Chapter 5 Renewable Energy

Introduction

In FY 2012, 12.2% of the nation's electric power was generated via renewable resources.[26] The Administration's energy strategy encourages increased conventional energy production, and has also opened a new frontier for solar, wind, and geothermal energy production on public lands and waters. Development of utility-scale renewable energy projects on federal land occurs primarily on lands managed by BLM and, to a lesser extent, on tribal lands and areas managed by the Forest Service.[27] Hydroelectric power plants operated by the Bureau of Reclamation (Reclamation) continue to provide low cost sources of renewable energy. Reclamation is the second largest producer of hydroelectric power in the United States, which ranks fourth in the world for hydroelectric power production. Reclamation maintains 58 hydroelectric plants accounting for 23 percent of the hydroelectric generating capacity in the Western United States.

In aggregate, generating electricity by renewable energy reduces the amount of electricity supplied by fossil fuel plants, along with the associated emissions. Market values of power typically do not consider these external costs associated with fossil fuel generated electricity. Renewable energy activities were estimated to:

- contribute $4.4 billion in output; and
- support 18,000 jobs.

Background

Wind and solar leases are treated as "rights-of-way" and are issued on a first-come-first-serve basis with the exception of offshore wind leases which are generally offered competitively. Geothermal leases are allocated via competitive lease sales. Most hydropower generating facilities were constructed many years ago. New hydropower facilities associated with existing Reclamation facilities are treated as "lease of power privileges."

Solar

The BLM conducted a comprehensive environmental analysis through which it identified 17 "solar energy zones" (SEZs) on public lands in six Western states where solar energy development would be encouraged.[28] The analysis also identified lands where solar energy development would be excluded and lands where solar energy could be developed if additional analysis showed appropriate. The BLM finalized their land use allocations in October, 2012. The BLM also launched the Restoration Design

[26] http://www.eia.gov/energy_in_brief/article/renewable_electricity.cfm.

[27] The Bureau of Indian Affairs is responsible for the administration and management of 55 million surface acres held in trust by the United States for Indian tribes, individuals, and Alaska Natives. Permitting renewable energy projects on tribal trust lands is handled on a project-by-project basis by the tribal surface owner and various agencies, including BIA and BLM.

[28] Arizona, California, Colorado, Nevada, New Mexico and Utah.

Energy Project (RDEP) in FY 2012.[29] The initiative identified lands across Arizona most suitable for solar and wind power projects, with a focus on disturbed areas, and those with few potential conflicts over natural and cultural resources. A Record of Decision was issued in January 2013 to incorporate land use allocations and programmatic and SEZ-specific design features into eight Arizona BLM land use plans.

In FY 2012, Interior collected $8.4 million in solar rentals, up from $6.8 million in FY 2011. This rental is based on a per-acre "base rent" fee and a per-MW of installed capacity fee. Solar rent is phased in over a five-year period after construction. Most solar projects are photovoltaic facilities, which have the lowest capacity fee. These fees are shown in Table 5-1.

Table 5-1. Solar Capacity Fee, by Technology

Generating Technology	Fee Per-MW of Installed Capacity
Photovoltaic (PV)	$5,256
Concentrated Solar Power (CSP)	$6,570
CSP with Storage	$7,884

Wind

In April 2011, BOEM announced approval of the Construction and Operations Plan for the Cape Wind project, the nation's first commercial lease to construct and operate an offshore wind facility located in Federal waters. The project consists of 130 turbines, each rated at 3.6 MW, for a total capacity of 468 MW. The 33-year lease covers 46 square miles in Nantucket Sound offshore Massachusetts, and will cost Cape Wind Associates, LLC $88,278 in annual rental payments prior to energy production, then annual operating fees of 2 to 7 percent once production has commenced. The annual fee is based on an estimate of the wholesale electric power price Cape Wind's power would receive in regional markets.

In October 2012 BOEM reached agreement with Bluewater Wind Delaware, LLC on a commercial wind energy lease for about 100,000 acres of the Outer Continental Shelf (OCS) offshore Delaware. Bluewater has proposed a 450-megawatt project – which could power over 100,000 homes – located to avoid shipping lanes, a proposed vessel anchorage ground and a munitions disposal area. BOEM will assess the plans based on environmental, technical and other factors before granting approval for construction.

BOEM has also issued leases for the OCS off of New Jersey to Deepwater Wind, LLC and Fishermen's Energy of New Jersey, LLC. These leases were made under the "interim policy" that pre-dated the 2009 Final Renewable Energy Framework governing management of the Renewable Energy Program. These 5-year leases were designed for resource data collection and technology testing, and convey no commercial rights.

[29] See http://www.blm.gov/pgdata/etc/medialib/blm/az/pdfs/energy/rdep.Par.61617.File.dat/faq.pdf and http://www.blm.gov/pgdata/etc/medialib/blm/az/pdfs/energy/rdep.Par.61787.File.dat/RDEP-ROD-ARMP.pdf for more information.

In FY 2012, Interior collected $1.6 million in wind rentals, up from $1.5 million in FY 2011. This rental is based on a fee of $4,155 per-MW of installed capacity. Wind rent is phased in over a three-year period after construction.

Geothermal

The BLM has authority for leasing 245 million acres of public lands with geothermal potential in 11 Western States.[30] This includes 104 million acres of National Forest lands. As of January 2013, the BLM manages 818 geothermal leases, including 59 producing leases with 1,275 megawatts of installed capacity; over 40 percent of U.S. geothermal energy capacity. Since the completion of a 2008 Programmatic EIS, the BLM has competitively leased over one million acres of federal lands in six states (see Table 5-2). The BLM's geothermal leases generated over 5,266 gigawatt hours of electrical power during 2012 and provided alternative heat sources for direct-use commercial endeavors, enough to power 1.2 million homes.

Table 5-2. Geothermal Leasing by State

State	Number of Parcels	Number of Acres
Nevada	251	724,085
Utah	67	241,490
Oregon	11	41,362
Idaho	13	17,580
California	14	14,110
Colorado	1	799
Total	**357**	**1,039,426**

Source: BLM Geothermal Factsheet (January 2013).

Competitive lease sales since 2007 have netted over $76 million in bonus bids for geothermal lease parcels in California, Colorado, Idaho, Nevada, Oregon, and Utah. Annual geothermal bonuses, rents, and royalties have averaged $11.7 million over 2003-2012. A portion of the bonus bids and royalty revenues are shared with states and counties.[31]

[30] For more details see: http://www.blm.gov/pgdata/etc/medialib/blm/wo/MINERALS__REALTY__AND_RESOURCE_PROTECTION_/energy/solar_and_wind.Par.4837.File.dat/Geothermal_01_2013.pdf

[31] States receive 50% of lease sales and royalty revenues and counties receive 25%.

Project Approvals, Outputs and Price Trend Data

Solar, Wind, and Geothermal – Project Approvals and Generating Capacity

Table 5-3 presents information on renewable energy projects approved and generating capacity. Figure 5-1 shows the locations of solar, wind, and geothermal projects on Federal lands.

Table 5-3. Renewable Projects, Approvals and Capacity

Type of Project	Projects Approved	Capacity (MW)
Geothermal		
To date	46	2,083
Since 2009	9	427
FY 2012	0	0
Solar		
To date	18	5,208
Since 2009	18	5,208
FY 2012[a]	2	489
Wind		
To date	34	3,034
Since 2009	7	2,359
FY 2012	2	1,815
Hydropower, MW		
Lease of power privilege (2011&2012)	8	38.4
Existing capacity		14,692

Source: BLM data.

[a] FY 2012 solar capacity includes a 350 MW project on tribal trust land in NV. Also, not every renewable energy project approved may ultimately be developed.

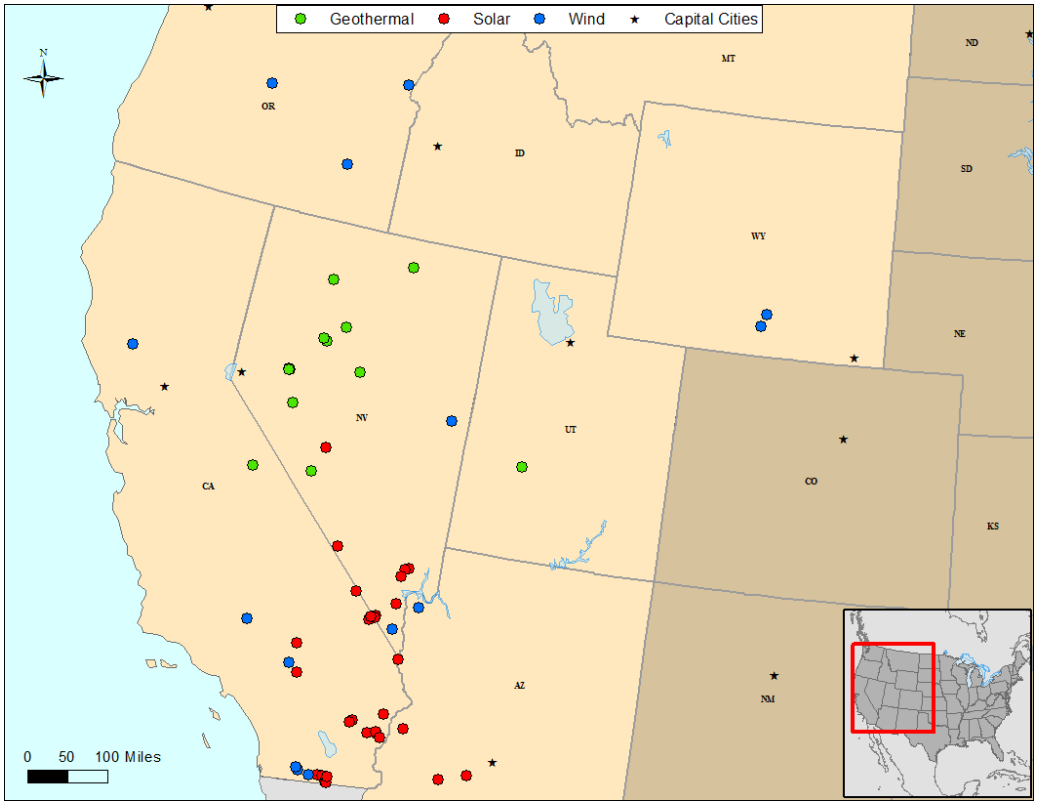

Figure 5-1. Solar, Wind, and Geothermal Energy Projects Approved Since 2009

Source: BLM data.

During FY 2012, BLM approved 5 solar and 2 wind projects with a total 1,504 MW of installed capacity. Geothermal leasing in FY 2012 totaled 8 parcels leased in Nevada and 2 parcels leased in Colorado.[32]

Table 5-4 shows geothermal leasing by state. Of the 1.04 million acres under lease for geothermal energy production, about 70% are located in Nevada. Reclamation operates 194 hydroelectric generating units with an installed capacity of 14,692,930 kilowatts. Net generation from Reclamation hydropower facilities in FY 2012 was about 47.5 MWH, compared to about 48.6 MWH in FY2011.

Table 5-4. Geothermal Leasing by State

State	Number of Parcels	Number of Acres
Nevada	251	724,085
Utah	67	241,490
Oregon	11	41,362
Idaho	13	17,580
California	14	14,110
Colorado	1	799
Total	**357**	**1,039,426**

Source: BLM Geothermal Factsheet (January 2013).

[32] http://www.blm.gov/wo/st/en/prog/energy/geothermal.html.

There has been considerable growth in solar, wind, and geothermal capacity in recent years. Figure 5-2 shows the growth in solar, wind, geothermal energy capacity on public lands since 1978.

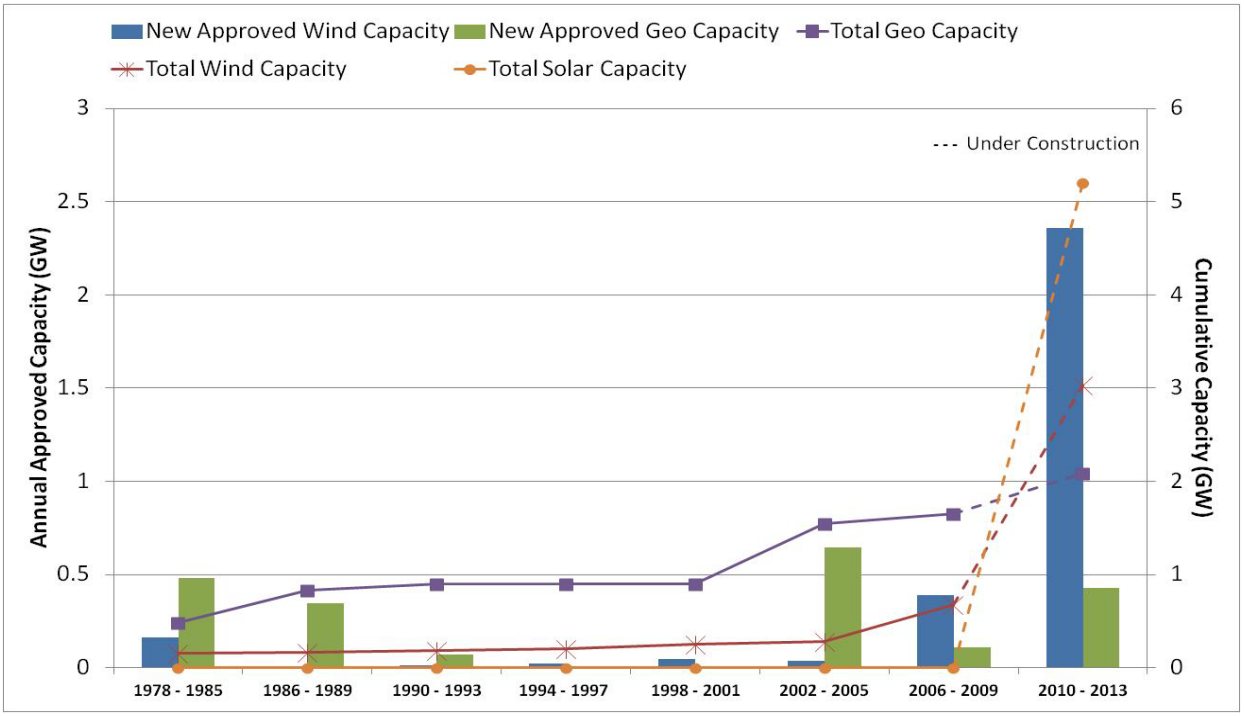

Figure 5-2. Solar, Wind and Geothermal Capacity on Federal Lands (1978-2013)

Source: BLM data.

As shown in Table 5-5, as of February 2013, solar, wind, and geothermal renewable energy developments on public land include 18 solar projects, 34 wind projects, and 46 geothermal projects, with associated transmission corridors and infrastructure that will enable the projects to connect to established power grids. Together, these projects have 10,400 megawatts of generation capacity, exceeding the President's goal of authorizing 10,000 megawatts of utility scale renewable energy on public lands by 2013. The projects will power more than 3 million homes.

Table 5-5. Renewable Projects, Approvals and Capacity

Type of Project	Projects Approved	Capacity (MW)
Geothermal		
To date	46	2,083
Since 2009	9	427
FY 2012	0	0
Solar		
To date	18	5,208
Since 2009	18	5,208
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[a] FY 2012 solar capacity includes a 350 MW project on tribal trust land in NV. Also, not every renewable energy project approved may ultimately be developed.

Hydropower – Project Approvals and Generating Capacity

In the late 1940s hydropower provided a third of U.S. electricity; by 2007 it had fallen to less than 6 percent. For FY 2012, hydropower accounted for about 7 percent of U.S. electricity generation.[33] The 58 hydroelectric power plants at Reclamation facilities generate over 40 billion kilowatt hours of electricity per year, enough to power over 3.5 million homes, and providing nearly a billion dollars in revenues. Figure 5-3 shows net generation at Reclamation operated hydropower facilities over FY 2003-FY 2012.

Reclamation's facilities avoid the production of over 27 million tons of carbon dioxide that result from producing this power by conventional power plants.[34] Reclamation has added approximately 80 megawatts of new hydropower capacity to its portfolio through turbine replacements, generator rewinds, and other projects that improve efficiency at Reclamation power plants. Over the last three years another 36 megawatts of power capacity have been added to Reclamation facilities through lease or license with non-federal entities.

[33] http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_1_01.

[34] FY 2013 U.S. Department of the Interior Budget in Brief, page BH-37.

Since entering into a Memorandum of Understanding in 2010 with the Department of Energy and U.S. Army Corps of Engineers, Interior has documented opportunities to generate nearly two million megawatt hours of new hydropower annually, either through additions to existing Reclamation facilities or through construction of new conduit hydropower systems.[35] Taking advantage of these opportunities, Reclamation has awarded lease of power privilege contracts on Ridgeway Dam and the Uncompahgre South Canal in Colorado.[36]

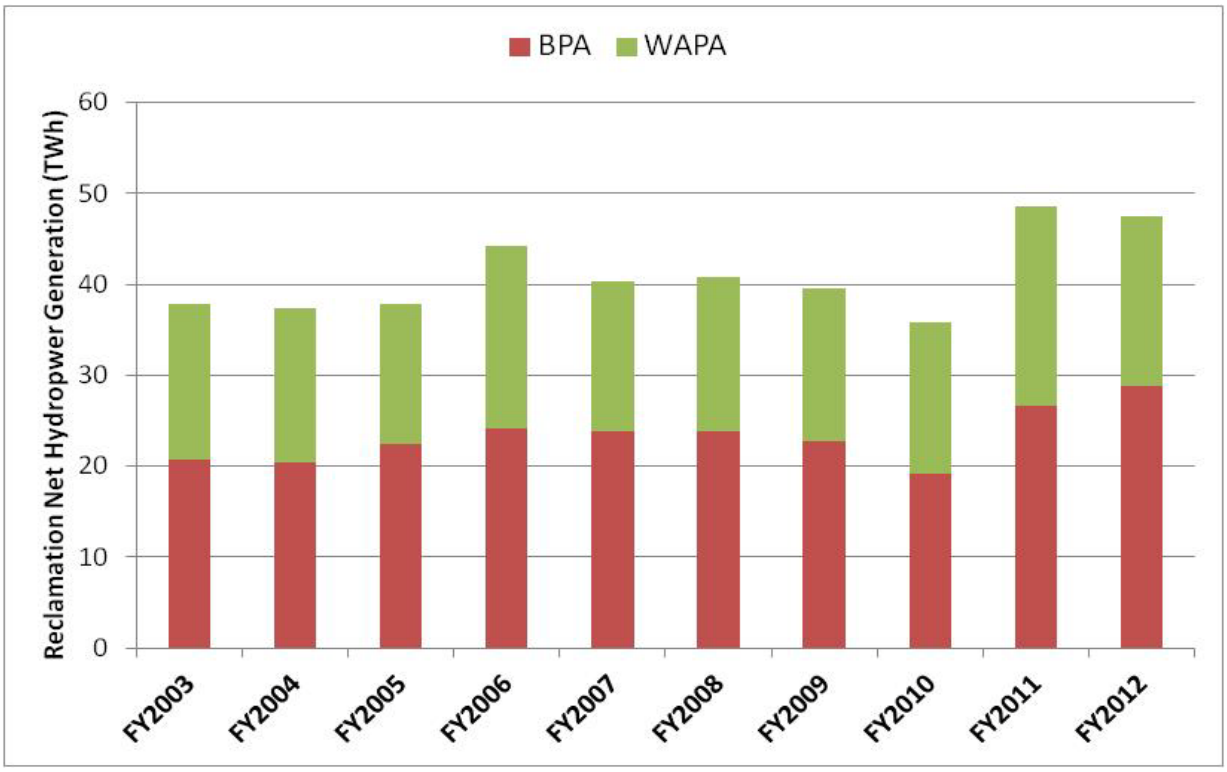

Figure 5-3. Net Generation at Reclamation Operated Hydropower Facilities over FY 2003-FY 2012

Source: Bureau of Reclamation data.

[35] http://www.usbr.gov/power/hydropower-mou/HydropowerMOU.pdf.

[36] Hydropower Resource Assessment at Existing Reclamation Facilities, a comprehensive review of power potential at all Reclamation facilities. See http://www.usbr.gov/power/AssessmentReport/USBRHydroAssessmentFinalReportMarch2011.pdf.

Economic Contributions and Economic Values

Geothermal, wind, solar, and hydro generated energy produced on Interior managed public lands in FY 2012 is estimated to have provided $4.4 billion in economic contributions, and supported about 18,000 jobs (value added information is not readily available).[37] Table 5-6 provides details. In particular:

- The wind energy capacity installed in FY 2012 resulted in over $7 million in direct economic contribution, $80 million in total output, and supported 500 jobs.
- The solar energy capacity installed in FY 2012 is estimated to provide over $560 million in direct economic contribution, $1.7 billion in total output and support 8,000 jobs.
- Geothermal energy production resulted in $240 million in direct economic contribution, $491 million in total output and supported over 2,500 jobs.
- Hydropower production was associated with value added of about $1.7 billion, economic contributions of about $2.1 billion, and about 6,700 jobs.

Table 5-6. Renewable Energy – Contributions and Value Added

Energy Source	Estimated Sales Value of Electricity Produced	Estimated Value Added	Estimated Economic Contribution	Estimated Employment Supported
		($ billions)		(number)
Wind[1]	$0.06	n/a	$0.08	466
Solar[1]	$0.15	n/a	$1.7	8,423
Geothermal	$0.29	$0.33	$0.49	2,539
Hydropower	$1.46	$1.7	$2.1	6,700
Total	$1.96	$2.03	$4.37	18,128

[1]Estimates calculated using installed capacity, capacity factor and average on-peak spot electricity prices for capacity installed in FY 2012.

The economic benefit of operating a renewable energy plant can be measured by the avoided cost, with the market price of electricity as a proxy for avoided cost. Avoided cost is the difference between the total power system cost of satisfying the demand for electricity "with" and "without" operating the plant. The market price of electricity reflects the cost of operating the marginal, or price-setting generation unit. For example, at a given level of electricity demand, generation of an additional

[37] Economic contributions associated with wind, solar, and geothermal energy produced on BLM land arise in the following manner. BLM issues permits for activities or sells leases. In the case of competitive lease sales, bonus bids and related revenues are transferred from companies to ONRR, and subsequently to Treasury, States, and Tribes. Companies pursue exploration and development and construct the power plants. These activities involving hiring labor and capital and may degrade various nonmarket goods and services; however, they may also offset degradation that would have occurred from developing and using fossil fuels. Companies produce power and during the production phase labor and capital are reduced to operating levels; power-purchase revenues fund the rental/royalty revenues paid to ONRR, and then to Treasury, States, Tribes, and grant recipients. This generation offsets impacts associated with fossil-fuel emissions.

megawatt hour of hydropower may avoid the costs associated with generating that power with a gas- or coal-fired generation unit.

The cost of operating a generation facility varies with the time of day. The variable cost of meeting demand varies on a second by second basis depending on the load, as well as the type and load-level of plants in operation. During off-peak periods, demand is typically satisfied with lower-cost coal, run-of-river hydropower, and nuclear units. During on-peak periods, the additional load is met with more expensive sources such as natural gas combustion turbine units. In aggregate, generating electricity by renewable energy reduces the amount of electricity supplied by fossil fuel plants, along with the associated emissions. Market values of power typically do not consider the effects, if any, of changing energy generation levels on system-wide powerplant emissions, regional air quality, or other external costs associated with the siting and operation of renewable energy facilities.