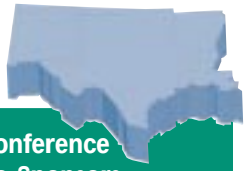
Climate Change: What Does It Mean for the Central Southwest?

A report on the October 30, 1997 EPA Regional Conference sponsored by the EPA Office of Policy, Planning and Evaluation, Office of Economy and Environment



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Central Southwest Challenged by a Changing Climate

In June 1996, Dallas, Texas sweltered in temperatures that remained over 100°F for 20 straight days, according to Jerry Clifford, acting regional administrator for the U.S. Environmental Protection Agency's Region 6. Opening a public conference on global warming with a dramatic hypothetical question, Clifford raised the possibility of new record highs under a changing climate and droughts that last for years.

The EPA conference on global climate change, held in Dallas on October 30, 1997, was co-sponsored by 14 organizations and attended by more than 200 people from the five states—Arkansas, Louisiana, New Mexico, Oklahoma, and Texas—that comprise EPA's Region 6.

Representatives from nine news organizations attended the conference. Articles appeared in *The Dallas Morning News, Houston Chronicle,* and *Fort Worth Star-Telegram,* and the ABC, NBC, and Fox affiliates in Dallas covered the conference.

The conference's second speaker, EPA Deputy Administrator Fred Hansen, noted that the diversity of stakeholders attending the conference "underscores just how seriously we as a nation must take the issue of global climate change." Participants included corporate and government officials, oil and gas company executives, environmental leaders, utility executives, members of the media, scientists, physicians, and policy analysts.

EPA Acting Regional Administrator Jerry Clifford challenged participants to think about the possibility of new record high temperatures in Texas under global warming.

BP America Chairman Steven Percy said that his company has a strong vested interest in the outcome of the global climate change debate.

Hansen compared global climate change to a fog-shrouded reef. "As the captain of the ship, we know that the reef is out there," he said. "We must decide: Do we turn now while there is still time, or continue on a collision course?"

Texas Coast At Risk

Another speaker was Garry Mauro, commissioner of the Texas General Land Office, who told the conference that his state stands to lose 500 square miles of shoreline as global warming causes the water level in the Gulf of Mexico to rise, compounding the problem of coastal subsidence. To picture the potential loss, he said, "imagine a modern-day Paul Bunyan with a chainsaw cutting one-and-a-half miles off the Texas coast all the way from Port Arthur south to the Rio Grande."

EPA's Assistant Administrator David Gardiner described other potential impacts. The bad smog years of 1988 and 1985, he said, are the "kind of conditions expected to be seen more often in Dallas, Houston, and El Paso" under climate change.

Oil Company Takes a Strong Stand

In the conference's keynote address, Steven W. Percy, chairman and CEO of BP America, the third largest petroleum company in the world, told participants, "We at BP have decided to act in a constructive way and take precautionary action to address global climate change."

During a question-and-answer session, Percy added, "We did a lot of listening to our employees, new

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Central Southwest Challenged by a Changing Climate - continued

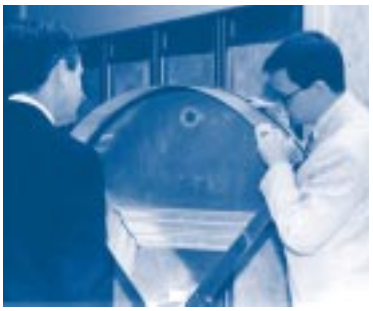
recruits to the company, and our customers, and we came to believe that the issue of climate change could no longer be discounted."

Other speakers discussed the science of climate change; potential impacts on human health, the economy, the insurance industry, coastal ecosystems, and agriculture; opportunities for reducing emissions in the utility and energy sectors; mitigation strategies for coastal wetlands, wildlife, and communities; and new markets for technologies such as solar and wind power.

Closing the conference, EPA's Jerry Clifford applauded the participants for meeting the conference's goal of facilitating a dialogue among the major stakeholder groups in the Central Southwest. He said that the meeting addressed "the effects of climate change, strategic thinking about how to reduce greenhouse gas emissions, and the policy options open to us." ●

← *Conference participant looks at EPA exhibit featuring renewable energy solutions to global warming.*

→ *Mark Cree Jackson demonstrates a concentrating solar photovoltaic system developed by Entech, Inc.*



"Climate change is like a fog-shrouded reef. As the captain of the ship, we must decide: Do we turn now while there is still time, or continue on a collision course?"

Fred Hansen
Deputy Administrator
U.S. Environmental Protection Agency

Broad Agreement on Climate Change

Carbon dioxide levels have risen 30 percent since 1860, and more than 2,000 scientists maintain that "there is broad agreement that global climate change is occurring," said EPA Deputy Administrator Fred Hansen.

← *EPA's Fred Hansen told the conference that climate change has "potentially drastic consequences for ourselves, our children, and our children's children."*

Climate change has "potentially drastic consequences for ourselves, our children, and our children's children," Hansen added. We are already seeing the kinds of effects that it could have. Floods, heavy snowfalls, and deadly heat waves are becoming "all-too-common stories on the nightly news."

Deaths from heat waves in Dallas could triple by the year 2050, and it could cost $4 to $13 billion for sand replenishment to protect the Texas coastline from a 20-inch rise in sea level. "The industry, agriculture, fisheries, wildlife, and public health of this region could be profoundly affected," Hansen said.

Describing the U.S. pre-Kyoto proposal for returning greenhouse gas emissions to 1990 levels by the years 2008 to 2012, Hansen said, "Our country has the will, the commitment, and the technological know-how to meet these targets in ways that will build our economy."

In fact, he said, we can cut greenhouse gas emissions by one-fifth with technologies that are now on the market. One compact fluorescent light bulb, for instance, can save nearly 1 ton of carbon emissions over its lifetime of use while reducing the purchaser's energy bills. If all U.S. consumers bought energy-efficient household appliances over the next 15 years, we would save nearly $1 billion in energy costs. Energy-saving features in Compaq computers alone have saved carbon emissions equivalent to taking 150,000 cars off the road. ●

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Native Texan Speaks Out

In an impassioned speech, Texas land commissioner Garry Mauro told the conference that his office sits squarely in the middle of all stakeholders when it comes to energy and environmental issues such as global warming. The bulk of the revenue of the Texas General Land Office comes from 18,000 oil and gas wells, but at the same time the office is charged by the state with responsibility for overseeing environmental protection.

Land commissioner Garry Mauro said that we can begin by getting more out of every barrel of oil and every ton of coal.

"No public policymakers should ignore global warming," said Mauro, who said that he remembers the exact date when he could no longer ignore the issue. It was February 21, 1996 (his 48th birthday), and the temperature in Austin, Texas, was 100°F. "I'm not a climate expert or a scientist," he added, "but I have good common sense, and a 100°F day is not supposed to happen in February."

Mauro described some of the potential regional impacts of climate change, such as a reduction of water resources. A recent University of Texas study showed that a 4°F rise in temperature would result in a 35 percent reduction of the flow of water in the state's rivers and streams. Under drought conditions, the drop could increase to 85 percent. "The last thing we need," said Mauro, "is a reduction of our already overtaxed water supply."

The time to begin stopping global warming is now, he told the conference. "We can begin by getting more out of every barrel of oil and every ton of coal," he said. "And improving energy efficiency is the American thing to do. After all, 'waste not, want not' dates back to Ben Franklin."

Greenhouse gas emissions can be cut without waiting for technological breakthroughs. Energy-efficient and renewable energy technologies are available today, and using those technologies could benefit the U.S. economy, and Texas in particular. The state has ample natural gas, which produces fewer carbon emissions, as well as abundant wind and sunshine. Windmills were a common sight when Mauro was growing up in Waco, Texas, and solar energy technologies are a promising industry for the state. In fact, Texas could be called the "Saudi Arabia of sunlight."

Addressing global warming just means practicing "good old American frugality," Mauro said. "If the naysayers are right, and we take the measures I've outlined, then we'll gain a number of benefits anyway. And we'll be better prepared for the day when China and India are using 119 million barrels of oil—double what the whole planet consumes today."

"No public policymakers should ignore global warming."

Garry Mauro
Commissioner
Texas General Land Office

Climate Change reports the results of a conference sponsored by the U.S. Environmental Protection Agency entitled, "Climate Change: What Does It Mean for the Central Southwest?" The conference took place on October 30, 1997, in Dallas, Texas.

For more information about the conference, visit the U.S. Environmental Protection Agency's global warming conference Web site at: http://eis.wpi.org/epaworkshops/.

In addition, EPA publishes a number of fact sheets about global warming and energy conservation. Call EPA's Fax-On-Demand Service (202-260-2860) or access EPA's global warming Internet site at http://www.epa.gov/globalwarming.

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"I teach at A&M University, and my students are very interested in global warming. I decided to come and hear first-hand without the filters you get through the media."

Maggie Moorhouse
President
Moorhouse Associates, Inc.

Tracing the Lines of Evidence

Gerald North, head of Texas A&M University's meteorology department, used to be skeptical about global warming. Today he believes that the climate is changing and humans are responsible. What changed his mind? The growing evidence.

Considered individually, North said, the lines of evidence for global warming may not be totally convincing. But together, they add up to a compelling picture.

The pattern of warming over the past century is in line with climate model predictions, according to North, which indicate that the land should warm faster than the oceans. And that is in fact what is happening. "The fingerprint, the smoking gun left by greenhouse gas warming, is right in front of our eyes," he said.

North reported that scientists can now detect the influence of greenhouse gases in the climate record with "99 percent certainty." Researchers also can detect the cooling effects of volcanic eruptions and sulfate aerosols. "They're different enough from one another that we can pluck them out" of the record, North said. "We have a hard time determining how strong they are, but we can see them."

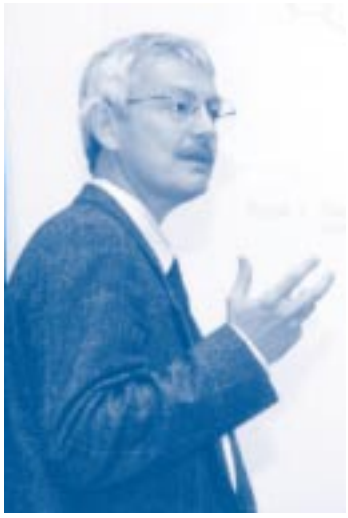
According to Thomas Crowley, professor in the department of oceanography at Texas A&M University, the global warming of the last two decades is an "exceptionally unusual" phenomenon compared with the climate record of the last 600 years.

Furthermore, Crowley said, today's concentration of CO_2 in the atmosphere "far exceeds" any level that has occurred over the last 200,000 years. Carbon emitted by the burning of fossil fuels carries a chemical signature, allowing researchers to determine that the increase in CO_2 cannot be due to natural causes.

Crowley said that if current emission trends continue until fossil fuel reserves are exhausted, the atmospheric concentration of CO_2 in the next few centuries could rise to six or seven times higher than it was in pre-industrial times. That would be as high as any level that has occurred over the past 300 million years.

"From a scientist's perspective," Crowley told the conference, "the evidence indicates that the present warming is very unusual, the CO_2 concentrations are extremely unusual, and we have the potential to perturb the system to a much greater level." ●

→ *Gerald North, of Texas A&M University, told the audience that the evidence for global warming adds up to a compelling picture.*



← *Thomas Crowley, of Texas A&M University, presented the "long view" on global climate change.*

What Can Texas Expect?

"Water is likely to become more precious over the next 50 years in Texas," said Gerald North. He cautioned that it is hard to predict climate change at the regional level. For Texas, he said, "the biggest uncertainty, but potentially the largest problem, is water resources."

A warming of 3.6°F, without a change in rainfall, would have a "profound influence" on the state's water budget, according to North. Higher temperatures would mean more evaporation. If the evaporated water is not replenished by more rain, "it will really affect rivers in Texas," he said. "Estuaries will receive less freshwater, so the mix of fresh and salt water will change dramatically, with a significant effect on fisheries."

Agriculture may benefit from higher CO_2 levels, he added, although farming may become concentrated mostly in the eastern part of the state.

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Risks and Rewards Ahead

Global warming poses serious risks for human health, ecosystems, and coastal communities in the Central Southwest, according to EPA Assistant Administrator David Gardiner. Efforts to reduce greenhouse gas emissions would lower these risks and also would create "broad new opportunities" for the region.

← *EPA's David Gardiner described how the region would benefit from efforts to cut greenhouse gas emissions.*

Gardiner warned that global warming is likely to strike "much sooner and closer to home" than most people think.

Heat-related deaths in Dallas could triple by the middle of the next century, and urban smog in cities such as Houston, El Paso, and Dallas could increase. Higher temperatures would promote the spread of dangerous diseases, such as malaria and dengue fever.

Warmer seas could increase the intensity, duration, and extent of harmful algal blooms. Gardiner noted that two-thirds of the Texas coastline was closed to shellfish harvesting in 1996, due to contamination by an unusually large bloom of toxic marine algae.

Sea level rise presents an especially important risk to the region. In Galveston, Texas, and along the Louisiana coastline, seas are rising more rapidly than the U.S. average because coastal land in the two states is sinking. Gardiner noted that sea level in Galveston is predicted to rise 3 feet by the year 2100 and an additional 4 feet by 2200.

A 20-inch rise in global sea level would cause a 30 percent loss of Texas coastal wetlands, threatening essential breeding grounds for the young shrimp, crabs, and fish that are essential to thousands of jobs for coastal families.

Sea level rise will exacerbate flooding, erosion, and other damage caused by coastal storms. "For every foot that the ocean rises, the storm surge will go farther and farther inland," he said.

The worst natural disaster in U.S. history was a hurricane in 1900 that killed 6,000 people in Galveston, and Gardiner noted that there are "many, many more" people along the Texas and Louisiana coasts today. "As sea levels rise and storms worsen, a lot more people and property will be at risk."

Reaping Benefits from Reducing Emissions

International and domestic efforts to reduce global warming could help the Central Southwest economy, Gardiner said. Benefits will come from improving energy efficiency, fuel switching, and the growing international market for renewable energy technologies.

"We are a modern 21st century society that uses 19th century fuel combustion technology," Gardiner said. "Every year we still throw billions of dollars' worth of energy up the stack or out the tailpipe. Surely, the most technologically advanced nation on the earth can find ways to burn carbon more efficiently."

Gardiner predicted that areas with large natural gas resources, such as Texas, will benefit as utilities shift from burning coal to natural gas. And the worldwide market for renewable energy technologies, many of which are produced in the Central Southwest, will "only grow bigger" as developing countries look for clean ways to expand their economies.

"If we use our heads," Gardiner concluded, "we can reduce the risk of climate change and grow the economy at the same time. That's the challenge that we face today." ●

"We are a modern 21st century society that uses 19th century fuel combustion technology."

David Gardiner
Assistant Administrator
U.S. Environmental Protection Agency

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Oil Company Shows the Way

In the conference's keynote address, BP America Chairman and CEO Steven W. Percy told the audience that his company has made a long-term commitment to addressing climate change.

British Petroleum is the world's third largest petroleum company, and its U.S. subsidiary is the largest U.S. producer of oil. The company operates or franchises 7,900 gas stations.

"When we make business decisions at BP," he said, "we constantly weigh uncertainties." For petroleum companies, the gambles range from the prospects for striking oil when drilling new wells to the uncertainties of international currencies and oil markets. BP weighed climate science along with a host of other factors such as these and "decided to act in a balanced and constructive way."

Partnerships Are Key

The company is reviewing its operations to develop specific targets for reducing its own greenhouse gas emissions. In order to establish realistic and achievable targets and milestones, British Petroleum is working with EPA's Climate Wise program to develop an improved accounting system for measuring the emissions produced in the company's operations. BP will review its targets annually and report on its progress.

In addition, in partnership with the World Resources Institute, the company is conducting a joint review of policy options available for reducing greenhouse gas emissions.

Under the federal government's Joint Implementation program to reduce greenhouse gas emissions internationally, BP is working with The Nature Conservancy to protect five million acres of rainforest in Bolivia as a natural carbon sink.

Percy added that British Petroleum strongly supports the use of market forces to reduce emissions. The company is collaborating with the Environmental Defense Fund in a pilot emissions trading program. EDF is designing a program for independent verification of the results of emissions trading.

Finally, British Petroleum is working with Bechtel National Laboratory, Electric Power Research Institute, and the Japanese government to hold regional workshops around the world. The purpose is to accelerate the role of technologies in reducing greenhouse gas emissions.

"We" is the key word in solving climate change, Percy said. These projects "lay the groundwork for the breakthrough thinking that will be necessary to solve a problem of this magnitude."

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"Everyone in the oil industry is obviously interested in this topic. What I'm trying to do is separate the hype from the science."

Richard L. Charter
Vice President
FINA, Inc.

←
BP America Chairman Steven Percy chats with EPA's David Gardiner.

Conference participant Maggie Moorhouse (center) wanted to hear about global warming without "the filters you get through the media."

Citizens for a Sound Economy

←
Protesters from Citizens for a Sound Economy held a demonstration outside of the conference facility voicing their concerns about the science of climate change, the international negotiations, and its potential impact on energy costs.

Oil Company Shows the Way - continued

Solar Power at BP

British Petroleum is also one of the largest producers of solar photovoltaic cells in the world. "We at BP are optimistic about solar energy," Percy said. Right now, solar power accounts for .001 percent of the world's energy supply. By the year 2020, Percy said, solar and other renewable energy technologies could supply 5 percent worldwide.

Solar photovoltaics are a $100 million business today at British Petroleum. The company is committed to solar power becoming a core business at BP and raising the revenues from solar to $1 billion.

BP's Commitment

Asked about the feasibility of the carbon reduction targets that were on the table for discussion at the international negotiations in Kyoto in December, Percy said that BP is generally optimistic that technology will deliver solutions.

The company supported the process leading to the Kyoto negotiations, but BP believes that climate change is a long-term problem that will not be solved in a single summit meeting. It is important not to wait for a finished and polished solution to garner unanimous support. "We need to get started now," Percy said.

Percy noted that a survey by the World Wildlife Fund indicated that two-thirds of the people polled believe that climate change is a very serious or somewhat serious threat right now. "Those are the voices of our customers," said Percy. "Our customers increasingly expect us to take their interests into consideration when making our business decisions."

Percy said that the company is not actively seeking publicity for its stance, although BP certainly has achieved a high profile because it has broken ranks with the rest of the oil industry. "This is not about PR," Percy said. He added that the company is participating in the climate debate only through public meetings such as EPA's regional conference in Dallas.

"BP has a strong vested interest in the outcome of the global climate change debate," Percy concluded. "BP is engaged in the climate journey for the long haul, and we believe that we are on the right course." ●

Grandmother Offers to Give Up Oil Royalties

"I'm here on behalf of my great-grandson who is now six months old," Morine Kovich told the conference during a question-and-answer session. At the microphone, she continued, "When I hear about global warming, I'm very concerned. I'm 76 years old, and I will never give up the fight to reclaim our world for future generations."

The audience listened intently as she said: "I have partial ownership in an oil field. When it blew in, they thought it would last 100 years. It lasted about 40 years. I'll give up my oil royalties if we can develop solar."

Kovich concluded with a ringing call for action: "We cannot do it with a short-term vision. I urge you to *think long term* and *act now*."

"Last Out, Lights Out!"

Conference participant Ollie Maier, conservation coordinator for Southwest Texas State University, has a creative way to encourage students and faculty members to save energy. Maier runs a weekly "last out, lights out" contest, in which he conducts random inspections after classes are completed for the day. The first department that has turned out all of its lights in empty rooms receives money for its coffee bar, along with a coffee mug. If no winner emerges, the money goes back into the pot, providing an even bigger incentive the following week. Money for the contest is generated by the school's recycling program.

Rebel With a Cause

As a member of a ranching family that has also been in the oil business, Sierra Club environmental educator Molly Rooke Seay must appear something of a rebel. "Global warming is real, and we need to do something about it," Seay says. How does her family feel? "They were resistant at first, but once I gave them some information, they turned around."

"BP is engaged in the climate journey for the long haul, and we believe that we are on the right course."

Steven W. Percy
Chairman and CEO
British Petroleum America

EPA

Impacts on Renewable and Sustainable Energy

Renewable energy sources, such as hydroelectric, biomass, geothermal, solar, and wind, account for just 8 percent of total energy production in the United States today, according to Rudi Schoenmackers, director of the Southwest Technology Development Institute. This share of the energy pie is likely to grow in the future as costs come down and as policies to reduce greenhouse gas emissions begin taking effect.

Ninety-three percent of renewable energy in the United States comes from hydropower and biomass resources, Schoenmackers said. Hydropower accounts for 4 percent of the total U.S. energy production, supplying 340,000 gigawatt-hours per year with about 79,000 megawatts of potential generating capacity. Most of this power comes from large dams built by the U.S. government and electric utilities, although Schoenmackers said that future growth potential in hydropower lies mainly in mini- and micro-hydropower plants.

Biomass, which historically has been "the most vital fuel source in the world," accounts for just 3 percent of total U.S. energy production. According to U.S. Department of Energy estimates cited by Schoenmackers, biomass actually could provide up to 55 percent.

Biomass resources are derived from agricultural waste, energy crops, manures, municipal solid waste, sawmill and wood products, and sewage sludge. Schoenmackers noted that despite its small total market share, biomass is a growing energy sector projected to increase 14 percent by the year 2030.

Geothermal energy, primarily found in the Rocky Mountains, also represents a growing energy sector. Geothermal supplies the United States with 15,500 gigawatt-hours per year of power at a cost ranging between $0.05 and $0.08 per kilowatt-hour. The geothermal industry, with the help of the U.S. Department of Energy, hopes to bring the cost down to $0.03 per kilowatt-hour. This would result in about 15,500 megawatts of new capacity, Schoenmackers said.

← *Michael Sloan, of Virtus Energy Research Associates, noted that Texas is the leading state in terms of potential for solar and wind technologies.*

The solar and wind energy sectors account for only a small fraction of the total U.S. renewable energy production, but Schoenmackers believes that both sectors have some long-term growth potential. The Clinton administration's "Million Solar Roofs Initiative" will promote the use of photovoltaic solar panels in the United States to slow greenhouse gas emissions, expand U.S. energy options, create a number of high-technology jobs, and help U.S. companies remain competitive.

Michael Sloan, president of Virtus Energy Research Associates, discussed how policies to reduce global warming can provide national and international market opportunities for alternative energy technologies. However, Sloan said at the outset that he is "very skeptical that this climate change initiative is going to translate into work for renewable energy."

According to Sloan, the costs for solar, biomass and wind technologies have been decreasing rapidly since the mid-1980s. He projected that this trend will continue through 2010, with Texas as the leading state in terms of renewable energy potential.

Consumers may help drive the expanded use of clean energy, Sloan said. A 1996 Central Southwest poll by utility companies concluded that electricity customers want a clean environment, predictable costs, diversity in the resource mix, and the use of clean energy sources.

In addition, more than 80 percent of the customers polled indicated that they are willing to pay at least a little extra per month for clean renewable energy.

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(L-R) Conference speakers Rudi Schoenmackers and Michael Sloan chat about renewable energy technologies.

Impacts on Renewable and Sustainable Energy- continued

Sloan said that consumers must be educated, through emissions labeling or other measures, to understand that when they buy electricity or drive a car, they are responsible for producing pollution.

Michael Niemann, of RUST Environment and Infrastructure, discussed the benefits of recovering and using landfill methane to reduce global warming. Although most landfill operators control methane by flaring the gas, an increasing number of projects use landfill methane to fuel boilers or internal combustion engines and turbines that drive electrical generators.

Michael Niemann, of RUST Environment and Infrastructure, concluded that there are major opportunities for landfill methane energy projects in the Central Southwest.

Such projects have a double benefit, Niemann noted, by combusting methane (itself a powerful greenhouse gas) and by reducing fossil fuel consumption at power plants. Based on the number of landfills in the Central Southwest, Niemann concluded that there are "major opportunities" for landfill methane energy projects in the region.

Challenges for Utilities

Roger Duncan, director of planning, environment, and conservation services for the City of Austin, discussed some of the impacts of utility restructuring on climate change and energy efficiency.

Duncan asserted that the trend toward the enactment of new legislation for deregulation will result in utility companies trying to become more attractive to consumers by generating power from renewable energy.

David Montgomery, of Charles River Associates, presented an analysis of the possible impacts of utility restructuring and climate change policies on the southwestern United States. Montgomery projects that the cost of meeting targets to reduce emissions will rise rapidly after the year 2000.

Montgomery concluded that the central southwestern states would experience an increase in electricity prices. He also maintained that higher energy costs from meeting emission reduction targets could have a pervasive economic impact. Higher energy costs could result in a gradual reduction in consumer purchasing power, business investments would slow, and energy-intensive industries would face increasing international competition.

→ *Austin's Roger Duncan said that deregulation will mean that utilities will need to turn to renewable energy technologies to attract customers.*

← *David Montgomery, of Charles River Associates, projects that the cost of meeting targets to reduce emissions will rise rapidly after the year 2000.*

"We feel this is an issue that needs addressing, and our agency will continue investigating this topic."

Becky Norton
Ecologist
Arkansas Department of Pollution Control and Ecology

EPA

Endangered Coasts

Coastal wetlands in the Mississippi Delta are disappearing as sea levels rise, according to John W. Day, Jr., of Louisiana State University's Coastal Ecology Institute. The reason is that flood control levees and other human activities are slowing the deposition of sedimentation, which prevents the delta from growing fast enough to keep up with the rising sea. Management practices, such as sediment fences and river diversions through the levees, could help prevent additional wetland loss.

Denise Reed, Louisiana Universities Marine Consortium

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Evidence of sea level rise is clearly visible in coastal Louisiana communities.

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Texas also has high rates of erosion and coastal wetland loss, according to John Anderson of Rice University. The Texas coast is experiencing a relative sea level rise ranging from 0.06 inches to 0.4 inches a year. The highest rates, Anderson said, occur near bays where people and industries are concentrated. Future sea level rise will depend on what happens to Antarctic and Greenland ice sheets as the climate warms.

Denise Reed, of the Louisiana Universities Marine Consortium, described the impacts of sea level rise on coastal communities.

Karl Brown, of the U.S. Army Corps of Engineers, explained how sediments dredged from shipping channels can be used to create coastal wetlands and bird rookery islands, offsetting some of the habitat loss due to sea level rise. Dredged materials also can be used for shoreline stabilization, breakwaters, and beach nourishment, all at relatively low cost.

Denise Reed, Louisiana Universities Marine Consortium

Phil Bowman, administrator of the Louisiana Department of Wildlife and Fisheries' Fur and Refuge Division, told conference participants that the loss of coastal wetlands has a huge economic impact on Louisiana. Fish and wildlife represent an $8.7 billion a year business in the state, Bowman said, and the "vast majority" of that resource is in coastal areas. Louisiana is a leading producer of warm-water shrimp and oysters, has a thriving fin-fishing industry, produces 40 percent of all furs taken in the United States annually, and is an important overwintering site for waterfowl.

Coastal marshes are disappearing at a rate of 25 to 35 square miles a year in Louisiana, Bowman concluded, and the "substantial losses" projected for the future would threaten critical habitat for fish and wildlife in the region.

Sea level rise poses a threat to coastal communities and infrastructures, explained Denise Reed, of the Louisiana Universities Marine Consortium. Louisiana's low-lying barrier islands are the coast's first line of defense against storms such as hurricanes.

Thousands of oil and gas wells, built for protected in-shore environments, will soon be sitting in the open Gulf of Mexico as barrier islands disappear over the next 30 years.

If marsh loss continues, waterways, highways, hurricane protection levees, and railroads also will become exposed to the ocean. Hurricane Danny, a relatively minor storm that hit coastal Louisiana in the summer of 1997, caused "massive destruction" in a community that had lost most of its wetlands over the past 30 years.

"If we don't deal with wetland loss in a preventive fashion," Reed said, "then FEMA will be dealing with it the next time a hurricane comes in."

"We already have catastrophic coastal land loss in Louisiana. Everything that happens with global warming will be on top of that."

Doug Daigle
Programs Director
Coalition to Restore
Coastal Louisiana

Rising Risk of Dengue and Leishmaniasis

Robert E. Shope, a physician in the pathology department at the University of Texas, believes that higher temperatures will increase the risk of infectious diseases such as dengue and leishmaniasis. "Dengue can be used as a paradigm to show what temperature will do to increase risk," Dr. Shope told the conference.

Since 1989, dengue has been progressively increasing in Latin America and Mexico. The mildest form of dengue causes fever, headache, and a rash, but mortality runs 5 to 15 percent for cases of hemorrhagic dengue, a more virulent form of the disease. Dengue is caused by a virus and transmitted by a mosquito that feeds almost entirely on humans.

During a 1995 outbreak, 4,000 cases were reported in Mexico along the U.S. border, and a few cases occurred in the United States.

The mosquito that transmits dengue is found as far north as Memphis, Tennessee, and could range farther north as temperatures rise. Its rate of reproduction increases at higher temperatures, so global warming would lead to greater populations of the mosquito. In addition, the incubation period for the dengue virus is shorter at warmer temperatures.

"If you add and subtract all of these factors," Shope said, "under a warming of 4°F in New Mexico, Texas, and Louisiana, this mosquito would be a very efficient vector for transmitting the disease."

Dr. Robert Shope reported that the mosquito that transmits dengue has become resistant to widely used pesticides.

Shope reported that there are no good methods of control. The mosquito that transmits dengue has become resistant to pesticides, and there is no vaccine.

A sandfly that occurs in San Antonio, Texas, transmits leishmaniasis, which causes sores that do not heal. If the disease occurs on the face, it can eat into the nose and the skin around the eye. "It is disfiguring but usually not fatal," said Shope. "Those of us who have worked with this disease feel that it is one of those that could become amplified under global warming for the same reasons as dengue."

Water Resources, Agriculture, Severe Weather and the Insurance Industry

We know that a strong connection exists between warming temperatures in the Pacific Ocean and the weather that we experience in the United States. We know that changes in precipitation occur during El Niño years, but what we do not know is whether any given year will be wetter or drier.

That was the conclusion offered by Gregory McCabe, a physical scientist with the U.S. Geological Survey. "We are just beginning to understand more about what we don't know," said McCabe. "Every El Niño is different. You may have a wet winter in Texas, or you may not."

A shift in soil moisture would affect agriculture. Bruce McCarl, professor of agricultural economics at Texas A&M University, has run computer models to simulate what could happen under climate change. Some models show farm income in Texas remaining unchanged, others show it going down 24 percent.

"Wheat could be fairly hard hit," said McCarl, "especially winter wheat. Grapefruit and tomatoes would gain from warmer temperatures."

Increases in severe weather pose a problem for the insurance industry, according to James W. Russell, vice president of the Institute for Business and Home Safety, an initiative of the insurance industry charged with reducing deaths, injuries, and property loss due to natural disasters.

"A growing number of people are living in harm's way," said Russell, "along the Atlantic, Gulf, and Pacific coasts, along the nation's rivers, and in the paths of tornadoes." Almost half of the nation lives in coastal counties, if the Great Lakes are included.

By the year 2010, according to the U.S. Census Bureau, more than 73 million people will live in hurricane-prone areas. The dollar value of residential and commercial structures in the first tier of coastal counties in 1993 was $3.15 trillion, up 69 percent from 1968.

Between 1990 and 1994, the insurance industry suffered a loss of $53.9 million from floods, hail, wind, and other natural disasters. "In a society that sees insurance as an entitlement virtually mandating coverage for all," said Russell, "insurers, in the presence of extreme events, teeter on the edge of financial collapse. Indeed, after Hurricane Andrew, 8 of 10 companies went out of business in Florida."

Gregory McCabe, with the U.S. Geological Survey: ""Every El Niño is different."

Russell concluded by citing another dramatic statistic: Of the catastrophes that occurred worldwide in 1996, America suffered 32 percent but had 81 percent of the insured losses.

"Representative Terri Hodge and I wanted to broaden our knowledge of global warming as a long-term hazard to the health of our constituents in downtown Dallas."

Michael Martinez
Administrative Aide to
Terri Hodge
The State of Texas
House of Representatives

EPA

"I was impressed at the diversity of the participants."

Kyle M. Mills
Regional Environmental Officer
Federal Emergency Management Agency

Facing the Technology Challenge

What will it take to speed the use of clean energy technologies worldwide? That was the question posed by Terry Thorn, senior vice president of ENRON CORP.

Terry Thorn, of ENRON CORP, outlined measures to increase the use of clean energy.

"The most important thing the clean technology business needs today is price signals," Thorn said. Targets and timetables for reducing greenhouse gas emissions will provide those signals, he argued, because they set a value for clean energy and internalize the cost of pollution.

Eliminating subsidies for coal and oil use, subsidies that the World Bank has estimated at $210 billion a year worldwide, would help level the playing field for clean technologies. At the same time, legal, administrative, and regulatory reforms should be undertaken in developing countries to facilitate technology transfer.

Thorn went on to say that an international carbon trading program also is needed to provide a boost to clean energy. Carbon trading would put a dollar value on reduction of carbon emissions, help internalize the cost of climate change, and provide accurate, market-based signals for the value of clean technologies and improved energy efficiency.

Electricity restructuring will help as well. "We won't see base-load coal plants built again," Thorn said. Instead, small power plants will be constructed close to the end users, providing opportunities for natural gas, fuel cells, and solar power.

Finally, Thorn pointed out the many economic benefits of reducing greenhouse gas emissions. Saving energy saves money, and helps companies meet targets for other pollutants such as NO_x and particulates. Texas in particular stands to gain from the increased use of natural gas as power plants switch away from coal. Texas companies also will benefit from business opportunities abroad for energy efficiency retrofits.

"Most of the companies that are screaming bloody murder about an economic disaster," said Thorn, referring to requirements to reduce greenhouse gas emissions, "haven't even done a carbon inventory of their own facilities to see where they might be able to save."

Conference Speakers

John Anderson, Ph.D., Professor, Department of Geology and Geophysics, Rice University
Phil Bowman, Administrator, Fur and Refuge Division, Louisiana Department of Wildlife and Fisheries
Karl Brown, U.S. Army Corps of Engineers, Galveston District
Jerry Clifford, Acting Regional Administrator, U.S. Environmental Protection Agency, Region 6
Thomas Crowley, Ph.D., Professor, Department of Oceanography, Texas A&M University
John W. Day, Jr., Ph.D., Professor, Coastal Ecology Institute, Department of Oceanography and Coastal Sciences, Louisiana State University
Roger Duncan, Director of Planning, Environment and Conservation Services, City of Austin
John P. Foster, Communications Officer, Office of Ecomony and Environment, U.S. Environmental Protection Agency
David Gardiner, Assistant Administrator for Policy, Planning and Evaluation, U.S. Environmental Protection Agency
Fred Hansen, Deputy Administrator, U.S. Environmental Protection Agency
George Hozendorf, Special Assistant to the Regional Administrator, General Services Administration
Mary G. Kemp, Chief, Air Quality Analysis Section, U.S. Environmental Protection Agency, Region 6
Garry Mauro, Commissioner, Texas General Land Office
Gregory McCabe, Ph.D., Physical Scientist, U.S. Geological Survey
Bruce McCarl, Professor, Department of Agricultural Economics, Texas A&M University
Jan Moneysmith, Air Quality Analysis Section, U.S. Environmental Protection Agency, Region 6
David Montgomery, Vice-President, Charles River Associates
Michael Niemann, Landfill Gas Assessment Coordinator, Gas Recovery Group, RUST Environment and Infrastructure
Gerald North, Ph.D., Head, Department of Meteorology, Texas A&M University
Patrice (Pete) Parsons, Associate Deputy Commissioner, Texas General Land Office
Steven W. Percy, Chairman and CEO, BP America
Denise Reed, Associate Professor, Louisiana Universities Marine Consortium
James W. Russell, Ed.D., Vice President, Program Coordination, Institute for Business and Home Safety
Dr. Rudi Schoenmackers, Director, Southwest Technology Development Institute, New Mexico State University
Bob Shope, M.D., Professor of Pathology, Department of Pathology, University of Texas, Austin
Michael Sloan, President, Virtus Energy Research Associates
Steve Thompson, Climate Change Coordinator, U.S. Environmental Protection Agency, Region 6
Terry Thorn, Senior Vice President, Environment and International Government Affairs, ENRON CORP

To learn more about global warming, check out EPA's global warming Internet site: http:/www.epa.gov/globalwarming

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