

# Global warming inspires a look at solar, wind energy

## Southwest eyeing ways to cut emissions from fossil fuels such as oil and coal

BY MELANIE LENART

Now that many Americans accept the reality of global warming, they want to do something about it. In the Southwest, that desire is being harnessed into initiatives to improve energy efficiency and boost alternative forms of power, such as solar and wind energy.

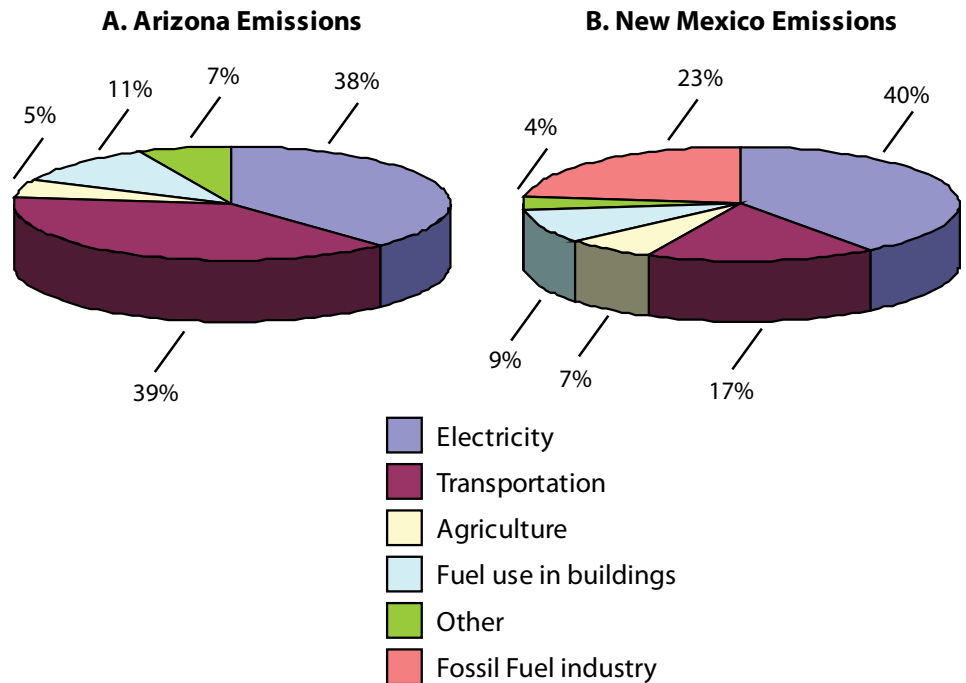
The rising temperatures of recent decades trace back largely to emissions of greenhouse gases, mainly from the burning of fossil fuels like coal, gas, and oil. So the first step toward reigning in global warming involves reducing fossil fuel emissions.

The United States releases more greenhouse gases from fossil fuels than any other nation. Per-person emissions tally about six times higher in the United States than in China, the runner-up for title of world's biggest producer of greenhouse gases. Yet the U.S. government has declined to join the international effort to reduce greenhouse gas emissions, known as the Kyoto Protocol.

Many states, cities, companies, and individuals are attempting to fill the void left by the federal government. New Mexico and Arizona are making efforts to reduce fossil fuel emissions by supporting alternative fuels and improving energy efficiency. The state efforts also affect cities, companies, and individuals, especially those interested in powering their homes and offices with solar energy.

### Statewide initiatives

"The governors are moving on this primarily because the federal government is not," explained Sandra Ely, New Mexico's Energy and Environment Coordinator. Ely served as the point person for the state's Climate Change Advisory Group, which released an action report in December. Arizona released its action report in mid-2006. The groups



**Figure 1.** The pie charts show the source of greenhouse gas emissions in Arizona (a) and New Mexico (b) based on 2000 data. New Mexico has an additional category, Fossil Fuel Industry, which largely reflects its coal mining and processing operations.

identified major sources of greenhouse gases (Figure 1) and recommended ways to reduce them. (See links to these documents on page 6.)

In September, Arizona Governor Janet Napolitano responded to the report by issuing an executive order requiring the state to drop back to 2000 levels by 2020, and to 50 percent below 2000 levels by 2040. At the time, she noted that the proposed recommendations would actually save money, amounting to \$5.5 billion through 2020 and more in subsequent years.

In New Mexico, Governor Bill Richardson had issued an executive order in 2005 setting up the advisory group and asking it to think of ways to reduce the state's total greenhouse gas emissions to 2000 levels by the year 2012, to 10 percent below those levels by 2020 and to 75 percent below by 2050. To address the quotas, the advisory group decided to focus on the electricity

consumed within the state, which represents roughly a quarter of all the greenhouse gas emissions produced. The governor followed up with an order last month prescribing some actions, including making new buildings and cars more energy-efficient.

Both states face the challenge of trying to stabilize greenhouse gas emissions even as their populations explode. The number of Arizona residents rose by 40 percent during the 1990s, while New Mexico's population increased by 20 percent. Population growth averaged 13 percent in the nation during this time frame.

Arizona's population growth is translating directly into the country's highest growth rates in greenhouse gas emissions, noted Kurt Maurer, an Arizona Department of Environmental Quality employee who helped organize Arizona's Climate Change Advisory Group.

continued on page 4



## Sun and wind, continued

“Our growth rate is outpacing astronomically what other states are experiencing. We’re the fastest growing state in the country,” Maurer said.

In both states and the country as a whole, per-capita greenhouse gas emissions—measured in metric tons of carbon dioxide equivalent per person—remained roughly stable since 1990.

New Mexico’s large coal industry coupled with its relatively small population help make the state’s per-capita greenhouse gas emissions about double the national average. The New Mexico advisory group targeted changes in this sector as one of the most effective ways to reduce overall emissions.

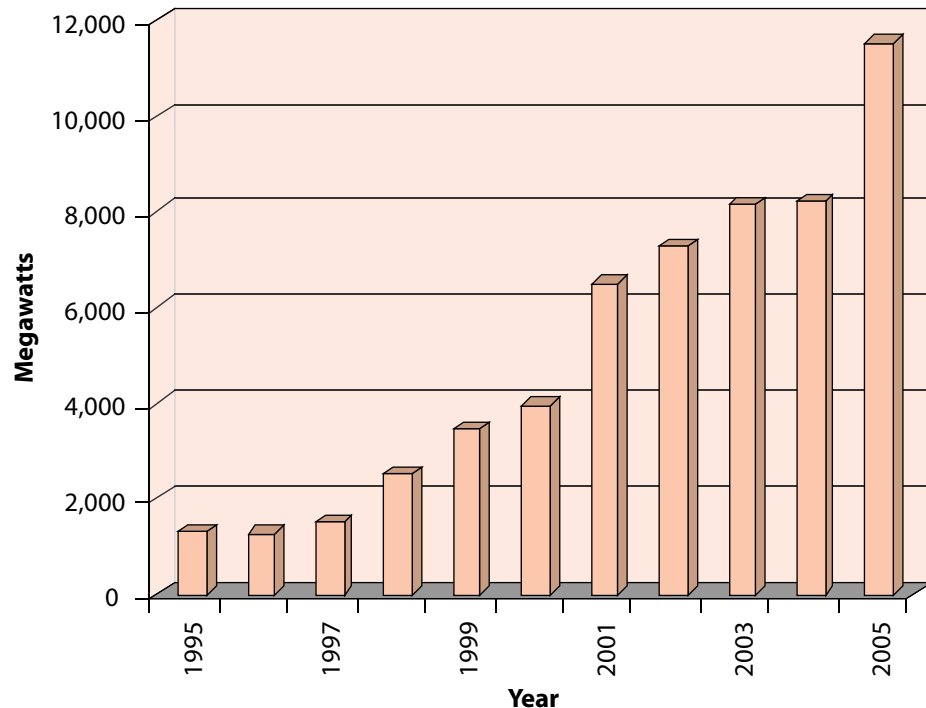
Arizona falls below the national average for greenhouse gas emissions per person, in part because the region’s mild winters demand less heating. Still, electricity demands for Arizona homes have quadrupled in recent years as developers build larger structures and air conditioners replace swamp coolers.

### Better buildings

Energy use in buildings accounts for about two-fifths of greenhouse gas emissions in the Southwest, counting the lighting and cooling provided by electricity. This has inspired leaders in both states to push for more energy-efficient structures.

Governor Richardson has promised to move forward on several regulatory fronts that don’t need legislative approval. These include requiring contractors to follow the green building rating standards known as LEED, for Leadership in Energy and Environmental Design. This energy-efficient approach offers one of the best economic returns, Ely said.

“You may have some initial upfront costs of maybe 2 percent more, but you get so much back from that initial



**Figure 2.** Wind power installments, measured by the capacity of windmills set up each year, rose by an average of 24 percent a year since 2000. Data from the Global Wind Energy Council.

investment that you make the money back fairly quickly,” she noted. Although homeowners will pay a bit extra for the home, the longer-term energy savings would amount to about \$12 per ton of carbon dioxide equivalent by 2020, the report projects.

Even existing homes sometimes can benefit from improvements in energy efficiency, noted Tom Goldtooth, executive director of the Indigenous Environmental Network. Some reservation homes even have ice building up in corners, a sign that energy is leaking out of the cracks, he explained during a December Tribal Lands Climate Conference held in Yuma.

Federal tax credits for home improvements including insulation continue through this year. (See links on page 6.)

### Fuel-efficient cars

Greenhouse gas emissions from vehicles rival the amount coming from energizing buildings in Arizona. Transportation

accounts for about 39 percent of fossil fuel emissions in Arizona and 17 percent in New Mexico. Our nation’s driving habits account for about half of the auto emissions around the planet, a 2006 Environmental Defense study showed, in part because Americans favor large vehicles with low gas mileage.

New Mexico plans to shift into more stringent vehicle emission standards by adopting California’s Clean Car guidelines. California’s interest in reducing its greenhouse gas emissions and related air pollution inspired Fran Pavley and other legislators to set a quota for electrical cars and restrict the sale of vehicles with low fuel efficiency. Auto makers and their organizations have sued to keep the state from implementing the law.

Arizona is holding off on adopting the California standards until the lawsuit is settled, Maurer said. In the meantime, the governor issued an executive order requiring that departments purchase

continued on page 5



## Sun and wind, continued

fuel-efficient or hybrid vehicles so that the official fleet will meet these standards by 2010.

Plans are also moving forward for Arizona Grain, Inc., to open an ethanol production plant in Maricopa by mid-year. The company plans to convert corn into 50 million gallons a year of a fuel blend containing 85 percent ethanol. Ethanol is an alternative to oil that emits fewer pollutants than a conventional system, including perhaps 20 percent fewer greenhouse gases.

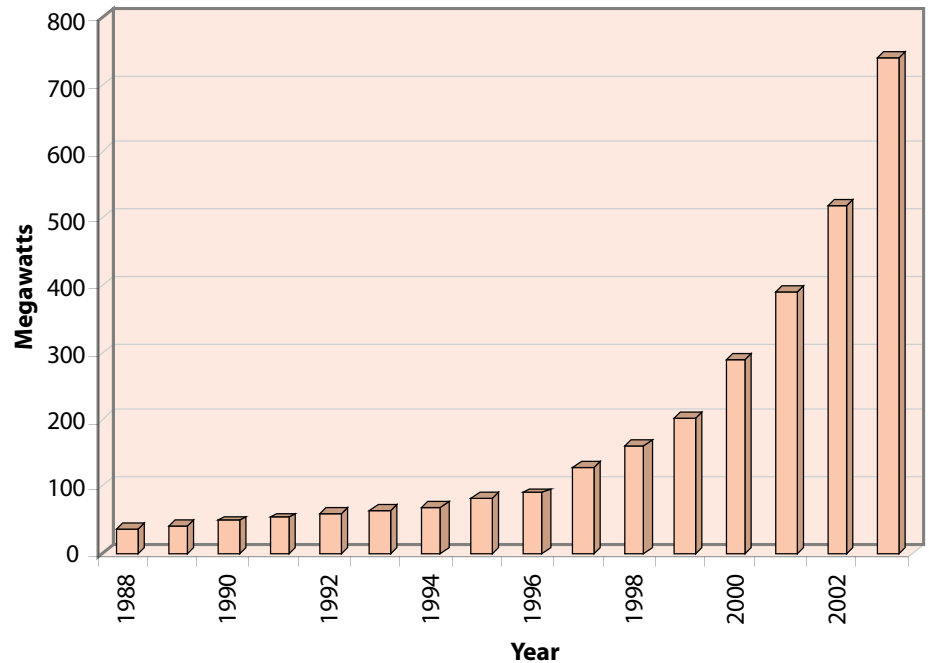
However, some policy experts worry that its widespread adoption could worsen conditions for the world's poor in the long run. Lester Brown, president of the Earth Policy Institute, has cautioned that a large-scale move to ethanol would force less developed countries to compete with wealthy countries for world grain supplies. Because of this risk, Brown instead promotes developing wind energy to power electric vehicles.

### Wind power

Whether cars reap the bounty of wind energy in the Southwest or not, utilities in both states will be employing more windmills to meet requirements that renewable energy comprise a greater share of their generating capacity. Existing laws require Arizona to meet 15 percent of its electrical needs from renewable sources by 2025, while New Mexico must obtain 10 percent by 2011.

New Mexico already has a 204-megawatt wind farm in House, with windmills dotting the landscape on private ranches amid grazing cattle, Ely pointed out.

"The ranchers love it. It's a great utilization of their ranchland," she added. The leases for windmills provide an ongoing source of income to ranchers with a livelihood that is subject to change with climate fluctuations.



**Figure 3.** Electrical generation from solar cells lags behind wind globally, but the rate of increase surpasses 30 percent a year since 2000. Data here are estimates based on published graphs of information from PV Energy Systems, Inc.

According to Ben Luce, director of the New Mexico Coalition for Clean and Affordable Energy, New Mexico will need more electricity transmission lines to profit from wind potential. The coalition supports adding transmission lines throughout eastern New Mexico, a windy area that could eventually supply 4,000 to 8,000 megawatts of wind power—enough to power the whole state, he said

"A lot could change in this whole discussion in the next couple of years if we get this off the ground. Basically we could displace coal in the Southwest," Luce ventured. "The beauty is this is all local technology, so it won't hurt the economy. It could even help it."

New Mexico could develop a wind turbine manufacturing plant in an Albuquerque railyard under one proposal on the table, Luce said. Discussions call for the plant to produce windmills that can generate between 1.5 megawatts and 4 megawatts of electrical power each.

A shortage of windmills threatens to derail some U.S. projects in the short term. Many experts consider the shortage temporary, soon to be relieved with upcoming windmill production plans.

China currently overwhelms the windmill market with its demand, but lately the nation of 1.3 billion people has been stepping up its own production of windmills in hopes of meeting its needs independently. An upswing in windmill production in China and other countries is expected to ease the shortage within a few years.

At 10 cents a kilowatt-hour and falling, wind energy prices compete directly with electricity produced from fossil fuels. This helps explain their growing popularity around the world (Figure 2). Creating solar-powered electricity, meanwhile, remains relatively expensive, although passive solar heating of water pays off quickly. As a result, solar electrical systems haven't been keeping pace with wind except in rates of increase (Figure 3).

continued on page 6



## Sun and wind, continued

### Solar power

Both Arizona and New Mexico provide cash incentives to homeowners to supplement federal subsidies for renewable energy. As a result, the government covers about half the cost of rooftop panels using photovoltaic cells (PVCs). (See links to the right.)

A roof-mounted system from American Solar, which participated in Arizona's climate change advisory group, would cost about \$14,000 after cashing in federal and state credits, explained spokesman Tom Alston. A system this size would supply half the electrical needs of a typical Arizona home, he said.

American Solar's systems run about \$3 per watt of electrical energy installed, or \$3,000 per kilowatt, Alston estimated. Electric bills come in kilowatt-hours, which measures the number of hours in which a system uses 1,000 watts of energy. Although solar energy is produced only while the sun is shining, Southwestern homeowners generally can sell their extra electricity to their utility companies at retail prices, then buy back what they need during the night.

The investment pays off before the 25-year warranty runs out, Alston said, noting it would yield a 6 and a half percent return over its lifetime assuming a modest increase of about 3 percent a year in electricity rates.

"But it's also like buying an energy future," Alston added, referring to the stock market tactic of banking on the likelihood of future price increases. "Every time the rates go up, the system becomes more valuable. I'm essentially ensuring my rates don't go up for the next 25 years."

Arizona Public Service has one of the world's largest electrical plants using solar power. Its Springerville, Arizona, plant hosts a 5-megawatt facility. American Solar also is finalizing plans for a

1-megawatt solar plant on the Gila River Indian Reservation south of Phoenix.

Luce hopes to lure PVC manufacturing plants into New Mexico, especially in places like Demming and Las Cruces where they could supply viable sunny sites nearby. An Albuquerque development known as Mesa del Sol might benefit from Sandia Laboratory efforts on a version of power known as concentrated solar power, he said.

With the concentrated approach, lens arrays follow the sun's daytime passage through the sky, focusing the captured light onto PVCs, explained Roger Angel, director of The University of Arizona's Mirror Lab. The Mirror Lab is researching concentrated solar power, applying its expertise in astronomy to the effort.

"It's like many little telescopes looking at the sun," said Angel. With the focused energy, fewer PVCs can yield more electricity compared to conventional solar. Angel has a team of investigators working to refine the materials and technique in the hope of bringing costs into the commercial range. "There's no difficulty in making energy from the sun," he said. "The key issue is can you do it for \$1 a watt [installed], not \$4 a watt."

Creating energy from PVCs remains relatively high for several reasons. Germany's appetite for solar panels is helping to keep demand greater than supply. Also, a shortage of refined silicon, an essential material for PVCs, limits production. Concentrating solar power could help get past this barrier because it provides more energy per unit-area of PVCs.

The Southwest is leading the way on concentrated solar, as befits the region with the lion's share of the nation's harvestable sunshine. An APS project in Red Rock, Arizona, is planning to use concentrated solar power to heat oil to generate power, Alston said.

By tapping into the power of the sun and wind and improving the energy efficiency of buildings and cars, officials hope to curb the growth of greenhouse gas emissions. This, in turn, could help stabilize climate and avoid some of the impacts of the ongoing global warming.

There's still a long way to go, but government mandates are fueling a revived interest in alternative power and conservation. Those who buy into these efforts enjoy the satisfaction of knowing they're doing their share to stabilize climate.

*An upcoming article will address efforts to reduce greenhouse gas levels via forest management, carbon sequestration, and renewable energy credits.*

*Melanie Lenart is a postdoctoral research associate with the Climate Assessment for the Southwest (CLIMAS). The SWCO feature article archive can be accessed at the following link: <http://www.ispe.arizona.edu/climas/forecasts/swarticles.html>*

## Helpful Links

### Arizona Climate Change Advisory Group

<http://www.azclimatechange.us/>

### New Mexico Climate Change Advisory Group

<http://www.nmclimatechange.us/>

### Database of State Incentives for Renewables & Efficiency

<http://www.dsireusa.org/>

### Energy Star on federal incentives

[http://www.energystar.gov/index.cfm?c=products.pr\\_tax\\_credits#1](http://www.energystar.gov/index.cfm?c=products.pr_tax_credits#1)

### New Mexico Coalition for Clean & Affordable Energy

[www.nmccae.org](http://www.nmccae.org)

### Calculating individual greenhouse gas emissions

<http://www.cool-it.us/index.php?refer=&task=carbon>

