers of clerical, bureaucratic, and administrative positions that do not produce goods and services for consumption.

Myth: Green jobs forecasts are reliable.

Reality: The green jobs studies made estimates using poor economic models based on dubious assumptions.

Myth: Green jobs promote employment growth.

Reality: By promoting more jobs instead of more productivity, the green jobs described in the literature encourage low-paying jobs in less desirable conditions. Economic growth cannot be ordered by Congress or by the United Nations. Government interference – such as restricting successful technologies in favor of speculative technologies favored by special interests – will generate stagnation.

Myth: The world economy can be remade by reducing trade and relying on local production and reduced consumption without dramatically decreasing our standard of living.

Reality: History shows that nations cannot produce everything their citizens need or

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desire. People and firms have talents that allow specialization that make goods and services ever more efficient and lower-cost, thereby enriching society.

Myth: Government mandates are a substitute for free markets.

Reality: Companies react more swiftly and efficiently to the demands of their customers and markets, than to cumbersome government mandates.

Myth: Imposing technological progress by regulation is desirable.

Reality: Some technologies preferred by the green jobs studies are not capable of efficiently reaching the scale necessary to meet today's demands and could be counterproductive to environmental quality.

In this Article, we survey the green jobs literature, analyze its assumptions, and show how the special interest groups promoting the idea of green jobs have embedded dubious assumptions and techniques within their analyses. Before undertaking efforts to restructure and possibly impoverish our society, careful analysis and informed public debate about these assumptions and prescriptions are necessary.

Contents

The solutions to environmental and economic problems, domestically and internationally, are often tied together. The assertion that "green jobs" can be created to improve environmental quality while reducing unemployment is behind an aggressive push for a "green economy" in the United States and elsewhere. For example, a recent report from the U.S. Conference of Mayors, *Current and Potential Green Jobs in the U.S. Economy,* contends that investing in green jobs would produce a remarkable range of benefits:

> The economic advantages of the Green Economy include the macroeconomic benefits of investment in new technologies, greater productivity, improvements in the U.S. balance of trade, and increased real disposable income across the nation. They also include the microeconomic benefits of lower costs of doing business and reduced household energy expenditures. These advantages are manifested in job growth, income growth, and of course, a cleaner environment.[1]

Green jobs advocates see no downside to their preferred polices: "It is all good news."[2] The Conference of Mayors estimated that green jobs can provide "up to 10% of new job growth over the next 30 years"[3] and others are similarly optimistic.[4] Governments, non-governmental organizations, and international bodies all seek to promote the creation of green jobs. Given the claims that every dollar spent on a host of green job programs will be repaid many times over, it is hard to see how creating green jobs or "greening" existing jobs could be seen as anything other than a fantastic opportunity.

Our review of the claims of green jobs proponents, however, leaves us skeptical because the green jobs literature is rife with internal contradictions, vague terminology, dubious science, and ignorance of basic economic principles. Indeed, the green jobs literature claims resemble the promises of long-term financial prosperity offered by Ponzi schemes. New taxes, increased public borrowing, and government subsidies will be needed to support green jobs programs. We find no evidence that these "investments" in green jobs can support the promised results. Investing taxpayers' money in developing green jobs as an economic and environmental

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[1] UNITED STATES CONFERENCE OF MAYORS, U.S. METRO ECONOMIES: CURRENT AND POTENTIAL GREEN JOBS IN THE U.S. ECONOMY 2 (2008), *available at* http://www.usmayors.org/pressreleases/uploads/GreenJobsReport.pdf [hereinafter MAYORS].

[2] Roger Bedzek, AMERICAN SOLAR ENERGY SOCIETY, RENEWABLE ENERGY AND ENERGY EFFICIENCY: ECONOMIC DRIVERS FOR THE 21ST CENTURY, at vii (2007), *available at* http://www.misi-net.com/publications/ASES-EconomicDrivers07.pdf [hereinafter ASES].

[3] MAYORS, *supra* note 1, at 17.

[4] As of Dec., 2008 ASES projects over 37 million green jobs by 2030. AMERICAN SOLAR ENERGY SOCIETY, DEFINING, ESTIMATING, AND FORECASTING THE RENEWABLE ENERGY AND ENERGY EFFICIENCY INDUSTRIES IN THE U.S. AND IN COLORADO, at xii (2008), *available at* http://www.ases.org/images/stories/ASES/pdfs/CO_Jobs_Final_Report_December2008.pdf. In 2007, the estimate was over 40 million (assuming an "aggressive deployment forecast scenario"). ASES, *supra* note 2, at iv.

panacea, are likely, like a Ponzi scheme, to result in empty bank accounts.[5]

Our review convinces us that the real purpose of the green jobs initiative is not to create jobs but to remake society. The sweeping changes advocated in these reports under the guise of greening our economy are intended to shift the American and world economies away from decentralized decision making, in favor of centralized planning. Therefore, instead of allowing individuals to voluntarily trade in free markets in pursuit of their own ends, green jobs advocates would instead discourage trade and allow technologies to be chosen by central planners and politicians, who would determine the choices faced by consumers and workers. By wrapping these policy shifts in the green jobs mantle, those advocating the reorganization of much of life hope to avoid a debate over the massive costly changes they want to impose.

We assess the green jobs literature by focusing on several recent major reports purporting to demonstrate both the need for and benefits of green jobs, the most ambitious of which we briefly summarize below to present the vision of the economy green jobs advocates propose. These are the most serious efforts to document claimed benefits. They are frequently quoted and cited as authoritative by the news media and in public policy debates. Our analysis has three parts. First, we examine the problems with their attempts to both define when a job qualifies as "green" and to calculate how many such jobs exist. Second, we analyze how the green jobs literature treats key economic concepts and find the literature makes fundamental economic errors in its analysis. Third, we examine specific areas of technology where we believe the green jobs literature makes errors that typify the literature as a whole. We then conclude by suggesting that deep skepticism is the most appropriate response to the hyperbolic claims of the green jobs literature.

Green job claims are widespread. Some assertions are based on political posturing,[6] while others tout impressive numbers with little accompanying analysis to back up the claims – this is especially true of press accounts. We focus most intensively in this paper on the recent substantive efforts to describe green jobs: The United Nations Environment Programme (UNEP) report,[7] the U.S. Conference of Mayors ("Mayors") report,[8] the American Solar Energy Society report[9] ("ASES") and the Center for American Progress ("CAP") report.[10] All of these reports attempt comprehensive analyses, providing greater detail than the anecdotal claims elsewhere.

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[5] The expenditures required "will likely be in the hundreds of billions, and possibly trillions, of dollars." *See* UNITED NATIONS ENVIRONMENT PROGRAMME, GREEN JOBS: TOWARDS DECENT WORK IN A SUSTAINABLE, LOW-CARBON WORLD 306 (2008) [hereinafter UNEP], *available at* http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf. That is, the wealth of nations is at stake.

[6] During the 2008 presidential campaign, John McCain stated "We can move forward and clean up our climate and develop green technologies ... so that we can clean up our environment and, at the same time, get our economy going by creating millions of jobs." Jeanne Cummings, *Can Green Jobs Save Us?*, POLITICO, Oct. 14, 2008, http://www.politico.com/news/stories/1008/14551.html. In the same debate, Barack Obama stated that "if we create a new energy economy, we can create 5 million jobs, easily, here in the United States." *Id.* The Republican Party platform in 2008 did not discuss this issue; the Democratic Party platform did, *see* DEMOCRATIC NATIONAL CONVENTION COMMITTEE, THE 2008 DEMOCRATIC NATIONAL PLATFORM: RENEWING AMERICA'S PROMISE 17-18 (2008), *available at* http://www.democrats.org/a/party/platform.html.

[7] *See* UNEP, *supra* note 5. At 376 pages, this is a substantive report, not just a call to action.

[8] MAYORS, *supra* note 1.

[9] ASES, *supra* note 2.

[10] CENTER FOR AMERICAN PROGRESS, GREEN RECOVERY: A PROGRAM TO CREATE GOOD JOBS AND START BUILDING A LOW-CARBON ECONOMY, (2008), *available at* http://www.americanprogress.org/issues/2008/09/pdf/green_recovery.pdf [hereinafter CAP].

Assessing green jobs claims requires examining the underlying arguments made in favor of them, not just assertions or the hyperbole of political discourse.

These four studies are authored by different interest groups. The UNEP report is the joint product of the United Nations' staff that focuses on environmental issues and the Worldwatch Institute, an environmental advocacy group noted for promoting population reduction,[11] with the assistance of the Cornell University Global Labor Institute, a pro-union organization.[12] That report starts with the climate change analysis of another international organization, the Intergovernmental Panel on Climate Change (IPCC), which concludes that global warming poses a significant threat to the quality of life on earth.[13] Using the IPCC assessment as its point of departure, the UNEP report calls for major actions to force changes in economic activity so as to significantly lower levels of carbon emissions, as well as other greenhouse gas emissions, and force what is asserted to be more efficient use of resources. The programs recommended would mean a worldwide restructuring of almost all economic activity and employment, as the report concedes.[14]

The Mayors report, on the other hand, is an effort to forge a consensus among a diverse set of American local politicians and focuses on making a case for green jobs as an urban economic development strategy. Unsurprisingly, given the interests of its sponsor, this report does not focus on radical restructurings of the economy but instead on specific benefits for every community in the nation, paid for by the federal government rather than the community that would benefit.

The ASES report is published by a trade group for an alternative energy industry – solar power. As such, it reflects the interests of that industry, promoting, at a cost to the taxpayers, a particular energy technology rather than a wholesale change in the structure of the economy.

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[11] UNEP's report was produced by the Worldwatch Institute, a Washington, D.C. based environmental advocacy group, founded by Lester Brown. Press Release, Worldwatch Institute, *Lester Brown to Launch New Venture* (Mar. 21, 2001), *available at* http://www.worldwatch.org/node/1691. Worldwatch lists its mission statement as "Worldwatch Institute delivers the insights and ideas that empower decision makers to create an environmentally sustainable society that meets human needs. Worldwatch focuses on the 21st century challenges of climate change, resource degradation, population growth, and poverty by developing and disseminating solid data and innovative strategies for achieving a sustainable society." Worldwatch Institute, Worldwatch *Mission Statement*, http://www.worldwatch.org/node/24 (last visited Feb. 18, 2009). Worldwatch was founded by Lester Brown, author of a number of alarmist books on population. *See, e.g.*, Lester R. Brown, WHO WILL FEED CHINA? WAKE-UP CALL FOR A SMALL PLANET (1995); Lester R. Brown, TOUGH CHOICES: FACING THE CHALLENGE OF FOOD SCARCITY (1998), Lester R. Brown, et al., BEYOND MALTHUS: NINETEEN DIMENSIONS OF THE POPULATION CHALLENGE (1999). In 1997, *The Economist* summarized Brown's record on population and food issues as follows:

> Lester Brown of the Worldwatch Institute began predicting in 1973 that population would soon outstrip food production, and he still does so every time there is a temporary increase in wheat prices. In 1994, after 21 years of being wrong, he said: "After 40 years of record food production gains, output per person has reversed with unanticipated abruptness." Two bumper harvests followed and the price of wheat fell to record lows. Yet Mr. Brown's pessimism remains as impregnable to facts as his views are popular with newspapers. The facts on world food production are truly startling for those who have heard only the doomsayers' views. Since 1961, the population of the world has almost doubled, but food production has more than doubled.

Plenty of Gloom: Forecasters of Scarcity Are Not Only Invariably Wrong, They Think That Being Wrong Proves Them Right, ECONOMIST, Dec. 20, 1997, at 21, 22.

[12] The Institute's homepage explains its mission by stating: "The Cornell Global Labor Institute (GLI) offers a unique venue for unions at the local, national and global level to work together to strengthen labor's response to the challenges posed by globalization." Cornell Global Labor Institute Home Page, http://www.ilr.cornell.edu/globallaborinstitute/ (last visited Feb. 18, 2009).

[13] *See, e.g.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007 SYNTHESIS REPORT 13-14 (Rajendra K. Pachauri et al. eds., 2007), *available at* http://www.ipcc.ch/ipccreports/ar4-syr.htm.

[14] UNEP, *supra* note 5, at 292-93 (discussing the "Challenges to Just Transition").

Finally, the CAP report is the product of left-leaning think tanks in Washington, D.C.[15] and a University of Massachusetts think tank.[16] Like the UNEP report, this one uses green jobs as a means to develop economic policies that suit its underlying vision of a greatly expanded government.

These interests are inevitably reflected in the substance of the reports and comparing them allows us to examine the interplay between interests, assumptions, and predicted outcomes.[17]

Absent from our analysis is our own laundry list of policy proposals. We believe the world economy would benefit from more economic activity, and that, all else equal, reducing energy consumption and developing new sources of energy are good ideas. However, we do not believe that massive bets by politicians on their preferred energy sources are likely to deliver any of the above.

As we discuss later in this Article, market forces constantly "green" both consumer goods and industrial processes. From refrigerators to steel production, energy use has fallen dramatically without any central direction or infusion of massive amounts of taxpayer resources. This greening of industries and jobs is the natural result of competitive markets' pressure to reduce costs combined with the ingenuity of millions of production workers, product designers, managers, property developers, and engineers.

We are not arguing for our own alternative set of favored policy prescriptions, but for a different approach to the issue. By analyzing the problems with the green jobs literature's claims, we hope to persuade readers that the fundamental question is not whether to spend $20 billion or $400 billion of taxpayers' money on solar or wind power but who should decide how resources should be allocated: people in the marketplace or planners and politicians in Washington, D.C.

Before we dive into the analysis of the green jobs literature, we want to note that much of this discussion is really about energy. Modern economies and the lives we enjoy rely on energy

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[15] CAP is headed by former Clinton Administration member John Podesta, Center for American Progress, John Podesta: President and Chief Executive Officer, http://www.americanprogress.org/aboutus/staff/PodestaJohn.html (last visited Feb. 18, 2009), who served as co-chair of the Obama transition team, Lois Romano, *In Any Guise, Podesta a Smooth Master of the Transition Game*, WASH. POST, Nov. 25, 2008, at C01. After the 2008 election, the CAP report was cited by members of the incoming Obama economics team. It issued a report asserting that the proposed "economic stimulus" plan would create nearly four million jobs by the end of 2010 and that some of these would be green jobs. Christina Romer & Jared Bernstein, THE JOB IMPACT OF THE AMERICAN RECOVERY AND REINVESTMENT PLAN, 11 (2009), *available at* http://otrans.3cdn.net/ee40602f9a7d8172b8_ozm6bt5oi.pdf.

[16] PERI (Political Economy Research Institute) describes itself as "progressive" and notes its links to "activists" such as ACORN. *See* PERI – Political Economy Research Institute: Links & Organizations, http://www.peri.umass.edu/203/ (last visited Feb. 18, 2009). At the time of this writing, it was promoting a statement by "progressive economists" who advocate a massive expansion of government, income redistribution, more political power for labor, and regulation of financial institutions "so they will serve people's needs." PERI – Political Economy Research Institute: Economists' Statement, http://www.peri.umass.edu/statement (last visited Feb. 18, 2009).

[17] Readers should be just as skeptical of us as we are of the authors of the various green jobs reports. Three of us are traditional economists (i.e. not "ecological economists" or some other variety) trained at mainstream economics Ph.D. programs and inclined to be skeptical of claims that governments or international NGOs such as UNEP can effectively induce significant improvements in the U.S. economy without causing significant costs. This Article was produced with support from the Institute for Energy Research, a nonprofit organization that favors market solutions to energy issues where one of us (Morriss) is a Senior Fellow. While we think it likely that IER asked us to undertake this project with a pretty good guess where our professional skepticism would likely lead us, neither IER nor anyone else had advance approval rights over our results or interfered in any way with our analysis. We suspect the same is true of the authors of the reports discussed herein – that the people who commissioned the reports had reasonable ideas about how the results might come out given the authors they selected. Healthy skepticism is our recommendation for all analyses of green job claims, including ours.

usage at a much greater level than our ancestors enjoyed. The following figures from the Department of Energy explain the sources of energy used today and the primary uses of that energy.

The green jobs literature focuses on phasing out virtually all of our current energy sources – 93 percent (as shown on the left side of Figure 1). Only about 7 percent of our energy now comes from what are called renewable sources. Regardless of the source, as the right side of the figure shows, the energy goes to heat and cool our homes, schools, and offices. Energy powers our cars, the ambulances that take injured people to hospitals, and the trucks that deliver goods. Our current energy sources provide power for industry and agriculture to help produce every good we enjoy. Green jobs promoters assert that this energy should be eliminated. In fact, former Vice President Al Gore has stated that our current sources of electricity – almost 40 percent of all energy in the United States – should be eliminated within a decade.[18]

Since Gore, like others, focuses on electricity, let us consider it in more detail. As Figure 2 shows, less than 10 percent of electricity in the U.S. comes from renewable sources, making the change insisted upon by Gore and others draconian. As Table 1 shows in detail, what are commonly called "renewable" energy sources by green jobs advocates—wind, solar, geothermal and biomass—represent about 3 percent of our electricity generation capacity.[19] While the capacity is rising, it will still represent a tiny fraction of our electric capacity in 10 years—and beyond—regardless of the wishes of Mr. Gore and other politicians.[20]

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[18] "If we set our minds to it, we in this country could produce 100 percent of our electricity from renewable and carbon free sources in 10 years," Gore said. "That is possible." J.R. Pegg, *Gore Urges Congress to Confront Climate Emergency,* ENVIRONMENT NEWS SERVICE, January 28, 2009. Available at: http://www.ens-newswire.com/ens/jan2009/2009-01-28-10.asp

[19] As we discuss below, conventional hydroelectric and nuclear power, while not carbon emission sources, are not considered to be "renewable."

[20] President Obama, in his stimulus plan, asserts the nation's renewable energy sources will double in three years. See *Remarks of President Barack Obama – Address to Joint Session of Congress,* February 24, 2009. Available at http://www.whitehouse.gov/the_press_office/remarks-of-president-barack-obama-address-to-joint-session-of-congress/. That is very ambitious and will require massive taxpayer subsidies, but even if it happens, and then happens again and again in subsequent three-year periods, it will be not remotely close to what Mr. Gore advocates.

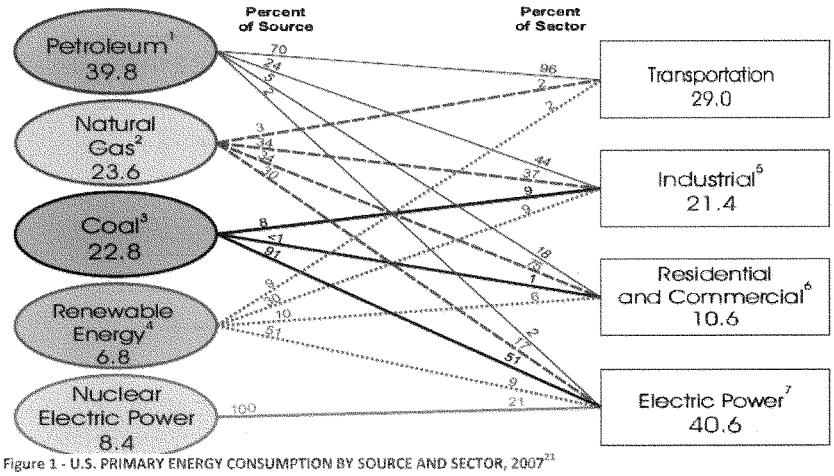

Figure 1 - U.S. PRIMARY ENERGY CONSUMPTION BY SOURCE AND SECTOR, 2007[21]

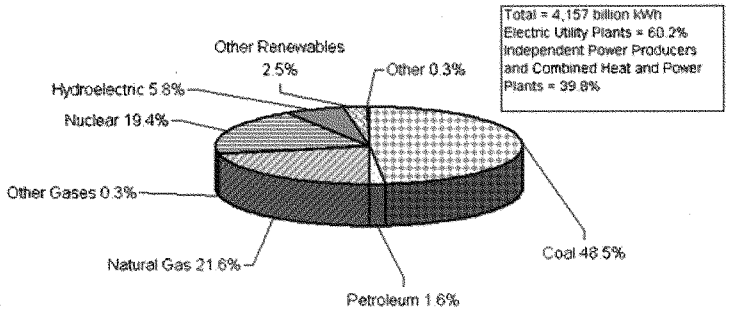

Figure 2 - US ELECTRIC POWER INDUSTRY NET GENERATION, 2007[22]

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[21] Energy Information Administration, U.S. Department of Energy, ANNUAL ENERGY REVIEW 2007, Report No. DOE/EIA-0384 (2007); Posted: June 23, 2008. Available at: http://www.eia.doe.gov/emeu/aer/pecss_diagram.html. Table footnote numbers:

[1]Excludes 0.6 quadrillion Btu of ethanol, which is included in "Renewable Energy."
[2]Excludes supplemental gaseous fuels.
[3]Includes 0.1 quadrillion Btu of coal coke net imports.
[4]Conventional hydroelectric power, geothermal, solar/PV, wind, and biomass.
[5]Includes industrial combined-heat-and-power (CHP) and industrial electricity-only plants.
[6]Includes commercial combined-heat-and-power (CHP) and commercial electricity-only plants.
[7]Electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public.

Table 1 - Existing Electrical Capacity by Energy Source, 2007[23]

Electrical Energy Sources	Capacity (MW)	Source as % Capacity
Coal	336,040	30.9
Petroleum	62,394	5.7
Natural Gas	449,389	41.3
Other Gases	2,663	0.24
Nuclear	105,764	9.7
Hydroelectric Conventional	77,644	7.1
Wind	16,596	1.5
Solar Thermal and Photovoltaic	503	0.05
Wood & Wood Derived Fuels	7,510	0.7
Geothermal	3,233	0.3
Other Biomass	4,834	0.4
Pumped Storage	20,355	1.9
Other	866	0.08
TOTAL	1,087,791	100

Cost aside—and the cost is too big to be ignored—significant technical issues exist that would prohibit a commitment to electricity only from renewable sources in 10 years. Turning off the electricity generated from coal and other non-renewable sources that soon would mean that most Americans would literally freeze in the dark. The reasons why the green jobs programs touted—and partly funded by the 2009 stimulus package—are unrealistic and extraordinarily costly helped inspire this Article. We appreciate that many people like to believe that good things happen when we all "pull together" and that policy makers want to offer solutions, but the reality is more complex than politicians and "green" promoters want us to believe—and the alternative is not as grim as they portray.

I. Envisioning a World of Green Jobs

Before beginning our analysis of the green jobs literature, we briefly summarize the most comprehensive piece of green jobs literature, the UNEP report. We do so to provide the reader with a sense of the scope of the transformation that would be required of the American economy, the world, economy and our society to implement green jobs proposals. These suggestions by the report are not simple ones, such as hiring the unemployed weatherize schools. They are suggestions that fundamentally restructure our society and the world economy.

The UNEP report stresses that new, green jobs will be created to achieve its programmatic goals. Some workers will switch from traditional production to greener

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[22] Energy Information Administration, Form EIA-923, *Power Plant Operations Report,* and predecessor form(s) including Energy Information Administration, Form EIA-906, *Power Plant Report,* and Form EIA-920, *Combined Heat and Power Plant Report.* Available at: http://www.eia.doe.gov/cneaf/electricity/epa/figes1.html

[23] Energy Information Administration, ELECTRIC POWER ANNUAL with data for 2007, Table 2.2. Report Released: January 21, 2009. Available at: http://www.eia.doe.gov/cneaf/electricity/epa/epat2p2.html.

production. But the report notes, unlike most green jobs reports, that existing jobs will be destroyed as disfavored methods of production are forced to cease, replaced by new, preferred methods of production. It also explains that while some existing jobs will, after retooling, continue to exist, these are usually lumped into the category of green jobs since the change is forced by environmental objectives.[24]

How will all this happen? "Forward-thinking government policies" are "indispensible."[25] The report presumes that little will happen without government action. The policy changes called for by the report fall into nine categories:

- **Subsidies.** Subsidies for "environmentally harmful industries" will be terminated; the funds will be shifted to renewable energy, efficiency technologies, clean production methods, and public transit.
- **Carbon Markets.** Carbon markets, such as carbon trading under the Kyoto Protocol, are not doing as much as needed, so they must be strengthened. Besides carbon credits being traded, carbon must be taxed so revenues can be used as "adequate funding sources for green projects and employment."
- **Eco-taxes.** Eco-taxes must be initiated and used to discourage polluting and carbon-producing activities.
- **Government Regulations.** "Regulatory tools" must be used "to the fullest extent" to force greener technologies. This includes expanded government land-use controls, revised building codes, more stringent energy-efficiency standards, and increased renewable energy production.
- **Electrical Grid Access.** Alternative energy production will be forced by guaranteeing access to electric grids at favorable prices.
- **Expanding Recycling Requirements.** Manufacturers will be required to take back their products after use, so producers will ensure that products will be recycled properly at the end of their useful life.
- **Mandatory Eco-labeling.** Eco-labeling of products will be required, so consumers can make informed choices among alternatives given the environmental costs.
- **Shifting Energy Research Funding.** Cut support for nuclear power and fossil fuel research in favor of greater funding for renewable energy and technical efficiency.
- **Changes in Foreign Aid.** Reorient foreign aid away from fossil fuel and hydro-electric power projects in favor of renewable energy sources.

Note that the action items are all government mandates. This is because the report claims that environmental improvements that occur naturally "are insufficient and may simply be overwhelmed by continued economic growth." Not only will new kinds of jobs be created in place of old jobs, but for environmental (and human) sustainability, lower standards of living are an unfortunate fact. The UNEP report, for example, calls for "retool[ing] not only the economy, but also economic thought" so that people will use "a different way of measuring human activity" and a "different theory," no longer focused on "quantitative growth" but instead on "a shift from the acquisition of goods" to "the continuous receipt of quality, utility, and

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[24] UNEP, *supra* note 5, at 3 ("it would appear that many existing jobs (such as plumbers, electricians, metal workers, and construction workers) will simply be transformed and redefined as day-to-day skill sets, work methods, and profiles are greened.").

[25] *Id.* at 5. The discussion that follows immediately comes from this source.

performance."[26] Mass production will generally end, as will the jobs that comprise the modern economy, according to UNEP.[27] This will mean many displaced workers, so we need to think of how to "share available work better among all those who desire work."[28]

Another major green job area is building. New buildings should high green standards, but existing buildings can be retrofitted to be more efficient.[29] Emission savings can be significant and the technology exists now to incur such savings, according to these reports.[30] The UNEP report estimates that this could create two million jobs in the European Union and the United States, and, obviously, millions more around the world.[31]

Energy conservation is another major area of concern in the green jobs reports. Although private incentives to save resources are strong, the report asserts that they are insufficient to resolve the greenhouse gas problem. Transportation contributes about 23 percent of such emissions.[32] While aircraft today are 70 percent more fuel-efficient than those built 40 years ago, and continued improvements are projected, those are insufficient and will not halt emissions, the reports claim.[33] Car and truck traffic are also major contributors. While engines are more efficient now than in the past, and new engine technology is coming into play, given the rapid increase in demand for vehicles in China, India, and other parts of the world, the emission problem will not be "solved," if you believe the green jobs reports.[34]

Besides continued improvement in cars and truck engines, there must be a push to public transit systems, they report.[35] For this to succeed, cities throughout the nation must have greater density, implying massive population shifts from the suburbs to central cities. Subways are not realistic in sprawling cities.[36] High-density living also means that walking and bicycling will become more realistic alternatives and will replace cars for many, according to the reports.[37] All this will be done in a labor-intensive way. For example, the UNEP report decries the falling employment in the production of locomotives and rolling stock in China. Despite the growth of the rail network by 24 percent from 1992 to 2002, employment fell from 3.4 million to 1.8 million. "A sustainable transport policy needs to reverse this trend," UNEP reports.[38] A senior manager at a Chinese rolling stock company, a state-owned enterprise, told one of the authors that the single biggest challenge for his company is to keep employment up (which the government prefers) as it continues to modernize and expand production. Most such state-dominated organizations have surplus, inefficient labor. With modern production methods, it seems dubious that more workers will be needed as the UNEP report hopes.

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[26] *Id.* at 83.

[27] It surely must since we are no longer going to focus on "large scale purchases of 'stuff'" but instead on "quality retail, in which the salesperson knows how to sell intelligent use rather than simple ownership." *Id.* at 77. Consumers will "obtain desired services by leasing or renting goods rather than buying them outright." *Id.* at 78.

[28] *Id.* at 6.

[29] *Id.* at 131.

[30] *Id.* (suggesting savings of 29 percent in greenhouse gas emissions from retrofitting).

[31] *Id.* at 12.

[32] *Id.* at 12-14.

[33] *Id.* at 149.

[34] *Id.* at 151.

[35] *Id.* at 152.

[36] *Id.* ("Denser cities and shorter distances reduce the overall need for motorized transportation.")

[37] *Id.* at 14, 167.

[38] *Id.* at 13.

The UNEP also puts great hope on increased recycling of steel and aluminum to reduce energy usage compared to production of virgin metals.[39] In addition, it assumes new technology will allow for less pollution than traditional production. The same is true in other areas where recycling is technologically feasible. As we show below in more detail, there is a trend toward more energy efficiency in steel and aluminum production, but it is the result of market forces not mandates. And millions of people are in already recycling[40] - but this includes people who scour garbage dumps around the world.[41] The employment problem is that much existing recycling is small scale and not environmentally friendly.[42]

The green reports also take aim at the world's agricultural system. A little over a third of the world's workforce is in agriculture.[43] Much of the work is on small plots of land, not the large industrial-scale farming in the United States that requires few workers. The continuous decline of the share of the workforce in agriculture poses a conundrum for the UNEP authors as they recognize the tradeoff between large-scale, efficient modern agriculture and traditional small plots that still dominate in poor countries.[44]

Modern agriculture relies on inputs such as chemical fertilizers. Those are not green.[45] Further, existing global integration of agriculture means large companies "dictate 'take it or leave it' terms on those who actually grow the food."[46] That is, farmers who have found it to their advantage to sell produce to large companies must cease such activities so food is not carried off to Carrefour and other large retailers.[47] Farmers should focus on local production and consumption.[48] Small-plot agriculture is to be encouraged.[49] Large scale meat production "is neither green nor decent"[50] and must come to an end in favor of a few animals on small plots of land that keep hundreds of millions employed.[51] Of course, with many people living in high-density cities, if agricultural production as we know it is undesirable because shipments across long distances is carbon-intensive, then we must have "sustainable urban agriculture" that will employ hundreds of millions, according to the United Nations report.[52] Unfortunately, the net effect of this proposal is to increase food prices, thereby injuring the poor most of all, and reduce choice as people will be required to eat domestic products and not enjoy diverse foods from around the world.

The last major sector considered is forestry. Forests must be expanded and deforestation

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[39] *Id.* at 14-18.

[40] *Id.* at 219.

[41] *Id.* at 242.

[42] *Id.* at 216-17 (describing Egyptian "Zabaleen" or informal garbage collectors and South Asian ship dismantlers).

[43] *Id.* at 40.

[44] *Id.* at 19.

[45] *Id.*

[46] *Id.*

[47] *Id.* at 19-20.

[48] *Id.* at 19.

[49] *Id.* at 19-20.

[50] *Id.* at 19.

[51] *Id.* at 19-21.

[52] *Id.* at 20.

reversed in many countries.[53] Since this occurs primarily in very low income areas, the cost of moving from deforestation to forestation is estimated to be relatively small at $5-10 billion per year.[54] Keeping millions busy requires investment in agroforestry, such as expansion of fruit trees, but the report authors admit that the fragmented nature of the industry makes solid projections difficult.[55]

The change to green jobs will not be easy, voluntary or cheap. "Governments at the global, national, and local levels must establish an ambitious and clear policy framework to support and reward sustainable economic activity and be prepared to confront those whose business practices continue to pose a serious threat to a sustainable future."[56] What this means is that massive public spending is needed and many existing methods of production terminated if we are to achieve the technological and economic transformations on the scale needed to achieve significant reductions in energy production and use, and to have the changes in methods of energy production.

The UNEP report explains the scope of what is at stake in the green jobs policy discussion; it does not pretend that this is a simple matter. In contrast to domestic reports we review here, which assert that green jobs programs are all win-win and assert to know how exactly many green jobs will be created decades from now, the UNEP report, while comprehensive, does not pretend that the costs can be known exactly, nor does it sugarcoat some parts of the structural changes that would be needed to force massive change.

What the UNEP report makes clear is the broad scope of the social change it proposes. Virtually every aspect of daily life – from where people live, where their food comes from, how they commute to work, to what they do at work – will be dramatically altered. Such massive social change is costly in both monetary terms and in terms of the disruption of lives. Before launching a program to transform the lives of billions of people at a cost of hundreds of billions of dollars, we should be sure that not only is this the future we want but that the theory on which the vision is built is correct. The history of the twentieth century is in part the history of failed efforts to remake societies according to visions that proved unsustainable. Before launching yet another effort, on an even grander scale, we need to thoroughly critique the vision. We turn to doing so now.

II. Defining "green" jobs

We must address four definitional issues concerning green jobs before we can understand green job proponents' claims. First, studies differ on what constitutes a green job among. They differ on their definitions of both green jobs that might be created by new environmental initiatives as well as how to "green" existing jobs. When examined closely, green job estimates turn out to depend on highly contested definitions of "green" which differ from study to study. These differences render most comparisons among green jobs claims fruitless. If we want to conduct a policy debate over green jobs measures, we must requiring greater specificity about what constitutes a green job. Even more importantly, the varying definitions incorporate important, but often unstated, assumptions about environmental policy, economics, and the appropriate standard of living. These assumptions have the potential to produce counterproductive environmental policies that lead to worsening of environmental quality,

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[53] *Id.* at 22.

[54] *Id.*

[55] *Id.* at 23.

[56] *Id.* at 24.

interfere with economic efficiency, and a reduce standard of living.

Second, forecasts of potential growth in green jobs, however they are defined, depend on extrapolating from recent growth rates in the numbers of existing green jobs, which raises issues about the calculation of these growth rates. As a result of low base numbers for many categories of jobs, green jobs forecasts are likely to be over-optimistic about the potential for green employment, however defined. Moreover, these calculations are largely based on surveys by interest groups and conjecture rather than on hard numbers from comprehensive research. As a result, policy debates over green job measures cannot be reasonably conducted without ensuring that those advocating particular green job strategies include technical appendices so as to disclose the basis for the extrapolations central to their claims. They have largely failed to do so. Given the scale of the investment, much better data is needed to justify the gamble that such growth rates can be sustained.

Third, many green job estimates focus only on job gains without considering job losses as employment shifts to favored industries, such as solar power, and away from disfavored ones, such as coal power plants. Even when green job estimates attempt to calculate job losses, they do so using inappropriate methodology. Subjecting any claims regarding a jobs program to a net jobs test is critical to informed decision making, and a green jobs program should be no exception.

Finally, the green jobs literature often defines a job as "green" based on the inefficient use of labor within a production process. While low labor productivity is a drag on the economy, it does not follow that it will lead to lower environmental impact. This focus on inefficiency stems in part from the efforts of those dissatisfied with free markets, and its logical outgrowth, free trade, to use environmental issues to achieve political policy objectives for the economy.[57] Further, by focusing green job expenditures on economic activity with low labor productivity, resources can be forced to be shifted from capital to favored workers in line with these groups' economic priorities. Before policymakers adopt green jobs strategies, they need to be aware that these proposals are often simply part of a "Bootleggers and Baptists" coalition to achieve unrelated policy aims of the labor movement.[58]

In this section we examine each of these definitional issues in detail, providing examples from the four reports.

A. What counts as "green"

As the UNEP report notes, "not all green jobs are equally green."[59] To its credit, that report's authors insist that the "bar needs to be set high" in defining green jobs to prevent the term from becoming so diluted as to be meaningless and to stop short of achieving the goal of "dramatically reduc[ing] humanity's environmental footprint."[60] In economic terms, the

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[57] *See* Jonathan H. Adler, *Clean Politics, Dirty Profits: Rent-Seeking Behind the Green Curtain, in* POLITICAL ENVIRONMENTALISM: GOING BEHIND THE GREEN CURTAIN 1, 2 (Terry L. Anderson ed., 2000).

[58] That concept was first developed in Bruce Yandle, *Bootleggers and Baptists: The Education of a Regulatory Economist*, REGULATION, May-June 1983, at 12. It means politics makes for strange bedfellows. Those who wanted prohibition of alcohol (the Baptists) ended up on the same side of the issue as the bootleggers who profited from the existence of prohibition. Those parties have nothing in common but end up, inadvertently, in an alliance. That can be seen in certain environmental issues where environmental groups (the Baptists in this case) champion a policy, such as mass transit construction, that finds a natural alliance in labor unions that will profit from the union-wage construction jobs created.

[59] Some actions and related jobs are "lighter shades of green" than others. UNEP, *supra* note 5, at 299.

[60] *Id.* at 4.

definitional issue is critical. If the widespread subsidies proposed by many for green jobs are implemented, classifying a job as green will be valuable. Special interest groups and employers will assert many activities to be green where the jobs in question are not green at all. For an analogy, consider how the federal financial bailout program grew from a focus on repairing financial institutions to include subsidies for wooden arrow makers and tax breaks for rum producers.[61] So too, a massive green jobs program will attract its own set of what economists refer to as "rent seekers." Rent-seeking refers to the use of the political process to obtain rewards for a factor of production in excess of the market rate.[62] It often occurs when individuals or groups invest in the political process to create barriers to entry or capture public resources for private gains, especially for the groups promoting the policies. Any efforts to develop a public program to promote green jobs must therefore include a carefully drafted definition of "green" to limit rent-seeking.

What qualifies as "green"? In the literature, being green differs significantly depending on who is doing the classification. For example, the Mayors defined a "green" job as:

> Any activity that generates electricity using renewable or nuclear fuels, agriculture jobs supplying corn or soy for transportation fuels, manufacturing jobs producing goods used in renewable power generation, equipment dealers and wholesalers specializing in renewable energy or energy-efficiency products, construction and installation of energy and pollution management systems, government administration of environmental programs, and supporting jobs in the engineering, legal, research and consulting fields.[63]

Somewhat inexplicably, the Mayors report counts *current* nuclear power generation jobs as green jobs but not *future* jobs in nuclear power.[64] In contrast, the UNEP report defined "green jobs" both more restrictively, excluding all nuclear power related jobs and many recycling jobs, and more expansively, including all jobs asserted to "contribute substantially to preserving or restoring environmental quality."[65] The UNEP defines a green job as:

> Work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution.[66]

The differences between these definitions are substantial. The more expansive supply chain claims included in the UNEP report allows the authors to claim credit for a considerable number of jobs in supplier industries. For example, wind turbine towers involve "large amounts

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[61] Emergency Economic Stabilization Act of 2008, Pub. L. No. 110-343, § 503, 122 Stat. 3765, 3877 ("Exemption from Excise Tax for Certain Wooden Arrows Designed for Use by Children"); Section 308. Increase in Limit on Cover Over of Rum Excise Tax to Puerto Rico and the Virgin Islands. 122 Stat. 3765, 3869.

[62] Gordon Tullock, *Rent Seeking*, *in* 4 THE NEW PALGRAVE: A DICTIONARY OF ECONOMICS 147, 147-149 (John Eatwell, Murray Milgate & Peter Newman eds., 1987).

[63] MAYORS, *supra* note 1, at 5. The report included jobs involved in the production of corn and soy to the extent the corn and soy are used for biofuels. *Id.*

[64] *Id.* at 12 (nuclear power jobs "are not included in our projection scenario.").

[65] UNEP, *supra* note 5, at 3.

[66] *Id.*

of steel" and so the supply chain for the wind power industry involves green jobs extending back into the steel industry so long as the steel being created ends up in a wind turbine.[67] The steel jobs themselves are not required to be "green," only the use of the steel made by the employees in question. Comparing these two definitions illustrates the significant hurdles to establishing a consistent, workable definition of a "green job." Important value judgments, that are often not explained, are embedded in the definitions.

One important issue is illustrated by the Mayors and UNEP reports' respective treatments of nuclear power-generation jobs and their comparison with the broader debate over the future role of nuclear power. While the UNEP report explains (briefly) the basis for nuclear jobs' total exclusion from the green category, the Mayors report says little about its reasons for including the nuclear jobs of today, but not those in the future.[68] The more restrictive approach with respect to nuclear power means that the UNEP report does not count any jobs in nuclear power.[69] There is room for disagreement over whether nuclear power is a "green" strategy or not, and advocates of increasing nuclear generation include both governments traditionally seen as green[70] and some environmentalists.[71]

As we discuss in detail later, nuclear power is seen by many as an important component of a strategy to address greenhouse gas emissions by fossil-fuel-based power plants,[72] yet the environmental impact of waste disposal issues could be the basis for a principled exclusion, as it appears to be in the UNEP report. The lack of consensus across reports is significant not simply because it reflects a major difference among those calculating green job numbers but because it mirrors a wider debate over the appropriate role of nuclear power created by the growing

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[67] *Id.* at 4. Creating a "sustainable" steel industry itself is also expected to produce green jobs. *Id.* at 15 ("Making steel mills greener and more competitive is a must for job retention.").

[68] One possible explanation for the difference is that Worldwatch, a major contributor to the UNEP report, like many environmental advocacy groups, has opposed nuclear power, lumping it with coal and oil. Gary Gardner & Michael Renner, *Opinion: Building a Green Economy*, EYE ON EARTH, Nov. 12, 2008, http://www.worldwatch.org/node/5935 ("Wind and solar technologies are not just more environmentally benign than oil, coal, and nuclear power, but also more jobs-intensive."). On the other hand, the Mayors report represents mayors who benefit from nuclear power plants roles as taxpayers and as the source of energy, and that report is careful to stress that all regions of the United States could benefit from a focus on green jobs. *See, e.g.*, Mayors, *supra* note 1, at 21 ("one of the promising aspects of Green Jobs is that the vast majority of them are not restricted to any specific location, so cities and their metro areas across the country can and are expected to compete to attract this job growth.")

[69] These are excluded because

> nuclear power is not considered an environmentally acceptable alternative to fossil fuels, given unresolved safety, health, and environmental issues with regard to the operations of power plants and the dangerous, long-lived waste products that result. Being capital-intensive, the nuclear industry is also not a major employer, and is thus similarly ill-suited as a solution to the world's employment challenges.

UNEP, *supra* note 5, at 89.

[70] France leads among larger nations at nearly 80 percent of power from nuclear sources. World Nuclear Association, Nuclear Power in the World Today, http://www.world-nuclear.org/info/inf01.html (last visited Feb. 19, 2009). Globally, sixteen percent of electricity is from nuclear sources. *Id.* Coal is the dominant alternate source. *Id.* Sweden, which gets about half its electricity from nuclear power, had planned to phase out nuclear plants, but the government is reversing policy and considering building new plants. *Sweden Wants to Lift Reactor Ban*, N.Y. TIMES, Feb. 6, 2009, at A10, *available at* http://www.nytimes.com/2009/02/06/world/europe/06sweden.html?ref=world.

[71] Jeremy Plester, *Environmentalists May Go Nuclear*, TIMES (United Kingdom) 50 (Jan. 3, 2005); Ira Flatow, *Some Environmentalists Warming Up to Nuclear*, TALK OF THE NATION/SCIENCE FRIDAY (NPR). (June 2, 2006).

[72] William Tucker, TERRESTRIAL ENERGY: HOW NUCLEAR POWER WILL LEAD THE GREEN REVOLUTION AND END AMERICA'S ENERGY ODYSSEY (2008). *See also* Max Shulz, *Nuclear Recovery*, AMERICAN SPECTATOR, Dec. 2008, at 90, 90-91 (reviewing Tucker and contrasting Tucker's views to those of Amory Lovins and Thomas Friedman).

concern with greenhouse gas emissions.[73]

Nuclear power is not the only technology, or even the only energy technology, that requires trading off one environmental problem for another. As an illustration, consider that producing renewable energy equipment creates pollution. As the UNEP report notes, producers of solar photovoltaic (PV) cells often produce long-lived hazardous byproducts that are frequently disposed of improperly[74] – a problem conceptually similar to the waste disposal problems of the nuclear power industry. Unlike nuclear power jobs, however, the UNEP report does not exclude all photovoltaic-related jobs, even as the lower cost photovoltaic production caused by improper disposal has played a role in the rapid expansion of the use of photovoltaics by reducing their costs.

The failure to treat technologies consistently – such as excluding products that pose environmental threats when disposed of improperly – is emblematic of an important problem in the green jobs literature. When winners and losers are selected according to non-transparent and inconsistent application of selection criteria, the potential for rent-seeking is enormous. Before billions in public money is committed to promoting green jobs, proponents need to make clear the criteria used to select those who qualify for access to those resources.

A different version of this problem can be seen in the way some analyses consider almost anything green if the technology does not use petroleum without considering the environmental impacts of the alternative's environmental impact. For example, the Mayors report touts biomass as a "group of technologies where additional investment and jobs will help to develop the nation's alternative energy infrastructure."[75] Most of the green jobs literature extols the virtues of generating energy using "wood waste and other byproducts, including agricultural byproducts, ethanol, paper pellets, used railroad ties, sludge wood, solid byproducts, and old utility poles. Several waste products are also used in biomass, including landfill gas, digester gas, municipal solid waste, and methane."[76]

Unfortunately, because biomass includes burning wood, "perhaps the oldest form of human energy production,"[77] a means of energy production associated with smog, air pollution, and massive release of carbon.[78] Yet biomass is included "because of the short time needed to re-

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[73] *See, e.g.,* TUCKER, *supra* note 72 (discussing role of nuclear power); Amarjit Singh, *The Future of Energy*, 9 LEADERSHIP & MGMT. ENGINEERING 9, 9-25 (2009); Kathleen Vaillancourt, Maryse Labriet, Richard Loulou & Jean-Philippe Waaub, *The Role of Nuclear Energy in Long-Term Climate Scenarios: An Analysis with the World-TIMES Model*, 36 ENERGY POLICY 2296, 2296-2307 (2008); Benjamin. K. Sovacool, *Valuing the Greenhouse Gas Emissions from Nuclear Power: A Critical Survey*, 36 ENERGY POLICY 2950, 2950-2963 (2008) (study of total lifecycle emissions, not direct GHG emissions).

[74] UNEP, *supra* note 5, at 111. Using "environmentally responsible" methods raises the cost of producing polysilicon for solar PV cells from between $21,000/ton and $56,000/ton to $84,000/ton. *Id.*

[75] MAYORS, *supra* note 1, at 9.

[76] *Id.*

[77] *Id.*

[78] Wood burning, despite its status as a renewable source, can be a major source of fine particulate matter air pollution. As noted by Michael Faust of the Sacramento Metro Chamber,

> Wood burning has been identified as the largest single source of wintertime PM 2.5 in the Sacramento region. The 2005 emission inventory for Sacramento County shows that wood smoke accounts for 45% of wintertime PM 2.5 emissions and is the largest single category. Prohibiting wood burning on days when particulate levels are projected to exceed a set threshold has been identified as the most cost effective way to reduce PM 2.5. By prohibiting the release of particulate matter from wood smoke on specific days, the Sacramento region can prevent particulate matter levels from reaching unhealthy levels, and avoid being designated an nonattainment for the federal 24-hour PM 2.5 standard.

Michael Faust, Vice President of Public Policy, Sacramento Metro Chamber, Testimony before Sacramento Metropolitan Air Quality Management District regarding Wood Burning Rule 421 (Sept. 26, 2007), *available at* http://sacramentocacoc.weblinkconnect.com/cwt/external/wcpages/wcwebcontent/webcontentpage.aspx?contentid=1225.

grow the energy source relative to fossil fuels."[79] In other words, biomass counts as green because it is not petroleum, even though biomass causes environmental problems. Similarly, the Mayors report counts biodiesel and ethanol as green "because of their ability to reduce reliance on fossil fuels,"[80] overlooking arguments that growing corn or soy for ethanol or biodiesel requires agricultural practices that increase air and water pollution,[81] bring marginal land into production reducing wildlife habitat,[82] increase emissions of carbon dioxide and nitrous oxides,[83] and increase the amount of nitrogen and pesticides in the environment.[84]

Even if we focus on the one environmental issue that the green jobs literature generally puts at the top of the list of reasons to develop green jobs – preventing greenhouse gas emissions – there are significant problems with the definitions. It is not surprising that "not all fuels derived from biomass necessarily offer meaningful carbon emission advantages over fossil fuels, and some may even impose new environmental costs," UNEP concedes.[85] Even if we ignore the costs of heavily-subsidized programs such as ethanol, before embarking on large-scale burning of used railroad ties and corn extracts (which may not be so environmentally friendly), it would be wise to know more about the specifics of the science underlying the claim that all the things labeled "biomass" do in fact produce a net environmental gain when used as an energy source.

While we do not claim to know the science of such diverse technical matters to make a

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Areas that have been declared nonattainment of Federal primary (health-related) ambient air quality standards for particulate matter pollution at one time or another partly due to wood burning include Tacoma, and Spokane, Washington; Eugene, Oregon; Sandpoint and Pinehurst, Idaho; and Kalispell and Missoula, Montana. Tacoma Urbanist, Port Activities and Wood Stoves Designate Tacoma as *Non-Attainment* For Pollution, http://i.feedtacoma.com/Erik/port-activities-wood-stoves-designate/ (Jan. 17, 2008); SPOKANE COUNTY AIR POLLUTION CONTROL AUTHORITY, DRAFT TECHNICAL ANALYSIS PROTOCOL FOR THE SPOKANE PM10 NONATTAINMENT AREA PM10 LIMITED MAINTENANCE PLAN AND REDESIGNATION REQUEST (2004), *available at* http://www.spokanecleanair.org/documents/sip/Draft%20Spokane%20LMP%20TAP.pdf; Idaho Dep't of Envtl. Quality, *Air Monitoring Overview: How DEQ Assesses Air Quality*, http://www.deq.state.id.us/air/data_reports/monitoring/overview.cfm (last visited Feb. 19, 2009); Mont. Dep't of Envtl. Quality, *Citizens' Guide to Air Quality in Montana: Understanding Air Quality*, http://www.deq.state.mt.us/AirMonitoring/citguide/understanding.asp (last visited Feb. 19, 2009).

[79] MAYORS, *supra* note 1, at 9.

[80] *Id.* at 11 n.12.

[81] *See* Timothy Searchinger et al., *Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change*, 319 SCIENCE 1238, 1240 (2008). We are aware of the controversy this paper sparked. *See, e.g.*, Posting of pwintersatbiodotorg to Biofuels & Climate Change, http://biofuelsandclimate.wordpress.com/2008/02/28/is-the-debate-on-land-use-over/#comments (Feb. 28, 2008). The point is not whether Searchinger et al. are correct about the net impact but whether the green jobs literature acknowledges the active scientific controversy over these issues. It largely does not.

[82] Conversion of habitat to cropland is generally deemed to be the most significant pressure on terrestrial species, habitat and ecosystems. *See* MILLENNIUM ECOSYSTEM ASSESSMENT, ECOSYSTEMS AND HUMAN WELL-BEING 67 (2005), *available at* http://www.millenniumassessment.org/documents/document.356.aspx.pdf [hereinafter MEA]; Indur M. Goklany, *Saving Habitat and Conserving Biodiversity on a Crowded Planet*, 48 BIOSCIENCE 941, 941 (1998). Likewise, diversions of freshwater for human uses are deemed to exert the greatest pressure on freshwater biodiversity. *E.g.*, A. Brautigam, *The Freshwater Biodiversity Crisis*, 2 WORLD CONSERVATION 4, 4-5 (1999), *available at* http://www.iucn.org/bookstore/bulletin/1999/wc2/content/freshwaterbio.pdf. 7 November 2001; IUCN. 2000. Confirming the Global Extinction Crisis. IUCN Press Release, 28 September 2000. <http://www.iucn.org/redlist/2000/news.html>. Visited 7 November 2001; Wilson 1992; *see also* MEA, *supra* note 82.

[83] Searchinger et al., *supra* note 81, at 1238 (carbon dioxide); G. Philip Robertson et al., *Sustainable Biofuels Redux*, 322 SCIENCE 49, 50 (2008) (nitrous oxide).

[84] *See infra* Part III.C, where this matter is addressed in greater detail. The UNEP report took a more skeptical approach to biofuels, perhaps because it was less concerned with the political calculation necessary to build support for green jobs initiatives within the United States. *Full of Sound and Fury*, ECONOMIST, July 14, 2007, at 32, 32-33 (U.S. Congressional debates over energy policy, ethanol and other renewable, and taxation of oil companies); Paul B. Thompson, *The Agricultural Ethics of Biofuels: A First Look*, J. AGRIC. & ENVTL. ETHICS, Apr. 2008, at 183, 183-198.

[85] UNEP, *supra* note 5, at 90.

final judgment on how green particular biomass and biofuel programs are, the enthusiastic advocates of the green jobs programs do not appear to know the difference either. They make simplistic assertions about what energy can be counted on to substitute for current supplies and offer only vague cost and environmental impact estimates. Policies designed to have major impacts on the economy and environment should be better researched and understood before massive resources are committed to them.

Finally, calculations of green jobs often incorporate criteria unrelated to the environmental impact of the job or production process. For example, recycling is generally touted as a major source of green employment.[86] But in the UNEP report many current jobs in recycling industries[87] are excluded because those jobs are "characterized by extremely poor practices, exposing workers to hazardous substances or denying them the freedom of association."[88] Even today's symbol of environmental consciousness, the hybrid car, is not necessarily "green" in the eyes of all green jobs proponents. The UNEP report cautions that "only under certain conditions" can hybrids "be seen as unambiguous proxies for a greener auto industry."[89]

There may be good reasons to exclude public support from jobs that fail to meet various criteria related to the ability to form labor unions or employers' record in workplace safety. However, those reasons have nothing to do with the environmental impact of the job and including such criteria in a definition of a "green" job obscures the issues. Moreover, those criteria are themselves contested – whether governments should promote, hinder, or remain neutral in labor disputes is not something on which there is a consensus.

What these examples demonstrate is that the green jobs literature does not engage in serious analysis of whether a particular job is "green" but instead simply labels jobs as green if they are found within a favored industry.[90] Are these jobs truly green? The only criteria used by any of these analyses to exclude a job within a favored industry is UNEP's insistence on job characteristics unrelated to environmental quality, such as "decent work, i.e. good jobs which

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[86] ASES, *supra* note 2, at 29 (noting that recycling is the second biggest "green job" in the U.S.).

[87] UNEP, *supra* note 5, at 215 ("While recycling is of great value in terms of resource conservation, it can entail dirty, undesirable, and even dangerous and unhealthy work, and it is often poorly paid."); *Id.* at 219 ("While recycling offers the benefit of recovering resources that otherwise would have to be mined and processed at considerable environmental expense, the procedures prevalent in most of China's recycling sector themselves impose considerable human and environmental costs. Particularly the manual disassembly jobs cannot be described as green jobs.").

[88] UNEP, *supra* note 5, at 4.

[89] *Id.* at 154; *see also* CNW Marketing Research, Inc., DUST TO DUST: THE ENERGY COST OF NEW VEHICLES FROM CONCEPT TO DISPOSAL (2007), http://cnwmr.com/nss-folder/automotiveenergy/DUST%20PDF%20VERSION.pdf (a controversial report contending that the net environmental impact of a Toyota Prius was greater than of a Hummer H1).

[90] For example, *Occupational Outlook Quarterly* quoted Ann Randazzo of the Center for Energy Workforce Development in Washington, D.C. that "jobs in renewable energy are not all that different from jobs in traditional energy sources. . . . For example, a person who is trained to work on power lines also has many of the skills to work on wind turbines." Phillip Bastian. On the Grid: Careers in Energy. 52(3) OCCUPATIONAL OUTLOOK QUARTERLY 33-41 (Fall 2008). Similarly, Mayors suggests that existing manufacturing operations will simply switch from making other things to making wind turbines. *See* MAYORS, *supra* note 1, at 13. The report states

> The technology of wind electricity is relatively new, but the manufacturing base for its production is very similar to past products. Every state in the country has firms and a labor force with experience making products similar to the blades, gearboxes, brakes, hubs, cooling fans, couplings, drivers, cases, bearings, generators, towers and sensors that make up a wind tower. These jobs fall into the familiar durable manufacturing sectors of plastics and rubber, primary metals, fabricated metal products, machinery, computer and electronic products, and electrical equipment.

Id. Likewise, the CAP report states that "the vast majority" of the green jobs its program would create are "in the same areas of employment that people already work in today..." CAP, *supra* note 10, at 5. And the UNEP study noted that job creation in "sheet metal work, semiconductors, electronic equipment, and others" would be "a welcome antidote to the loss of manufacturing jobs in recent years." UNEP, *supra* note 5, at 110.

offer adequate wages, safe working conditions, job security, reasonable career prospects, and worker rights."[91] These are wonderful characteristics of any job, but their inclusion seems to be motivated more by a desire to build a coalition with labor groups than by any interest in improving the environment.

In fact, making green jobs more expensive seems like a sure way to ensure that there are fewer of them. Other groups, including developing nations[92] and women and ethnic minorities[93] also receive consideration that has little to do with the environment. Again, there is nothing wrong with advocating transfer payments to developing nations or employment quotas or other programs for favored groups; the troubling aspect is the inclusion of such advocacy in an "environmental" strategy.

These definitional issues are not simply inconveniences to the analysis of green jobs claims, although they make it impossible to compare the different reports' claims.[94] They represent fundamental confusion about the very idea of a "green job," a confusion that ought to be resolved before committing billions of taxpayer dollars and compelling even larger sums of private resources to generate "green jobs." Indeed, these examples point to a serious problem in the green jobs literature. Because there is not only no agreement on what it means to be a "green" job, and little transparency in making clear the differences in assumptions underlying the various definitions, the literature obscures fundamental public policy choices that require thorough debate. The green job advocates create incentives for interest groups to work the political system to have their own industries or jobs designated as "green" and their rivals' excluded. Such rent-seeking not only wastes resources but is likely to entrench inferior technologies in the market place, as has occurred with ethanol.[95] The heavy weight put on non-environmental criteria suggests that the "green" label is already a vehicle for rent seeking. Moreover, failure to consider the entire life cycle costs of technologies in choosing which will be favored and which will not undermines the credibility of the literature's definitions of "green."[96] The lack of such consideration is endemic in the literature. Developing an open, clear definition of "green" is a critical prerequisite to public policy measures to promote green jobs if such efforts are not to turn into rent-seeking extravaganzas with little impact on the environment. Thus far such a definition has not appeared.

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[91] UNEP, *supra* note 5, at 4. It is unlikely that the vast majority of jobs around the world, green or not, would meet that criteria as it would be understood by most Americans.

[92] *See, e.g., id.* at 28 ("Just as vulnerable workers should not be asked to incur the costs of solving a problem they did not cause, the same principle should apply to resource-starved countries that today face major problems due to climate change caused by the emissions of the richer countries.").

[93] *See, e.g., id.* at 26 ("There are important equity issues with regard to minorities as well as gender.").

[94] Even the UNEP study conceded that existing green jobs literature is made up of studies using quite different methodologies and assumptions. *Id.* at 101 ("One problem with the array of existing studies is that they employ a wide range of methodologies, assumptions, and reporting formats, which makes a direct comparison of their job findings—or any aggregation and extrapolation-very difficult or impossible.")

[95] Jonathan H. Adler, *Rent Seeking Behind the Green Curtain*, 19 REGULATION, Fall 2006, at 26, 26, *available at* http://www.cato.org/pubs/regulation/regv19n4/v19n4-4.pdf (describing rent seeking in 1990s ethanol programs); *see also* U.S. Office of Tech. Assessment, INNOVATION AND COMMERCIALIZATION OF EMERGING TECHNOLOGIES 87-88 (1995) ("Regulations that are overly prescriptive can lock in existing technologies to the detriment of other technologies that might meet or exceed requirements."); Envtl. Law Inst., BARRIERS TO ENVIRONMENTAL TECHNOLOGY AND USE 6 (1998) ("Technology-based emission limits and discharge standards, which are embedded in most of our pollution laws, play a key role in discouraging innovation.").

[96] We will discuss this below in the case of mass transit in the U.S.

There is some overlap – every report thinks weatherizing public buildings is a good idea, for example. If there are unemployed people, why not put them to work replacing windows in public schools? There are undoubtedly less productive uses of public funds – such as the classical Keynesian suggestion of having one group dig holes and another fill the holes in[97] – but that is hardly a positive recommendation. The question is not whether weatherization is a good thing generally but whether the weatherization that occurs only when subsidized is a good thing. Without a clearer explanation of the theory of market failure underlying the proposals, even these areas of overlap are questionable.

B. What counts as a "job"

The second major problem with the green jobs literature is that it consistently counts jobs that do not produce final outputs as a benefit of spending programs. These jobs should be counted as a cost. For example, the Mayors report includes as green jobs those jobs involved in "government administration of environmental programs, and supporting jobs in the engineering, legal, research and consulting fields.[98] The UNEP report also includes such jobs in its definition.[99] Another estimate of green jobs, by Management Information Services, the primary consultant on the ASES report, found that the single biggest increase were secretarial positions; next were management analysts; then bookkeepers, followed by janitors. Most dramatically, Management Information Services estimated that there were fewer environmental scientists than any of the other jobs just listed.[100]

The impact of including non-productive employees within the definition of green jobs can be seen in the Mayors' list of the top 10 metropolitan areas for current green jobs, which is led by New York City (25,021) and Washington, D.C. (24,287).[101] As there is little manufacturing or corn or soy farming in such locations, this suggests that most of the green jobs in both locations are likely to be in the overhead categories. Indeed, the report emphasizes that "engineering, legal, research and consulting positions play a major role in the Green Economy, as they account for 56% of current Green Jobs. They have also grown faster than direct Green Jobs since 1990, expanding 52%, compared with 38% growth in direct jobs."[102] Note that this lumps engineers and scientists inventing new technologies with lawyers and accountants devising ways to obtain government subsidies, lobbying, or engaging in other forms of unproductive rent-seeking.

The Mayors report makes a "conservative" estimate of one new indirect job for every two direct jobs, conceding that "we do not expect that each marginal electricity generating job will require another environmental lawyer … and not every retrofitting position will require commensurate growth in research or consulting."[103] That it could be seen as a positive benefit if policies required more lawyers or consultants demonstrates the fundamental incoherence of green job definitions. This problem is widespread in the green jobs literature, with the focus

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[97] John Stossel, *Jobs Plan: Dig Holes, Fill Them*, FORT WAYNE JOURNAL GAZETTE (Feb. 22, 2009) available at http://www.jg.net/apps/pbcs.dll/article?AID=/20090222/EDIT05/302229929/1021/EDIT

[98] MAYORS, *supra* note 1, at 5.

[99] UNEP, *supra* note 5. *See supra* note 66 and accompanying text.

[100] Roger H. Bezdek, et al., *Environmental Protection, the Economy, and Jobs: National and Regional Analyses*, 86 J. ENVTL. MGMT. 53, 66 (2008). Bezdek and his associates are primary authors of the ASES report.

[101] MAYORS, *supra* note 1, at 5.

[102] *Id.* at 16.

[103] *Id.* UNEP also notes a high range of indirect jobs from energy efficiency measures, finding estimates from 90percent to 66percent indirect job creation. UNEP, *supra* note 5, at 136-137.

almost entirely on the hypothesized economic impact of increased public spending on favored projects.[104]

These numbers illustrate an important point. The purpose of a business, green or not, is not to *use* resources (e.g. labor, energy, raw materials, or capital). The purpose of a business is to produce a good or service desired by consumers that can be sold in the marketplace for more than the cost of production. For a given level of output, businesses that use more resources are less efficient – have higher costs -- than those using fewer resources. Moreover, it is crucial to recognize that many jobs created in response to government mandates are *not* a *benefit* of environmental measures but rather represent a *cost* of such programs. Such costs may be worth incurring for the benefits the program produces, but they must be counted as costs not benefits.[105]

A simple example comparing two hypothetical energy policies illustrates the point. Both policies require power companies – whenever possible – to use renewable energy plants rather than their fossil fuel power plants to generate the energy they sell. Policy A requires the power companies to install a data recorder that measures how much power comes from each type of plant in real time and transmit the information to the Environmental Protection Agency (EPA), where a computer program analyzes the data. When the program detects underuse of renewable energy plants, it alerts an EPA official, who can then initiate enforcement action against the power company for violating the rules. Aside from the initial work in installing the monitor and programming the computer, and whatever maintenance is required on the monitors and computer program, this policy requires only the occasional attention of the EPA official. Policy B requires the same monitor, software, and EPA headquarters staff. However, it also requires an EPA employee be stationed in the power companies' control rooms 24 hours a day, 7 days a week, 365 days a year to ensure that no one tampers with the monitoring unit. Policy B produces many more "green" jobs under both the Mayors and UNEP definitions. Yet these additional employees add nothing to the actual greening of energy production.[106]

The inclusion of consultants, lawyers, and administrators as benefits of green job spending illustrates a major problem with the definition of green jobs.[107] By making increasing labor use the *end*, rather than treating labor inputs as a *means* to production of environmentally friendly goods and services, the literature makes a foundational error in analyzing the economy. By promoting inefficient use of labor resources, green jobs policies will steer resources towards technologies, firms, and industries that will be unable to compete in the marketplace without

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[104] For example, CAP touts retrofits of public buildings because they "have the most potential for operating at a large scale within a short time period." CAP, *supra* note 10, at 16. (CAP's proposal is for a $26 billion program to retrofit all 20 billion square feet of education, government office, and hospital space.) *Id.* The average pay back for these expenditures would be "about five years" because they would save "about $5 billion per year" in energy costs. *Id.* And CAP promises that spending $20 billion on "mass transit and light rail and smart grid electric transmission systems" would "reap similar macroeconomic returns over time as these investments stabilized oil prices through transportation diversification and energy efficiency gains." *Id.*

[105] On the costs and benefits of alternative environmental policies, *see* Andrew P. Morriss & Roger E. Meiners, *Borders and the Environment*, 39 ENVTL. L. (forthcoming 2009).

[106] At most they deter some fraudulent tampering with the monitors. For our purposes we can assume this is zero. Of course, much tampering can be detected *ex post* rather than prevented *ex ante*, and so the marginal amount of fraud deterred will be less than the total amount of fraud possible. It is not just bureaucrats who get counted as a benefit rather than a cost under these definitions but repair personnel as well. For example, UNEP forecasts that there will be "tremendous job growth" in installing and maintaining solar systems. UNEP, *supra* note 5, at 8. This ignores the fact that a system that requires more labor to install or maintain is less efficient than one that requires less labor.

[107] This is the same logic as declaring that a "benefit" of the war on drugs is an increase in the number of prison guards.

permanent subsidies. Dooming the environmentally friendly economic sector to an unending regime of subsidies is both fiscally irresponsible and harmful to efforts to continue to build a competitive and environmentally friendly economy. As we discuss later, this is a seriously under-appreciated feature of economic progress.

C. Forecasting

Forecasts of green jobs are universally optimistic. For example, *Occupational Outlook Quarterly's* forecast for green jobs notes that renewable power "is one of the fastest growing segments of the electric power industry."[108] The Mayors report asserts that "wind energy is currently the fastest growing alternative energy source in the country,"[109] and "solar power is an alternative energy source providing opportunity for massive job growth" [110] Similarly, the UNEP report claims that "[a]long with expanding investment flows and growing production capacities, employment in renewable energy is growing at a rapid pace, and this growth seems likely to accelerate in the years ahead."[111]

We found five major problems with these optimistic forecasts. First, many of the sectors declared to be green are extremely small and even quite minor changes in capacity produce large percentage increases in growth. Whether such large percentage increases will continue, or whether the progressively larger denominator from prior periods' growth will result in a slower rate of growth is thus an important question that must be answered before extrapolating from current growth rates. Ironically for an area so concerned with sustainability issues, the reports generally assume that these rapid rates of growth can continue even as the denominator grows.

Second, the growth rates forecast are huge by any standard, thus raising questions regarding their reliability. In the energy field in particular, the projections in green job reports yield astonishingly fast spreads of new technologies, some of which do not even exist yet in economically viable forms. Such assumptions are inconsistent with past experience with other technologies.

Third, the green jobs literature exhibits a selective technological optimism, assuming away any problems that might slow adoption of favored technologies while ignoring the likelihood of technological improvements of disfavored ones. This selective optimism about technological change biases the forecasts in favor of the favored technologies, but is unsupported by evidence of systematically faster growth in favored technologies over their competitors.

Fourth, because many industries discussed as major drivers of green jobs are small and new, no official, vetted statistics are available. This means that quite a few assumptions about the distribution of green and less green employment within the larger categories for which data are collected are necessary. As a result, the underlying basis for many of these forecasts are not statistics collected by neutral, skilled analysts, such as those at the U.S. Energy Information Administration, but estimates made by green jobs proponents and interest groups with a vested interest in the outcomes.[112] This source of potential bias means that caution must be exercised in

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[108] Bastian, *supra* note 90, at 38.

[109] MAYORS, *supra* note 1, at 6-7.

[110] *Id.* at 7.

[111] UNEP, *supra* note 5, at 6.

[112] For example, the Department of Energy estimated that if the U.S. attempted to achieve 20 percent wind power by 2030 (which would be an incredible undertaking given the slow rate of growth), there would be 500,000 jobs at that time in the wind-related field, of which 150,000 would be manufacturing, construction, and maintenance. U.S. Dep't of Energy, 20% WIND ENERGY BY 2030: INCREASING WIND ENERGY'S CONTRIBUTION TO U.S. ELECTRICITY SUPPLY 13 (2008), *available at* http://www.nrel.gov/docs/fy08osti/41869.pdf [hereinafter DOE, 20% WIND]. That contrasts to the ASES claim that to achieve a

making policy decisions based on such numbers.

Finally, the reports often assert results that appear precise, giving the illusion of scientific certainty. Yet these apparently detailed results vary widely from estimate to estimate of the same issue, thereby illustrating the inappropriateness of reliance on the results. We will now walk through the specific details of each of these areas.

1. Small base numbers

Rapid growth on a small base produces an absolute number that is still small. This is concealed in the presentation in green jobs reports by emphasizing growth rates and using misleading base numbers. For example, the Mayors report states:

> Wind energy is currently the fastest growing alternative energy source in the country. ... The rapid pace of investment has continued, leading to a 45% increase in capacity, and net generation from wind energy is expected to increase significantly in 2008. This rapid investment has led to an increased share of electricity generations, and it now accounts for 10% of renewable electricity generation. In terms of total energy generation for the U.S., though, it maintains an extremely low share, generating just 0.8% of the total in 2007.[113]

If one focused on the "rapid pace of investment," the "45% increase in capacity," and "significantly" increased share of electricity generation, it would appear that shifting a large share of electricity production to wind generators would be feasible in the short term. When we look at the base on which these increases are calculated, however, it becomes clear how small even a much larger wind energy sector would be. For example, even the Mayors note that solar power provided just "0.2% of [U.S.] alternative-based energy in 2007."[114]

Let us be clear what this means. Wind power constituted 0.3 percent of total energy consumption in the U.S. and solar PV only 0.08 percent -- eight-one-hundredths of 1 percent -- of total energy consumption in the U.S. in 2007.[115] The consequence of the tiny level of production is ignored in the emphasis on rapid growth: electricity generated from photovoltaic and thermal devices rose 23 percent between 2000 and 2007 and investment in solar "surged 21% in 2007."[116] Extrapolating from the growth over such a small base is unreliable, however, since random factors can have an immense impact due to the small base size. Indeed, wind power generation has run into significant problems, as the quality of equipment has proven

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goal of 15% renewable energy (wind, solar, etc.) by 2030 would mean 3.1 million jobs by then; a goal of 30% would mean 7.9 million new jobs in that sector of the economy by 2030. ASES, *supra* note 2, at 7. The ASES numbers are not broken down by energy source, but they are vastly higher than the jobs numbers projected by the Department of Energy, which only looked at wind.

[113] MAYORS, *supra* note 1, at 6-7.

[114] *Id.* at 7. The Mayors report notes that solar has not been adopted widely because of "high generation costs relative to fossil fuel-based power." *Id.*

[115] Energy Info. Admin., U.S. Dep't of Energy, RENEWABLE ENERGY CONSUMPTION AND ELECTRICITY PRELIMINARY 2007 STATISTICS (2008), *available at* http://www.eia.doe.gov/cneaf/alternate/page/renew_energy_consump/reec_080514.pdf. See Table 3 of this report for details of electricity generation from renewable sources. *Id.* at 11. The Mayors' report is right that massive job growth would accompany any significant increase in use of solar power to generate electricity just to install the photovoltaic panels necessary to reach even 1 percent of total electricity demand would take an extraordinary number of installers.

[116] MAYORS, *supra* note 1, at 7. The absolute numbers are much less impressive than the percentages. The Mayors' report concedes that production of photovoltaic cells increased only from 46,354 peak kilowatts of capacity to 337,268 peak kilowatts from 1997 to 2006, with employment in manufacturing growing from 1,700 to 4,000. *Id* at 8.

problematic in a number of instances.[117] Moreover, given the subsidies for expanding these technologies, their expansion has been driven to an unknown extent by the subsidies rather than by technological promise alone. This appears to be the case for solar PV[118] and the U.S. corn-based ethanol industry, for example.[119]

Because the expansion of many green industries has occurred from such a small base and because of the considerable degree of policy-driven behavior, rather than market driven behavior, the reported large percentage increases are unreliable indicators of the future potential of these green technologies. Until these industries have developed a long-term track record of production of a significant share of electricity generation, it would be unwise to assume that they can readily scale up without encountering problems.

2. Huge growth rates

The spread of new green technologies is forecast by all green jobs proponents to proceed at remarkable rates. For example, the Mayors report assumes a 17-fold increase in wind power and a 621-fold increase in solar power between 2008 and 2038.[120] It predicts that there will be a 59-fold increase by 2018 alone. Yet the report contains no references to the massive solar-generation equipment and sites that would have to be under construction already for this to occur.

Overall, the Mayors report proposes that the share of "renewable" energy of our total electricity use to rise from 3 percent in 2008 to 40 percent by 2038, which is a transformation of more than 1 percent of the total each year.[121] Similarly, an ASES report projects an increase in wind energy employment of one million persons by 2030, up from the 39,600 people employed in 2007, about a 25-fold increase, based on a "push the envelope" policy to move to significant renewable energy by 2030.[122] The figures are based on a multiplier[123] of base employment in the

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[117] *See* Tom Wright, *India Windmill Empire Begins to Show Cracks,* WALL ST. J., Apr. 18, 2008, at A1, *available at* http://online.wsj.com/article/SB120846287761023921.html; Michael Connellan, *Spinning to Destruction,* GUARDIAN, Sept. 4, 2008, at 1, 1, *available at* http://www.guardian.co.uk/technology/2008/sep/04/energy.engineering (Danish government requires mandatory service checks on all windmills in country after cracking problems develop).

[118] *See* Figure 1 *infra.*

[119] *See infra* Part IV.B.

[120] MAYORS, *supra* note 1, at 12. The report, published in October 2008, estimated wind power generation in 2008 to be at 38,850 million Kilowatt hours (MW). The wind industry estimated operating capacity at the end of 2008 to be 25,170 MW, which represented an increase of 8,359 MW capacity over 2007, almost a 50 percent increase. Why the Mayors report would presume more than a doubling from 2007 to 2008 is not known. The report presumes an increase averaging over 18,000 MW per year from 2008 to 2018, which is way beyond the optimistic assumption of the wind trade association. The American Wind Energy Association claims 85,000 people were employed in the wind industry in 2008. Less than ten percent of those jobs were in construction; the total count includes "legal and marketing services and more." Press Release, American Wind Energy Ass'n, *Wind Energy Grows by Record 8,300 MW in 2008,* (Jan. 27, 2009), *available at* http://www.awea.org/newsroom/releases/wind_energy_growth2008_27Jan09.html. The AWEA noted that in 2009 employment was falling as production and construction was slowing due to financial problems.

[121] According to the Energy Information Administration, renewable energy sources accounted for 7 percent of power in 2007. How Mayors got this down to 3 percent is not clearly explained, but it obviously dropped big hydroelectric sources as the only hydropower it reports for 2008 and forward is "[i]ncremental Hydropower added since January 1, 2001." MAYORS, *supra* note 1 at 12. Apparently the Mayors report does not wish to include big Hydro, such as the Grand Coulee Dam, as such items are on the no-no list for some environmentalists, as we discuss later; the only hydro to be counted are new little hydro projects. Removing big hydro drops renewable source energy substantially, making the renewable energy development battle even more daunting.

[122] ASES, *supra* note 2; Robert H. Bezdek, AMERICAN SOLAR ENERGY SOC'Y, GREEN COLLAR JOBS IN THE U.S. AND COLORADO: ECONOMIC DRIVERS FOR THE 21ST CENTURY, 7, 25 (2009). This report is an update to the ASES report used throughout this article, but the primary change is the section on Colorado; the November 2007 report cited routinely here had a similar section on Ohio, although Ohio was not worthy of mention in the title unlike the Colorado version.

[123] The issue of multipliers, which is important since it runs the job count way up, will be discussed below in Section II.D at note 129 and associated text.

industry, which, in the case of wind, was 17,300 direct jobs in 2007.

The Mayors report forecasts a 16-fold increase by 2038 in hydropower production, with a 4-fold increase by 2018.[124] Such rapid growth is implausible given the lack of existing hydropower projects and the ongoing elimination of existing hydropower sites due to environmental concerns. We are unaware of a single major new dam/hydropower project underway in the United States and the major hydropower-related activity in the United States is the *removal* of existing electricity-generating dams to improve water quality and fish habitat.[125] That "minor" detail of a decline in existing hydro power sources is ignored.

Despite the rapid growth estimates for hydropower, the Mayors report implies that big hydro (such as the Hoover Dam), which accounts for most hydropower generation, may decrease. Instead, "small hydro," is asserted to be the wave of the future. Citing a U.S. Department of Energy study, the Mayors state that if every state ramped up construction on "all potential" small hydro projects, a majority could double their hydro power.[126] But a doubling of hydro power is not remotely close to a 16-fold increase.

It is not just hydropower where such rapid growth rates are assumed. Geothermal power is to increase more than 14-fold by 2038 (5-fold by 2018).[127] Once again, no details about when and where this massive power increase is supposed to occur. Biomass energy is to increase 12-fold—again with no explanation.[128] The nation is already planted corner to corner in corn to produce ethanol—and corn prices were driven to record levels in 2008—so where will the biomass increase come from? And in this case, all this energy must be produced domestically since the Mayors report asserts that importing energy "is worse than a tax – for the money flows out of the country."[129]

The UNEP report has similarly optimistic assessments of the potential for growth among its favored technologies:

- Spending on wind power installations is expected to expand from $8 billion in 2003 and $17.9 billion in 2006 to $60.8 billion in 2016.[130]
- Markets for the manufacturing and installation of solar PV modules and components are slated to grow from $4.7 billion in 2003 and $15.6 billion in 2006 to $69.3 billion by 2016.[131]

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[124] MAYORS, *supra* note 1, at 12. The 2009 ASES study, seeing little future for hydro apparently, barely registers it as a bump on the employment chart for 2030. ASES, *supra* note 2, at 7.

[125] Peter Fimrite, *Steps Taken Toward Removing Klamath River Dams*, S.F. CHRON., Nov. 14, 2008, at A-1, *available at* http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/11/14/MNA21441S7.DTL. The plan includes a surcharge for customers of the electric utility, as it must find alternative electricity sources for the 70,000 customers the hydro sources serve. Solar and wind power would be considered. Hydro power sources are also being removed in Maine. *See, e.g.*, Colin Hickey, *Fort Halifax Dam Deal Rejected*, KENNEBEC J., June 29, 2007, http://kennebecjournal.mainetoday.com/news/local/4044480.html. There is no doubt dams have environmental consequences—as do the construction of any source of electricity.

[126] MAYORS, *supra* note 1, at 8.

[127] *Id.* at 12.

[128] *Id.*

[129] *Id.* at 3.

[130] The asserted expansion is in doubt. The largest project, a multi-billion dollar 2,700 wind turbine project in West Texas, had to put plans on hold because of the decline in oil and natural gas prices. *T. Boone Pickens puts Texas wind farm project on hold,* DALLAS MORNING NEWS, Nov. 12, 2008 (http://www.dallasnews.com/sharedcontent/dws/bus/stories/111308dnbuspickens.ae1b50.html?npe)

[131] UNEP, *supra* note 5, at 93.

- The biofuels market of $20.5 billion in 2006 is projected to grow to more than $80 billion by 2016.[132]
- The markets for fuel cells and distributed hydrogen "might" grow from $1.4 billion in 2006 to $15.6 billion over the next decade, according to Clean Edge; Roland Berger Strategy Consultants project a $103 billion market for fuel cells by 2020.[133]
- Geothermal power "might" become a $35 billion industry by 2020.[134]
- Ocean wave power "could" become a $10 billion per year industry by 2012."[135]

These are astonishingly rapid expansions of a set of technologies of dubious technical practicality, let alone economic viability.[136]

No doubt assorted renewable energy sources can do more, but much of this is purely speculative. Hydropower is not going to come from dammed up rivers; that is as politically off-the-table as drilling for oil near Santa Barbara. As the UNEP Report notes, even in other parts of the world large-scale hydro projects are "problematic."[137] Some hope that new technologies that capture ocean and tidal energy might be developed.[138] Despite interest in this new area of hydropower, the UNEP report, like the Mayors report, asserts that "small-scale hydro" will dominate.[139] Small-scale is not ocean or tidal hydro.

The point is that these renewable energy advocates who make renewable a part of immediate green jobs programs appear to have little appreciation for or knowledge of the technical realities of renewable alternatives. For example, a significant increase in geothermal energy is a vague claim. It can only happen, at unknowable costs, after basic research is started since little is admittedly known of how it could work on the massive scale envisioned.[140] Nevertheless, the CAP report claims that geothermal is an "obvious option for rapid green investment."[141] To assert that geothermal and other renewable power sources output will increase significantly in the next decade and beyond is simply wishful thinking unless it is backed by a careful inventory of where such projects might actually be constructed and assessment of the technologies they might use (cost considerations aside). As the Cape Wind project in Nantucket Sound illustrates well, our existing regulatory structure is not designed to facilitate bringing alternative energy projects online quickly and politically powerful opponents are often able to block or significantly delay alternative energy programs.[142]

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[132] *See infra* note 171.

[133] UNEP, *supra* note 5, at 93.

[134] *Id.*

[135] *Id.*

[136] We discuss the current size of several of these sectors below.

[137] *Id.* at 60.

[138] ASES, *supra* note 2, at 36. At the World Economic Forum in Davos in 2009 there was a negative report on such possibilities. Lord Turner of the UK's Committee on Climate Change said there was "mounting skepticism over the Government's plans for a huge expansion of wind and tidal power." Robin Pagnamenta, *Scepticism grows over the viability of green projects*, SUNDAY TIMES, Jan. 29, 2009, http://business.timesonline.co.uk/tol/business/economics/wef/article5607996.ece

[139] UNEP, *supra* note 5, at 42.

[140] *Id.* at 37; the Mayors report sees a four-fold increase in the U.S. by 2018 and a ten-fold increase by 2028. MAYORS, *supra* note 1, at 12.

[141] CAP, *supra* note 10, at 6.

[142] Jonathan H. Adler, *Foul Winds for Renewable Energy*, NAT'L REV. ONLINE, Sept. 28, 2007, http://article.nationalreview.com/?q=Mjg1YWVjNDZjZTBkNDhlODUzZjVkZThmM2U0YjAwNjE=#more. The Cape Wind farm has some regulatory approvals after years of planning—are all such permit requirements to be swept aside? It was proposed in 01; by early 09 it only had some permits; but was not done yet. Cape Wind: America's First Wind Farm on Nantucket Sound, http://www.capewind.org/ (last visited Feb. 21, 2009). *See also* Wendy Williams & Robert Whitcomb, CAPE WIND: MONEY,

The rapid expansion rates for new technologies in green job estimates are also often based on unrealistic assessments of potential. For example, the Mayors report asserts that four states with the most potential for wind power, North Dakota, Texas, Kansas and South Dakota, have the potential to generate 4,500 billion kWh of electricity, "enough to power the entire country."[143] Perhaps so, but wind power is unable to provide base load generation capacity because winds do not blow consistently when power is needed, even in North Dakota.[144] And a recent major technology effort to reduce wind power generation costs fell short.[145]

Policies that rely on rapid rollout of new technologies are inherently prone to error. We understand how long it takes to build railroad tracks, highways, and oil refineries because many have been built. But much less is known about building wind farms, solar panel arrays, and biomass generators, especially on the scale the reports discussed – a scale never before attempted. We have considerable experience with the reliability of coal, nuclear, and natural gas fired power plants, but much less experience with alternatives. The growth rates assumed in these reports do not take into account the uncertainties and difficulties in ramping up new technologies on such massive scales.

3. Selective technological optimism

The green jobs literature exhibits a selective technological optimism about favored technologies, but assumes no technological progress in disfavored ones. For example, the Mayors study asserted that "[t]he basic technology [for solar powered electricity generation] has existed for decades" while conceding that "widespread adoption has not occurred mostly because of high generation costs relative to fossil fuel-based power."[146] Similarly, one might note that the "basic technology" of landing people on the moon has existed for decades, but that commercial lunar tourism has failed to materialize because of high costs. What matters is technology at an affordable price.

While estimates about favored energy technologies are resolutely sunny or windy, predictions for conventional energy sources are dark and dreary. For example, the Mayors report estimates oil costs will be an average of $240 billion per year based on the consulting firm Global Insight's cost forecasts and "expectations for crude oil prices."[147] It asserts that this cost

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CELEBRITY, CLASS, POLITICS AND THE BATTLE FOR OUR ENERGY FUTURE ON NANTUCKET SOUND (2007). These rapid growth rates are assumed to be capable of transforming the economy at large as well. "[T]he creation of green employment in key parts of the economy has the potential to 'radiate' across large swaths of the economy, thus greening commensurately large sections of the total workforce. For example, providing clean energy supplies means that any economic activity has far less environmental impact than today, when fuels and electricity are still produced largely from dirty sources." UNEP, *supra* note 5, at 300.

[143] MAYORS, *supra* note 1, at 7.

[144] U.S. Dep't of Energy, NORTH DAKOTA WIND RESOURCE MAP, http://www.windpoweringamerica.gov/maps_template.asp?stateab=nd (last visited Feb. 21, 2009). Even a proposal by Stanford scientists for integrated wind farms capable of providing baseline electrical power would require more than a MWh of installed capacity per MWh of baseload capacity. Cristina L. Archer & Mark Z. Jacobson, *Supplying Baseload Power and Reducing Transmission Requirements by Interconnecting Wind Farms*, 46 J. APPLIED METEOROLOGY & CLIMATOLOGY 1701 (2007), *available at* http://www.stanford.edu/group/efmh/winds/aj07_jamc.pdf.

[145] *See* GE Wind Energy, LLC, NAT'L RENEWABLE ENERGY LABORATORY, REPORT NO. NREL/SR-500-38752, ADVANCED WIND TURBINE PROGRAM NEXT GENERATION TURBINE DEVELOPMENT PROJECT, (2006) (describing 7 year program to cut wind turbine generated electricity costs to $0.025/ kWh and inability to do so resorting to "high risk concepts" that were unmarketable).

[146] MAYORS, *supra* note 1, at 7. Astonishingly, just after conceding that photovoltaics are not yet in widespread use because of cost, the Mayors report asserts that "most areas receive enough sunlight for solar power to be economically viable." *Id.* at 7-8.

[147] *Id.* at 2

"acts very much as a tax on the U.S. economy." Indeed, it is worse than a tax the report explains–for the money flows out of the country–it is not spent domestically in areas such as health care, education, or infrastructure."[148] This is incorrect on multiple grounds. Not only is the form of fuel used to generate energy irrelevant to the buyer after controlling for cost, but making payments for solar energy is just as much a "tax" as oil.[149]

The optimism in the green jobs literature is so omnipresent that there is almost no bad news anywhere except related to fossil fuels. For example, air travel will be greatly reduced by proposed environmental restrictions, reducing employment in the airline industry.[150] Yet the report does not see this as a problem because we will have an increase in employment in the virtual conferencing services.[151] New farming techniques are needed – not a cost, but an opportunity for more USDA extension agents to teach farmers how to grow crops with fewer capital inputs.[152] This optimism extends to the quality of the jobs these policies will produce – despite the dominance of existing green job growth by green secretarial and janitorial positions[153]– green jobs advocates are quick to assure the public that green jobs are not just jobs, but good jobs that pay high wages.[154] Even the lower-paying green jobs are good ones because they "offer career ladders that can move low-paid workers into better employment positions over time."[155]

Where green means fewer jobs, green jobs proponents punt. For example, the UNEP report notes that data limitations prevent accurate calculations for the steel industry: "Steel industry employment data are incomplete and data collection for many aspects of this industry are still in its infancy in many developing countries. This limits the extent to which even rough green jobs calculations can be undertaken beyond the numbers suggested here."[156]

Wind power is greatly touted for green energy expansion, as good technology exists. However, the position of the U.S. in wind power is much like, but the reverse, of the position of China with respect to the U.S. Consider the iPod. The U.S. captures most of the economic value from iPods, but China gets the assembly work, which is little more than one percent of its retail

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[148] *Id.* at 3.

[149] The predicted oil prices look unrealistic in the Mayors' October 2008 report in light of the collapse of crude prices at the time of its publication. Mayors, *supra* note 1, at 2-3 ("forecasting an average outflow of $240 billion per year, measured in 2006 dollars, to pay for imported oil through the year 2030 …acts very much as a tax… worse than a tax…" Gas prices fell from an average of over $4 per gallon in July, 2008 to well under $2 per gallon in February, 2009. Mark Gongloff, *Falling Gas Prices May Be Gone As a Stimulus*, WALL ST. J. C1 (Feb. 12, 2009)

[150] UNEP, *supra* note 5, at 149 ("A climate-sensitive transportation policy will need to reduce the number of such short haul flights and encourage passengers to switch to high speed rail instead, which produces only a fraction of the emissions [of air travel].").

[151] *Id.* at 150 ("Business travelers account for a substantial share of flights. In addition to making considered choices as to the mode of transportation when traveling to conferences and business meetings, they may be able to shift to increasingly capable virtual-conferencing services when face-to-face meetings are not essential. Such services also offer business and employment opportunities in their own right.").

[152] *Id.* at 236 ("High-input farming has reduced both biological and genetic diversity, but farmers could be encouraged to rotate and diversify their crops—thus reducing the need for pesticides and fertilizers. Here, the employment implications are also positive. This kind of farming is knowledge intensive and requires research and extension systems 'that can generate and transfer knowledge and decision-making skills to farmers rather than provide blanket recommendations over large areas.' Developing the ecological literacy of farmers could, therefore, create significant employment.").

[153] Bezdek et al, *supra* note 100, at 69.

[154] *See, e.g.*, CAP, *supra* note 10, at 11 ("Green investments generate … significant numbers of well-paying jobs…"); *Id.* at 12 ("The average pay of the green investment program is about 14 percent higher than that for the industries associated with household consumption.")

[155] *Id.* at 11.

[156] UNEP, *supra* note 5, at 186.

value.[157] Wind turbines are much the same. The technology and patents are largely European. The United States imports most high-valued turbine parts. The largest maker, Vestas, is Danish, at about a quarter of the market. Gamesa from Spain and Enercon from Germany are next at about 15 percent of the market each. GE and Suzlon from India are next, but most of GE's components come from Europe. GE is not considered a strong player in the market, but is the only U.S. firm of significance in the production market.[158] Turbine technology is highly technical and not easy to replicate. Hence, most wind energy work in the U.S. consists of importing the key technology and performing the assembly work.[159]

We do have some evidence about how technology is changing. Hybrid electric-internal combustion vehicles are darlings of the environmental movement and their sales are growing, from 353,000 this year to a projected 578,000 in 2014.[160] A more efficient gasoline engine, using direct injection, will likely sell 5.1 million vehicles that same year, according to the same forecasting firm, up from 585,000 this year.[161] These engines can get up to 10 percent improved mileage at the fraction of the cost of a hybrid's 20 percent improvement.[162] Yet the green jobs forecasts rarely discuss the impact of such incremental improvements in existing technologies, relying instead on unknowable technological revolutions that will need to happen rapidly to expand the technologies they favor.

The selective technological optimism exhibited by the green jobs literature is evidence of important embedded assumptions within the literature. Before public resources are committed to promoting an economic vision based on these unstated assumptions, we must careful explore how realistic these assumptions are and how desirable policies based on them would be.

4. Unreliable underlying statistics

Estimates of future green jobs begin with estimates of existing green jobs. These estimates are problematic because they are based on opaquely calculated estimates by parties with an interest in the results, rather than more objectively and transparently calculated sources. For example, ASES estimates 16,000 jobs in wind turbine construction and maintenance in 2006 and 7,600 jobs in solar PV and solar thermal energy industries.[163] These numbers are derived from Bureau of Labor Statistics ("BLS") data using ASES's assumptions about how BLS categories

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[157] Hal R. Varian, *An iPod Has Global Value. Ask the (Many) Countries That Make It*, N.Y. TIMES, June 28, 2007, *available at* http://www.nytimes.com/2007/06/28/business/worldbusiness/28scene.html. The same is true of many "Made in China" products. A Chinese firm captured a trivial fraction of the market value for doing assembly work; the firms do not have the high-value technology.

[158] Market shares shift quickly; Chinese producers are expected to have a quarter of the market about 2009, but sales are likely to be domestic. Merrill Lynch, WIND TURBINE MANUFACTURERS; HERE COMES PRICING POWER (2007), *available at* http://www.ohiowind.org/InsideOWWG/ActionTeams/..%5C..%5Cpdfs%5CMerrill%20Lynch%20Wind%20Power%20Report1.pdf. Merrill Lynch predicted little entry into the industry despite growth. Interestingly, GE's wind business was acquired from Enron in its bankruptcy. *G.E. to Buy Enron Wind-Turbine Assets*, N.Y. TIMES, Apr. 12, 2002, at B2.

[159] Importing wind turbines is like importing oil; U.S. dollars go overseas. For a discussion of current wind market trends and events, *see* The "Who is Who" of Wind Energy, http://www.windfair.net/ (last visited Feb. 21, 2009).

[160] Matthew Dolan, *Gas Engines Get an Upgrade in Challenge to Hybrids*, WALL ST. J., Jan. 14, 2009, at B1. However, U.S. demand for the Prius fell as retail gas prices declined dramatically in 2008. Kate Linebaugh, *Toyota Delays Mississippi Prius Factory Amid Slump*, WALL ST. J., Dec. 16, 2008, at B1; Peter Haldis, *GM Cuts Production, Toyota Cancels U.S. Prius Production*, WORLD REFINING & FUELS TODAY, Dec. 16, 2008, at 6.

[161] Dolan, *supra* note 160.

[162] *Id.*

[163] ASES, *supra* note 2, at 24. The study states that the calculation is by ASES and its consultant, Management Information Services, Inc.

could be subdivided as BLS does not separately collect data on these industries.[164] The method of derivation is unclear. A similar problem lurks in the UNEP estimates of worldwide green jobs -- 2.3 million in renewables, 300,000 in wind, 170,000 in solar photovoltaics, and 600,000 in solar thermal.[165] These are not numbers collected by a neutral statistical agency, but are estimates by the Worldwatch Institute, which has not only a vested interest in the outcome but a record of historical inaccuracy with respect to its forecasts.[166] Although the reports all attempt to use official statistics, virtually every calculation depends at some point on estimates made by organizations interested in the outcome and are simply not objective, verified numbers on which to base an analysis.

Moreover, the calculations are not transparent, with little detail provided about how the estimates were created, the assumptions of any models used, or the review process that checked the results. Since there are internal consistency problems for at least some of the calculations visible from the estimates themselves, this omission is particularly serious. For example, the Mayors report notes that electricity generation in the U.S. in 2008 is likely to be 4.1 trillion kilowatt hours (TKW) and should rise to 5.4 TKW by 2038.[167] More electricity will be needed for millions of new homes and business operations, among other things. While all the new energy sources are being developed and constructed, the report also predicts enhanced efficiency in residential and commercial buildings that will produce a decline from 2.7 TKW power use in 2008 to 1.8 TKW use in 2038 (a 35 percent decline in use over 30 years).[168] Hence, in 2008, 66 percent of total power use is residential and commercial (2.7 out of 4.1 TKW); by 2038 only 33 percent will be residential and commercial (1.8 out of 5.4 TKW). That means a doubling of total electricity usage, as a share of the total, in non-residential and non-commercial sectors by 2038. Trillions of kilowatt hours are missing from their analysis of the 2038 estimates, yet there is no explanation of where those kilowatts are going.

Further, existing green jobs are often the result of subsidy programs, not success in the marketplace. For example, the "success" of ethanol and biodiesel programs in the United States is presented as an indication of the potential for green jobs. The Mayors report notes that "[b]oth ethanol and biodiesel production are growing rapidly in the United States, with heavy investment in both types of facilities in recent years."[169] Similarly, renewable energy sources are currently heavily subsidized by the Federal government. This is particularly true in terms of the amount of subsidy per unit of production for wind and solar, as Table 2 indicates.

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[164] Bastian, *supra* note 90, at 38.

[165] UNEP, *supra* note 5, at 295.

[166] *See supra* note 7.

[167] MAYORS, *supra* note 1, at 12.

[168] *Id.* at 15.

[169] *Id.* at 11.

Table 2 - Subsidies and Support to Electricity Production.[170]

Fuel/End Use	FY 2007 Net Generation (billion Kwh)	FY 2007 Subsidy and support (million 2007 $)	Subsidy and support per unit of production (2007 $/ Mwh)
Coal	1,946	854	0.44
Refined Coal	72	2,156	29.81
Natural Gas and Petroleum Liquids	919	227	0.25
Nuclear	794	1,267	1.59
Biomass and biofuels	*40*	*36*	*0.89*
Geothermal	*15*	*14*	*0.92*
Hydroelectric	*258*	*174*	*0.67*
Solar	*1*	*14*	*24.34*
Wind	*31*	*724*	*23.37*
Landfill Gas	*6*	*8*	*1.37*
Municipal Solid Waste	*9*	*1*	*0.13*
Unallocated Renewals	*NM*	*37*	*NM*
Renewables (subtotal)	360	1,008	2.8
Transmission and distribution	NM	1,235	NM
"Total	4,091	6,747	1.65

The response to subsidies is not indicative of the response to actual market conditions, making these numbers suspect as a basis for predicting market behavior. Further, the information available from the subsidized firms is itself questionable, since these firms have an incentive to report success to ensure their subsidies continue.[171]

Bias toward large numbers is embedded in the sources cited by the reports as well. For example, the UNEP cites as the basis for its calculations:

- forecasts from "Clean Edge," which it describes as a "U.S.-based research and advocacy

[170] Energy Info. Admin., U.S. Dep't of Energy, REPORT NO. SR/CNEAF/2008-01, FEDERAL FINANCIAL INTERVENTIONS AND SUBSIDIES IN ENERGY MARKETS 2007, at xviii tbl.ES6 (2008), *available at* http://www.eia.doe.gov/oiaf/servicerpt/subsidy2/pdf/subsidy08.pdf. Unallocated renewables include projects funded under Clean Renewable Energy Bonds and the Renewable. NM = not meaningful. The average U.S. electricity price was about $53 per Mwh at the wholesale level in 2006 and about $92 per Mwh to end users in all sectors in FY 2007

[171] John Ferak, *Ethanol Towns Also on Idle*, OMAHA WORLD-HERALD, Jan. 30, 2009, at 01D. Venita Jenkins, *Plans for Ethanol Plant Likely to Be Scrapped*, FAYETTEVILLE OBSERVER, Jan. 31, 2009. *But see* Tom LoBianco & Edward Felker, *Ethanol Producers Aim to Lift Cap on 10% as Gas Additive*, WASHINGTON TIMES, Feb. 4, 2009, at A01, *available at* http://www.washingtontimes.com/news/2009/feb/04/ethanol-industry-wants-10-per-gallon-of-gas-limit-/.

group;"[172]

- a study by the "Blue-Green Alliance (a joint effort of the Sierra Club and the United Steelworkers union)" showing 820,000 jobs possible from renewable energy investments;[173]
- a report by the "Apollo Alliance"[174] that showed 420,000 jobs from a 10-year, $36 billion investment;[175]
- a study by the California Public Interest Group (CALPIRG) Charitable Trust that suggested demand in California could support 5,900 MW of renewable energy producing 28,000 person-years of work in construction jobs and 3,000 permanent operations jobs and 120,000 person-years of maintenance work;[176]
- Environment California Research and Policy Center's estimate of creating 200,000 person years of work, with more than a third from exports;[177]
- the Solar Initiative of New York estimates of 3,000 direct installation jobs and 10,000 "manufacturing and integration jobs" in New York from 2000 MW of solar power;[178] and
- a Union of Concerned Scientists study showing 185,000 jobs by mandating 20% of demand be satisfied by renewables.[179]

All of these sources are from organizations with strong interests in the outcomes. Such interests do not mean that these groups necessarily do bad work but they do mean that such estimates must be treated with caution.

These flaws are difficult to detect because the studies generally do not address alternatives to their proposals.[180] Also troubling is the tendency to assume results by using highly controversial

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[172] UNEP, *supra* note 5, at 94, 99. Ron Pernick and Joel Makower. HARNESSING SAN FRANCISCO'S CLEAN-TECH FUTURE: A PROGRESS REPORT. Clean Edge, Inc. (2005).

[173] *Id.* at 99. The Renewable Energy Policy Project published several reports (available at http://www.repp.org/) which collectively found that " 820,000 new good-paying manufacturing jobs could be created across the country." http://www.sierraclub.org/energy/bluegreenjobs/.

[174] The Apollo Alliance is "a coalition of business, labor, environmental, and community leaders working to catalyze a clean energy revolution in America to reduce our nation's dependence on foreign oil, cut the carbon emissions that are destabilizing our climate, and expand opportunities for American businesses and workers." Apollo Alliance, *Our Mission*, http://apolloalliance.org/about/mission/ (last visited Feb. 21, 2009). Its funding appears to be substantially based on left wing foundations and labor organizations. *See* Apollo Alliance, Funders, http://apolloalliance.org/about/funders/ (last visited Feb. 21, 2009).

[175] UNEP, *supra* note 5, at 99; NEW ENERGY FOR AMERICA: THE APOLLO JOBS REPORT: FOR GOOD JOBS & ENERGY INDEPENDENCE 16-17 (2004). (Investment in renewable energy markets and biofuels development yields expected to yield 419,042 jobs over ten years.) Available at http://apolloalliance.org/downloads/resources_ApolloReport_022404_122748.pdf. *See also* Jay Inslee, APOLLO'S FIRE: IGNITING AMERICA'S CLEAN-ENERGY ECONOMY (2008).

[176] UNEP, *supra* note 5, at 100. Brad Heavnor and Susannah Churchill, RENEWABLES WORK: JOB GROWTH FROM RENEWABLE ENERGY DEVELOPMENT IN CALIFORNIA, CALPIRG Charitable Trust at 2 (2002).

[177] UNEP, *supra* note 5, at 100. Peter Asmus, HARVESTING CALIFORNIA'S RENEWABLE ENERGY RESOURCES: A GREEN JOBS BUSINESS Plan, Center for Energy Efficiency and Renewable Technologies at 14 (2008) available at http://www.ceert.org/reports_pdf/Harvesting_California_Renewable_Energy_Resources_080815_FINAL_1st_Ed.pdf (last visited March 12, 2009).

[178] UNEP, *supra* note 5, at 100. NEW YORK'S SOLAR ROADMAP: A PLAN FOR ENERGY RELIABILITY, SECURITY, ENVIRONMENTAL RESPONSIBILITY AND ECONOMIC DEVELOPMENT IN NEW YORK STATE at 2 (2007).

[179] UNEP, *supra* note 5, at 100. Union of Concerned Scientists, CASHING IN ON CLEAN ENERGY, July, 2007, http://www.ucsusa.org/news/press_release/new-report-shows-economic-0046.html ("[A] 20% national renewable electricity standard would generate more than 185,000 renewable energy jobs nationally by 2020 in manufacturing, construction and other industries." The UUC released an updated report in October, 2007, assuming a 15% standard. http://www.ucsusa.org/clean_energy/solutions/renewable_energy_solutions/cashing-in-on-clean-energy-a.html

[180] CAP's estimates are notable for its efforts to compare the impact of spending on green jobs to alternatives. More studies should attempt something similar. CAP also benchmarked its proposal against the February 2008 "stimulus" package, which simply gave consumers some additional cash. Economic Stimulus Act of 2008, Pub. L. No. 110-185, 122 Stat. 613, *available at*

assumptions to drive up the numbers of green jobs. For example, the Mayors report simply states that "we assume 40% of electricity generated in the United States [in 2030] must come from alternative resources. Qualifying alternative resources are wind, solar, geothermal, biomass and incremental hydropower."[181] The Mayors report's predicted percentages, based on linear projections,[182] differ dramatically from the Energy Information Administration's reference case for power sources, as Table 3 illustrates.[183] To take just one example, the Conference of Mayors' estimate of wind power's predicted share is 500 percent larger than the EIA's prediction.

Table 3 - Variations in Energy Projections

	Mayors	Energy Information Administration (EIA)	Difference: Mayors/EIA
Solar	8%	< 1%[184]	>800%
Wind	12%	2.4%	+500%
Biomass	12%	3.2%	+275%
Geothermal	4%	0.6%	+667%
Incremental Hydropower	4%	-1.3%[185]	+>500%
Coal	60%	54%	-30%
Natural Gas		14%	
Nuclear		18%	

Similarly, the Mayors report simply assumes that ethanol and biodiesel will provide 29 percent of transportation fuels for cars and light trucks by 2029.[186] Compare this assumption to the Energy Information Administration's estimate of 11 percent for light duty vehicles in

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http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_public_laws&docid=f:publ185.110.pdf. While we applaud the effort to benchmark, PERI's specific benchmark is deeply flawed. CAP compared spending $100 billion on "new oil and gas subsidies and subsidizing gasoline and oil prices" to green investments. CAP, *supra* note 10, at 10. But what CAP has done is convert a positive (the high efficiency of the domestic oil and gas industries) into a negative. "Relative to spending within the oil industry, the green investment program utilizes far more of its overall $100 billion in spending on hiring people, and less on purchasing machines and supplies." *Id.*at 11. CAP concedes that this is "the primary reason" why its proposal creates more jobs than the artificial alternatives it uses as benchmarks. *Id.* Of course any program that spends more on labor will hire more labor than will a program that spends less on labor. Dressing this up in a "model" is merely engaging in scientific mumbo-jumbo.

[181] MAYORS, *supra* note 1, at 12.

[182] *Id.* at 13.

[183] Energy Info. Admin., U.S. Dep't of Energy, REPORT NO. DOE/EIA-0384(2007), ANNUAL ENERGY REVIEW 2007, at 68-71 (2008), *available at* http://www.eia.doe.gov/aer/pdf/aer.pdf [hereinafter EIA ANNUAL].

[184] EIA projects that "Solar technologies in general remain too costly for grid-connected applications, but demonstration programs and State policies support some growth in central-station solar PV, and small-scale customer sited PV applications grow rapidly." *Id.* at 70. As a result, "Consumption of nonmarketed solar, geothermal, and wind energy also increases dramatically in the projections; however, it continues to account for less than 1 percent of all delivered energy use in the residential and commercial sectors." *Id.* at 58.

[185] EIA projects that hydropower will decline from 7.1 percent of capacity in 2006 to 5.8percent in 2030 because "environmental concerns and the scarcity of untapped large-scale sites limit its growth." *Id.* at 71.

[186] MAYORS, *supra* note 1, at 16.

2030.[187]

The data used as the basis for green jobs estimates are thus of questionable value. Some come from interest groups, some are derived by opaque methods, and some are simply of unclear origin. Before undertaking billions in public spending on green jobs initiatives, we need better data.

5. False precision masking large variations across estimates

How many green jobs are there or could there be? The estimates vary considerably. The ASES report claims that they are not something simply on the horizon but here now, claiming that in 2006 there were 8.5 million direct and indirect jobs in renewable energy and energy efficiency.[188] Even more green jobs are on the horizon. With no change in policy, by 2030, ASES asserts that 16.3 million jobs will be attributed to renewable energy and energy efficiency. With ASES' favored policies, it claims 40.1 million jobs (one in four in the nation) will be attributable to those categories by 2030.[189]

The CAP report contends that a "green economic recovery program" -- which should be kicked off with $100 billion new federal spending for solar and wind power, biofuels, smart electric grid, mass transit, and building retrofitting -- will lower unemployment around the country by more than one percentage point by creating two million jobs.[190] The asserted result will be lower energy costs and more jobs. Each state will get its share of these new green jobs, according to CAP. For example, under the plan envisioned by CAP, Missouri would receive $1.8 billion and New Mexico would receive $599.9 million. The unemployment rate in Oregon would fall from 5.5 percent to 4.1 percent and in North Dakota from 3.6 percent to 2.5 percent.[191]

Not to be outdone, the Mayors report provides even more job details. However, while the ASES report claims 8.5 million green jobs exist already, the Mayors report finds only 751,051 to exist.[192] Give or take 7.75 million existing green jobs, the Mayors plan to force development of renewable energy sources and energy-efficiency programs that would add 2.5 million new green jobs by 2018 and greater numbers in the years after that.[193] According to the Mayor's calculations, everyone will share in the new green jobs. By 2038, Santa Barbara, California, will have 6,145 new jobs; Vero Beach, Florida, will have 719 new jobs; Portland, Maine, will have 6,145 new jobs; and Corpus Christi, Texas, will have 5,178 new jobs. The numbers are provided city by city.[194]

The UNEP report does not provide estimates of green jobs specifically for the United States and acknowledges that green job counts differ significantly.[195] But it estimates that by

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[187] EIA ANNUAL, *supra* note 183, at 4.

[188] ASES, *supra* note 2, at vii.

[189] ASES, *supra* note 2, at 7.

[190] CAP, *supra* note 10, at 1. How much of the stimulus packages is asserted to be for this purpose?

[191] *Id.* at 27.

[192] MAYORS, *supra* note 1, at 5.

[193] *Id.* at 17.

[194] *Id.* at 20-33. This is, of course, impossible unless Congress is going to order a freeze in the location of workers and economic activity, something the report does not mention. The notion that green jobs will be spread evenly in proportion to the existing population is rhetoric to generate political support for the agenda from every burg in the country. Americans are highly mobile; some locations are shrinking and others are growing. *See, e.g.*, Richard Florida, THE RISE OF THE CREATIVE CLASS (2002).

[195] UNEP, *supra* note 5, at 17 ("Different methodologies in tallying employment, plus different approaches and diverging labor intensities in materials collection and recovery, make it almost impossible to compare countries across the world or to compute a

2030, worldwide there could be 2.1 million new jobs in wind energy, 6.3 million in solar, and 12 million in biofuels.[196]

As demonstrated here, despite the seeming precision of each of the estimates, the total green job count varies a great deal across the literature. Compare just the different estimates of the impact of a 20 percent renewable energy production mandate by 2020 made by different sources. The Union of Concerned Scientists estimated in 2004 that 355,390 jobs would be created by 2020 by such a requirement.[197] Such production would eliminate 197,910 jobs in the fossil fuel sector, for a net increase of 157,480 jobs.[198] Not only would net employment be created, but electricity and natural gas prices would drop, saving consumers $49.1 billion a year by 2020.[199] But things change quickly; three years later the same group estimated that the 20 percent renewable energy standard for 2020 would create a net increase of 120,000 jobs and result in annual consumer savings of $10.5 billion by 2020.[200] In contrast, a 2004 study from the University of California at Berkeley estimated that a 20 percent renewable energy policy for 2020 would produce a new increase in employment between 77,300 and 101,649 jobs depending on the mix of biomass, wind, and solar sources.[201] The authors of that study noted that a 2001 study published by the World Wide Fund for Nature estimated a net increase in employment from a 15 percent renewable energy by 2020 policy would result in a net increase in energy employment of 1,314,000.[202] A U.S. Department of Energy report estimated that, should the United States adopt a policy of achieving 20 percent electricity from wind generation, the result would be the creation of an average annual of 73,000 jobs between 2007 and 2030. The job measurement technique used in the report is the standard input-output analysis using multipliers.[203]

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reliable global total" in recycling); 36 ("different approaches result in findings that cannot simply be aggregated or extrapolated.")

[196] UNEP, *supra* note 5, at 8.

[197] Union of Concerned Scientists, RENEWING AMERICA'S ECONOMY: A 20 PERCENT NATIONAL RENEWABLE ELECTRICITY STANDARD WILL CREATE JOBS AND SAVE CONSUMERS MONEY 1 (2004), *available at* http://www.ucsusa.org/assets/documents/clean_energy/ACFoDbPiL.pdf.

[198] *Id.* at 1.

[199] *Id.* at 2.

[200] Union of Concerned Scientists, CASHING IN ON CLEAN ENERGY: A NATIONAL RENEWABLE ELECTRICITY STANDARD WILL BENEFIT THE ECONOMY AND THE ENVIRONMENT 1, 2 (2007), *available at* http://www.ucsusa.org/assets/documents/clean_energy/cashing-in-national.pdf.

[201] Daniel M. Kammen, Kamal Kapadia & Matthias Fripp, *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?*, RAEL REPORT, UNIV. CAL., BERKELEY 11 (2006), *available at* http://rael.berkeley.edu/old-site/renewables.jobs.2006.pdf.

[202] *Id.* at 15. A 2002 paper from the University of Illinois estimated that 200,000 new jobs would be created in a 10-state Midwest region by 2020 if there was a push for wind and biomass energy. Bezdek et al., *supra* note 100, at 66. Another 2002 study estimated that steady increases in energy efficiency and reductions in carbon emissions would produce an additional 660,000 net jobs by 2010 and 1.4 million net new jobs by 2020. *Id.* A 2004 study estimated that annual investments of $30 billion a year for ten years in renewable energy, energy efficient buildings and other infrastructure improvements would produce more than 3.3 million jobs and stimulate a $1.4 trillion increase in GDP. *Id.*

[203] The "direct impact" jobs would be in construction and manufacturing. Those jobs would support 66,000 more jobs by "indirect impacts" and 120,000 jobs by "induced impacts," for a total of 259,000 jobs per year. DOE, 20% WIND, *supra* note 112, at 205. The cumulative impact over 23 years is estimated to be $944 billion with a net present value of $358 billion. *Id.* That is similar to the job multiplier of 2.5 presumed for geothermal energy projects. *See* Cedric N. Hance, Geothermal Energy Ass'n, GEOTHERMAL INDUSTRY EMPLOYMENT: SURVEY RESULTS & ANALYSIS 7 (2005), *available at* http://www.geo-energy.org/publications/reports.asp. That is, each job created in the production and construction of wind turbines and related equipment would result in an additional 2.5 jobs. The indirect impact jobs are "in and payments made to supporting businesses, such as bankers financing the construction, contractors, and equipment suppliers;" induced impact jobs "result from the spending

These varying estimates – a range from 77,300 to 1,314,000 – suggest that the calculation of green job estimates has a long way to go before the figures are reliable and, thus replicable. This is an immensely complex matter oversimplified by assertions such as the Mayors report's prediction of 291 new green jobs in Pine Bluff, Arkansas by 2038.[204] The difficulty in making such detailed projections is magnified by the ongoing creation and destruction of jobs as part of the normal evolution of the economy.[205]

6. Summary: unreliable forecasts

As political literature, the green jobs reports are masterpieces. They provide what on the surface appears to be scientific statistical backing for their recommendations, add an impressive array of tables and charts, and throw out remarkably precise numbers in their forecasts. The most egregious in this regard is the Conference of Mayors report, which provides detailed breakdowns of potential green employment for every town in the United States. The problems with the numbers underlying this seeming precision are immense. Taken as a whole, they make the forecasts in the green jobs literature an unreliable basis for policy making. We next turn to the problematic nature of the method of analysis applied to the statistics.

D. The inappropriate use of input-output analysis

While cost discussions tend to be thin, a common thread among advocates of renewable energy and related programs is that they will create new jobs. No doubt that promise has political appeal to help generate support from voters who hear that the programs will create clean energy and many new employment opportunities. Who can be opposed to jobs, especially green jobs? A significant problem is that the predictions are derived from an inappropriate technique. Using a forecasting methodology whose assumptions are not met by the conditions the green jobs itself assumes exist, renders the results unbelievable.

As we have seen, a standard claim by those advocating for green jobs is that the green programs will have an even larger impact than it would appear at first blush because of the additional jobs and other benefits created. This claim rests on "economic multiplier" analysis. Economic multipliers are familiar in the applied policy literature, having been used to advocate for public subsidies for industries,[206] sports stadiums,[207] higher education,[208] and other spending programs. Multipliers are based on the idea that an increase in activity by one firm will lead to an increase in activity by other firms and employees that receive payment from the first. The contractor for a new football stadium buys concrete, the concrete subcontractor buys new tires

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by people directly and indirectly supported by the project, including benefits to grocery store clerks, retail salespeople, and child care providers." DOE, 20% WIND, *supra* note 112, at 202.

[204] MAYORS, *supra* note 1, at 20.

[205] A study of 34 metropolitan areas found that during a three-year period the average job loss was 20.5 percent, with a minimum of 13.3 percent. The net employment change over that period ranged from a low of -8.2 percent to a high of 19.4 percent, with an average of 6.0 percent. Randall W. Eberts & Joe Allan Stone, WAGE AND EMPLOYMENT ADJUSTMENT IN LOCAL LABOR MARKETS tbl.2.3 (1992).

[206] Douglas P. Woodward & Paulo Guimarães, BMW IN SOUTH CAROLINA: THE ECONOMIC IMPACT OF A LEADING SUSTAINABLE ENTERPRISE 9 (2008), *available at* http://mooreschool.sc.edu/export/sites/default/moore/research/presentstudy/bmw/BMWReportSept2008.pdf.

[207] A critical review of the literature along with case studies of specific cities is provided in Roger Noll & Andrew Zimbalist (eds.), SPORTS, JOBS, AND TAXES: THE ECONOMIC IMPACT OF SPORTS TEAMS AND STADIUMS (1997) [hereinafter Noll & Zimbalist].

[208] John J. Siegfried et al., *The Economic Impact of Colleges and Universities*, CHANGE, Mar./Apr. 2008, at 24, *available at* http://www.carnegiefoundation.org/change/sub.asp?key=98&subkey=2552. The authors reviewed 138 college economic-impact studies completed since 1992 and concluded that they are "public-relations documents masquerading as serious economic analysis." One report on higher education in Michigan asserted that every dollar of state money spent on public universities generated $26 of economic impact. Not many investments yield a 2,600 percent rate of return!

for its trucks, all the firms' workers go out to dinner, and so forth. There are several standard models of how these interactions promulgate through the economy.[209]

A fundamental question about these models is whether the multiplier is actually greater than zero. To see why this is a question, consider an economy at full employment. In such an economy, an increase in jobs in one industry must be offset by a decrease in jobs in another industry, so the multiplier equals zero. Of course, in the actual economy there are unused and underused resources. If investment that results in green jobs also induces some of these unused or underused resources to be put to good or higher-value use, then there could be an indirect effect that adds to the benefit.[210] Since the degree of unused resources varies with economic conditions, analyses using multipliers should include forecasts under a range of economic conditions. None of the green jobs analyses do so. Indeed, as U.S. economic conditions have changed dramatically over the past few years, what is most striking about the green jobs literature is that its predictions have remained constant.

In practice, multipliers are difficult to observe, and it is impossible to know them in advance. Therefore, they must be estimated by indirect means. The typical approach to constructing a multiplier is a technique known as "input-output analysis." This approach connects the ultimate destination of various products to their required components, and allows estimates of the increased economic activity in multiple sectors induced by an increase in activity in a single area, such as green energy.[211] In input-output analysis

> the structure of each sector's production process is represented by an appropriately defined vector of structural coefficients that describes in quantitative terms the relationship between the inputs it absorbs and the output it produces. The interdependence among the sectors of the given economy is described by a set of linear equations expressing the balances between the total input and the aggregate output of each commodity and service produced and used in the course of one or several periods of time.[212]

The vectors are calculated using data on various industries, thus making some of the problems with data on green jobs we pointed to earlier important, combined into a single representation of the economy being studied in a "matrix of technical input-output coefficients of all its sectors."[213]

Input-output analysis rests on two important assumptions. The first assumption is

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[209] A relatively transparent example of the use of such a model (IMPLAN) in the context of green jobs is found in S. Tegen, M. Milligan & M. Goldberg, NAT'L RENEWABLE ENERGY LABORATORY CONFERENCE PAPER NO. NREL/CP-500-41808, ECONOMIC DEVELOPMENT IMPACTS OF WIND POWER: A COMPARATIVE ANALYSIS OF IMPACTS WITHIN THE WESTERN GOVERNORS' ASSOCIATION STATES (2007). A literature review by staff of the International Monetary Fund provides both theoretical and empirical reasons to expect multipliers of various magnitudes. They conclude that multipliers will be larger and positive when increased government spending does not substitute for private spending, when it enhances the productivity of labor and capital, and government debt is low. When these conditions do not obtain, the multiplier will be smaller and perhaps even negative. *See* Richard Hemming, Michael Kell, and Selma Mahfouz, *The Effectiveness of Fiscal Policy in Stimulating Economic Activity: A Review of the Literature*, IMF Working Paper WP/02/208 (2002) at 35.

[210] Robert J. Barro, *Government Spending is No Free Lunch*, WALL ST. J., Jan. 22, 2009, *available at* http://online.wsj.com/article/SB123258618204604599.html (arguing that a multiplier of 0.8 is an upper bound for the impact of government spending).

[211] *See, e.g.*, Wassily Leontief, INPUT-OUTPUT ECONOMICS (2d ed. 1986).

[212] *Id.*, at 19.

[213] *Id.*

constant coefficients production. In other words, the ratio of outputs to inputs is constant regardless of the scale of production or the time period. This assumption removes the possibility that inputs may be substituted for each other, either because of technical progress or because of changes in factor prices.[214] A typical assumption would be that if a dollar of energy was required to produce ten dollars of steel at the time the input-output table was created, the same would be true in the future. Of course, if the price of energy increases, the relation is likely to change as has been the case with steel.[215] Higher energy prices would induce steel producers to change production techniques to reduce the amount of energy used per unit of steel. Even if that is not possible, it is not likely that the producer can fully pass along all of the increased energy costs to customers,[216] so that the ratio of energy cost to steel cost would change.

The assumption of constant coefficients production is particularly problematic in industries whose existence and growth are based on the expectation of both rapid technological progress that will enable changes in the needed inputs in various sectors of the economy and significant increases in energy costs. Since green jobs proponents are advocating precisely such a change, input-output analysis is particularly inappropriate for use in estimating green jobs.

The second assumption on which input-output analysis rests is constant factor prices. This assumption was implicit in the lack of factor substitution already discussed, but it has an explicit role in the implementation of input-output analysis. In most cases, the relation between inputs and outputs is calculated using dollar values rather than physical quantities.[217] This approach is only valid if the physical quantities and the monetary values have a constant ratio. In other words, prices must be fixed. That is unlikely to be the case with respect to green jobs estimates. One of the underlying justifications offered for supporting green technology is that oil and coal will become more expensive, either for technological reasons or because of a tax based on carbon dioxide emissions.[218] Because of the pervasive role that energy plays, these types of changes will alter factor prices throughout the economy, making the input-output analysis invalid. The role of oil as a non-energy input into production of many materials such as plastic means that any changes in the price of oil must have a direct impact on prices beyond the induced effect on the price of energy. Again, green job estimates are precisely the sort of analysis where input-output analysis is inappropriate.[219]

Suppose that we have overcome the difficulties in the kinds of data necessary to create a good multiplier. In general, targeting subsidies to a particular area or industry, as the green jobs literature advocates, has not been supported by peer reviewed analysis. A survey of the evidence concluded "targeting is based on poor data, unsound social science methods, and faulty economic reasoning and is largely a political activity."[220] Subsidy policies are driven more by

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[214] Tegen, Milligan & Goldberg, *supra* note 209, at 9-10.

[215] *See* notes 351 to 353 *infra* and associated text.

[216] The ability to cost shift depends on relative elasticities of supply and demand. Harvey Rosen, PUBLIC FINANCE 283 (6th ed. 2002).

[217] Leontief, *supra* note 211, at 14 ("In the case of a particular industry, we can easily compute the complete table of its input requirements at any given level of output, provided we know its input ratios. By the same token, with somewhat more involved computation, we can construct synthetically a complete input-output table for the entire economy.")

[218] *See, e.g.*, UNEP, *supra* note 5, at 92.

[219] Leontief, *supra* note 211, at 165 ("Each sector or industry thus has its own 'cooking recipe.' The recipe is determined in the main by technology; in a real economy it changes slowly over the periods of time usually involved in economic forecasting and planning.")

[220] Terry Buss, *The Case Against Targeted Industry Strategies*, 13 ECON. DEV. Q. 339, 339 (1999). In a fundamental contribution to the literature, Prof. Paul Courant outlined conditions under which subsidies can be theoretically justified: If (1) the economy exhibits diminishing marginal returns to factors, (2) taxes on mobile factors are levied on the benefit principle, (3) there is no

concerns about redistribution – a political issue – than by a true concern about enhancing economic efficiency.[221] The next question is to what that multiplier should be applied. The green jobs literature's approach is to apply the multiplier to the gross amount of jobs in the green energy sector.[222] However, this is likely to be an overestimate for two reasons: (1) the use of gross rather than net jobs and (2) the failure to account for deadweight losses.[223]

The deadweight loss problem is also serious as it reveals that the green jobs literature also incorrectly treats the financing of the billions it advocates spending. Many of the green jobs reports start with the assumption that spending public money is the best method to induce additional economic activity. But that spending must be paid for, in some fashion, by higher taxes now or in the future. Because people engage in activities to avoid taxation, the cost of the tax exceeds the revenue yielded by the tax, a phenomenon known as deadweight loss.[224] Including deadweight loss in the analysis will reduce the net benefit to which any multiplier

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non-frictional unemployment, and (4) the costs of local economic development are locally borne. Otherwise, any policy that subsidizes politically-favored business activities must reduce welfare in the economy. Paul Courant, *How Would You Know a Good Economic Development Policy If You Tripped Over One? Hint: Don't Just Count Jobs*, 47 NAT'L TAX J. 863, 867 (1994). In practice, one or more of these conditions is almost always violated.

[221] The emphasis on efficiency is not only theoretically justified but empirically validated. After surveying the literature, one influential researcher concludes, "Although there is uncertainty in current research, I would argue that we do know some useful things: tax incentives for economic development are not self financing, but have significant costs per job created; some programs that promote productivity appear to be effective." Timothy J. Bartik, *Jobs, Productivity, and Local Economic Development*, 47 NAT'L TAX J. 847, 852, 859 (1994).

[222] This is the approach taken in the three of the four studies that we most closely analyze and which estimate induced employment resulting from green jobs. *See* CAP, *supra* note 10, at 24-26; MAYORS, *supra* note 1, at 12-17; and ASES, *supra* note 2, at 30, 39, 46.

[223] Theoretically, the efficiency of employment "subsidy schemes is questioned because of the existence of non-additional employment and deadweight spending." Pierre M. Picard, *Job Additionality and Deadweight Spending in Perfectly Competitive Industries: The Case of Optimal Employment Subsidies*, 79 J. PUBLIC FIN. 521, 522 (2001). There is an additional technical flaw in much of the economic development literature, from which the green jobs literature also suffers. The discussion assumes that jobs are an unmitigated benefit, so that all of the wages should be considered as a net increase. In practice, there are unpleasant aspects to work, so that only the wages above some reservation amount should truly be considered an increment to welfare. Courant, *supra* note 220, at 872; Noll & Zimbalist, *supra* note 207, at 61 75. They go on to provide an example of incorrect analysis leading to vast overestimate of impact. *Id.* at 497-498; *see also* William T. Bogart, DON'T CALL IT SPRAWL: METROPOLITAN STRUCTURE IN THE TWENTY-FIRST CENTURY 107 (2006) (on example of economic impact of new Cowboys stadium in Arlington not acknowledging spillovers from existing Cowboys stadium in Irving).

[224] A textbook exposition of deadweight loss can be found in Harvey Rosen & Ted Gayer, PUBLIC FINANCE (8th ed. 2008). *See also* David Bradford, UNTANGLING THE INCOME TAX 135 (1986) (defining deadweight loss as "the effective waste of purchasing power owing to the distorting effects arising from the effort to avoid tax"). Because these effects are typically unobserved, their existence is sometimes doubted. Bradford illustrates the concept by hypothesizing a $1 million per pack tax on cigarettes. Such a tax would collect very little revenue – probably zero. Thus, the tax would seem to have no impact. However, there is the lost pleasure of law-abiding smokers who no longer can obtain cigarettes. There might also be considerable activity by private citizens raising and curing tobacco for their own use, all stimulated as a result of this measure. Another example is the result of the imposition of a door and window tax in France during the French Revolution and maintained until 1917. "Its originator must have reasoned that the number of windows and doors in a dwelling was proportional to the dwelling's size. Thus a tax assessor need not enter the house or measure it but merely count the doors and windows. As a simple, workable formula, it was a brilliant stroke, but it was not without consequences. Peasant dwellings were subsequently designed or renovated with the formula in mind so as to have as few openings as possible. While the fiscal losses could be recouped by raising the tax per opening, the long-term effects on the health of the rural population lasted for more than a century." James C. Scott, SEEING LIKE A STATE: HOW CERTAIN SCHEMES TO IMPROVE THE HUMAN CONDITION HAVE FAILED 47-48 (1999).

Subsidies, too, can have a deadweight loss as people alter their behavior to become eligible for the subsidy. James Sallee, *The Incidence of Tax Incentives for Hybrid Vehicles* (Harris School, University of Chicago, Working Paper No. 08.16, 2008), *available at* http://harrisschool.uchicago.edu/About/publications/working-papers/pdf/wp_08_16.pdf (showing that the imposition and expiration of tax incentives for purchase of hybrid vehicles led to the delay (waiting for imposition) or acceleration (prior to expiration) of purchases of Toyota Prius automobiles). A more recent example of behavior modification was the rush of financial institutions to be classified as banks and thereby become eligible for bailout funds.

should be applied.[225] The green jobs literature does not incorporate estimates of deadweight losses into their analyses and so does not provide net jobs calculations.

The net jobs problem is a serious one. The issue is jobs that would have been created had a subsidy not caused resources and jobs to be shifted elsewhere. "For example, construction jobs are touted as new jobs in targeting—say—an industrial park. But they are not; these construction workers would have been working on other projects if not reallocated to an industrial park by subsidies."[226] The proper measure is not total jobs that exist in an area receiving a subsidy but additional *net* new employment—jobs that would not otherwise have existed.

This will be a problem here because green jobs are substitutes for other jobs. An increase in electricity generation from wind, solar, or other sources will substitute for energy from, say, coal-fired generation, which in turn will reduce employment in coal mining and processing. The net impact on employment (before the multiplier) will depend on the relative labor intensity of energy production in the respective sectors at the margin of added or subtracted production.

Ignoring these issues renders the input-output analyses unconvincing. For example, studies that looked at jobs that were due to non-additional employment or deadweight spending in other government projects, out of the total employment in a subsidized area, found that between 40 and 90 percent of the jobs should be classified as simply displacing existing jobs.[227] That is, only between 10 and 60 percent of the jobs that the reports claimed to have been created by a subsidy actually could be classified as jobs that might not otherwise have existed.

Even that measure does not consider the opportunity cost of the subsidy. Where else in the economy could the funds have been used more efficiently? The measure used here only concerns jobs that would have existed anyway, but were falsely attributed to the subsidy, and to "windfall gains" captured by firms that received subsidies. Studies of the job creation resulting from public projects have shown that the job creation that results often is of dubious value, because the cost-per-job-created is high. For example, Camden Yards, the Baltimore Orioles stadium, was billed as a job creating project.[228] However, the estimated cost per job created was $127,000.[229] Similarly, in France one study noted that subsidies for the French fishing fleet were commonly justified by job "multipliers in the range of 3-5 jobs per seaman" but detailed analysis showed that only 1.4 to 1.5 on-shore jobs existed for every fishing fleet job.[230]

Even that more reasonable estimate does not get to the matter of the cost imposed on the economy as a whole by subsidizing a job with low economic value. To keep the fleet afloat, resources are sucked from the pockets of every French taxpayer; money that they could have spent on higher-valued goods and services of their own choosing and so created jobs in suppliers

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[225] A counterargument might be that the public investment represents money allocated from another source, so that the total tax revenue does not go up. However, the reduced spending in the other area would have multiplier impacts that could mitigate the multiplier effects of increased spending on green energy. Whether the source of the subsidy is higher taxes or altered government spending, there is a cost that reduces any net positive impact.

[226] Buss, *supra* note 220, at 347.

[227] Picard, *supra* note 223, at 522 tbl.1 (citing Foley).

[228] Proponents of stadium projects tout increased employment from tourism, construction jobs, and increased localized spending. Richard W. Schwester, *An Examination of the Public Good Externalities of Professional Athletic Venues: Justifications for Public Financing?*, PUB. BUDGETING & FIN., Sept. 2007, at 89, 90 ("A review of the literature shows that stadiums and arenas are insignificant in terms of creating employment . . . .").

[229] Buss, *supra* note 220, at 347. In contrast, a review of 48 studies found that reducing state and local taxes resulted in greater business activity. On average, a ten percent tax cut resulted in a three percent increase in business activity which, of course, included new jobs that were voluntarily created. Bartik, *supra* note **Error! Bookmark not defined.**, at 856.

[230] Benoit Mesnil, *Public-aided crises in the French fishing sector*, 51 OCEAN & COASTAL MGMT. 689, 697 (2008).

of those goods and services.

In another well-studied example, BMW, which has an assembly plant in upstate South Carolina, commissioned a study that reported it has a job multiplier of 4.3.[231] There were 5,400 direct BMW employees and 17,650 induced and indirect jobs for suppliers to BMW and local jobs created by economic activity of BMW employees. While the BMW plant is wonderful, the fact is that had it not been built there it would have been built somewhere else in the country, so the net job issue is irrelevant for the nation as a whole.[232] Job creation is a common argument for government subsidies of many projects around the world. Politicians find it to their advantage to cater to special interest groups, while imposing the costs on taxpayers at large, all the while claiming to be increasing economic output and jobs.

These problems outlined here of input-output analysis point to a major flaw in the green jobs literature. In addition to the theoretical incoherence of the definition of "green" and the issues with the statistics used for its forecasts, its basic forecasting methodology is fundamentally flawed and largely discredited from its use in prior forms of economic planning.[233] If the promised benefits are derived from input-output analysis, and premised on technology that disrupts the relationship upon which the input-output analysis depends, the resulting data are unreliable. Perhaps most damningly, these issues are not discussed in the green jobs literature, even though they are widely known among economic analysts. What the input-output analyses do is clothe the proposals in the garb of scientific respectability. What they do not do is provide any confidence that the results are reliable.

E. Promoting inefficient use of labor

Green jobs proponents have a curious attitude toward efficiency. On the one hand, they tend to see efficient use of non-labor inputs such as energy and raw materials as crucial to creating a green economy. For example, the UNEP report states that "[g]reater efficiency in the

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[231] Woodward & Guimarães, *supra* note 206, at 9.

[232] Even if it had been built in Canada rather than in the U.S., it does not mean that those who earn their living in jobs related to BMW assembly in South Carolina would have had no alternatives. For all we know, employment opportunities may have been worse, the same, or better, making the job multiplier claims little more than happy talk.

[233] There are multiple analyses that discredit such studies. For example, Bruce Seaman's study of job claims in Atlanta, found that the estimated average economic impact of several sports and cultural industries (commercial music, universities, professional sports) was $233 million in 1984, while the total personal income in the Atlanta metropolitan area was $32 billion. Bruce Seaman, *Arts Impact Studies: A Fashionable Excess,* in ECONOMIC IMPACT OF THE ARTS: 'A SOURCEBOOK 43, 48 (Anthony J. Radich & Sharon Schwoch eds., 1987). Thus, there could be at most 138 industries in the region before the entire income is accounted for.

Dennis Coates & Brad Humphrey, *Professional Sports Facilities, Franchises and Urban Economic Development*, 3 PUB. FIN. & MGMT. 335, 335-357 (2003), survey the evidence on the impact of sports teams on local economic activity. Most of the new construction of stadiums is accompanied by claims that their presence will boost the overall level of economic activity and especially employment. "Despite these claims, economists have found no evidence of positive economic impact of professional sports teams and facilities on urban economies." *Id.* at 335. There are four main reasons for this finding. First, spending on sports is easily substitutable for spending on other leisure activities. Thus, the increase in spending on professional sports in Oklahoma City, say, as a result of the relocation of an NBA team, is almost entirely accounted for by a decrease in spending on movie tickets, greens fees, restaurant meals, and so on. Second, the attention paid to local sports teams could reduce worker efficiency as they spend time discussing the game rather than working. Third, the money spent on sports teams and facilities might reduce the amount spent on other public facilities and services. Because roads, fire protection, and other local government services can improve productivity, a reduction in spending on them could reduce productivity and thus overall economic activity. Fourth, the multiplier on spending for sports might be smaller than the multiplier for other activities. Because most of the money spent by sports teams reflects salaries to wealthy individuals who might not even reside in the region, it is unlikely to have the same impact that a similar amount of spending that directly affected local workers would have.

use of energy, water, and materials is a core objective"[234] of a green economy. On the other hand, green jobs proponents see *increasing* the use of labor as a virtue, not a cost. For example, the UNEP report argues that a negative feature of today's economy is that it has increased labor productivity and so reduced the amount of labor necessary to deliver goods and services: "Any effort to create green jobs in food and agriculture must confront the fact that labor is being extruded from all points of the system, with the possible exception of retail."[235] Likewise, the same report criticizes the steel and oil industries for increasing labor productivity.[236]

Low labor productivity has critically important consequences. First, a society of low labor productivity jobs is an impoverished society in which output is restricted by the failure to make use of capital and in which wages are low by definition, for employees can receive only the value they generate absent transfer payments. Second, because green jobs proponents promise high wage jobs, they will have to force compensation higher than the competitive wage, producing permanent high unemployment. This is not a matter of theory; a comparison of European and North American labor markets over the past 50 years reveals that promoting high wage, low labor productivity jobs produces high structural unemployment.[237]

The ASES report asserts that "the net effect within a carbon-constrained energy economy is positive, creating roughly five jobs for each job lost,"[238] meaning that to produce the equal value in production of a given quantity of energy, five times as many bodies will be required. That implies a massive drop in productivity and, therefore, standard of living. Unsurprisingly, at such low levels of efficiency, as much as a quarter of the entire workforce may have to be involved in this enterprise.[239] Similarly, the Renewable and Appropriate Energy Laboratory at the University of California at Berkeley found it a positive feature of alternative energy that "renewable energy creates more jobs per kilowatt hour than traditional energy sources."[240] Again, this is simply a fancy way of stating that renewable energy is more costly in labor terms than alternatives – hardly a virtue to anyone asked to pay for the energy produced.

Increasing labor productivity is what makes societies wealthier and better able to satisfy their wants and needs, ranging from better education to better access to health services and

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[234] UNEP, *supra* note 5, at 4. The UNEP report discusses the cement industry and notes

> Energy efficiency in the [cement] industry is gained as new cement plants are built. Inefficient, outdated processes are mainly found in small, regional plants. Manufacturers in countries or regions with stagnant levels of demand still rely on inefficient technologies, such as small-scale vertical kilns and the wet production process. Efficiency improvements are generally being made in countries with an increasing demand for cement. More-efficient rotary kilns utilize the dry production process and are replacing inefficient vertical shaft kilns. New plants built in developing countries are larger, cleaner, and more efficient than those built 10 to 30 years ago in developed countries.

Id. at 197.

[235] *Id.* at 228.

[236] *Id.* at 184 ("[t]oday steel is no longer a labor-intensive industry. It is marked by rising globalization, ongoing consolidation, substantial gains in labor productivity through automation and computerization, and strong competition, particularly from Asian producers."). A similar criticism is made of the oil industry. *Id.* at 92 ("almost 40 percent of U.S. oil-refining jobs disappeared between 1980 and 1999; another 8 percent decline occurred between 2001 and 2006.").

[237] *See* Charles L. Schultze, OTHER TIMES, OTHER PLACES: MACROECONOMIC LESSONS FROM U.S. AND EUROPEAN HISTORY 27-33 (1986) (comparing US and European labor productivity and economic policies).

[238] ASES, *supra* note 2, at 14.

[239] ASES notes that, by 2030, forty million workers in the U.S. "about one in every four working Americans," could be in the renewable energy and energy efficiency areas. *Id.* at iv.

[240] Bastian, *supra* note 90, at 38.

medicines, and allows them to have more leisure time.[241] Moreover, reducing the labor component of obtaining any energy service would, all else equal, reduce overall costs to consumers because for most services the cost of labor generally exceeds the cost of materials, as anyone who has had the misfortune of getting a car, computer, or cell phone repaired can attest.

This glorification of inefficient labor practices captures a frequent mistake in the green jobs literature – mistaking the means for the end. For example, the UNEP study complains that "[e]conomic systems that are able to churn out huge volumes of products but require less and less labor to do so pose the dual challenge of environmental impact and unemployment."[242] As a result, the study is critical of carbon capture and sequestration efforts because they are "capital intensive, and therefore the jobs created per million dollars of investment can be expected to be low,"[243] in contrast to the greater labor intensity of biofuels harvesting.[244] The higher operating efficiency of coal power plants compared to solar power plants is portrayed as a *negative* feature of the coal plants, because coal plants produce fewer jobs per delivered megawatt of power since a greater peak capacity is needed by a solar PV facility to produce the same amount of delivered power.[245] As a result, more construction jobs are created by a need for delivery of a megawatt of power from solar PV than from coal, because a greater solar peak capacity is required to deliver the same amount of energy.[246] The study criticizes extractive industries generally for not employing large numbers of people.[247] Indeed, even increased labor productivity in green industries such as rail transportation is characterized as a problem rather than as a benefit.[248] This is so even though cutting labor costs would speed expansion of the green industry by lowering costs.

As a result, green jobs advocates often promote technologies that are inefficient users of labor precisely because the technologies are inefficient. For example, in discussing "bus rapid transit" ("BRT") systems, the UNEP report notes:

> In BRT systems, the frequency of service is carefully calibrated, and therefore bus breakdowns and other operational failures need to be minimized. This in turn implies that buses must be kept in excellent condition. Hence BRT systems offer a substantial number of maintenance jobs. Maintaining high-quality service also means it is critical to ensure good working conditions for drivers, who need to be well trained and are expected to take responsibility for their performance. Thus,

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[241] Indur M. Goklany, THE IMPROVING STATE OF THE WORLD: WHY WE'RE LIVING LONGER, HEALTHIER, MORE COMFORTABLE LIVES ON A CLEANER PLANET 44-48, 82-85 (2007).

[242] UNEP, *supra* note 5, at 6.

[243] UNEP, *supra* note 5, at 9.

[244] *Id.* at 120 ("The labor intensity of biofuels harvesting compares favorably with conventional fuels. On average, biofuels require about 100 times more workrs per joule of energy content produced than the capital intensive fossil fuel industry.")

[245] *Id.* at 102 (citing Kammen, Kapadia & Fripp, *supra* note 201).

[246] *Id.* at 102.

[247] *Id.* at 91 ("Extractive industries – the fossil fuel sector and other mining industries – do not employ many people."). The study also objects to the growth of capital intensive farming at the expense of labor intensive farming. *Id.* at 230 ("The trend towards consolidation and the growing market power of retailers that is occurring in the United States is also happening at the global level, and in some cases even more obviously so. Small 'greener' farmers are losing out to large capital intensive producers and suppliers. This process has contributed to rural unemployment and accelerated urbanization.").

[248] *Id.* at 169 ("China's rail network grew by 24 percent in 1992-2002, but due to boosted labor productivity employment was cut almost in half . . . India's network grew only 1 percent, but due to radically different policies, employment stayed almost the same. . . . Increased labor productivity [in Africa] has led to reduced railway employment.").

jobs for drivers and mechanics must be decent and well paying.[249]

Increasing the number and skill level of employees makes the BRT systems *more* expensive and *less* competitive relative to other means of transportation, such as personal automobiles or less labor-intensive bus systems, if the BRT must cover costs. It is a problem preventing the adoption of such systems, not a benefit, that they require more skilled labor than alternatives to deliver the same amount of transportation services.

The selection of maximizing labor use as the measure of success presents several major problems. First, the ultimate goal of economic activity is not the employment of labor or of other resources, but instead is the production of goods and services that satisfy human needs and wants. Higher labor productivity makes societies wealthier and better able to satisfy their wants and needs ranging from better education to better access to health services and medicines. It also allows them to have more leisure time and provides them the resources to enjoy that leisure.[250]

A new method of production that uses fewer inputs to produce the same outputs as an existing method frees up inputs for use in addressing additional human needs and wants. A prime example of this is agriculture. The labor intensity of agriculture in the United States has plummeted over the last 200 years, as farmers adopted mechanization, increased agricultural knowledge, and developed higher yield seeds. Merely 1.4 percent of the U.S. workforce is engaged in agriculture today compared to over 21 percent in 1929,[251] yet production today is much higher.[252] The people who left agriculture are now employed in alternative occupations, creating goods and providing services that would be unavailable if those people had remained employed in agriculture. Under the definitions of green jobs used in these reports, however, this transition is a negative change in the "greenness" of American agriculture.

Second, even assuming that some substitution of capital and other inputs for labor has negative environmental consequences, it does not follow that such substitutions generally are either net negative contributions to the environment or inappropriate. Again, agriculture provides an example. Agriculture is a dangerous occupation, with farming "among the most hazardous of industries in terms of number of fatalities, fatality rates, number of non-fatal injuries, and non-fatal injury rates."[253] Much agricultural labor was previously devoted to backbreaking, low productivity, unpleasant work that broke people down. New techniques that free people from dangerous, unpleasant work, and that increase production of food crops, have benefits that offset the claimed negatives of more capital intensive farming methods identified in these reports. As Martin Wolf notes "[s]ubsistence farming is among the riskiest of all human strategies, since starvation is one harvest away."[254] Whether particular techniques are better or worse for the environment or for the individuals engaged in the labor is thus not an issue that can be settled by assuming that all labor-intensive methods are to be preferred to all capital-intensive ones.[255] Yet

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[249] *Id.* at 166.

[250] Goklany, *supra* note 241, at 44-48, 82-85.

[251] U.S. Census Bureau, STATISTICAL ABSTRACT OF THE UNITED STATES 50 tbl.HS-29 (2003), *available at* http://www.census.gov/statab/hist/HS-29.pdf (1929 figures); U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES tbl.600 (2009), *available at* http://www.census.gov/compendia/statab/tables/09s0600.pdf (2007 figures).

[252] *See, e.g.*, U.S. Census Bureau, 2009 STATISTICAL ABSTRACT: HISTORICAL STATISTICS, Table HS-45 (comparing 1900 production in corn (2,662 mil. bu. vs. 9,008 mil. bu.), wheat (599 mil. bu. vs. 1,616 mil. bu.), and cotton (10,124 thousand bales vs. 17,100 thousand bales).

[253] J. Paul Leigh, et al., *Costs of Occupational Injuries in Agriculture*, 116 PUB. HEALTH REP. 235, 236 (2001).

[254] Martin Wolf, WHY GLOBALIZATION WORKS 196 (2004).

[255] If, as some green jobs advocates insist, labor-intensive agriculture produces a desirable lifestyle, one would expect to find people volunteering to do that for a living. But you can't keep Johnny down on the farm. Prohibiting capital intensive agriculture

this is precisely what the green jobs literature does.

Third, even in the favored green industries, increasing labor efficiency has been an important component in making the technologies more commercially viable. For example, corn-based ethanol cost reductions in the United States over time have been driven in part by "upscaling farms" (i.e., introducing economies of scale) and the advanced technology necessary to convert corn into ethanol.[256]

Increasingly efficient use of labor was a significant factor in the remarkable economic growth of the United States' economy during the nineteenth century. That growth was attributable to a significant degree to conditions of labor scarcity and a relentless drive to reduce the need for labor across industries. Labor scarcity led to high wages for American workers relative to workers elsewhere (an indicia of a good job, according to the UNEP report[257]). This then meant that, as an English investigative commission noted in 1854, "the whole energy of the people is devoted to improving and inventing labour-saving machinery."[258]

Labor was scarce in 19th century America because of the abundance of cheap, fertile land in United States that made agricultural output per man high and made it harder to lure people from agriculture into industry.[259] Labor scarcity meant that American manufacturers needed to organize their employees efficiently. For example, comparing English and American workers in the nineteenth century textile industry, "[t]he most conspicuous example of efficient use of labour is the training that the American manufacturers gave to their workers so that each was able to handle more looms."[260] Moreover, the increased training and skill levels of American workers then equipped those same workers to improve on the technology they used.[261] Again, all these are indicia of good jobs according to the UNEP report and all are the result of high labor productivity, not low labor productivity.

The green jobs literature's focus on inefficient labor use thus embodies three highly peculiar assumptions about human wellbeing. First, it assumes that increasing labor productivity,

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would indeed cause more labor to shift to agriculture as more people pick up hoes for a living, but the crash in standards of living from the loss of capital-intensive technology would not mean high-paying jobs.

[256] W.G. Hettinga, et al., *Understanding the reductions in US corn ethanol production costs: An experience curve approach,* 27 ENERGY POL'Y 190, 201 (2008).

[257] UNEP, *supra* note 5, at 4 ("good jobs which offer adequate wages"); 22 (praising green certification programs for leading to "increased wages"); 65 (green jobs need to be "decent with regard to wages").

[258] H. J. Habakkuk, AMERICAN AND BRITISH TECHNOLOGY IN THE NINETEENTH CENTURY: THE SEARCH FOR LABOUR-SAVING INVENTIONS 101 (1967) (quoting 50 Parliamentary Papers 51 (1854)); Douglass C. North, THE ECONOMIC GROWTH OF THE UNITED STATES, 1790-1860 173 (1966) ("The constant concern with laborsaving machinery was considered by the [British] commissioners [investigating US industry in 1850s] to be a fundamental explanation of the indigenous development of such innovations, and the relatively high price of labor was considered the driving force. Important innovations developed in every industry, frequently in small shops and firms at the hands of mechanics with little or no formal scientific training."); George Rogers Taylor, THE TRANSPORTATION REVOLUTION, 1815-1860 224 (1977) ("Americans excelled especially in inventions increasing the speed of machine operation and making processes so automatic that they required less and less attention from the operatives.").

[259] Habakkuk, *supra* note 258, at 13; Paul Wallace Gates, THE FARMER'S AGE: AGRICULTURE, 1815-1860 271 (1968) ("In the early decades of the nineteenth century, the greatest difference between farming in the Old World and farming in the New was that in American agriculture labor was scarce and its cost relatively high."); *Id.* (in 1840 the Massachusetts Commissioner of Agricultural Survey noted that "the price of labor is enormous.")

[260] Habakkuk, *supra* note 258, at 47.

[261] *Id.* at 51 (more changes in production methods came spontaneously from the workers in America than in England; "particularly when the worker had been self-employed earlier in life, and most of all when he had been a farmer, for he carried over into industry the inclination to seek his own methods of doing his job better.").

which increases output, should be discouraged. This reduces human welfare by reducing the goods and services available to people. While many environmentalists have promoted reductions in consumption for decades,[262] adopting a policy of reducing the goods and services available to the general population should be done through open debate not by smuggling it in through a green jobs policy. Such a policy will condemn those already poor to eternal poverty.

Second, low labor productivity produces low wages, as each factor of production receives its marginal productivity in a competitive economy. Since the green jobs literature insists that jobs must be high paying, creating a world of high-paying, low-productivity jobs requires an aggressively interventionist economic policy to shift rewards from high-productivity inputs (capital and resources) to low-productivity inputs (labor). Not only is such a policy inconsistent with an open market economy,[263] but the payment of a wage above what productivity justifies will lead to unemployment.[264] Again, an aggressive set of policy measures will be required to sustain such a shift in any economy competing with economies that have not adopted measures favoring low labor productivity.

Finally, subsidizing labor at the expense of capital is likely to delay the development of technologies that increase the efficiency with which scarce resources are used. For example, petroleum refining today is a highly capital intensive process, but these increases in capital intensity have yielded dramatic increases in the amount of fuels and specialty chemicals obtained from a barrel of crude oil.[265] By increasing the yield from crude oil, these innovations have boosted the efficiency of use of natural resources. Biasing production away from capital intensity reduces the incentive to produce such innovations that raise standards of living. Moreover, because environmental protection is itself often capital intensive (to the extent that it requires additional capital equipment to reduce emissions),[266] such a bias would likely increase the harm to the environment from the production that continued.

F. Assessing green job estimates

The problems with the methodologies of green jobs studies that we have identified are grounds for caution in accepting their policy proposals. Before trillions of dollars in public and private resources are directed into promoting "green jobs," we need to have a better understanding of the details of how such programs will transform our economy. What jobs will be considered "green" and why? Who will decide which jobs are green "enough"? Decision makers need to be skeptical about projections based on small base numbers and rapid expansion of technologies not well developed. We should worry about proposals that glorify low labor productivity, the modern version of the Luddites.[267]

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[262] *See, e.g.*, Ernst Friedrich Schumacher, SMALL IS BEAUTIFUL: ECONOMICS AS IF PEOPLE MATTERED (1973) (the best seller of its day).

[263] The green jobs proponents have a long way to go to demonstrate the viability of a scheme of higher-paying jobs for most of humanity in the absence of capital that increases productivity. This turns economic theory—and human experience—upside down.

[264] *See* Schultze, *supra* note 237.

[265] Petroleum products are used in some chemical and pharmaceutical products. David S. J. Stan Jones and Peter R. Pujadó, eds., HANDBOOK OF PETROLEUM PROCESSING (2006), at 1. A 42-gallon barrel of crude oil yields over 44 gallons of petroleum products, including asphalt, petrochemical feedstock and lubricants. U.S. Government Accountability Office, MOTOR FUELS: UNDERSTANDING THE FACTORS THAT INFLUENCE THE RETAIL PRICE OF GASOLINE (2005), at 1.

[266] *See, e.g.*, Waste Management Authority, THE DUTCH WASTE PROFILE 1990-*2005* 7 (2006) ("The environmental regulations lead to increased capital intensity, increase in scale of the installations and economy of scale.").

[267] *See* Kirkpatrick Sale, *Avowedly Low-tech: America's New Luddites,* LE MONDE DIPLOMATIQUE, Feb. 1997 (John Howe trans., English ed.), *available at* http://mondediplo.com/1997/02/20luddites (describing efforts to create coalition including environmentalists "to establish the legitimacy of resisting technological change.").

Our survey of problems in the green jobs literature is not merely methodological nit-picking, although we do have many methodological issues with the literature. All of the issues we have identified have a common theme: the masking of critically important policy choices beneath a series of questionable assumptions and definitions. Before billions, or perhaps trillions, of dollars are committed to an effort to remake human society on the basis of these assumptions, Americans deserve a full and open debate informed by the best data and analytical methods. Thus far the push for green jobs has provided neither. In addition to these problems, there are problems with how the green jobs literature approaches economic issues. We now turn to considering these.

III. Mistakes in economic analysis

As just reviewed, the green jobs literature contains highly problematic assumptions about the economics of employment. In this section we examine some of the peculiar assertions about economics in general. First, the literature rejects the existence of comparative advantage, suggesting a need to avoid trade. Second, the literature makes inappropriate calculations of consumer surplus, giving misleading results with respect to the benefits of the proposed policies. Third, the green jobs literature frequently confuses responses to mandates with market responses, improperly extrapolating from the former to predict the latter. Fourth, the literature neglects consideration of the opportunity costs of the resources it proposes to devote to green jobs programs. Opportunity costs are key to understanding the net benefit of a proposal, since the value of the alternative uses of the resources must be deducted from the gains created by the green jobs policies. Finally, green jobs analyses do not take into account how market incentives operate with respect to energy efficiency, instead using an incorrect model of behavior in which energy efficiency results only from government mandates.

By failing to take into account the incentive effects on energy consumption, green jobs analyses overstate the energy that is used in the absence of proposed mandates and thereby overstate the benefits of their proposals. Using data on improved energy efficiency over past decades, we show that the market produces substantial increases in energy efficiency without the drastic measures proposed by the green jobs literature.

That the literature contains so many basic economic errors is not accidental but instead reveals that much of the green jobs literature manifests a thinly concealed hostility to market ordered societies, a hostility which strongly influences its policy recommendations.[268] Taken together, these flaws in economic reasoning reveal fatal flaws in the green jobs literature's analysis of the economics of green job policies.

A. Rejecting comparative advantage

Nobel laureate Paul Samuelson once termed the theory of comparative advantage that underlies the economic analysis of trade an insight from economic theory that was both "nontrivial and nonobvious."[269] It is certainly not obvious in the green jobs literature, since green jobs reports routinely treat comparative advantage as false and view trade as a harm, rather than a benefit, to trade partners. This is problematic for two reasons. First, voluntary trade produces

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[268] Those who advocate central planning of economic activity because they believe markets to be deeply flawed have an intellectual and moral obligation to demonstrate that government planning can produce superior results. A century-plus of extensive literature on the topic produced a contrary result that cannot be dismissed merely by putting a green cloak on central economic planning and asserting that this time around it will produce a richer world.

[269] Michael Szenberg et al., PAUL SAMUELSON: ON BEING AN ECONOMIST 44 (2005).

benefits or it would not occur. Second, the assumption that trade is a net loss to an economy is hidden within the green jobs literature, not stated openly. As a result, the policies stated as intended to promote environmental and employment goals are also policies designed to reverse by implication long-standing public policies in favor of increasing trade.

The green jobs literature often simply asserts that green jobs are not subject to comparative advantage and will be distributed abundantly everywhere. For example, CAP reports that green jobs will be created "in every region and state of the country,"[270] while the Conference of Mayors takes pains to describe with an illusory precision in a 14-page appendix how the green jobs will be distributed among all metropolitan areas and "are not restricted to any specific location, so cities and their metropolitan areas across the country can and are expected to compete to attract this job growth"[271] Similarly, the UNEP report argues that comparative advantage should not apply, as "[p]ublic policy can and should seek to minimize disparities among putative winners and losers that arise in the transition to a green economy, and avoid these distinctions becoming permanent features" by protecting workers and communities that are dependent on non-green industries and companies from the consequences."[272]

Even looking only at the reports' internal descriptions of green industries, it is questionable whether or not these predictions of uniform benefits could be accurate, since these reports do recognize at times that green industries are not currently uniformly distributed. For example, a third of current world production of solar PV cells and wind turbines are German made.[273] As a result of this market dominance, any rapid increase in PV installations will have to involve German firms if it is to succeed.

Regardless of whether local content strategies are attainable, however, the green jobs literature uniformly regards them as desirable. For example, CAP touts the domestic content aspects of its program as a plus:

> In general, about 22 percent of total household expenditures will go to imports. With the green infrastructure investment program, only about 9 percent purchases imports. This is a critical benefit of a green economic recovery program: Investments are focused primarily on improving domestic infrastructure and making both local markets and the national economy more efficient over the long term.[274]

Similarly, the UNEP report concludes that green jobs' high local content is desirable since local content means "a more equitable distribution of wealth since the money saved is invested back into the local economy."[275] Where a purely local strategy cannot be followed, the green jobs literature is critical of the role of trade. An example is the UNEP report's discussion of biofuels where the main flaws are the potential sacrifice of "the interests of local communities" and that

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[270] CAP, *supra* note 10, at 5.

[271] MAYORS, *supra* note 1, at 18, 19-33, app.

[272] UNEP, *supra* note 5, at 4. To its credit, the UNEP report does also note that "there is also a potential contradiction between renewables as global source of jobs and renewables as a part of national competitive economic strategies. Although this does not have to be a zero-sum game, a stellar export performance by a handful of countries does imply more limited opportunities elsewhere on the planet." *Id.* at 9.

[273] *Id.* at 96. The UNEP report notes disapprovingly that this has come about in part because Germany has followed "low wage strategies" in producing solar equipment. *Id.* at 98. The assertion of "low" wages in Germany would come as a shock to employers in Germany and to most employees around the world.

[274] CAP, *supra* note 10, at 11. No citation is provided for this incredibly precise measure of hugely complex portions of economic activity.

[275] UNEP, *supra* note 5, at 136.

"human needs, especially of the poor and marginalized, all too easily lose out to profit interests."[276]

This anti-trade attitude embedded throughout the green jobs literature is part of a larger criticism of the global economy. The UNEP report is among the most explicit in stating its overall anti-trade agenda. The report argues:

> Particularly with regard to trucking services, however, there is a need to reassess the way in which the global economy is developing. So called "just in time" production systems are biased toward frequent, precisely timed deliveries of materials and parts to factories instead of warehousing of supplies. And both production and consumption now depend on shipments of raw materials, intermediate goods, and final products over ever longer distances. Highly complex production, shipping, and retailing networks have emerged on an increasingly global scale, with varied impacts on employment, wage levels, and the economic viability of communities and regions.
>
> The onslaught of ever-growing transportation volumes threatens to overwhelm gains from improving fuel efficiency and limiting pollutants on a per-vehicle basis. Companies like Wal-Mart (with its policy of global sourcing and especially its policy of searching for cheap products, with potential negative impacts for labor and the environment) are major drivers and symptoms of this phenomenon. When products are shipped around the world in "sending coals to Newcastle" fashion, improving the efficiency of vehicles or planes—or improving the energy efficiency of stores, as Wal-Mart has pledged to do—can only have limited impact. Ultimately a more sustainable economic system will have to be based on shorter distances and thus reduced transportation needs. This is not so much a technical challenge as a fundamental systemic challenge.[277]

The UNEP report goes on to argue that globalization is a particular problem with respect to food production, claiming that "there are many farmers' organizations, NGOs, and others in civil society who regard the existing global food system as fundamentally unsustainable and who propose a more radical change of course—a course that recognizes that traditional knowledge and skills of farmers are the key to solving the major problems of the existing food system and to meet the challenges of increasing demand."[278]

Despite citing United Nations statistics that show that per capita food production has increased by 25 percent and real food prices fallen by 40 percent over the last forty years, the

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[276] *Id.* at 119.

[277] *Id.* at 162.

[278] *Id.* at 223. The report contrasts this with the vision of the World Bank and WTO "who view the present liberalized and increasingly global food system as providing a path from poverty for hundreds of millions of rural dwellers, but who nonetheless recognize that it is a system that needs to do much more in order to become truly environmentally and socially sustainable." *Id.* The romantic view of traditional knowledge and happy peasants does not square with historical fact. By the 1950s and 1960s, traditional agriculture in the developed world seemed destined to lose the battle to feed the masses in many parts of the developing world. This led to dire predictions about coming famines that would inevitably decimate populations. *E.g.*, Paul R. Ehrlich, THE POPULATION BOMB (1968); William Paddock, FAMINE, 1975!: AMERICA'S DECISION: WHO WILL SURVIVE? (1967). However, it was the Green Revolution — a distinctly nontraditional form of agriculture — that saved the day. Not only has the Green Revolution helped reduce hunger and malnutrition in developing countries, it has also saved more land from conversion in the developing world than has been set aside in all the areas that have been fully or partly set aside for conservation. *See* Goklany, *supra* note 241, at 161-163.

UNEP report nonetheless sees an equivalence in the two perspectives, warning that as population increases and diets move toward more meat and processed foods that global food production will need to triple by 2050 without using more land or water.[279] Moreover, as noted earlier, it sees the increased labor efficiency of agriculture as a problem, concluding that "[t]he industrial model of agriculture, along with rich country subsidies to agribusiness, has been identified as one of the primary drivers of urbanization globally, which then spurs a cycle of urban unemployment or underemployment when economic development does not keep up with the growing urban labor supply. Policies that keep farmers on their land, and facilitating green production practices, could generate employment and income both in agriculture and in non-farm occupations."[280]

The point is not simply that trade is beneficial to human welfare. The problem is that the green jobs literature fails to acknowledge that its anti-trade assumptions are contested.[281] By burying critical assumptions on which exists considerable contradictory evidence and which are inconsistent with existing economic and trade policies (e.g. countries' commitments to the World Trade Organization),[282] the green jobs literature is smuggling in an economic policy in the guise of an environmental policy.

The anti-trade agenda is a fundamental tenet shared by many environmental organizations.[283] As this section's discussion makes clear, the green jobs literature has embedded in it many of these strong anti-trade assumptions, which are contradicted by both economic theory and the experience of the world economy. These unarticulated but central assumptions need to be clearly debated before accepting the green jobs literature's policy recommendations.

B. Consumer surplus

The green jobs literature asserts benefits of green jobs policies using a flawed conception of improvements in human welfare. In economics, policies are evaluated by the calculation of the net social benefits based on both consumer and producer surplus.[284] The green jobs literature contains almost no mention of consumer surplus, focusing almost exclusively on costs and benefits to favored producers. For example, the UNEP report criticizes increased agricultural trade between the United States and Mexico because "cheap corn from the United States has hurt Mexican farmers who grow maize on small- to medium-sized plots in difficult environments using low levels of technology."[285] No mention is made of benefits of cheaper corn to consumers

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[279] UNEP, *supra* note 5, at 224.

[280] *Id.* This assertion does not square with historical experience. All countries that have enjoyed rising standards of living have seen a shift in their economies such that they are less dependent on the agricultural sector in terms of its contribution to the economy and total employment. *See, e.g.*, Goklany, *supra* note 241, at 109.

[281] Although it is enthusiastically practiced in North Korea under its Juche method of economic organization. *See* Juche Idea Study Group of England, http://www.korea-dpr.com/users/jisge/ (last visited Feb. 22, 2009) (compiling links to documents on the benefits of this method of anti-trade organization).

[282] Sean Higgins, *"Buy American" Policy Now Law as Critics Fear Global Reaction; Final Wording Spares EU, Japan, and Canada; Brazil Mulls WTO Case*, INVESTOR'S BUSINESS DAILY A1 (FEB. 18, 2009).

[283] Wolf, *supra* note 254, at 188 ("It is widely accepted among critics of market-driven globalization that it is inherently inimical to protection of the environment. To the extent that it is not inherently inimical, they argue, it is so *de facto* because of the way the World Trade Organization operates. These propositions, though frequently repeated, suffer from a simple drawback: they are, where not altogether wrong, at least greatly exaggerated.") Wolf systematically demolishes the link between trade and environmental problems. *Id.* at 188-194.

[284] Consumer surplus is the difference between the price that consumers are willing and able to pay for a good and the value they place on a good (the highest price they would be willing to pay). Producer surplus is the difference between the price received by a producer when a good or service is sold and the lowest price the producer would have been willing to accept and still engage in the exchange. The existence of such surpluses is the reason exchange occurs—both parties gain. *See, e.g.*, Michael Mandel, ECONOMICS 398 (2009); Roger L. Miller & Roger E. Meiners, INTERMEDIATE MICROECONOMICS 581-82 (1986, 3rd ed.).

[285] UNEP, *supra* note 5, at 225.

worldwide, only the costs to uncompetitive domestic producers are considered.

The benefits of trade are not just assertions from other-world economic theorizing. Trade has real-life consequences that affect the quality of life, such as by providing more food at lower cost to billions of people.[286] That is a huge consumer surplus. More generally, the report criticizes expanded trade in foodstuffs because:

> [t]he growth of supermarkets in the global South is having a marked effect on farmers, and some maintain that this effect is bigger than that of trade liberalization. Leading supermarket chains have shifted away from wholesale markets where small farmers make their living, and toward procuring food through a few medium-to-large firms that can deliver a consistent quality product at large volumes.[287]

As a result, the UNEP report complains that:

> [T]he consolidation of retail has meant that farmers and producers often receive dwindling returns on their produce, as large retailers are in a position to lay down 'take it or leave it' conditions. Retailers are also in a position to dictate terms to processors and distributors and even large food manufacturers, which results in manufacturers being more concerned to serve the interests of retailers and less concerned to maintain a good relationship with farmers.[288]

These passages are typical of the results-driven nature of the green jobs literature's calculations of social costs and benefits. Economic concepts that the organizations sponsoring the reports do not like (e.g. markets, trade, lower prices for many consumers) are simply assumed to produce net costs. Yet, those economic concepts that the sponsoring organizations like (e.g. small holding agriculture, local production, and solar power) are assumed to produce net benefits. By counting only the benefits from the favored technologies and activities, and only the costs from the disfavored ones, the green jobs literature produces a distorted outcome.

Obviously, the benefits and the costs must be counted from both before an accurate comparison can be made. In particular, careful estimates of consumer surplus are necessary to

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[286] It also affects the stability of governments as evidenced by the demonstrations in about a dozen countries, including Mexico and Haiti, in the first half of 2008 to protest the escalating food prices. Kent Garber, *The Growing Food Cost Crisis,* U.S. NEWS & WORLD REP., Mar. 17, 2008, at 33, 33, *available at* http://www.usnews.com/articles/news/2008/03/07/the-growing-food-cost-crisis.html ("Then there is the elephant in the room: ethanol. Most experts agree that the race among western countries to produce this grain-based alternative fuel is responsible, in significant part, for the rising costs. Their logic is simple: When countries put corn aside for energy, the amount available for food is in greater demand, and prices rise. If demand is already high, the effect is amplified."); *see also* Elisabeth Malkin, *Thousands in Mexico City Protest Rising Food Prices,* N.Y. TIMES, Feb. 1, 2007, at A6, *available at* http://www.nytimes.com/2007/02/01/world/americas/01mexico.html?_r=1&scp=1&sq=Mexico+tortilla+riots&st=nyt&oref=slogin; Opinion, *The misguided politics of corn ethanol,* INT'L HERALD TRIB., Sept. 19, 2007, at 8, *available at* http://www.iht.com/articles/2007/09/19/news/edethanol.php. The price hike was partly due to the diversion of food crops such as corn, soy, and palm oil to meet the demand for ethanol created by subsidies and mandates in developed countries for biofuels to reduce dependence on foreign oil and greenhouse gas emissions. *See* Indur M. Goklany, *Fuels vs. Food,* N.Y. POST, Apr. 17, 2008, http://www.cato.org/pub_display.php?pub_id=9337 ("[F]ood riots resulting partly from the United States' alternative energy policies have arrived at our front door. Crowds of hungry demonstrators swarmed the presidential palace in Haiti last week to protest skyrocketing food prices."); *Mexicans Stage Tortilla Protest,* BBC NEWS, Feb. 1, 2007, http://news.bbc.co.uk/2/hi/americas/6319093.stm.

[287] UNEP, *supra* note 5, at 233.

[288] *Id.* at 234. This evinces a lack of understanding that "the interests of retailers" is consistent with that of their customers. Wal-Mart has been a champion at driving down prices by cutting tough bargains with suppliers, thereby allowing consumers, especially lower-income consumers, to enjoy more value for their scarce dollars.

compare the policies' impacts. This avoidance of the consideration of benefits from disfavored policies and costs of favored policies is not an accidental oversight – the elimination of the benefits of market competition from the green jobs literature represents its sponsors' rejection of modern economics and, thus, the basis for the world's economy today.[289] Debating these precepts is a necessary step before accepting the literature's claims about how a future economy would work.

C. Mandates vs. markets

Many green jobs programs are built around proposed government mandates to promote favored technologies over those chosen in a competitive marketplace.[290] The rationale for doing so is that without these mandates, market actors would not make the choice to use the green technology because they would not receive all of its benefits and/or would bear all the costs of using green alternatives. The argument is not just the usual one made concerning pollution – that the net social cost-benefit calculation is positive while the net private cost-benefit calculation is negative, requiring a subsidy or mandate to persuade private actors to adopt socially beneficial but privately costly measures. In a number of cases, the green jobs literature asserts that mandates are necessary to persuade individuals, firms, and local governments to adopt policies that will provide a net private benefit as well as a net social benefit, such as weatherization. Why mandates are necessary to encourage economic actors to act in their own benefit is unexplained.

Moving from markets to mandates introduces a qualitative change that requires careful consideration in any analysis for three reasons. First, a competitive market disciplines firms that make mistakes. For example, a firm that chose an inefficient technology over an efficient one would have higher costs than a rival that adopted the efficient technology. However, no such pressures apply to political choices of technologies. Thus a policy that depends on a political process designating particular technologies as "green" and directing investment to them lacks an important check.

Second, the shift of decisions about selecting technologies to a political process introduces new considerations unrelated to the merits. Does a firm that produces this technology have a plant in a key political figure's district?[291] Will a particular technology spoil the view from a senator's vacation home?[292] Choices made on political grounds are unlikely to maximize either economic efficiency or environmental benefits.[293]

Third, markets exert continual pressure for improvement. Mandates, on the other hand, tend to lock in technological choices. For all these reasons, mandates cannot be assumed to

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[289] The view taken by green jobs advocates harkens to a book that enthralled the previous generation at the time of a similar debate. Schumacher began with the "insight" that man is small, therefore small is beautiful. Schumacher, *supra* note 262. He advocated an end to modern technology and production in favor of "Buddhist economics." E. F. Schumacher, BUDDHIST ECONOMICS (1999), *available at* http://www.smallisbeautiful.org/pdf/buddhist_economics/english.pdf (last visited Feb. 22, 2009). In this world he imagined "a multitude of vibrant, self-sufficient villages which, from their secure sense of community and place, work together in peace and cooperation." *See* The E. F. Schumacher Soc'y, Buddhist Economics, http://www.smallisbeautiful.org/buddhist_economics.html (last visited Feb. 22, 2009).

[290] UNEP, *supra* note 5, at 24 ("On the basis of current experience in various areas – from vehicle fuel economy to carbon trading—it appears that a purely market-driven process will not be able to deliver the changes needed at a scale and speed demanded by the climate crisis.").

[291] *See, e.g.*, Alan K. Ota, *Bioenergy Investors Flexing Political Clout*, CONG. Q. TODAY, Nov. 16, 2007, http://public.cq.com/docs/cqt/news110-000002630067.html (describing ethanol industry's political connections).

[292] *See, e.g.*, Robert Whitcomb & Wendy Williams, CAPE WIND: MONEY, CELEBRITY, CLASS, POLITICS AND THE BATTLE FOR OUR ENERGY FUTURE ON NANTUCKET SOUND (2007).

[293] *See, e.g.*, Bruce Yandle, *Coase, Pigou, and Environmental Rights*, *in* WHO OWNS THE ENVIRONMENT? 119, 119-52 (Peter Jensen Hill & Roger E. Meiners eds., 1998).

produce positive outcomes but must be carefully and regularly scrutinized.

Mandating the use of particular technologies will certainly increase employment related to the mandated technology.[294] For example, it is true that requiring all public buildings to be retrofitted or offering "strong financial incentives" to private building owners to engage in retrofitting, as CAP proposes, would create some jobs.[295] Of course, so would requiring all public buildings to be painted purple or offering tax incentives to private building owners to paint their buildings purple. Painting jobs would increase, paint manufacturers would increase production of purple paint, paint stores would likely hire additional sales and delivery help, paint brush manufacturers would increase production, and so forth.

The question is not whether the mandate would spur some economic activity. The real question is: What would have happened to the resources used to meet the mandate or reap the incentive in the absence of the government program? The answer is that those resources would have been put to the building owners' highest and best use, and those uses would have also created demand for additional goods and services, even if not for purple paint. This is the same with the retrofitting mandates proposed in the green jobs reports.

Explanation of the costs of proposed green job strategies are vague, which is another key issue with the reports. The Mayors and ASES reports both say little more than costs will be incurred. The CAP report primarily cites another study that contends that all educational buildings, government offices and hospitals in the United States could be retrofitted for energy savings at a cost of about $26 billion, which would result in an annual energy cost saving of $5 billion per year.[296] The UNEP study notes that building retrofitting to improve energy usage "can be done on the basis of existing technology with little or no net cost."[297]

How could it be that a massive program such as retrofitting buildings is possible at no net cost but is not occurring in the absence of government mandates? The implication of the necessity of a mandate is that profit-seeking building owners are too foolish to make investments in energy saving despite the short-term paybacks. Consistently in the UNEP report, and at least assumed implicitly by the domestic reports, green job proponents assert that money could be made if only profit seekers were smart enough to recognize the opportunities: "Green innovation helps businesses ... hold down costs by reducing wasteful practices."[298] One study cited by the UNEP asserted that "green building" improvements are "paid back over 2-7 years."[299] Another claimed that a $9 billion investment in energy savings would generate $28 billion in savings over 17 years and generate 58,400 new jobs.[300] In short, the UNEP believes that one wonderful profitable opportunity after another is missed by profit-seeking corporations. Similarly, the Union of Concerned Scientists (UCS) claims that the auto makers could easily save themselves, if only they produced more fuel efficient cars. Since they will not on their own, the UCS advocates a federally imposed 35 mpg fuel standard that it claims would generate 241,000 more

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[294] A classic episode in this regard is the Clean Air Act. *See* Bruce A. Ackerman & William T. Hassler, CLEAN COAL/DIRTY AIR: OR HOW THE CLEAN AIR ACT BECAME A MULTI-BILLION DOLLAR BAIL-OUT FOR HIGH-SULFUR COAL PRODUCERS (4th ed. 1981).

[295] CAP, *supra* note 10, at 6-7.

[296] CAP, *supra* note 10, at 16.

[297] UNEP, *supra* note 5, at 131.

[298] *Id.* at 24.

[299] *Id.* at 139.

[300] *Id.* at 134.

jobs by 2020 and save consumers $37 billion per year.[301] If only GM, Ford and Chrysler would take this path, their futures would be secure. Unfortunately, contrary evidence is ignored.[302]

Green jobs proponents argue not only that for-profit businesses are missing obvious opportunities to make money. They also contend that requiring or directing investment into their favored programs will yield a wide range of benefits beyond simply creating jobs. Green job proponents believe the required investments will change the direction of the economy. For example, CAP argues that mandating (public) and incentivizing (private) building retrofits will create:

> new markets for energy-saving technology, and could serve as a foundation for administering rapid federal investment. They could become the active starting point for constructing a more ambitious national program of public building retrofits that ... could provide needed funds directly to cities and rural communities to invest in greater energy efficiency and reduced global warming pollution.[303]

In short, the mandated retrofit programs appear to be better than voluntary energy reduction measures because they are government programs.

Further, green jobs reports also allege that more jobs are created by green investments than by alternatives. Mandates are justified because they will produce higher employment than privately directed investment. For example, CAP claims that "[p]ublic spending directed toward a green recovery program ... would result in more jobs than spending in many other areas, including, for example, within the oil industry or on increasing household consumption, which was the primary aim of the April 2008 stimulus program."[304] Note that CAP is comparing public green spending to voluntary private spending, with green public spending "better" only because CAP's input-output model says it is. As we described earlier, CAP's model (and others' models as well) rests on crucial assumptions that dictate the outcome. For example, in the appendix describing the model, CAP notes that it used a "synthetic representation" of green industries because the larger government input-output model on which it based its calculations did not include those industries as separate sectors.[305]

Moreover, CAP examined the impact of spending, rather than energy production, within each energy sector.[306] In other words, CAP's model focused on the number of jobs an additional $1 million spent on solar energy would produce compared to $1 million spent on oil. Yet, as CAP notes, $1 million spent on solar energy would currently produce considerably less energy than $1 million spent on oil,[307] precisely because of the relative inefficiency of alternative energy

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[301] *Id.* at 159.

[302] *See, e.g.*, hybridCARS.com, Annual Hybrid Sales Drop for First Time, http://www.hybridcars.com/news/annual-hybrid-sales-drop-first-time-25388.html (last visited Feb. 22, 2009) ("The best-selling hybrid, the Toyota Prius, posted 158,884 sales in 2008, a drop of 12.3 percent from 2007. In mid-year when gas prices spiked above $4 a gallon, customers joined long waiting lists for the Prius. Those waiting lists, and general demand for hybrids, evaporated as gas prices plunged, falling below $2 a gallon by the end of the year.").

[303] CAP, *supra* note 10, at 6-7.

[304] *Id.* at 9. CAP continues to report such benefits, in detail, from the 2009 stimulus plan. Will Straw, Center for American Progress, *The Nationwide Allocation of Recovery Funding: An Interactive Map on the Final House-Senate Compromise*, http://www.americanprogress.org/issues/2009/02/compromise_map.html (last visited Feb. 22, 2009).

[305] CAP, *supra* note 10, at 20.

[306] *Id.* at 21.

[307] *Id.* at 21. CAP considered using a constant energy output model, an approach it noted was "most consistent with the idea that we are attempting to proceed to a low-carbon economy without having to make significant sacrifices in the total amount of

technologies. Solar and wind currently have capital costs per kWh generated that are sufficiently greater than costs of coal-fired and natural gas-fired power plants to make the cost of the electricity they produce uneconomic compared to conventional fuel-generated power. An investment in alternative energy would therefore produce less energy than a similar investment in fossil fuels.

More jobs per dollar might be created with alternative forms of energy, but there would not be as much energy, and what would be available will cost more, directly or indirectly, because of the subsidies and mandates embedded in their production. This would be true even if consumers are not presented with the bill for the subsidies and mandates at the gas pump or in their utility bills. The resulting loss in the quality of life of the American consumer, due to inefficient use of labor and other resources, is not accounted for in the CAP analysis.

In addition, CAP used a high multiplier for the indirect effects of the money paid to the individuals working as a result of the expenditures on alternative energy. Although CAP noted that estimates in the literature of such multipliers range from negative to 2,[308] it assumed a multiplier "closer to the high end estimates" because CAP's proposal "is designed specifically to generate a large induced expansion of jobs" by spending "focused on domestic industries rather than imports" and "stimulating private-sector investment rather than relying on government spending" and will "help control the upward movement in the price of oil."[309] CAP then adjusts its estimate downward to be "conservative," concluding that indirect job creation will only be one third of direct job creation.[310]

While mentions of the costs of alternative energy sources are vague in the reports advocating their adoption, the advocacy groups do agree that the costs should be considered. For example, the UNEP argues that "[t]o the extent that government mandates that such alternatives [such as solar power] be given equal access to the [electricity] grid, higher costs will be passed on to the consumers," but, "as renewables mature technologically … cost disadvantages disappear and may turn into a cost advantage."[311] Implicit in this discussion is that the utility companies are too short sighted to make investments in renewable energy projects that would produce profits. That premise is seriously at odds with the desire of a number of utilities to be allowed to sink large amounts of capital to build nuclear plants that take a decade or more to build and have a long recoupment period. If the people who make their living in the industry do

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energy we consume." *Id.* Such an assumption would be a fantasy indeed. CAP rejected it because "under this approach our employment estimates become highly sensitive to the current state of technology and energy costs in each energy industry. This would have produced highly inflated employment figures for solar power and other forms of renewable energy, where, at present, the costs of generating a given supply of BTUs is much more expensive than traditional energy sources." *Id.*

[308] Richard Hemming, Michael Kell & Selma Mahfouz, THE EFFECTIVENESS OF FISCAL POLICY IN STIMULATING ECONOMIC ACTIVITY: A REVIEW OF THE LITERATURE (2002); CAP, *supra* note 10, at 21. They refer to the IMF study cited in note 209 *supra.*

[309] CAP, *supra* note 10, at 21.

[310] *Id.* at 22. Similarly, virtually all green jobs reports point to the growth of ethanol and biodiesel in the United States, in response to public mandates and subsidies, as evidence that properly targeted incentives and rules can produce green jobs. *See, e.g., id.* at 8 ("public and private sector growth is already picking up pace, with renewable energy technology supporting sustained double digit rates of growth nationwide."); MAYORS, *supra* note 1, at 11 ("National and state energy policies have encouraged increased usage of ethanol branded blended with gasoline in recent years. That, combined with rising petroleum prices making biofuels more economically palatable, has led to dramatic growth in their usage."); UNEP, *supra* note 5, at 93 (citing estimate that biofuels market could grow $80 billion by 2016). But they also conclude that not enough spending is occurring. CAP notes that "an unstable policy environment and the lack of long term incentives have hurt the investment climate for these technologies, preventing them from realizing even greater growth." CAP, *supra* note 10, at 8. More investment is needed in "infrastructure for next-generation biofuels." *Id.*

[311] UNEP, *supra* note 5, at 47.

not see the wisdom of investing in massive wind and solar farms, unless they are heavily subsidized, then the economic feasibility of such green projects is much more dubious than the political promoters assert them to be.

Further, the premise that reorienting our economy in a "greener" direction by shifting to "sustainable" energy production will increase net employment in the economy is not true because the bulk of jobs in renewable energy sectors are not self-sustaining without subsidies. In particular, most jobs in solar PV energy and wind energy rely heavily on direct subsidies (via favorable tax treatment) or mandates (e.g. renewable portfolio standards). A study done for the American Wind Energy Association (AWEA) and the Solar Energy Research and Education Foundation (SEREF) in early 2008 estimated that if the investment tax credit for solar PV projects and the production tax credit for wind energy were not to be renewed at the end of 2008, then together those industries could lose 77 percent of their jobs. Specifically, in 2009, jobs in the solar PV industry could drop by 57 percent (from 69,000 jobs to 29,600 jobs), while jobs for the wind energy industry could decline by 93 percent (from 82,300 to 5,700 jobs).[312] Further, a report prepared for the Center for American Progress itself notes that, "Lapses in federal production tax credits, occasional one- to two-year extensions, and uncertainty about the future of these credits have led to a 'boom and bust' cycle in the development of wind power."[313] See Figure 3. For example, the production tax credit (PTC) expired in 2003 and additions to wind power capacity fell from 1,687 megawatts in 2003 to 389 megawatts in 2004. The result: "when the tax credits were renewed in 2005, wind capacity rose sharply, by 2,431 megawatts."[314]

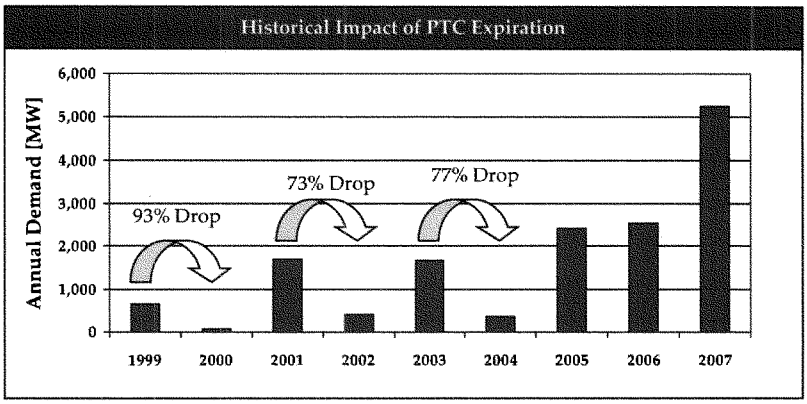

Figure 3 - Historical impact of the expiration and reinstatement of production tax credits (PTCs) for wind energy. PTCs expired in 1999, 2001 and 2003, which resulted in sharp reductions in wind projects in the following years.[315]

[312] Navigant Consulting, Inc., ECONOMIC IMPACTS OF THE TAX CREDIT EXPIRATION (2008), *available at* http://www.seia.org/galleries/pdf/Navigant_Tax_Credit_Impact.pdf (prepared for the American Wind Energy Association and the Solar Energy Research and Education Foundation).

[313] CAP, *supra* note 10, at 16.

[314] *Id.*

[315] Navigant Consulting, Inc., *supra* note 312.

In fact, U.S. subsidies for renewable energy projects are so attractive that in November 2008, BP announced that it has dropped all plans to build wind farms and other renewable projects in Britain; instead it is shifting its renewables programs to the United States, where government incentives for clean energy projects provide "a convenient tax shelter for oil and gas revenues," and a BP spokesman said "the best place to get a strong rate of return for wind is the U.S."[316] The following month Royal Dutch Shell announced that it was also abandoning wind energy projects in Britain in favor of the United States.[317] These developments lend support to the idea that renewable energy — including wind energy, the renewable source for electricity generation deemed most likely to become cost-competitive with fossil fuels — is viable only because of subsidies and mandates.

D. Neglecting opportunity costs

As the above examples illustrate, a constant in the green jobs literature is the idea that maximizing employment, not attempting to maximize human welfare with the resources at hand, is the goal. Indeed, the UNEP study goes so far as to refer to the creation of jobs from spending on environmental projects as the "double dividend."[318] What is missing from these analyses is consideration of the opportunity cost of the public and private expenditures sought.[319] For example, the CAP study asserts that if $100 billion is spent on assorted green activities that 935,200 jobs would be directly created,[320] implying a cost of $107,000 per new job created. Most people could go to a modestly priced college or university full time for four years for that sum.[321] The opportunity costs are real. Either the funds for these programs were taken from the pockets of people who have $100 billion less to spend on other things, causing an economic contraction in those other areas, or it means a bill passed on to the grandchildren of today's taxpayers through deficit spending, who will thus have less to spend.

The lack of consideration of opportunity costs can be seen in the UNEP report's consideration of a study of German tax and transit policy which suggested higher gasoline taxes, the revenue from which would be split evenly between "new infrastructure and financial support for public transport, and thus jobs in mass transit" and lowered taxes in other areas. The increased consumer spending from the tax cuts (financed by higher gasoline taxes) was predicted to produce three-quarters of the total net jobs produced by the policy. However, if that money were spent on reducing labor costs "by reducing employers' social security contributions" instead of being returned to taxpayers through tax cuts, "the net employment effects were

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[316] Terry Macalister, *Blow to Brown as BP Scraps British Renewables Plan to Focus on US*, GUARDIAN, Nov. 7, 2008, at 37, *available at* http://www.guardian.co.uk/business/2008/nov/07/bp-renewable-energy-oil-wind.

[317] Danny Fortson, *Shell to Quit Wind Projects*, SUNDAY TIMES, Dec. 7, 2008, at 2, *available at* http://business.timesonline.co.uk/tol/business/industry_sectors/natural_resources/article5299195.ece.

[318] UNEP, *supra* note 5, at 10.

[319] CAP does give some consideration to the issue. CAP asserts that more jobs will be created by the "green investment" program than if the money was used in other ways. The report notes that if $100 billion was spent on domestic oil industry jobs only 542,000 jobs would be created—far fewer than the 935,200 their proposal would generate. Why? The oil industry would spend a lot of money "purchasing machines and supplies." CAP, *supra* note 10, at 11. Apparently capital equipment is a bad, as are the jobs creating the equipment, compared to the more labor-intensive green jobs.

[320] *Id.* at 9.

[321] We are not arguing that a college education would necessarily be a better use of that much money (despite our self-interest in the growth of the higher-education industry), but the report gives no evidence that their prescription for the expenditure is better than the same amount spent on education or some other area of activity. Full tuition at York College of Pennsylvania in 2008-09 is $13,680. See http://ycp.edu/admissions/208.htm. Full tuition for an in-state student at Penn State in 2008-09 is $13,014 for a freshman or sophomore and $14,070 for a junior or senior. See http://tuition.psu.edu/Rates2008-09/UniversityPark.asp.

thought to range as high as 400,000 new jobs."[322] No consideration appears to have been given to the increase in the satisfaction of human needs and wants possible by leaving the tax revenues with taxpayers. This can also be seen in the negative attitude toward even environmental improvements that reduce demand for labor.[323]

The UNEP report, unlike domestic reports, does note that the push for green jobs means that some workers will move from declining areas such as fossil fuels to renewable fuels (substitute jobs). Some jobs will be eliminated as disfavored practices, such as certain packaging materials, are prohibited. Other traditional jobs will be transformed. Plumbers will become green job plumbers as "work methods ... are greened."[324] Crucially, however, this estimate does not consider either the alternative use of nearly $1 trillion over that time period nor does it estimate how many jobs would be destroyed.[325] In other words, no *net* job estimate was developed.

If $1 trillion is spent on wind energy generation projects, then there is $1 trillion less to spend on solar energy, education, health-related research and development, or any other activity. Jobs that could have been created in alternative sectors will not be created. Further, since the goal is to replace a portion of existing power generation with wind energy, then fewer people will be employed in energy production from coal and other fossil fuel sources.[326] A "job demultiplier," which is likely at least as large as the multiplier assumed to be 2.5, and perhaps more, for reasons discussed below, would need to be applied to the lost jobs in those sectors. If a worker simply transfers from a job at a coal-fired electric plant to one at a wind-turbine electric plant, there is no job impact at all. This does not mean that wind energy production may not be a good idea, but that the job creation claims assume there is no alternative use for the resources devoted to this activity. It is likely that the net impact on employment is much lower and thus could even be an overall negative impact on the economy as we move away from the allocation of resources based on highest valued use in a competitive economy to allocation determined by political fiat.

Ignoring these net effects, green job estimates often claim credit for converting existing jobs into a "green" job. Retrofitting existing buildings, for example, is frequently cited as a major source of green jobs. The Mayors report predicts that:

> traditional contractors will develop their skill sets and expand their knowledge bases in ways that will allow them to transform large numbers of ordinary buildings into some of the most energy efficient in the world. The existing stock of energy inefficient buildings offers an opportunity to reduce total electricity demand and create jobs for these workers.[327]

This type of reasoning is endemic in the green jobs literature. Consider how it deals with the benefits of retrofitting existing buildings to higher energy efficiency standards. The CAP report

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[322] UNEP, *supra* note 5, at 170-171.

[323] *Id.* at 185 ("Making steel mills greener and more competitive is a must for job retention. At the same time, it must also be acknowledged that more energy efficient mills do not necessarily employ many people. In the United States, electric arc furnaces (which require far less energy than blast furnaces) are characterized by a lean workforce.").

[324] *Id.* at 3.

[325] ("The results do not reflect the net impacts of construction or operation of other types of electricity-generating power plants or replacement of existing power generation resources to meet growing needs.") DOE, 20% WIND, *supra* note 112, at 203.

[326] The UNEP report occasionally considers job losses, but generally finds them to be a positive effect. *See, e.g.*, UNEP, *supra* note 5, at 150 ("In a sustainable economy, there will be fewer jobs in airplane manufacturing and air travel services than today. But from a macro-economic perspective, this is not necessarily a negative development. Many jobs in the aviation industry are effectively heavily subsidized, via exemptions from fuel duty, value added tax, and duty-free rules.").

[327] MAYORS, *supra* note 1, at 10.

argues that retrofitting would enable replacing "at least" the 800,000 construction jobs lost due to the housing downturn between July 2006 and July 2008[328] and so should be required by the government for "all public buildings" and induced in private buildings by "strong financial incentives including both loan guarantees and tax credits."[329]

The UNEP concedes that "exact figures are unknown" but nonetheless states that "it is easy to imagine that a worldwide transition to energy-efficient buildings could create millions or even tens of millions of jobs and would green existing employment for many of the estimated 111 million people already working in the sector."[330] These jobs get counted as "new" because, as the UNEP report states, "[r]etrofitting buildings directly increases employment because without an attempt to make the building more efficient, the work would not have been done. Types of jobs that are likely to be created directly in the retrofitting process are auditors, engineers, estimators, project managers, and various jobs in the construction trades including pipe fitters, sheet metal workers, HVAC technicians, engineers, electricians, and general construction workers."[331] This assumes that these workers have no alternative employment. Removing them from doing whatever it was they would have done otherwise – unless they were all unemployed – eliminates jobs and production in those other areas.

E. Ignoring incentive effects

The green jobs literature focuses heavily on public policies intended to induce greater energy efficiency, both to reduce greenhouse gas emissions from power generation and because it generally seeks to shift expenditures away from fossil fuels. However, energy efficiency occurs naturally as a result of market processes even without expensive government programs. Because the literature ignores this trend, which has occurred in multiple industries over many decades, the green jobs literature overstates the benefits of its conservation measures by claiming credit for conservation that would occur even without such measures.[332]

Because energy is costly, market forces provide incentives to produce and consume using less energy. These forces have produced real change: from the late 1970s to 2000, energy utilization per dollar of real GDP produced fell by 36 percent.[333] Total energy usage increased because of economic growth over that time, but efficiency increased more than growth in all major energy-using sectors.[334] This trend has meant that past efforts to forecast future energy use have consistently overestimated future energy demands. During the 1970s the United States had grave concerns about the sufficiency of energy sources. Oil prices hit an all time high. Part of the problem was caused by an Arab oil embargo, and the domestic problem was exacerbated by price controls imposed by the Nixon Administration, causing concern that the energy crunch

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[328] CAP, *supra* note 10, at 2.

[329] *Id.* at 6-7.

[330] UNEP, *supra* note 5, at 12. Similarly, the UNEP report notes that "New green construction does allow for the possibility of some new jobs due to the increased investment in the construction phase. But most of the jobs created through green building practices are likely to occur from energy savings and reinvestment." *Id.* at 138. The literature also notes that retrofitting would "stimulate jobs in the manufacturing of green building components and systems" for buildings and wind, solar, etc. *Id.* at 143.

[331] *Id.* at 140.

[332] Most measured technological progress has occurred in about the last 200 years and much of it has to do, one way or another, with increases in efficiency.

[333] Paul L. Joskow, *Energy Policies and Their Consequences After 25 Years*, ENERGY J., Oct. 2003, at 17, 37.

[334] *Id.*

could inflict major economic harm as far into the future as could be seen. Would there be sufficient energy to drive the economic engine?[335]

Knowledgeable researchers in the late 1970s looked ahead to estimate energy use by 2000. Their conclusion was disturbing. It showed significant increases in energy would be needed.

Looking back, we know that the estimates of that time proved to be 60 to 80 percent too high compared to actual use by 2000.[336] In other words, the experts, who knew efficiency would increase, still greatly underestimated technical progress in efficiency. Further, the apparent incentive to conserve energy should have been lessened because oil prices turned out to be much lower by the mid-1980s than were anticipated by scholars in the late 1970s based on that decade's oil shock. The situation is no different today. We find no good reasons to be concerned about energy security in the future, but the future will not look like today because of innovations that emerge and that cannot now be known.

Given the bias against many technologies in the green jobs literature, as we documented earlier, we would expect the predictions made in it to be even more likely to incorrectly discount the chances of improvements in energy efficiency caused by market forces. Predictions of future energy efficiency depend on forecasts of technological change. But technical progress is a perpetual process, difficult to measure and difficult to force.

The green jobs literature is not the first time that government mandates have been proposed to reduce energy consumption. Mandatory energy savings have been popular since the oil shocks of the 1970s. Utilities were required at that time to engage in assorted "negawatt" programs that would result in less electricity being required over time.[337] Either due to political pressure to show good results, or simply due to poor ability to comprehend costs, the savings from the programs that emerged after the 1970s energy shock were vastly overstated or, conversely, the costs were underestimated "by a factor of two or more on average."[338] The claims in the green jobs literature should be evaluated keeping in mind this record of failure by political planners of energy policy. Proponents of new policies bear the burden to explain how their proposals will succeed where past efforts did not.

Market competition creates incentives for firms to find more efficient ways to achieve results.[339] There is potential profit in what is commonly viewed as waste. One of the first

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[335] Some were convinced that could not be possible, so doom was on the horizon. *See* Ehrlich, *supra* note 278.

[336] *Id.* at 35.

[337] *See* Fred Sissine, Cong. Research Serv., REPORT NO. IB10020, ENERGY EFFICIENCY: BUDGET, OIL CONSERVATION, AND ELECTRICITY CONSERVATION ISSUES, at CRS-1 to CRS-3 (2006), *available at* https://www.policyarchive.org/bitstream/handle/10207/744/IB10020_20060120.pdf?sequence=23 (discussing background and origins of energy efficiency programs).

[338] Paul L. Joskow & Donald B. Marron, *What Does a Negawatt Really Cost? Evidence from Utility Conservation Programs*, ENERGY J., Sept. 1992, at 41, 41-74.

[339] While the review that follows focuses on several areas, we must emphasize that waste reductions (improvements in efficiency are pervasive. A decade ago, the Federal Reserve Bank of Dallas estimated that a bank transaction in person cost a bank $1.14 (this ignores the bank customer time and cost of traveling to the bank) while an online transaction cost one cent. *See* FED. RESERVE BANK OF DALLAS, THE NEW PARADIGM: 1999 ANNUAL REPORT 15, *available at* http://www.dallasfed.org/fed/annual/1999p/ar99.pdf. A few decades ago there were many more bank jobs because many more tellers were needed. Those productive resources, humans, were released to other activities. The same report noted that Wal-Mart reduced truck operating costs by 20 percent by using computers, GPS, and cell phones in trucks and that Amoco's use of new seismic processes and computer analysis reduced the cost of finding oil from about $10 per barrel in 1991 to about $1 per barrel in 1999. *Id.* at 14. Weyerhaeuser's use of scanners and computers in log milling increased yields by 30 percent in less than a decade and "precision farming" technology using computers, sensors on machinery, and GPS systems reduced agricultural costs

extensive works to document this was by the business and technology journalist Peter Lund Simmonds who, in a 400-page study published in 1862, noted that "[i]n every manufacturing process there is more or less waste of the raw material, which it is the province of others following after the original manufacturer to collect and utilize."[340] He reported on such work involving cotton, wool, silk, leather, and iron. Even Karl Marx grudgingly acknowledged this productive feature of competition:

> With the advance of capitalist production the utilization of the excrements of production and consumption is extended. . . . The general requirements for the re-employment of these excrements are: A great quantity of such excrements, such as is only the result of production on a large scale; improvements in machinery by which substances formerly useless in their prevailing form are given another useful in reproduction; progress of science, especially of chemistry, which discovers the useful qualities of such waste.[341]

Other, less earthy, economists of that era discussed the wonders of the Chicago meat packing industry where there were developments "of tallow, glue, soap, felt, bone meal, glycerin, knife handles, buttons and countless other articles whose main inputs were previously wasted blood, feet, heads and other non-edible animal parts."[342] Later, Henry Ford built his Dearborn, Michigan, River Rouge complex with waste reduction in mind. Among many innovations, a cement plant was built next to the car factory to be able to dispose of tons of blast furnace slag; some of the cement was used in Ford construction activities, the rest was sold.[343] The process of technological innovation is continuous and usually so gradual we do not appreciate the extent of improvements.

Over the long term, market forces in conjunction with technological change have increased the efficiency of energy processes remarkably.[344] Table 4 shows the technological progress in delivering energy for heating, stationary power, electricity, transportation and lighting since the start of the Industrial Revolution around 1750. Although most of the data are from the United Kingdom, they are qualitatively applicable to the United States. The table shows that, compared to 1900, each unit of energy input in 2000 could provide four times as much useful heat, move a person 550 times farther, provide 50 times more illumination, and produce 12 times as much electricity. Much of the improvements occurred prior to 1950, that is, before the advent of the regulatory era in either the United Kingdom or the United States.

More importantly, after taking into consideration the changes in fuels, fuel mixes and energy conversion technologies, these forces have decreased the cost of energy services —

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and raised yields. *Id.* at 12. The list of improvements seem endless but, living amid it all, we often do not see the forest for the trees.

[340] Peter Lund Simmonds, WASTE PRODUCTS AND UNDEVELOPED SUBSTANCES; OR, HINTS FOR ENTERPRISE IN NEGLECTED FIELDS 2 (1862).

[341] Karl Marx, CAPITAL: A CRITIQUE OF POLITICAL ECONOMY: VOL. III – PT. I: THE PROCESS OF CAPITALIST PRODUCTION AS A WHOLE ch. 5, at 120-121. (Friedrich Engels ed., Cosimo Classics 2007).

[342] Pierre Desrochers, *Did the Invisible Hand Need a Regulatory Glove to Develop a Green Thumb?*, 41 ENVTL. & RESOURCE ECON. 519, 526 (2008).

[343] Pierre Desrochers, *By-product Development Before the Modern Environmental Era*, 8 ENTERPRISE & SOC'Y 348, 353-54 (2007).

[344] *See supra* tbl.1; *See also* Jesse H. Ausubel, *Technical Progress and Climate Change*, 23 ENERGY POL'Y 411, 411-416 (1995), *available at* http://phe.rockefeller.edu/tech_prog/.

namely, the provision of heat, stationary power, transport and lighting — to the consumer by an order of magnitude or more (see Table 4). As Fouquet and Pearson note:

> In [the] last two hundred and fifty years, the cost of generating useful heat has fallen more than 10-fold. To generate a unit of power costs 50 time less. To travel one kilometre is 150 times cheaper. To produce the same quantity of light, it costs us 8,000 times less.[345]

These improvements occurred when there was an upward trend in average energy prices during the latter half of the nineteenth century and much of the twentieth century, a period that witnessed massive changes in energy systems and substitutions towards more expensive but higher "quality" fuels, such as petroleum for transport, and natural gas and electricity for other uses.[346]

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[345] Fouquet & Pearson, *supra* note 347, at 11.

[346] *Id.* at 1.

Table 4 - Long-Run Trends in the Energy Technologies, UK or US, 1750-2000. [347]

ENERGY SERVICE	AREA	YEAR					
		1750	1800	1850	1900	1950	2000
Heating (% energy converted to heat)	UK	11	11	13.5	21	41	86
Stationary power (% thermal efficiency converted to power; includes power derived from electricity.)	UK	0.5	4.6	10	15	20	
Thermal power plant (Watt-hours of electricity produced per thousand BTU of heat input)[348]	USA				8.3	71.3	98.0
Transport (Passenger-kilometer per tonne of oil equivalent.)	UK		10	24	36	11,700	20,000
Lighting (Lumen-hours per kilowatt-hours.)	UK	29	36	190	500	11,600	25,000

[347] Goklany, *supra* note 241, at 144; EIA ANNUAL, *supra* note 183, at 364 tbl.A6; Roger Fouquet & Peter J.G. Pearson, *Long Run Trends in Energy Services, 1300-2000,* (Dep't of Econ. Univ. of the S. Pac., Fiji, Ctr. for Envtl. Policy Working Paper, 2005), *available at* http://www.webmeets.com/files/papers/ERE/WC3/154/HisEnS10.pdf.

[348] The figure for 1900 is taken from 1899. Goklany, *supra* note 241, at 144. 1950 and 2000 figures are from the Energy Information Administration. EIA ANNUAL, *supra* note 183, at 364 tbl.A6.

Table 5 - Long-Run Trends in the Price of Energy Services, UK or US, 1750-2000.[349]

ENERGY SERVICE	AREA	YEAR					
		1750	1800	1850	1900	1950	2000
Heating (Constant (2000) pounds sterling per tonne of coal equivalent of *effective* heat.)	UK	1,400	700	500	460	380	130
Stationary Power (Constant (2000) pence/kilowatt-hour.)	UK	140	35	35	20	4	2.5
Electricity, residential (Constant (2000) cents/kilowatt-hour)[350]	USA				267	17.4	8.2
Transport (Constant (2000) pence per passenger-kilometer.)	UK	15	5	1	0.38	0.16	0.1
Lighting (Constant (2000) pounds sterling/millions of lumen-hours.)	UK	13,690	6,630	1,175	276	10	1.7

In the following subsections, we examine U.S. energy consumption trends in some specific energy-intensive sectors and with respect to some specific energy consuming technologies to demonstrate both how this process operates and its importance in energy consumption.

1. Iron and Steel

The iron and steel industries are crucial industrial sectors, therefore "greening" jobs in these areas is a high priority for green jobs advocates.[351] If one only read the green jobs literature, you would be left with a strong sense that these are remarkably energy-inefficient industries. The reality is that iron and steel production has become much more energy-efficient without the sort of programs advocated by green jobs proponents. For example, the amount of energy consumed per ton of U.S. produced steel declined by over 60 percent from 1980 to 2006, and 29 percent

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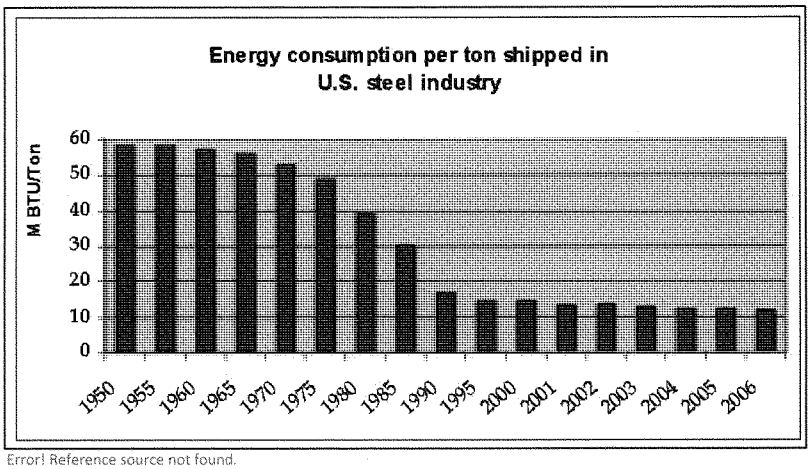
[349] Bureau of the Census, U.S. Dep't of Commerce, HISTORICAL STATISTICS OF THE UNITED STATES: COLONIAL TIMES TO 1970 (1976); EIA ANNUAL, *supra* note 183; Fouquet & Pearson, *supra* note 347; Bureau of Econ. Affairs, U.S. Dep't of Commerce, All NIPA Tables, http://www.bea.gov/national/nipaweb/SelectTable.asp (follow "Table 1.2.4. Price Indexes for Gross Domestic Product by Major Type of Product (A) (Q)" hyperlink) (last visited Feb. 22, 2009).

[350] 1900 figure is taken from 1902 data and calculated from Department of Commerce data. Bureau of the Census, *supra* note 349, at 211, 827; EIA ANNUAL, *supra* note 183; Bureau of Econ. Affairs, *supra* note 349.

[351] UNEP, *supra* note 5, at 15 ("making steel mills greener and more competitive is a must for job retention."); 49 (higher energy and materials productivity is "particularly critical" in industries like steel that consume a great deal of energy and natural resources.)

from 1990 to 2006.[352] These improvements were driven by the need to stay competitive in a tough business environment, which led to restructuring of the industry through the bankruptcies in the 1990s and early 2000s, closure of older and inefficient operations, and increases in the proportion of scrap iron and steel recycled via electric arc furnaces.[353] Not reflected in Figure 4 is the fact that today's steels are thinner and stronger, which means that for the average application, the decline in energy intensity is even greater than reflected on the figure.



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2. Aluminum

Based on data for 2000, it takes 44,700 Btu to produce one pound of primary aluminum in the United States, which makes it the most energy intensive major material manufactured.[354] On the other hand, secondary aluminum (that is, recycled aluminum) requires only 6 percent of the energy necessary to manufacture primary aluminum.[355] Between 1960 and 2000, secondary aluminum as a share of total aluminum production increased from 18 percent to 47 percent.

In addition to reduced energy consumption from recycling, primary aluminum production also became more efficient. Between 1960 and 2000 the energy required for smelting a kilogram of the primary ore, a key energy intensive operation necessary to produce the primary metal,

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[352] American Iron & Steel Inst., *US Steel Industry: World Leaders in Energy Efficiency*, http://www.steel.org/AM/Template.cfm?Section=Environment1&CONTENTID=21986&TEMPLATE=/CM/ContentDisplay.cfm. (last visited Feb. 22, 2009).

[353] U.S. Envtl. Prot. Agency, ENERGY TRENDS IN SELECTED MANUFACTURING SECTORS: OPPORTUNITIES AND CHALLENGES FOR ENVIRONMENTALLY PREFERABLE ENERGY OUTCOMES, at 3-53 to 3-54 (2007), *available at* http://www.epa.gov/sustainableindustry/pdf/energy/report.pdf.

[354] William T. Choate & John A. S. Green, U.S. ENERGY REQUIREMENTS FOR ALUMINUM PRODUCTION: HISTORICAL PERSPECTIVE, THEORETICAL LIMITS AND NEW OPPORTUNITIES, at B-1 app. B (2003), *available at* http://www.secat.net/docs/resources/US_Energy_Requirements_for_Aluminum_Production.pdf (prepared by BCS Corp. for the U.S. Dep't of Energy).

[355] *Id.* at 59.

declined by 35 percent. As a consequence, the total energy intensity of aluminum production in the U.S. declined by more than 58 percent over this period (see Figure 5).[356]

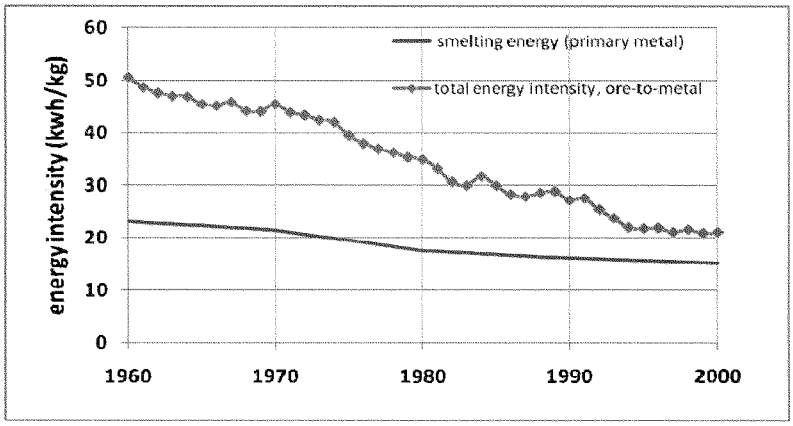

Figure 4 - Energy intensity for US aluminum production, 1960-2000.[357]

3. Ammonia

Ammonia production is the third most energy intensive production process, after aluminum, and pulp and paper production (12,200 Btu per pound).[358] As was the case with iron and steel, and aluminum, ammonia production became steadily more efficient during the twentieth century. Newer ammonia factories use 30 percent less energy than plants from the 1970s,[359] and are approaching the theoretical minimum based on the processes that are in use today (see Figure 6). Note that most of the efficiency gains preceded the modern regulatory era and so were the result of competition, not government mandates.

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[356] *Id.* at app. L.

[357] *Id.*

[358] This isn't just your mother's household cleanser; in 2006 146.5 million tons were produced as it is a common ingredient in a wide range of products. Ammonia – Wikipedia: The Free Encyclopedia, http://en.wikipedia.org/wiki/Ammonia (last visited Feb. 22, 2009).

[359] Int'l Fertilizer Indus. Ass'n, FERTILIZERS AND CLIMATE CHANGE 2 (2008), *available at* http://www.fertilizer.org/ifa/Home-Page/SUSTAINABILITY/Climate-change (follow "Download the entire module as a PDF file" hyperlink).

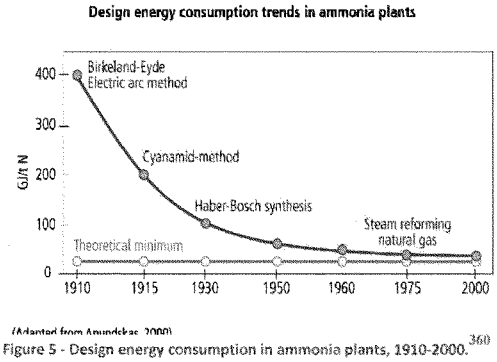

Figure 5 - Design energy consumption in ammonia plants, 1910-2000.[360]

4. Pulp and Paper

The second most energy intensive industry after aluminum is production of paper and paper board (15,100 Btu per pound).[361] Typically, two-thirds of the energy used by this industry is in the form of heat, with the remainder being consumed as electricity.[362] Unfortunately, the energy efficiency story in this industry is not as happy - the International Energy Agency (IEA) notes that the United States is the largest chemical pulp producer in the world, and has one of the world's most energy intensive pulp and paper industries, "at least partly due to the old age of [its] pulp and paper mills."[363]

Why has the pulp and paper industry not modernized its equipment and adopted more energy efficient production methods? A major part of the problem is that U.S. environmental regulations applicable to new sources act as a deterrent to replacing old plants and equipment. That is, a regulatory bias against new sources ("new source bias") leads to an "old plant effect," whereby companies would rather retain old inefficient plants by patching them up occasionally instead of replacing them with more efficient, but more capital intensive, new plants which would be made even more expensive because of the need to meet tighter regulatory standards.[364]

5. Appliances

The preceding sections describe both increasing energy efficiency in production of important goods and how regulatory barriers sometimes impede market forces pushing firms to adopt more efficient methods of production. We now turn to consumer goods, where increasing

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[360] *Id.*

[361] Int'l Energy Agency, WORLDWIDE TRENDS IN ENERGY USE AND EFFICIENCY: KEY INSIGHTS FROM IEA INDICATOR ANALYSIS 35 (2008), *available at* http://www.iea.org/Textbase/Papers/2008/Indicators_2008.pdf [hereinafter IEA].

[362] *Id.*

[363] *Id.* at 37.

[364] Jonathan Remy Nash & Richard L. Revesz, *Grandfathering and Environmental Regulation: The Law and Economics of New Source Review*, 101 NW. U. L. REV. 1678, 1708-1712; *see also id.* at 1691, 1692, 1694; Bruce Yandle, *Public Choice and the Environment*, POLITICAL ENVIRONMENTALISM 31, 36 (Terry L. Anderson, ed., 2000) ("The technology approach uses a batch process that is information-intensive and time-sensitive; it induces momentary discoveries then freezes the chosen technology.")

energy efficiency has been an important policy goal for decades.

California began setting energy efficiency standards for appliances as early as 1978.[365] Beginning in 1980, a Federal labeling program for major household appliances ("EnergyGuide"), enacted into law in 1975, went into effect. In 1988, Department of Energy (DOE) started imposing federal standards under the National Appliance Energy Conservation Act (NAECA) of 1987[366] which was enacted, in large part, to preempt a multiplicity of state standards.[367] NAECA established minimum efficiency standards for many household appliances, such as refrigerators, refrigerator-freezers, and freezers; room air conditioners; fluorescent lamp ballasts; clothes washers and dryers; dishwashers; kitchen ranges and ovens; pool heaters; television sets (withdrawn in 1995);[368] and water heaters.[369] Congress set initial federal energy efficiency standards and established schedules for DOE to review these standards.[370] The Energy Policy Act of 1992 (EPAct) added standards for additional devices and systems, such as some fluorescent and incandescent reflector lamps, plumbing products, electric motors, commercial water heaters, and heating, ventilation, and air conditioning (HVAC) systems, and allowed the future development of standards for several other products.[371] It also provided for voluntary testing and consumer information programs for office equipment, luminaries, and windows.[372] The existence of a federal standard for energy or water conservation products generally preempts state standards, unless the state standard is identical to the federal standard.[373] These standards provide an opportunity to test the efficacy of the sort of mandates for energy efficiency proposed by green jobs advocates.

Among home appliances, refrigerators are among the largest energy consumers (see Figure 7). The U.S. experience with refrigerators is a way to test the home appliance standards' effectiveness.

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[365] IEA, ENERGY LABELS AND STANDARDS 107 (2000), *available at* http://www.iea.org/textbase/nppdf/free/2000/label2000.pdf; Regulations for Appliance Efficiency Standards Relating to Refrigerators, Refrigerator-Freezers and Freezers (adopted Nov. 3, 1976.). Available at http://www.energy.ca.gov/appliances/appl_regs_1976-1992/1977_12_22_Appl_Regs.pdf

[366] Lawrence Berkeley Nat'l Lab., U.S. Dep't of Energy, ENERGY EFFICIENCY STANDARDS: THE STANDARD SETTING PROCESS, *available at* http://ees.ead.lbl.gov/node/2 (last visited Feb. 22, 2009); National Appliance Energy Conservation Act of 1987. Pub. L. 100-12, Mar. 17, 1987, 101 Stat. 103).

[367] Lawrence Berkeley Nat'l Lab., *supra* note 366; *see also* National Appliance Energy Conservation Act of 1987 Pub. L. No. 100-12; IEA, *supra* note 365, at 173-75; Senate Report No. 100-6, at 2-3. Reprinted in U.S.C.C.A.N., 100th Cong.., 1st Sess., vol. 2, at 52-54.

[368] Bldg. Tech. Program, U.S. Dep't of Energy, 2008, Appliances and Commercial Equipment Standards: History of Federal Appliance Standards, http://www1.eere.energy.gov/buildings/appliance_standards/history.html (last visited Feb. 22, 2009); Weatherization Assistance Program Technical Assistance Ctr., Weatherization Program Notice 00-5, http://www.waptac.org/sp.asp?id=6897 (last visited Feb. 22, 2009) [hereinafter WAPTAC]; Lawrence Berkeley Nat'l Lab., *supra* note 366; *see also* National Appliance Energy Conservation Act of 1987 Pub. L. No. 100-12, Section 3 (amending section 322(a) of the Energy Policy and Conservation Act, 42 U.S.C. 6292(a)(1)-(13)).;

[369] Bldg. Tech. Program, *supra* note 368; WAPTAC, *supra* note 368; 42 U.S.C. 6292(a)(4) (water heaters).

[370] Bldg. Tech. Program, *supra* note 368; WAPTAC, *supra* note 368; Energy Conservation Standards, Section 5, Pub. L. 100-12.

[371] Bldg. Tech. Program, *supra* note 368; Energy Policy Act of 1992, Pub. L. 102-486, 102 Stat. 2776.

[372] *Id.*

[373] Bldg. Tech. Program, *supra* note 368; Preemption of State Regulations (Energy Conservation Program for Consumer Products) 10 C.F.R. 430.33 (2009) ("Any State regulation providing for any energy conservation standard, or water conservation standard… or other requirement with respect to the energy efficiency, energy use, or water use… of a covered product that is not identical to a Federal standard in effect under this subpart is preempted by that standard….").

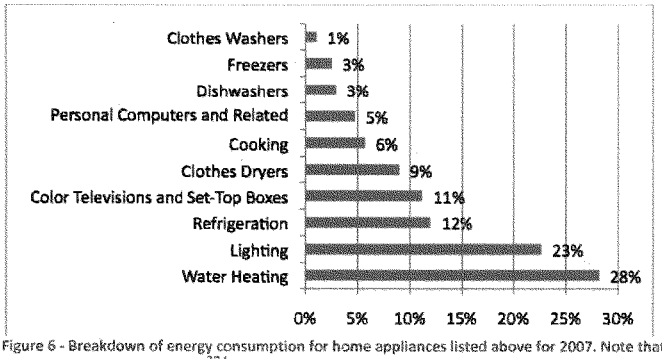

Figure 6 - Breakdown of energy consumption for home appliances listed above for 2007. Note that heating, ventilation and air conditioning are excluded. [374]

The first thing we notice in examining refridgerator energy efficiency is that the efficiency of household refrigerators has been increasing steadily at least since the mid-1970s (see Figure 8). Several analysts claim that "the majority of efficiency gains have been driven by the introduction of regulatory policies."[375] If true, this would support the introduction of the sort of mandate policies advocated by green jobs proponents.

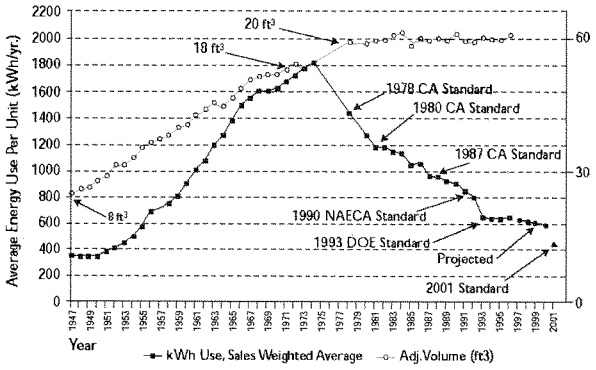

Figure 7 - Average energy use per unit, 1947-2000. [376]

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[374] Energy Info. Admin., U.S. Dep't of Energy, REPORT NO. DOE/EIA-0383(2009), ANNUAL ENERGY OUTLOOK 2009 EARLY RELEASE app. A, at 9, tbl.A4, *available at* http://www.eia.doe.gov/oiaf/aeo/pdf/appa.pdf (full report forthcoming early 2009).

[375] Mark Ellis et al., *Do Energy Efficient Appliances Cost More?*, at 1129 (2007) (conference proceeding of ECEEE 2007 Summer Study: Saving Energy — Just Do It!), *available at* http://www.leonardo-energy.org/drupal/node/4038 (follow "Download" hyperlink); IEA, *supra* note 365, at 107-08.

[376] IEA, *supra* note 375, at 108.

There are a number of reasons to believe that the improvements in refridgeration efficiency have not been due to the mandates. First, as Figure 8 shows, more than half the improvements preceded the imposition of Federal standards. Instead the change in slope of the line in Figure 8 appears in response to the first oil shock of 1973, which was reinforced by the run up in energy prices from 1979 to 1985.[377] Since the slope reverses prior to the policies, the policies cannot be the cause of the change. Second, even the post-federal policy efficiency improvements in the early- to mid-1980s can be ascribed to high energy prices reinforced by the ready availability of information to the consumer, via labeling requirements (that is, the EnergyGuides available for each appliance) rather than the efficiency guidelines. Third, a portion of these improvements particularly since the 1980s can be attributed to broader use of microchips and electronic controls, and the drop in in the price of such controls.[378] These factors were probably driven as much, if not more, by consumer desires and increased competition in the market place heightened by globalization and trade than by mandates.[379]

Moreover, the increase in the energy use per unit prior to the mid-1970s was not due to increased energy inefficiency in home refrigerators. Rather it was caused by increases in the sizes of refrigerators (see Figures 8 and 9), and progressive improvements in their features over time. These features include increases in the relative size of freezer sections, advent and greater penetration of frost free/ frost-proof units, and icemakers.[380] In short, consumers were getting more and better refrigerators for their money which, however, required greater energy to maintain and use. At a time of cheap energy prices, it is unsurprising that the market provided consumer goods that used energy to eliminate unpleasant chores such as defrosting freezers or enabled consumers to economize by storing food in larger freezer units.

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[377] EIA ANNUAL, *supra* note 183, at xxiv fig.20.

[378] W.J. Spencer & T.E. Seidel, *International Technology Roadmaps: The U.S. Semiconductor Experience*, *in* PRODUCTIVITY AND CYCLICALITY IN SEMICONDUCTORS: TRENDS, IMPLICATIONS, AND QUESTIONS -- REPORT OF A SYMPOSIUM 135, 135-136 (Dale W. Jorgenson & Charles W. Wessner eds., 2004); Nadejda M. Victor & Jesse H. Ausubel, 2002, *DRAMs as Model Organisms for Study of Technological Evolution*, 69 TECH. FORECASTING & SOC. CHANGE 243, 243-262 (2002).

[379] This was an era in which made-in-America goods were under increasing pressure from made-in-Asia goods, first from Japan, then Taiwan and Korea, and currently, China, Thailand, and Malaysia. Appliance manufacturing was part of this general trend. This led to greater pressures to improve the quality of products and reduce their cost to consumers.

[380] *See e.g.*, Ass'n of Home Appliance Mfrs, *Appliance Milestones*, http://www.aham.org/consumer/ht/a/GetDocumentAction/id/1408 (last visited Feb. 22, 2009); Electrolux Int'l Co., History of Frigidaire, http://www.frigidaire-intl.com/history.asp (last visited Feb. 22, 2009); *see also* Frigidaire Co., Frigidaire: 85th Anniversary, http://www.frigidaire.com.hk/download/~Frigidaire%20history%20-%2085th%20anniversary%202004.pdf (last visited Feb. 22, 2009).

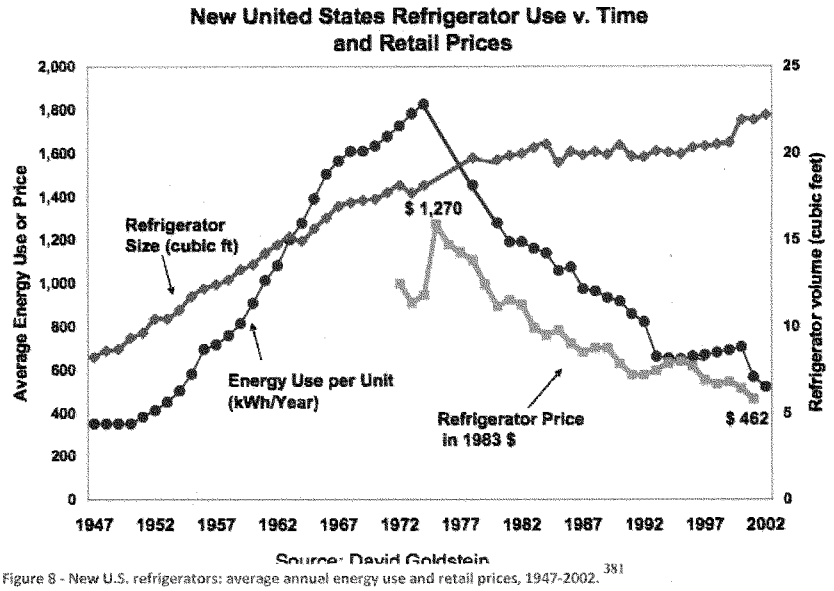

Figure 8 - New U.S. refrigerators: average annual energy use and retail prices, 1947-2002.[381]

Moreover, national refrigerator sales data indicate that following the introduction of refrigerator standards, real prices decreased, even after adjusting for changes in refrigerator size and amenities (see Figure 9). Normalised to food and freezer volumes, real refrigerator prices declined 8 percent from 1987 to 1993.[382] It has been argued, therefore, that energy standards have little or no effect on appliance prices. This, of course, is probably a testament to the price-lowering effects of competition (see Tables 4 and 5). It is possible that the price may have dropped further but for the standards. Alternatively, the price may not have been much different because reduced energy consumption is an amenity that the manufacturers would, in a competitive free market system, have provided of their own volition to consumers sooner or later regardless of the existence of any standards (as Tables 4 and 5 suggest).

Our analysis is consistent with the findings of the IEA examination of similar data across countries:

> Analysis ... for 16 IEA countries shows that improved energy efficiency has been the main reason why final energy use has been decoupled from economic growth. Without the energy efficiency improvements that occurred between 1973 and 2005 in 11 of those countries, energy use would have been 58%, or 59 EJ, higher

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[381] Arthur H. Rosenfeld, Cal. Energy Comm'n, *From the Lab to the Marketplace to Standards 22* (Mar. 21, 2007) (presentation to Berkeley Energy Res. Collaborative, Univ. of Cal., Berkeley), *available at* http://www.energy.ca.gov/2007publications/CEC-999-2007-014/CEC-999-2007-014.ppt.

[382] INT'L ENERGY AGENCY, *supra* note 375, at 109.

> in 2005 than it actually was. However, since 1990 the rate of energy efficiency improvement has been much lower than in previous decades.
>
> These findings provide an important policy conclusion — that the changes caused by the oil price shocks in the 1970s and the resulting energy policies did considerably more to control growth in energy demand and reduce CO2 emissions than the energy efficiency and climate policies implemented in the 1990s.[383]

Our examination of energy consumption across both producer and consumer goods demonstrates three important lessons relevant to the evaluation of the claims of green jobs advocates. First, market forces provide a powerful incentive that drives greater efficiency with respect to costly inputs. This suggests that the net gains from green jobs policies mandating conservation are likely to produce fewer gains than the advocates claim since some, all, or even more than the efficiency gains claimed would occur even in the absence of mandates due to rising energy prices. Second, regulatory policies have, at least some of the time, slowed or blocked energy efficiency gains through unintended consequences. Adopting mandates is thus not risk free with respect to energy efficiency. Third, the green jobs literature does not even discuss the extensive data, including that summarized here, on increases in energy efficiency over time in the very industries they propose to regulate. This ahistorical approach casts serious doubt on the credibility of the green jobs literature. The authors of this paper are not experts on aluminum or refrigerators. Yet we were able to find from widely distributed, publicly available sources, extensive data on a crucial issue in the green jobs literature that is completely ignored by that literature. Such gaps suggest a need for great skepticism in evaluating the claims.

F. Market hostility

As we have shown in the preceding sections, underlying much of the green jobs literature is a deep hostility to market societies that favor voluntary and decentralized decision making over centralized decision making. There is a clear preference for centrally-directed programs built on mandates. The unprecedented increase in human welfare resulting from the industrial revolution is dismissed as "[t]he story of economic change is, however, also a story about political choices. More often than not, these choices have put the accumulation of wealth before the needs of the majority."[384] For example, the UNEP report insists that there is an:

> urgent need to make economies far more sustainable and thus to re-examine the prevailing production and consumption model. Concepts such as dematerialization, remanufacturing, 'zero-waste' closed-loop systems, durability, and replacing product purchases with efficient services (such as 'performance contracting') have been discussed for some time and tested in some instances, but by and large have yet to be translated into reality.[385]

In the eyes of green jobs proponents, the answer to a problem is almost always a massive public expenditure or regulation[386] rather than less intrusive interventions.

For example, although the UNEP report identified the obstacle to green building techniques as due in large part to an information problem—people's overestimation of the

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[383] IEA, *supra* note 3622, at 15.

[384] UNEP, *supra* note 5, at 278.

[385] *Id.* at 6.

[386] *Id.* at 278 ("Fortunately, the effort to create a Just Transition can draw encouragement from the long tradition of social and labor legislation put in place to protect the poor and disadvantaged, to facilitate the creation of socially necessary work, and to embed social solidarity in the fabric of economic life.").

additional cost of green techniques—the recommendation is government action instead of the provision of information.[387] Perhaps nothing captures the contempt for improving the lives of ordinary people that is rampant in the green jobs literature better than the UNEP report's suggestion that rickshaws could become a significant form of transportation in a green economy.[388] This rejection of the basic principles underlying decentralized, market-based societies leads to a focus on mandates and conceptual errors that render the results of these studies untrustworthy.

The point of our critique in this section is not simply that the green jobs literature contains important methodological and conceptual errors, although we believe it does. The most important problem is that these errors are part of a systematic bias toward a society based on centrally-directed, politically-determined choices and away from one based on decentralized decision-making in the free marketplace.

Energy is involved in every aspect of our lives – energy policy analyst Robert L. Bradley, Jr. labels it "the master resource" – and the green jobs proposals to remake the energy industry will touch every corner of Americans' lives for generations if enacted. The sweeping proposals to alter free trade policies that have existed since the end of World War II and return to the devastating protectionism of the 1920s and 1930s will impoverish both Americans and our trading partners around the world. The redefinition of economic welfare to exclude consumer surplus – an economically incoherent approach – will lead to higher prices for virtually all goods. Before such a radical restructuring of the economies at home and abroad is undertaken, it needs to be openly debated and discussed. We believe that any such debate would result in an overwhelming rejection once the consequences are widely understood. Such changes should occur only after an open debate, not as the result of hidden assumptions.

IV. Ignoring technical literatures

We next examine three issues across the studies where the green jobs literature routinely ignores important technical literatures that raise issues that cast doubt on some of the assumptions underlying the green jobs program. We first examine the treatment of mass transit. Then we turn to the literature's examination of biofuels. Finally, we address the analysis of electricity generation. In each case, the literature consistently ignores important facts that cast doubt on its claims and engages in the sort of selective technological optimism we described earlier.

A. Mass transit

Green jobs proponents often advocate investment in expanding public transportation as a means of creating jobs with an environmentally friendly purpose. For example, CAP argues that building light rail and subway systems will produce "job growth in engineering, electrical work, welding, metal fabrication, and engine assembly sectors" and such investment in "both urban and rural communities … can be an engine for far broader economic activity."[389] More money for

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[387] *Id.* at 139 (UNEP notes that "Despite the overall social, economic, and environmental benefits, sustainable building practices remain a niche market. The cost of green building or the perceived cost is still a major barrier." People overestimate the costs of green building as 17 percent rather than 2-5percent or at most 10%, with 2-7 year paybacks.)

[388] *Id.* at 14 ("bicycles and modern bicycle rickshaws offer a sustainable alternative and create employment in manufacturing and transportation services."). The romantic view of happy workers pulling or peddling rickshaws for a joyful life in service to others is provided by wealthy UN employees who may ride in them when visiting poor countries to dispense wisdom.

[389] CAP, *supra* note 10, at 7-8.

freight rail would "yield some immediate job gains in similar professions, creating substantial employment through both construction operations, alongside a down payment on more job creation over two years through improved maintenance and expansion of services."[390] In the short run, CAP advocates more bus and subway services, reducing public transportation fares, increasing federal support for mass transit "to deal with increased ridership," increased federal subsidies for employer-based mass transit incentives, and "[h]igher funding for critical mass transit programs currently bottlenecked for lack of federal dollars to encourage new ridership and more transportation choices."[391]

Similarly, the UNEP study contends that "a more sustainable system will have to be based on shorter distances. Reduced distances and greater density of human settlements enables a re-balancing of transportation modes—giving greater weight to public transit systems, as well as walking and biking. A modal shift away from private vehicles and toward rail and other public transport can generate considerable net employment gains, while reducing emissions and improving air quality."[392] The reason for this position is that it is an article of faith in the environmental community and government circles that mass transit (including different forms of rail travel) is more energy efficient than automobiles.[393] A cursory examination of the amount of energy used to move one passenger one mile (a "passenger mile") reinforces this belief.

Table 6 shows the energy needed per passenger mile for different modes of travel, arranged in the order of increasing efficiency. Data for the Toyota Prius are shown at the very end to provide a sense of the possibilities of increasing efficiencies for automobiles. This table shows that bus transit is generally less efficient than automobiles in general, while rail transit is more efficient than automobiles. However, Table 6 is misleading in several important respects. First, the raw numbers do not account for the fact that for rail transit to function, it is necessary to have an extensive bus feeder system that moves people to the rail stops. Taking this into account reduces, and may even eliminate, the savings in energy or reductions in CO2 emissions suggested by Table 6.

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[390] *Id.* at 8.

[391] *Id.* at 7.

[392] UNEP, *supra* note 5, at 13. Remember that "net employment gains" generally means higher costs due to lower productivity. Lower standards of living do not produce a greater level of sustainability for humans.

[393] *Id.* (UNEP: "Railways are more environment-friendly and labor intensive than the car industry."); *id.* at 164 ("Public transit is less energy and carbon-intensive than automobiles.") .

Table 6 - Modal Energy Consumption and CO2 Emissions per Passenger Mile.[394]

Mode	Energy Expended (BTUs)	Emissions (lbs. of CO_2)
Ferry Boats	10,744	1.73
Automated Guideways	10,661	1.36
Light Trucks	4,423	0.69
Motor Buses	4,365	0.71
Trolley Buses	3,923	0.28
All Automobiles[395]	3,885	0.61
Light Rail	3,465	0.36
Passenger Cars	3,445	0.54
All Transit	3,444	0.47
Heavy Rail	2,600	0.25
Commuter Rail	2,558	0.29
Toyota Prius†	*1,659*	*0.26*

As O'Toole explains, transit agencies, to get people to the rail stations, typically increase bus service. Bus routes that used to serve the rail corridor are turned into feeder bus routes for the rail. However, since many people drive to rail stations, the average passenger load of the feeder buses tends to be smaller than it used to be for the corridor buses they replaced. Consequently, the advent of new rail transit lines could increase fuel usage because the average loads of the buses is reduced. For example, in 1991, before St. Louis built its light rail system its buses averaged more than 10 riders and consumed 4,600 BTUs per passenger mile. After the light-rail line opened, average bus loads in 1995 declined to 7 riders and energy consumed per passenger-mile increased to 5,300 BTUs. CO_2 emissions increased from 0.75 pounds to 0.88 pounds per passenger mile. Similarly, energy and CO_2 performance also deteriorated for Sacramento and Houston after rail transit was implemented.[396]

Second, even if rail transit results in a net reduction in energy use and CO_2 emissions, these improvements may be more than offset by the energy required to construct the rail system, and any resulting emissions. For example, Portland's North Interstate light rail line is estimated to save about 23 billion BTUs per year while its construction is estimated to consume 3.9 trillion BTUs, that is, it would take 172 years to offset the extra energy needed for construction.[397] Not

[394] Randal O'Toole, *Does Rail Transit Save Energy or Reduce Greenhouse Gas Emissions?*, POL'Y ANALYSIS, Apr. 14, 2008, at 4, *available at* http://www.cato.org/pubs/pas/pa-615.pdf.

[395] This figure includes passenger cars and light trucks.

[396] O'Toole, *supra* note 394, at 14-15.

[397] *Id.* at 15.

only would this exceed the lifespan of the line, "long before 172 years, automobiles are likely to be so energy efficient that light rail will offer no savings at all."[398]

Similarly, Seattle's North Link light-rail line is estimated to save about 346 billion BTUs of energy in 2015 and 200 billion BTUs in 2030.[399] The energy savings will not repay the construction energy cost of 17.4 trillion BTUs until 2095.[400] Despite the claim that the light rail project should have about a 100-year lifespan, experience from the Washington and Bay Area metro systems indicate that the expected lifespan is probably closer to 40 years, before which additional capital and energy investments would need to be made to rebuild or replace the system.[401] Of course, any alternative to rail transit will also consume energy and emit CO_2. However, highways are likely more efficient than rail transit because, compared to the latter, each mile of urban highway typically carries far more passenger-miles. For instance, the average mile of light-rail line moved only 15 percent as many passenger miles as the average lane mile of urban freeway in rail regions.[402] Highways also carry millions of tons of freight that can share the cost of construction.[403]

Moreover, contrary to the claims of disproportionate spending on highways, mass transit already receives more than its share (as measured by passenger-miles) of government funds. Data for 2001-2003 from the Bureau of Transportation Statistics indicate that although mass transit is responsible for less than 1 percent of the total passenger miles moved in the United States, it receives about 23 percent of the Federal Transportation Grants (in dollars).[404] By contrast, highways which are responsible for almost 90 percent of the passenger miles, receive about 70 percent of the grants.[405]

Such disproportionate spending on transit might be justifiable were mass transit to provide net social value. However, studies indicate that most transit systems may not be socially desirable.[406] As Winston and Maheshri observe:

> Despite a decline in its mode share, investment to build new urban rail transit systems and extend old ones continues... [Based on estimates of] the contribution of each U.S. urban rail operation to social welfare based on the demand for and cost of its service....[w]e find that with the exception of BART in the San Francisco Bay area, every system actually reduces welfare and is unable to become socially desirable even with optimal pricing or physical restructuring of its network. We conclude rail's social cost is unlikely to abate because it enjoys powerful political support from planners, civic boosters, and policymakers."[407]

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[398] *Id.*

[399] *Id.*

[400] *Id.*

[401] *Id.*

[402] *Id.* at 16.

[403] *Id.*

[404] Bureau of Transp. Statistics, U.S. Dep't of Transp., NATIONAL TRANSPORTATION STATISTICS 2008, tbls.1-37 & 3-30b (William H. Moore ed., 2008), *available at* http://www.bts.gov/publications/national_transportation_statistics/pdf/entire.pdf. This ratio is consistent with the 2009 stimulus bill; it allocates $27 billion for highway projects and $12 billion for rail and mass-transit projects. Bob Johnson, *For Road Crews, Stimulus Promises More Opportunity*, WASH. POST, Feb. 15, 2009, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2009/02/15/AR2009021500551.html?hpid=sec-business.

[405] Bureau of Transp. Statistics, *supra* note 404, at tbls.1-37 & 3-30b.

[406] Clifford Winston & Vikram Maheshri, *On the Social Desirability of Urban Rail Transit Systems*, 62 J. URBAN ECON. 362, 362-383 (2007); O'Toole, *supra* note 394.

[407] Winston & Maheshri, *supra* note 406, at 362.

They go on to note that:

> Unfortunately, transit systems have been able to evolve because their supporters have sold them as an antidote to the social costs associated with automobile travel, in spite of strong evidence to the contrary.[40] As long as rail transit continues to be erroneously viewed in this way by the public, it will continue to be an increasing drain on social welfare.[408]

To summarize, with regard to reduced energy usage and lower greenhouse gas emisions, mass transit provides few if any benefits over the automobile. In fact, it may even be counterproductive if one adds in the energy consumed during construction. Consequently, it makes little sense to continue to subsidize this form of transportation for the masses, and even less sense to add to these subsidies. In other words, it is the wrong sort of infrastructure on both economic and environmental grounds.

One logical fallacy in much of the discussion about private cars is the asymmetric treatment of innovation, which we have identified, is a consistent problem in the green jobs literature. It is logically inconsistent to assume that technological progress will solve the current problems in generating and transmitting wind or solar power while simultaneously assuming no progress in solving problems of powering private automobiles.[409] The rapid diffusion of hybrid vehicles and the projected introduction of fully electric vehicles is evidence that technological innovation is not necessarily biased against automobiles.

In the historical record, mass transit is an anomaly, occupying a dominant role for the brief period when its greater speed was enough to outweigh its inconvenience. Further, mass transit's most lasting effect was to facilitate the *decentralization* of metropolitan areas by allowing individuals to live farther than walking distance from their place of employment.[410]

Even in the unlikely event that households suddenly reduced their reliance on private automobiles, their switch to mass transit will have no dramatic effect on the metropolitan structure. A study of the various explanations of metropolitan decentralization in the United States found that a 10 percent reduction in households owning one or more cars would only reduce the size of a metropolitan area by about 0.5 percent.[411] For a typical metropolitan area of about 160 square miles, this implies a reduction in size of less than 1 square mile, hardly the source of a substantial new demand for buses, much less biking and walking.

B. Biofuels.

Green jobs proponents put a great deal of emphasis on developing biofuels to replace petroleum. For example, the CAP report mentions several time the need to "invest" huge sums of taxpayers' money in "next-generation biofuels," "advanced biofuels," and "low-carbon" and

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[408] *Id.* at 381.

[409] There is a bit of schizophrenia in the green policy view. Cars are should be eliminated in favor of mass transit and rickshaws because they are dreadful polluters, but that the same time they should increase their miles per gallon of gasoline consumed. The green policy advocates are positive the car companies can do much better, if only they put their minds to it.

[410] Bogart, *supra* note 223, at 41.

[411] Robert Wassmer, *Causes of Urban Sprawl in the United States: Auto Reliance as Compared to Natural Evolution, Flight from Blight, and Local Revenue Reliance*, 27 J. POL'Y ANALYSIS & MGMT. 536, 536 (2008).

"cellulosic biofuels"[412] without further explanation than the terms just quoted.[413] The UNEP report notes that the issue is not so clear: "There is vigorous and contentious debate over the economic and environmental merits of biofuels, including the question of direct competition with food production."[414] While the UNEP report addresses some concerns, the others presume biofuels to be the wave of the future. The discussions exhibit technological optimism about "advanced" biofuels, while continuing technological pessimism about fossil fuels, and generally ignore important issues revealed by the history of the efforts to develop biofuels. These problems are particular evident with biofuels because we already know a great deal about how government programs to expand biofuel production operate.

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[412] "The term "cellulosic biofuel" means renewable fuel derived from any cellulose, hemicellulose, or lignin that is derived from renewable biomass and that has lifecycle greenhouse gas emissions, as determined by the Administrator, that are at least 60 percent less than the baseline lifecycle greenhouse gas emissions." 42 U.S.C. 7545(o)(1)(E) (2009). This problem is noted in some of the literature itself. *See, e.g.* UNEP, *supra* note 5, at 33 ("Many studies that lay out pathways toward a sustainable economy declaim a future of green jobs—but few present specifics. This is no accident. There are still huge gaps in our knowledge and available data.").

[413] CAP, *supra* note 10, at 2, 5, 8 & 25 ("next-generation"); *id.* at 6, 8 & 9 ("advanced"); *id.* at 29 ("low-carbon" and "cellulosic").

[414] UNEP, *supra* note 5, at 118. This report dedicates ten pages to the issue at this point, noting that increased use of biofuels threatens the affordability of food for the poor and may cause increased cultivation of land. So there are a host of economic and environmental tradeoffs. Of greatest concern is that biofuels will come from mechanized agriculture; the report advocates using labor-intensive methods of cultivation of the plants devoted to such use.

Table 7 - Energy subsidies not related to electricity production. [415]

Fuel category	Fuel consumption (quadrillion Btu)	FY 2007 subsidy and support (million 2007 $)	Subsidy per million Btu (2007 $)
Coal	1.93	78	0.04
Refined coal	0.16	214	1.35
Natural gas and petroleum liquids	55.78	1,921	0.03
Ethanol/Biofuels	0.57	3,249	5.72
Geothermal	0.04	1	0.02
Solar	0.07	184	2.82
Other renewables	2.50	360	0.14
Hydrogen	n.a.	230	NM
Total fuel specific	60.95	6,237	NM
Total Non-Fuel Specific	NM	3,597	NM
TOTAL END-USE & NON-ELECTRIC ENERGY	NM	9,834	NM

NOTE: NM = not meaningful

In Fiscal Year 2007, ethanol and biofuels received federal subsidies and support of at least $3.25 billion in the United States alone.[416] (See Table 7). Note that this estimate does not include the value associated with the Renewable Fuel Standard (RFS) mandate and so underestimates the total subsidy. Since then, Congress, with one minor downward adjustment, has greatly expanded the scope and level of biofuel subsidies in the future. Under the 2008 Farm Bill, gasoline suppliers will receive 45 cents per gallon of ethanol, down from 51 cents per gallon. However, it provided special subsidies for cellulosic ethanol which, at the time of passage of the Farm Bill, had yet to be manufactured commercially.[417] Under it, refiners will get $1.01 per gallon of ethanol, and growers will get $45 per ton of biomass.[418] In addition, domestic

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[415] Source: Energy Information Administration, FEDERAL FINANCIAL INTERVENTIONS AND SUBSIDIES IN ENERGY MARKETS 2007. Report #:SR/CNEAF/2008-01 (2008)available at http://www.eia.doe.gov/oiaf/servicerpt/subsidy2/index.html.

[416] Energy Info. Admin., *supra* note 170, at xviii.

[417] Tom Capehart, CONG. RESEARCH SERV. REPORT NO. RL34738, RENEWABLE ENERGY POLICY IN THE 2008 FARM BILL, at CRS-4 (2008), *available at* http://assets.opencrs.com/rpts/RL34738_20081107.pdf. I.R.C. Section 40(h)(2) (2008).

[418] *Id.*; I.R.C. Section 40(b)(6)(B) (2008) (Cellulosic biofuels credit). 7 U.S.C. 8111(d)(2)(B) ($45 per ton maximum biomass assistance).

suppliers of ethanol continue to be protected from imports via an import duty of 54 cents per gallon.[419]

The changes in the Farm Bill followed the upward revision of the Renewable Fuels Standard (RFS) under the Energy Independence and Security Act of 2007.[420] Under the Energy Policy Act of 2005, the RFS required the amount of renewable fuel in gasoline to increase from 4 billion gallons in 2006 to 7.5 billion gallons in 2012. The 2007 EISA increased this from 9 billion in 2008 to 36 billion gallons by 2022.[421] Corn ethanol's share of the RFS is effectively capped at 15 billion gallons per year.[422] The EISA also specifically mandates the use of 16 billion gallons of cellulosic biofuel by 2022 and 1 billion gallons of biomass-based diesel fuel annually by 2012, although the EPA Administrator has the authority under certain conditions to waive these requirements in whole or part.[423] Recently, the request for a waiver from the Governor of Texas to reduce the effect of the RFS on food and feed prices (and the Texas economy) was denied by the Administrator.[424]

Support for subsidizing biofuels (including ethanol) is based on one fact and many oversights. The fact is that that biofuels are the products of photosynthesis, that is, they are derived from vegetation that takes carbon dioxide from the atmosphere and converts it into biomass which then may be processed into liquid or gaseous biofuels (such as ethanol) that, when burnt, provide energy to meet human needs while returning the carbon dioxide to the atmosphere. Thus, in theory, from the perspective of greenhouse gases, the production and consumption of a biofuel should be part of a closed loop system, with no net emissions of CO_2, the primary anthropogenic greenhouse gas (GHG) in the atmosphere.[425] As will be shown below, however, reality is much more complex. Several unintended consequences are associated with the use of biofuels.[426] Belated recognition of these has led to the current emphasis on cellulosic ethanol, which biofuel supporters believe can reduce, if not avoid, some of these consequences.[427]

Assuming that the biomass is grown as part or all of a crop, as opposed to being scavenged off the landscape, it takes extra energy to grow the biomass. This energy is provided in the form of fertilizers and pesticides needed to increase crop yields, and fuels used to operate the machinery needed to cultivate, seed, and harvest the crop. If the energy is not needed in

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[419] Capehart, *supra* note 417, at CRS-5; Food, Conservation, and Energy Act of 2008, Pub. L. 110-234. Ethanol Tariff Extension (through 1/1/2011), 122 Stat. 923, at 1516. For actual tariff imposed, see http://www.cia.doe.gov/oiaf/aeo/otheranalysis/aeo_2008analysispapers/ffttc.html.

[420] Capehart, *supra* note 417, at CRS-1, CRS-2; Pub. L. 110-140, Dec. 19, 2007, 121 Stat. 1492.

[421] Brent D. Yacobucci, Cong. Research Serv., REPORT NO. RS22870, WAIVER AUTHORITY UNDER THE RENEWABLE FUEL STANDARD (RFS), at CRS-2 (2008), *available at* http://www.nationalaglawcenter.org/assets/crs/RS22870.pdf.; 42 U.S.C. 7545(o)(2)(B)(i) (2007); 42 U.S.C. 7545(o)(2)(B)(i)(I) (2009).

[422] Yacobucci, *supra* note 421, at CRS-2; 42 U.S.C. 7545(o)(2)(B) (2009).

[423] *See, e.g.*, Yacobucci, *supra* note 421, at CRS-3.

[424] *EPA Rejects Landmark Attempt to Cut Ethanol Mandate*, CLIMATE WIRE, Aug. 8,2008, http://www.eenews.net/climatewire/2008/08/08/archive/3?terms=rfs+perry+waiver.

[425] *E.g.*, Want to Know It? Answers to Life's Questions, Advantages of Biofuels, http://wanttoknowit.com/advantages-of-biofuels/ (last visited Feb. 22, 2009); The Administrator may use the traditional administrative rulemaking process to modify Congressionally-mandated greenhouse gas reduction percentages, but not below 40 percent for advanced biofuel & biomass diesel; 10 percent for renewable fuel; and 50 percent for cellulosic biofuel. 42 U.S.C. 7545(o)(4) (2009).

[426] Indur M. Goklany, *Unintended Consequences*, Int'l Herald Trib., Apr. 24, 2007, at 9, *available at* http://www.iht.com/articles/2007/04/23/opinion/edgolany.php.

[427] Dale Buss, *Bush Comments Lend Another Boost to Cellulosic Ethanol*, EDMUNDS AUTO OBSERVER, 29 Feb. 2008, http://www.autoobserver.com/2008/02/bush-comments-lend-another-boost-to-cellulosic-ethanol.html.

concentrated - and preferably liquid - form, it is probably more efficient overall to burn the biomass as wood without further processing. Otherwise extra energy will be required to convert the biomass into more concentrated liquid forms (e.g., methanol, ethanol, or biodiesel). Consequently the net energy obtained from such biofuels is significantly less than the gross energy produced when it is finally consumed.

The uncertainties related to the net energy balance associated with the life cycle of biofuel production and use has led to a cottage industry in estimating whether the production of particular liquid biofuels produces any net energy benefit.[428] The answers vary with assumptions regarding, among other things, the specific crops used to grow the biomass, crop yields, cultivation practices, the amount of energy consumed at the farm and in ethanol processing, whether the byproducts and residues can be used to supplement food or feed, and the amount of greenhouse gas or energy credit that should be given for that. Currently, however, the accepted wisdom is that substituting at least some biofuels for gasoline does indeed produce net energy savings.[429]

Even if biofuels produce net usable energy, it does not follow that their use would necessarily reduce greenhouse gas emissions. First, nitrogenous fertilizers which are used as inputs to grow energy crops, are a primary source of nitrous oxides, a greenhouse gas (GHG) that is pound-for-pound 300 times more effective as a greenhouse gas than carbon dioxide.[430] Second, cultivation of any crop generally involves disturbing the soil. Globally, there is more carbon stored in the soil than in the atmosphere. Disturbing the soil leads to decomposition or oxidation of the stored carbon, which results in carbon dioxide emissions to the atmosphere.[431] Accordingly, clearing any vegetated land (such as forests and grasslands) to raise energy crops initially adds to the atmospheric concentration of GHGs, which some have labeled as a "carbon debt" that would have to be "repaid" by the net reductions in carbon dioxide emissions resulting from the subsequent use of any biofuels produced from that land.[432] Fargione et al. estimate that it would take 93 years to repay the carbon debt if central U.S. grassland is converted to cropland for corn (for ethanol), and 48 years if land enrolled in the Conservation Reserve Program (CRP) for 15 years was converted for corn ethanol.[433] However, if biofuels were made from waste biomass or from biomass grown using perennials on CRP lands, then the carbon debt, if any, could be repaid in as little as a year.[434]

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[428] *E.g.*, David Pimentel & Tad W. Patzek, *Ethanol Production Using Corn, Switchgrass, and Wood; Biodiesel Production Using Soybean and Sunflower*, 14 NAT. RESOURCES RES. 65, 65-76 (2005); Tad W. Patzek, *Thermodynamics of the Corn-Ethanol Biofuel Cycle* (2006), *available at* http://petroleum.berkeley.edu/papers/patzek/CRPS416-Patzek-Web.pdf (updated version of Tad W. Patzek, *Thermodynamics of the Corn-Ethanol Biofuel Cycle*, 23 CRITICAL REVS. IN PLANT SCI. 519, 519-67 (2004)); Justus Wesseler, *Opportunities (Costs) Matter: A Comment on Pimentel and Patzek Ethanol Production Using Corn, Switchgrass, and Wood; Biodiesel Production Using Soybean and Sunflower*, 35 ENERGY POL'Y 1414, 1414-16 (2007); Michael Wang, Argonne Nat'l Lab., *Key Differences Between Pimentel/Patzek Study and Other Studies* (2005), *available at* http://eere.ra.utk.edu/etcfc/docs/pr/MichaelWangResponse~7-19-05.doc.

[429] *See, e.g.*, Searchinger et al., *supra* note 81, at 1238.

[430] Intergovernmental Panel on Climate Change, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 35 (2007), *available at* http://www.ipcc.ch/ipccreports/ar4-wg1.htm.

[431] *See, e.g.*, Jörn P.W. Scharlemann & William F. Laurance, *How Green Are Biofuels*, 319 SCIENCE 43, 43-44 (2008) [hereinafter Scharlemann & Laurance, *Biofuels*]; Searchinger et al., *supra* note 81, at 1238.

[432] Joseph Fargione et al., *Land Clearing and the Biofuel Carbon Debt*, 319 SCIENCE 1235, 1235-38 (2008); Searchinger et al., *supra* note 81.

[433] Fargione et al., *supra* note 432.

[434] *Id.* at 1236, fig.1D.

Searchinger et al. used a worldwide agricultural model to estimate emissions from the conversion of habitat to cropland as farmers worldwide respond to higher prices for food commodities set in motion with the artificially created demand for biofuels.[435] This increased demand would result in greater conversion of forest and grassland to new cropland to replace the grain (or cropland) diverted to biofuels. Specifically, they found that:

> corn-based ethanol, instead of producing a 20% savings, nearly doubles greenhouse emissions over 30 years and increases greenhouse gases for 167 years. Biofuels from switchgrass, if grown on U.S. corn lands, increase emissions by 50%. This result raises concerns about large biofuel mandates and highlights the value of using waste products.

Neither the Searchinger or Fargione papers are definitive, and both have come under criticism.[436] Alternative assumptions regarding the type of tilling system or other agronomic practices, for instance, may change the results dramatically.[437] The key point is that there is an active scientific controversy about the net impact of biofuels, a controversy that is barely acknowledged in the green jobs literature. The green jobs reports simply assert that "next-generation biofuels" deserve massive public support.[438] Ignoring an ongoing debate over whether the policies in question actually produce a net benefit is a serious problem.

An even larger environmental problem for biofuels than whether they actually reduce greenhouse gases is that the biomass used for feedstock is generally harvested as part of a crop. If grown as a crop, it is plagued by all the environmental problems associated with agriculture, namely, it contributes to soil erosion, pesticide residues, and nutrient run-off from the fertilizers, all of which worsens water quality. Even more important, biofuel crops divert land and freshwater from other uses.[439] In fact, conversion of land and freshwater to agriculture is the single largest threat to the conservation of terrestrial and freshwater species and biodiversity in the United States and worldwide,[440] and growing energy crops to produce biofuels only adds to these pressures.

Scharlemann and Laurance reported in *Science* on a Swiss study by Zah et al.[441] that compared, for 29 kinds of fossil fuels and biofuels, the net greenhouse gas emissions and "total" environmental impacts based on life cycle analysis.[442] The total environmental impacts are estimated by aggregating estimates of natural resource depletion, and damage to human health and ecosystems into a single indicator. While the results no doubt are sensitive to the specific impacts included in the study, the methodologies used to estimate these impacts, the aggregation

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[435] Searchinger et al, *supra* note 81.

[436] Bruce Dale, Biofuels, *Indirect Land Use Change and Life Cycle Analysis: Do We Now Know Enough to Know That We Don't Know?* (July 25, 2008) (presentation to Low Carbon Fuels Webinar), *available at* http://www.ncbioconsortium.org/vertical/Sites/%7B2CDC9F83-EF8C-48DE-BCA4-C099640B955B%7D/uploads/%7BA292DD0E-EF23-4121-B96C-973EDC3CDC2B%7D.PDF.

[437] *Id.*

[438] CAP, *supra* note 10, at 2, 5, 8, 25.

[439] *See, e.g.*, Searchinger et al., *supra* note 81; Carey W. King & Michael E. Webber, *Water Intensity of Transportation*, 42 ENVTL. SCI. & TECH. 7866, 7866-72 (2008).

[440] MEA, *supra* note 82, at 117; Goklany, *supra* note 82, at 941.

[441] Rainer Zah, *LCA of Biofuels in Switzerland: Environmental Impacts and Improvement Potential?* (Aug. 28, 2007) (presentation to LCM 07 Zürich), *available at* http://www.lcm2007.org/presentation/Tu_2.07-Zah.pdf.

[442] Scharlemann & Laurance, *Biofuels, supra* note 431, at 43-44; Jörn P.W. Scharlemann & William F. Laurance, *How Green Are Biofuels?* SCI. SUPPORTING ONLINE MATERIAL (2008), http://www.sciencemag.org/cgi/data/319/5859/43/DC1/1 [hereinafter Scharlemann & Laurance, ONLINE].

methodology, the weights employed in reducing the different types of impacts to a common metric, the fact that the study was based on 2004-vintage technologies, and a host of other assumptions, the results indicate that when broader environmental factors are considered, many biofuels may create substantially greater environmental problems than the fossil fuels they would replace. Furthermore, these environmental problems may not be offset by reductions in greenhouse gas emissions (see Figure 10).

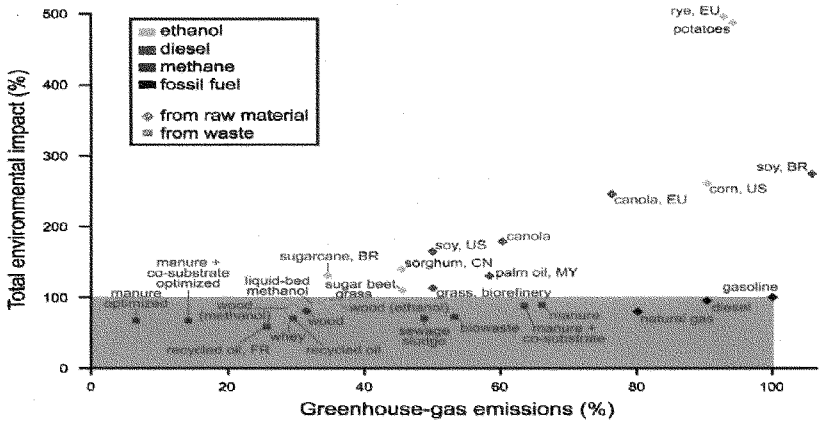

Figure 9 - Greenhouse-gas emissions versus overall environmental impacts of various fossil- and bio-fuels, scaled relative to gasoline.[443]

Counterintuitively, soy- and corn-based biofuels grown in the U.S. have substantially higher environmental impacts than natural gas, diesel, and gasoline despite reductions in GHG emissions. This brings into question one of the central premises for subsidizing or mandating biofuels.

These are not just theoretical concerns. In 2007, 25 percent of the U.S. corn crop ended up as ethanol (see Figure 11). This has increased the pressure to take land out of the Conservation Reserve Program (CRP) and cultivate it once again.[444] In South Dakota alone,

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[443] Scharlemann & Laurance, *Biofuels, supra* note 431(based on Zah, *supra* note 441). Note: The origin of biofuels produced outside Switzerland is indicated by country codes: Brazil (BR), China (CN), European Union (EU), France (FR), Malaysia (MY), and United States (US). Fuels in the shaded area are considered advantageous in both their overall environmental impacts and greenhouse-gas emissions.

[444] Dan Morgan, *Subsidies Spur Crops on Fragile Habitat*, WASH. POST, Dec. 7, 2008; David Streitfield, *As Prices Rise, Farmers Spurn Conservation Program*, N.Y. TIMES, Apr. 9, 2008.

about 425 square miles of grassland were turned into farmland between 2002 and 2007 partly because of the demand for corn to be used in ethanol stimulated by subsidies and mandates against a backdrop of higher oil prices due to the petroleum demand from China, India, and other economies that were then firing on all cylinders.[445] In fact, cropland devoted to corn and soybean, which is used for biodiesel, has increased sharply in the U.S. over the past few years, as indicated by Figure 12.

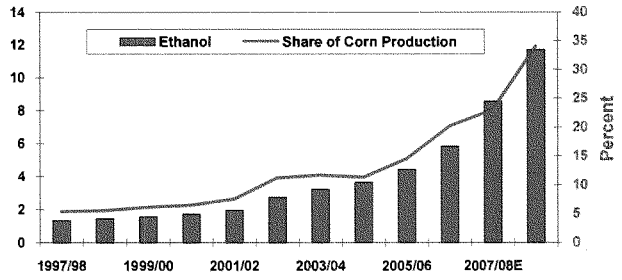

Figure 10 - Growth in US ethanol production (in billions of gallons), and the share of corn production going to ethanol.[446]

[445] Morgan, *supra* note 444; Streitfeld, *supra* note 444.

[446] Hunter H. Moorehead, The Farm Bill and Beyond, 2008 MAEA Annual Meeting, (Oct. 31, 2008).

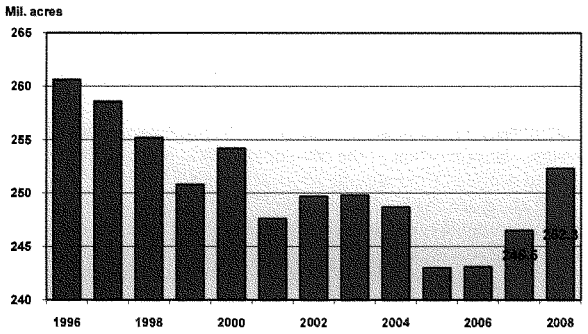

Figure 11 - US cropland, 1996-2008. Includes wheat, feed grains, soybeans, upland cotton, and rice.[447]

Not surprisingly, the total amount of U.S. cropland devoted to grains has increased over the last few years, with crops now being planted on land that would otherwise not have been cultivated with the help of biofuel subsidies and mandates (see Figure 12, which also confirms Searchinger et al.'s basic approach).

In addition to questions about the net environmental benefits of biofuels, scientists also have serious issues relating to the impacts of biofuels on the world's poor. For a literature that so regularly expresses concern for exactly these populations, it is surprising that this problem receives so little attention.[448] The analyses represented in Figure 12, as well as the analyses of Fargione et al.[449] and Searchinger et al.,[450] do not consider these impacts of biofuel subsidies and mandates on global food production, and any resulting consequences for global hunger and malnutrition. Consideration of these factors further reduces the attractiveness of biofuels, and associated subsidies and mandates.

For example, the increased demand for corn for ethanol has additional "multiplier" effect on other food and feed commodities by increasing the price of all corn-based products, including feed for animals, and many foods consumed by human beings. Ethanol-related demand for corn has been linked to increases in the price of eggs, milk, meat, cereal, candy bars and any product containing corn-based sugars or starches, to name just a few.[451]

The food price increases are clearly linked to corn-based ethanol. Although commodity prices have declined more than 50 percent since the middle of 2008, the UN Food and

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[447] Source: Hunter H. Moorehead, *The Farm Bill and Beyond,* 2008 MAEA Annual Meeting. (October 31, 2008). Note: 2008 planted area based on September 12, 2008, *Crop Production* report.

[448] The UNEP report is the only one to address this issue, noting that the FAO is concerned about the percent of cropland that could be turned from feeding people to producing fuel, but the report comes down in favor of more biofuels so long as done in a labor-intensive manner with respect for water supplies and such. UNEP, *supra* note 5, at 117-26.

[449] Fargione et al., *supra* note 432.

[450] Searchinger et al, *supra* note 81.

[451] *E.g.*, Siobhan Hughes, Ian Talley & Anjali Cordeiro, *Corn Ethanol Loses More Support*, WALL ST. J., May 3, 2008, at A4.

Agricultural Organization's Food Price Index was 28 percent higher in October 2008 than two years previously.[452] These price increases, fueled in part by the diversion of cropland to produce energy rather than food (and feed) fueled by energy subsidies and mandates in the United States and the EU, reduced the availability of food for millions in the developing world.[453]

As a result, the FAO estimates that 963 million people worldwide were suffering from chronic hunger in 2008, an increase of 115 million compared to the 2003-2005 period.[454] This marks a reversal of one of mankind's signal achievements of the 20th century — the reduction of hunger in developing countries. The proportion of the developing world's population suffering from chronic hunger, which had declined from around 30-35 percent in 1969-1971[455] to 16 percent in 2003-2005, has now increased to about 18 percent.[456] As the FAO's *State of Food and Agriculture* report notes, biofuel production would have a significant negative impact on hunger globally but provide relatively modest energy gains.[457]

Many have argued that the problems associated with using crops and cropland for producing biofuels can be avoided by using cellulose as feedstock.[458] However, tilting the field to help cellulosic ethanol, whether directly through subsidies or indirectly through mandates, will inevitably make it more attractive for farmers to divert land and water to grow fuel rather than food.[459] As a result, some portion of the resources that would otherwise be used for food production would go toward fuel production. This is exactly what is indicated by Searchinger et

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[452] Food & Agric. Org., HIGH-LEVEL CONFERENCE ON WORLD FOOD SECURITY: THE CHALLENGES OF CLIMATE CHANGE AND BIOENERGY (2008), *available at* http://www.fao.org/fileadmin/user_upload/foodclimate/HLCdocs/HLC08-Rep-E.pdf [hereinafter FAO, HIGH-LEVEL CONFERENCE].

[453] Food & Agric. Org., STATE OF FOOD INSECURITY IN THE WORLD 2008: HIGH FOOD PRICES AND FOOD SECURITY – THREATS AND OPPORTUNITIES 11 (2008), *available at* ftp://ftp.fao.org/docrep/fao/011/i0291e/i0291e00.pdf [hereinafter FAO, INSECURITY] (The FAO estimates that in 2007-2008, 4.7 percent of global cereal production will be used for biofuel production).

[454] *Id.* at 2; FAO, HIGH-LEVEL CONFERENCE, *supra* note 452.

[455] In 2008, the FAO modified its recommendations for the minimum daily energy requirement (MDER) for an individual in order for the individual to survive and fulfill basic functions. The MDER varies with the country, age group, and levels of daily activities a person may indulge in. This change, along with new population estimates and other methodological changes, resulted in a net reduction in earlier estimates for the total number of chronically undernourished in developing countries of less than 8 percent for 1990-1992. FAO, INSECURITY, *supra* note 453, at 45-47. Estimates for 1969-1971, previously estimated at 37 percent, were, however, not revisited. Goklany, *supra* note 241. Based on the changes in numbers using the latest methodologies and assumptions, 30-35 percent would, therefore, seem to be a reasonable approximation for 1969-1971.

[456] FAO, INSECURITY, *supra* note 453.

[457] *Id.*

[458] Former President Bush stated that, "The solution to the issue of corn-fed ethanol is cellulosic ethanol," Amanda Paulson, *U.S. Eyes Shift Away From Corn Ethanol*, CHRISTIAN SCI. MONITOR, May 1, 2008, at 3, *available at* http://www.csmonitor.com/2008/0501/p03s03-usec.html. That is, there are "good" biofuels and "bad" biofuels. This argument was most cogently summarized by a *New York Times* editorial:

> It is time to end an outdated tax break for corn ethanol and to call a timeout in the fivefold increase in ethanol production mandated in the 2007 energy bill. . . .
>
> This does not mean that Congress should give up on biofuels as an important part of the effort to reduce the country's dependency on imported oil and reduce greenhouse gas emissions. What it does mean is that some biofuels are (or are likely to be) better than others, and that Congress should realign its tax and subsidy programs to encourage the good ones. Unlike corn ethanol, those biofuels will not compete for the world's food supply and will deliver significant reductions in greenhouse gases. . . .
>
> Congress's guiding principle should be to tie federal help to environmental performance. The goal is not just to stop the headlong rush to corn ethanol but to use the system to bring to commercial scale promising second-generation biofuels - cellulosic ethanol derived from crop wastes, wood wastes, perennial grasses. These could provide environmental benefits and reduce dependence on oil without displacing food production.

Editorial, *Rethinking Ethanol*, N.Y. TIMES, May 11, 2008, at 11.

[459] Posting of Indur Goklany to Cato-at-Liberty, *Wishful Thinking on Cellulosic Ethanol*, http://www.cato-at-liberty.org/2008/05/01/wishful-thinking-on-cellulosic-ethanol/ (May 1, 2008 08:39 EST).

al.'s research.[460] Specifically their results indicate that "biofuels from switchgrass, if grown on U.S. corn lands, increase emissions by 50%." If switchgrass is grown on CRP land, its GHG impacts would be worse.[461]

It is also claimed that using crop wastes would increase the effective yield of biofuel production, and therefore mitigate some negative environmental impacts of crop-based biofuels. However, this argument overlooks the fact that so-called crop "wastes" are often utilized to conserve both soil and moisture (that is, water) on many farms, and they are frequently cycled back to the soil, in order to replenish its nutrient content. That is, crop waste is frequently a misnomer.

From this brief survey of the biofuels debate we can draw two important conclusions. First, biofuels are not necessarily environmentally preferable to fossil fuels, particularly in their present forms. Requiring billions of dollars of investment in biofuels infrastructure and production before we know enough to choose the right technologies will require government planners to have a greater degree of insight into future technological developments than is humanly possible. Policies that require large, early bets on specific technologies are less desirable than ones that spur innovation (e.g. prize competitions). Second, the record of ethanol's development thus far is not encouraging as it reveals an extraordinary degree of rent seeking from the start.[462]

C. Electricity Generation

The green jobs literature contains numerous calls for massive shifts in power generation. As we described earlier, the literature is selectively optimistic about favored power generation technologies (e.g. wind, solar, biomass) and selectively pessimistic about disfavored ones (e.g. coal and nuclear). As with biofuels, the literature barely acknowledges the serious problems facing its preferred technologies. In this section we briefly survey the literature on three power generation technologies: wind, solar, and nuclear, and show how the green jobs literature fails to adequately address the technical issues involved with each.

1. Wind power

Partly because of subsidies, the contribution of wind to *renewable electricity* generation is expected to increase from 7 percent in 2006 to 16 percent in 2020 and 20 percent in 2030.[463] However, despite being heavily subsidized, its total contribution to "energy security" is slight, and unlikely to rise to a significant level over the foreseeable future. Wind contributes less than 0.6 percent of total U.S. energy production, based on federal statistics from January through

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[460] Searchinger et al, *supra* note 81.

[461] *Id.* at 1238, 1240.

[462] *See, e.g.*, Jonathan H. Adler, *Rent Seeking Behind the Green Curtain*, 19 Regulation No. 4, at 26 (1996) (describing rent-seeking in 1990s ethanol programs); Jonathan H. Adler, *Clean Politics, Dirty Profits: Rent-Seeking Behind the Green Curtain*, in POLITICAL ENVIRONMENTALISM: GOING BEHIND THE GREEN CURTAIN 1, 2 (Terry L. Anderson ed., 2000) (same); Jonathan H. Adler, *Clean Fuels, Dirty Air* in ENVIRONMENTAL POLITICS: PUBLIC COSTS, PRIVATE REWARDS (Michael S. Greve & Fred L. Smith, Jr. eds., 1992) at 19 (clean fuels program as ethanol subsidy).

[463] Energy Info. Admin., *supra* note 374, at tbl.17. This report, which is issued each year, provides the Department of Energy's best estimate of future supply and demand for the energy sector, based on its judgments about economic growth, labor supply, technological change, and so forth. It "generally assumes that current laws and regulations affecting the energy sector remain unchanged" throughout the projection period (2030 for this document). *See id.* at 2. In this respect, it differs from the Department of Energy study cited previously, DOE, 20% WIND, *supra* note 112, which was an anlysis of the consequences of meeting a target for wind energy to increase to 20 percent its contribution to total electricity generation.

September 2008.[464] According to the DOE's latest projections, it will account for less than 0.9 percent of total *energy* consumption in 2020 and 1.1 percent in 2030.[465] Wind plays an increasing role in electricity generation, but electricity is only a fraction of *energy* production in the United States which is why wind is such a tiny share of total energy produced.

Wind's contribution to energy security is diminished by its ability to deliver electricity only intermittently. Wind turbines cannot produce when wind speed is either too low or too high, or if the turbine blades or other critical components are iced up. In fact, the Electric Reliability Council of Texas (ERCOT) assumes, based on historical experience, that only 8.7 percent of wind power's installed capacity would be available during summer peak hours, one of the times when electricity is most needed.[466] Because of this lack of reliability and the fact that wind energy cannot be stored to alleviate the reliability/availability problems, electricity generated by wind must be backed up by more reliable electric generation sources, which effectively increases the cost of wind energy substantially.[467] So while wind is free, even if one ignores construction, installation and transmission costs (see below), wind turbines by themselves cannot satisfy consumers' need for reliability and continuous, round-the-clock availability.

Yet another problem associated with wind energy is that the most favorable locations for wind power are often not accessible by the existing electrical grid,[468] a problem recognized by President Obama:

> One of, I think, the most important infrastructure projects that we need is a whole new electricity grid. Because if we're going to be serious about renewable energy, I want to be able to get wind power from North Dakota to population centers, like Chicago. And we're going to have to have a smart grid if we want to use plug-in hybrids then we want to be able to have ordinary consumers sell back the electricity that's generated from those car batteries, back into the grid. That can create 5 million new jobs, just in new energy.[469]

Additional electrical transmission lines are also key to entrepreneur T. Boone Pickens'

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[464] Energy Info. Admin, U.S. Dep't of Energy, REPORT NO. DOE/EIA-0035(2008/12), MONTHLY ENERGY REVIEW: DECEMBER 2008 (2008), *available at* http://tonto.eia.doe.gov/FTPROOT/multifuel/mer/00350812.pdf.

[465] Energy Info. Admin., *supra* note 374, at tbls.1 & 17.

[466] ERCOT, Report on the Capacity, Demand, and Reserves in the ERCOT Region (May 2008). *See also* Drew Thornley, TEX. PUB. POLICY FOUND., TEXAS WIND ENERGY: PAST, PRESENT, AND FUTURE 3 (2008), *available at* http://www.texaspolicy.com/pdf/2008-09-RR10-WindEnergy-dt-new.pdf. A study of small (10 kW or less) wind projects funded by the Massachusetts Technology Collaborative (MTC), which admininisters the state's Renewable Energy Trust and has has been funding small wind systems through the Small Renewables Initiative since 2005 indicates that on average such facilities are generating only 6.6percent of the energy that they could have had they been operating at full capacity for all the time during the year. Mass. Tech. Collaborative, Small Wind Progress Briefing Summary (June, 12 2008), *available at* http://www.masstech.org/RenewableEnergy/sm_renew/Progress%20Briefing%20Summary%20061208.pdf.

[467] This is more than a problem of people shivering in the cold or sweltering in the summer when the power goes off. Hospitals must have constant, reliable power. People who use electric-powered oxygen machines or ventilators require reliable power. "Britain's wind farms have stopped working during the cold snap due to lack of wind, it has emerged, as scientists claimed half the world's energy could soon be from renewables. The Met Office said there has been an unusually long period of high pressure across the UK for the last couple of weeks, causing the cold snap and very little wind". Louise Gray, *Wind Energy Supply Dips During Cold Snap*, TELEGRAPH, Jan 10, 2009, at , *available at* http://www.telegraph.co.uk/earth/energy/windpower/4208940/Wind-energy-supply-dips-during-cold-snap.html.

[468] Matthew Wald, *The Energy Challenge: Wind Energy Bumps Into Power Grid's Limits*, N.Y. TIMES, Aug. 29, 2008, at A1, *available at* http://www.nytimes.com/2008/08/27/business/27grid.html?_r=1&pagewanted=print.

[469] Rachel Maddow Show, *Barack Obama Talks to Rachel Maddow 5 Days Before Election* (MSNBC television broadcast Oct. 30, 2008), *available at* http://www.msnbc.msn.com/id/27464980/.

dream of turning Texas into "the Saudi Arabia of wind."[470] According to the Department of Energy, it would require an additional 12,000 miles of high-voltage transmission lines costing $60 billion (undiscounted) to increase the contribution of wind to national electricity production to 20 percent by 2030.[471]

Wind power thus faces two key problems in increasing its share of electricity generation. First, it is unavailable at some times of peak power demand and so requires costly backup capacity. Second, current infrastructure is inadequate to support a rapid expansion of wind energy generation. Further, as we noted earlier, existing efforts to increase wind generation capacity have run into major hurdles with regulatory laws and NIMBY efforts.[472] Despite these widely known problems, which are never discussed in depth in the green jobs literature, green jobs policy proposals propose enormous increases in wind capacity without detailing a strategy for how these problems will be solved.[473] Green jobs proponents thus exhibit extensive technological optimism with respect to wind's prospects.

2. Solar power

Solar power is a second favored technology in the green jobs literature. As with wind energy, substantial – and largely unacknowledged – hurdles to a significant expansion exist in solar electric generation. First, despite decades of effort and high subsidies,[474] the current contribution of solar to meeting the nation's energy needs is only 0.05 percent.[475] Most of this (95 percent) is from solar thermal and hot water production rather than electricity generation. The remainder is from solar PV.[476] By 2030, the contribution of solar to energy consumption is projected by the EIA to rise to just 0.13 percent, with only half of that from solar PV.[477]

Although solar PV is projected to grow faster than other forms of solar energy, current technical analyses suggest that the costs of current solar PV installations so far exceed their benefits. Indeed, no reasonable valuation of the benefits of greenhouse gas reductions would result in positive estimates for the total net benefits from solar PV.[478] A comprehensive analysis of this issue by Borenstein accounts for the fact that in California and in most U.S. locations, solar electric power is produced disproportionately during summer peak demand hours, that is, at times when the value of electricity is high. Second, Borenstein considers that energy losses from electricity transmission and distribution from PV sources is low because it is primarily generated on-site. Despite taking into consideration these factors that favor solar technology, Borenstein

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[470] *Pickens Set on Turning Texas into Saudi Arabia of Wind*, ENVTL. LEADER, July 23, 2008, http://www.environmentalleader.com/2008/07/23/pickens-set-on-turning-texas-into-saudi-arabia-of-wind/; see also *Pickens Plan: The Plan*, http://www.pickensplan.com/theplan/ (last visited Feb. 22, 2009) (discussing the "Pickens Plan").

[471] DOE, 20% WIND, *supra* note 112, at 95, 98.

[472] *See supra* note 142.

[473] *See supra* notes 113-119 and accompanying text.

[474] *See supra* tbl.1.

[475] ENERGY INFO. ADMIN., *supra* note 374, at tbls.2 & 17.

[476] *Id.* at tbl.17.

[477] *Id.* at tbls.1 & 17.

[478] Severin Borenstein, *The Market Value and Cost of Solar Photovoltaic Electricity Production* (Ctr. for the Study of Energy Mkts., Working Paper, Paper No. WP 176, 2008) [hereinafter Borenstein]; Severin Borenstein, Response to Critiques of "The Market Value and Cost of Solar Photovoltaic Electricity Production," http://faculty.haas.berkeley.edu/borenste/SolarResponse.pdf (last visited Jan. 1, 2009) [hereinafter Borenstein, Response].

finds that:

> the net present cost of installing solar PV technology today far exceeds the net present benefit under a wide range of assumptions about levels of real interest rates and real increases in the cost of electricity. Lower interest rates and faster increases in the cost of electricity obviously benefit solar PV, but even under the extreme assumption of a 1% real interest rate and 5% annual increase in the real cost of electricity, the cost of solar PV is about 80% greater than the value of the electricity that it will produce. It is worth noting that even without further technological progress in energy generation from wind, geothermal, biomass, and central station solar thermal, with a 5% annual increase in the real cost of electricity, all of these technologies would be economic (without subsidies or recognition of environmental externalities from fossil fuels) well before the 25-year life of the solar panels was over. Under more moderate assumptions about the real interest rate and the escalation in the cost of electricity, the net present cost of a solar PV installation built today is three to four times greater than the net present benefits of the electricity it will produce. [479]

Borenstein estimates for a range of scenarios that the market costs of solar PV exceed market benefits by $148/MWh to $492/MWh, in 2007 dollars.[480] This cost-benefit gap is, he notes, "much greater than plausible estimates of the value of greenhouse gas reduction."[481] In a meta-analysis of over 200 estimates, economist Richard Tol concludes that there is a 1 percent probability that the social cost of carbon exceeds $78 per tonne of carbon in 1995 dollars, based on a 3 percent pure discount rate of time preference.[482] And in a response to critiques of his analysis, Borentein concludes that:

> the current cost of solar PV, as it is being installed in California and the rest of the U.S. today, is extremely high not just compared to fossil fuel generation, but also compared to generation from wind, central station solar thermal, geothermal and other renewable resources.[483]

Finally, Borenstein makes other points with respect to solar PV, but which are applicable across the board to many alternative energy technologies:

> if solar PV costs are coming down very rapidly for reasons exogenous to the solar PV subsidy policy, then it is more likely to make sense to delay investment. If solar PV costs are declining by 20% per year, for instance, the same amount of investment (in present value terms) made 5 years from now will yield much more renewable energy than today. Given that the damage from GhGs is cumulative over time, it makes almost no difference whether the gasses are released in 2007 or 2012.[484]

Just as with our other examples, the green jobs literature's treatment of the technical challenges facing solar power suffer from selective technological optimism.

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[479] Borenstein, *supra* note 478.

[480] *Id.*

[481] *Id.* at 26.

[482] Richard S.J. Tol, *The Social Cost of Carbon: Trends, Outliers and Catastrophes*, ECON.: OPEN-ACCESS OPEN-ASSESSMENT E-JOURNAL, Aug. 12, 2008, at 9-10, http://www.economics-ejournal.org/economics/journalarticles/2008-25/view.

[483] Borenstein, Response, *supra* note 478, at 1.

[484] Borenstein, *supra* note 478, at 24.

Even more problematically, the literature forecasts substantial increases in solar power generation without a serious discussion of the hurdles.

3. Nuclear power

In contrast to how the favored technologies are treated, the green jobs literature almost completely dismisses nuclear power generation. We are not advocating increasing or decreasing nuclear power generation here. We are noting the inconsistency of green jobs advocates between how unproven technologies with serious technical problems, such as wind and solar PV are treated, and how existing technology with widespread commercial use that actually produces a significant share of U.S. electric power, are treated in the literature. This difference reveals important embedded assumptions.

The U.S. currently gets just under 20 percent of its electricity from nuclear reactors.[485] This power is essentially carbon free to generate, just like solar and wind, and does not require blanketing huge areas of land with wind turbines or solar panels.[486] In Europe, 15 nations produce an even greater share of their electricity from nuclear power. Japan and South Korea also get a larger share of electricity from nuclear power than does the United States.[487] The widespread use of nuclear power across nations -- something likely to increase as European nations formerly skeptical of the environmental impact of nuclear power turn to it to reduce greenhouse gas emissions and to reduce their reliance on shaky Russian natural gas supplies[488] -- is a striking contrast to the tiny shares of electricity generated by wind and solar.

One reason for the failure of the green jobs literature to assign a role to nuclear power appears to be its political unpopularity among green jobs proponents' constituents. In the United States, nuclear power became unpopular after the Three Mile Island incident in 1979, during which a small amount of radiation was released.[489] That, combined with falling energy prices in the 1980s, reduced interest in and political support for nuclear power.[490] Politically, nuclear power is controversial and the U.S. environmental groups oppose it as a survey of their websites indicates:[491]

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[485] Nuclear is responsible for a little over eight percent of U.S. energy. *See* Energy Info. Admin, U.S. Dep't. of Energy, RENEWABLE ENERGY CONSUMPTION AND ELECTRICITY PRELIMINARY STATISTICS 2007, at tbl.1 (2008), *available at* http://www.eia.doe.gov/cneaf/alternate/page/renew_energy_consump/table1.pdf. It produces about 20 percent of electricity. *See* Energy Info. Admin, U.S. Dep't of Energy, TOTAL ELECTRIC POWER INDUSTRY SUMMARY STATISTICS, http://www.eia.doe.gov/cneaf/electricity/epm/tablees1a.html (last visited Feb. 22, 2009).

[486] Jesse H. Ausubel, *Renewable and Nuclear Heresies*, 1 INT'L J. NUCLEAR GOVERNANCE, ECON. & ECOLOGY 229, 229-43 (2007), *available at* http://www.inderscience.com/storage/f419103782512116.pdf.

[487] *See supra* note 70.

[488] John Deutch & Ernest J. Moniz et al., THE FUTURE OF NUCLEAR POWER: AN INTERDISCIPLINARY MIT STUDY 71 (2003), *available at* http://web.mit.edu/nuclearpower/pdf/nuclearpower-full.pdf; Anna Momigliano, *Russian Gas Cut-off Energizes Nuclear Comeback*, CHRISTIAN SCI. MONITOR, Jan. 16, 2009, at 6, *available at* http://www.csmonitor.com/2009/0116/p06s01-wogn.html; *Gas row shakes Europe's trust in Russian energy*, KYIV POST, January 21, 2009, at http://www.kyivpost.com/business/33934

[489] U.S. Nuclear Regulatory Comm'n, *Fact Sheet on the Three Mile Island Accident*, http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.pdf (last visited Feb. 22, 2009). The disaster at the Chernobyl reactor in the USSR in 1986 was another matter. An improperly run Soviet reactor caused a large radiation leak and loss of life. *See* World Nuclear Ass'n, Chernobyl Accident, http://www.world-nuclear.org/info/chernobyl/inf07.html (last visited Feb. 22, 2009).

[490] *See, e.g.*, EIA ANNUAL, *supra* note 183, at 312.

[491] In each case the main website was used. The term "nuclear power" was entered in the site search box and the quotes come from the first page that appeared. All were accessed on Nov. 25, 2008.

- Sierra Club: "The Sierra Club opposes the licensing, construction and operation of new nuclear reactors...."[492]
- Greenpeace USA: "Dangerous. High-Risk. Meltdown. Catastrophe... See why these words accurately describe nuclear energy and join us as we push for no new nukes."[493]
- National Audubon Society and National Wildlife Federation: "Clean, renewable energy like solar and wind power currently produces about 2 percent of our electricity nationwide. In contrast, nearly 90 percent of our electricity still comes from polluting sources of energy like coal and nuclear power."[494]
- World Wildlife Fund (WWF): "But among currently deployed commercial technologies, scaling up nuclear power is not an effective course to avert carbon emissions."[495]
- Environmental Defense Fund: "Serious questions of safety, security, waste and proliferation surround the issue of nuclear power. Until these questions are resolved satisfactorily, Environmental Defense cannot support an expansion of nuclear generating capacity."[496]

This skepticism is incorporated into the green jobs literature. For example, as noted previously, the UNEP report states that "nuclear power is not considered an environmentally acceptable alternative to fossil fuels, given unresolved safety, health, and environmental issues with regard to the operations of power plants and the dangerous, long-lived waste products that result."[497]

The overt opposition to nuclear power, or ignoring of it, raises questions about the real concern of advocates of "green power" with effective strategies to reduce carbon. Nuclear power represents proven technology that is moving ahead rapidly in the rest of the world. Plants in operation today in the United States were licensed in the 1960s and early 1970s, and so represent technology about 40 years old, but 23 new plants were under consideration in 2007 and 2008.[498] In an extreme case of the selective technological pessimism in the literature, opponents of nuclear power, despite the lack of problems in the United States even with the old technology, still talk as if 40-year-old technology was the norm today, as the website quotes above indicate.

While the experts at assorted environmental groups claim to know that nuclear power should be off the table and that limited options, such as wind and solar, are desirable, the same is not true among experts outside these groups. The National Research Council issued a report in 2008, recommending that to help deal with carbon emissions, a concerted effort should be

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[492] Sierra Club Conservation Policies – Nuclear Power, http://www.sierraclub.org/policy/conservation/nuc-power.asp (last visited Nov. 25, 2008). This is a 1974 resolution from the board of director—subject to many qualifications; but no significant change in position since 1974.

[493] Greenpeace USA, *Nuclear*, http://www.greenpeace.org/usa/campaigns/nuclear (last visited Nov. 25, 2008).

[494] Nat'l Audubon Soc'y & Nat'l Wildlife Fed'n, GLOBAL WARMING: IMPACTS, SOLUTIONS, ACTIONS 10 (2008), *available at* http://www.audubon.org/local/pdf/Global_Warming_Users_Guide_short.pdf. No other comment is made about nuclear power in the report.

[495] WWF, *Climate Solutions: WWF's Vision for 2050*, at 28, http://www.worldwildlife.org/climate/Publications/WWFBinaryitem4911.pdf (last visited Nov. 25, 2008). The report calls for a "phase-out of nuclear power," *id.* at 1, "due to its costs, radiotoxic emissions, safety, and proliferation impacts," *id.* at 8.

[496] Environmental Defense Fund, *Questions and Answers on Nuclear Power*, http://www.edf.org/article.cfm?contentid=4470 (last visited Nov. 25, 2008).

[497] UNEP, *supra* note 5, at 89. The report also notes, at that point, that nuclear power is not employment intensive, so would not be a source of many jobs.

[498] Nuclear Energy Inst., *New Nuclear Plant Licensing*, http://www.nei.org/keyissues/newnuclearplants/newnuclearplantlicensing/ (last visited Feb. 22, 2009).

underway to enhance research in nuclear energy and to streamline the process to get the approvals for new plants, as they take years to construct.[499]

In 2003, a group of experts at MIT issued a major report on addressing greenhouse gases and urged that nuclear power generation should be taken seriously as an option.[500] The MIT Study concluded that, for the foreseeable future, only four major "realistic options" existed for reducing carbon dioxide emissions in electricity production, including nuclear. Crucially, the authors state that it is not possible to know, looking decades ahead, which strategy is best; rather, "*it is likely that we shall need all of these options and accordingly it would be a mistake at this time to exclude any of these four options from an overall carbon emissions management strategy.*"[501] The MIT Study discusses, in depth, the key issues of cost, safety, proliferation, and waste. None of the issues involved are simple.

What the study illustrates is that technology consistently advances and that there are strategies to deal with real problems inherent in any complex process. The best technologists cannot predict what technology will dominate years from now, as they know technology changes. A policy that eliminates major possible options, assuming that the technology we know today is what will exist in decades to come, will have us locked into costly, economically destructive policies.

This is not to say that there are not serious technological issues that must be addressed if nuclear power use is to be expanded. The crucial point is that the failure of the green jobs and green power advocates to deal in a straightforward manner with alternatives such as nuclear power indicates a bias. The prospects for technological change should be treated consistently across technologies.

V. Conclusion

The costs of the green jobs programs proposed by the interest groups that authored these reports and others with less fully developed proposals are staggering. Already the federal government has committed $62 billion in direct spending and $20 billion in tax incentives to green jobs programs in the recently passed stimulus bill.[502] Even the proponents are reluctant to give a firm price tag. For example, the UNEP report concludes that:

> [n]o one knows how much a full-fledged green transition will cost, but needed investment will likely be in the hundreds of billions, and possibly trillions, of dollars. It is still not clear at this point where such high volumes of investment capital will come from, or how it can be generated in a relatively short period of time.[503]

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[499] Nat'l Research Council, REVIEW OF DOE'S NUCLEAR ENERGY RESEARCH AND DEVELOPMENT PROGRAM (2008), *available at* http://www.ne.doe.gov/pdfFiles/rpt_NationalAcademiesReviewDOEsNE_RDProgram_2008.pdf. The report notes that the federal nuclear energy research budget "had collapsed to $2.2 million" in FY 1998. *Id.* at 9. It has risen rapidly since, allowing further advances in nuclear research.

[500] Deutch & Moniz et al., *supra* note 488.

[501] *Id.*, at I (emphasis in original).

[502] *See* Kate Sheppard, *A Green Tinged Stimulus Bill,* GRIST (Feb. 12, 2009) available at http://gristmill.grist.org/story/2009/2/12/83439/6486.

[503] UNEP, *supra* note 5, at 306.

The scale of social change that could be imposed is equally immense. To take just one example, the worldwide production of cement in 2007 was 2.77 billion metric tons.[504] Cement is ubiquitous in modern society. Anyone reading this article in a developed country can likely see cement from where he or she sits. Yet we are told that "[t]he cement industry will only become sustainable if the building industry finds completely new ways to create and use cement or eventually figures out how to replace it altogether."[505] And, as we have described in detail above, green jobs advocates propose equally dramatic shifts in energy production technologies, building practices, and food production. These calls for dramatic changes in every aspect of modern life are wrapped in a new package in the green jobs literature, promising not only a revolution in our relationship with the environment but to employ millions in high paying, satisfying jobs. Despite their new packaging, these calls for creating a new society through central planning are as old as human history. The failure of the twentieth century's utopian experiments suggests caution in undertaking such widespread transformations of society.

Unfortunately, the analysis provided in the green jobs literature is deeply flawed, resting on a series of myths about the economy, the environment, and technology. We have explored the problems in the green jobs analysis in depth; we now conclude by summarizing the mythologies of green jobs in seven myths about green jobs:

Myth 1: There is such a thing as a "green job." There is no coherent definition of a green job. Green jobs appear to be ones that pay well, are interesting to do, produce products that environmental groups prefer, and do so in a unionized workplace. Yet such criteria have little to do with the environmental impacts of the jobs. To build a coalition for a far reaching transformation of modern society, "green jobs" have become a mechanism to deliver something for every member of a real or imagined coalition to buy their support for a radical transformation of society.

Myth 2: Creating green jobs will boost productive employment. Green jobs estimates include huge numbers of clerical, bureaucratic, and administrative positions that do not produce goods and services for consumption. Simply hiring people to write and enforce regulations, fill out forms, and process paperwork is not a recipe for creating wealth. Much of the promised boost in green employment turns out to be in non-productive (but costly) positions that raise costs for consumers.

Myth 3: Green jobs forecasts are reliable. The forecasts for green employment optimistically predict an employment boom, which is welcome news. Unfortunately, the forecasts, which are sometimes amazingly detailed, are unreliable because they are based on questionable estimates by interest groups of tiny base numbers in employment, extrapolation of growth rates from those small base numbers, and a pervasive, biased, and highly selective optimism about which technologies will improve. Moreover, the estimates use a technique (input-output analysis) that is inappropriate to the conditions of technological change presumed by the green jobs literature itself. This yields seemingly precise estimates that give the illusion of scientific reliability to numbers that are simply the result of the assumptions made to begin the analysis.

Myth 4: Green jobs promote employment growth. Green jobs estimates promise greatly expanded (and pleasant and well-paid) employment. This promise is false. The green jobs model is built on promoting inefficient use of labor, favoring technologies because they employ large numbers rather than because they make use of labor efficiently. In a

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[504] U.S. Geological Survey, CEMENT STATISTICS (2008), available at http://minerals.usgs.gov/ds/2005/140/cement.pdf.

[505] UNEP, *supra* note 5, at 203.

competitive market, factors of production, including labor, earn a return based on productivity. By focusing on low labor productivity jobs, the green jobs literature dooms employees to low wages in a shrinking economy. Economic growth cannot be ordered by Congress or by the U.N. Interference in the economy by restricting successful technologies in favor of speculative technologies favored by special interests will generate stagnation.

Myth 5: The world economy can be remade based on local production and reduced consumption without dramatically decreasing human welfare. The green jobs literature rejects the benefits of trade, ignores opportunity costs, and fails to include consumer surplus in welfare calculations to promote its vision. This is a recipe for an economic disaster, not an ecotopia. The twentieth century saw many experiments in creating societies that did not engage in trade and did not value personal welfare. The economic and human disasters that resulted should have conclusively settled the question of whether nations can withdraw into autarky. The global integration of wind turbine production, for example, illustrates that even green technology is not immune from economic reality.

Myth 6: Mandates are a substitute for markets. Green jobs proponents assume that they can reorder society by mandating preferred technologies. But the responses to mandates are not the same as the responses to market incentives. There is powerful evidence that market incentives induce the resource conservation that green jobs advocates purport to desire. The cost of energy is a major incentive to redesign production processes and products to use less energy. People do not want energy; they want the benefits of energy. Those who can deliver more desired goods and services by reducing the energy cost of production will be rewarded. There is no little evidence that successful command and control regimes accomplishing conservation.

Myth 7: Wishing for technological progress is sufficient. The preferred technologies in the green jobs literature face significant problems in scaling up to the levels proposed. These problems are documented in readily available technical literatures, but resolutely ignored in the green jobs reports. At the same time, existing technologies that fail to meet the green jobs proponents political criteria are simply rejected out of hand. This selective technological optimism/pessimism is not a sufficient basis for remaking society to fit the dream of planners, politicians, patricians, or plutocrats who want others to live lives they think other people should be forced to lead.

To attempt to transform modern society on the scale proposed by even the most modest bits of the green jobs literature, such as the Conference of Mayors report, is an effort of staggering complexity and scale. To do so based on the combination of wishful thinking and bad economics embodied in the green jobs literature would be the height of irresponsibility. We have no doubt that there will be significant opportunities to develop new energy sources, new industries, and new jobs in the future. Just as has been true for all of human history thus far, we are equally confident that a market-based discovery process will do a far better job of developing those energy sources, industries, and jobs than could a series of mandates based on imperfect information.

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