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California points the way, in the United States, to an energy-efficient future

By Erica Gies

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SAN FRANCISCO: California, in the 1970s, passed a law to prioritize energy efficiency. Since then, annual average per capita consumption in the United States has risen to 12,000 kilowatt hours from 8,000 kilowatt hours, but consumption in California has remained flat, at 7,000 kilowatt hours. Among the 50 states, California now tops the ranking for per capita energy efficiency, up from 28th place in 1976.

Energy efficiency isn't sexy, but it's effective. "Efficiency is always the cheapest, cleanest, safest, quickest way to cut down on both global warming and pollution," said Tim Greeff, deputy legislative director of the League of Conservation Voters, a U.S. nonprofit group.

California's success reflects a multifaceted strategy. In 1975 it introduced new regulations on appliances and buildings; and in 1982 it decoupled utility profits from electricity sales, instead offering incentives for conservation. For more than 30 years, the state's commitment to these policies has remained firm, and it regularly tightens standards.

"Energy efficiency is a renewable resource because once you make some change, the technology continues to evolve, the costs continue to change, you can find new materials that you can substitute," said Jim McMahon, head of the Energy Analysis Department at Lawrence Berkeley Lab in Berkeley, California. "If you come back every few years and look again, there's another opportunity."

The energy commissioner of California, Art Rosenfeld, attributes one-third of the state's edge over the rest of the United States to these policies. For another third he credits the state's relatively high energy prices, which result from its lack of cheap coal and its investment in renewable energy over the years - it has a target of 20 percent renewables by 2020. The final third he attributes to the location of most of the population along the coast, where heating and cooling buildings is not necessary.

When California decoupled profits from electricity sales, it required utilities to conduct energy efficiency programs and tied profits to their effectiveness. "The utility will emulate efficient market outcomes and do the cheapest thing first," said Amory Lovins, chairman and chief scientist of Rocky Mountain Institute, an organization in Colorado that researches and promotes market-based energy solutions. "It works extremely well."

Most governments around the world still regulate retail electricity tariffs using a price cap, rather than a revenue cap. This effectively encourages power utilities to try to expand sales and discourages consumption efficiency. "This is just as dumb as a possum and we need to stop doing it," Lovins said. Both U.S. presidential candidates support some form of decoupling.

After California introduced efficiency standards for appliances in the 1970s, it rapidly found itself setting benchmarks for the whole country. Because it is expensive to maintain two distinct product lines, manufacturers often "apply the California standard to all appliances sold in the United States," said Adam Gottlieb, spokesman for the California Energy Commission.

The impact can be seen clearly in refrigerator design and technology. In response to Californian standards, technology improvements from 1972 to 2002 cut the average energy consumption of refrigerators on the U.S. market by 75 percent - saving energy equivalent to the output of 40 one-gigawatt power plants, according to a report by Rosenfeld last year. At the same time refrigerator prices have declined in constant dollar terms and their size has increased.

In 1991, the U.S. government started to adopt California's appliance standards and, like the state, has continued to tighten them.

The state also in some cases offers incentives to consumers to motivate them to upgrade to more energy efficient products.

When debating whether to invest in an energy-saving appliance, "typically consumers want their money back in two years or they don't do it," said Rosenfeld: so the state finances rebates through the retail and energy supply chain to shorten the payback time.

In the United States, 40 percent of all energy goes to heating, lighting and cooling buildings, according to

Ed Mazria, an architect who founded the nonprofit group Architecture 2030 to encourage industry and government to reduce building emissions. The energy footprints of buildings in developed countries worldwide are probably comparable, he said.

California has the toughest building standards in the United States. By 2030, all new commercial buildings must consume zero net energy. The deadline for new residential buildings is 2020.

A new single-family home built in the state today uses about one-fourth the energy of a new house built in the 1970s, Lovins said. Still, room for improvement remains. In 1992, he and Rosenfeld helped guide an ongoing project called ACT2 at Pacific Gas & Electric, one of the main utilities in the state. They showed that at no extra or even a lower cost, houses could be comfortable with no air conditioning when outside temperatures were 115 degrees Fahrenheit (46 Celsius).

For Lovins, this was no mere academic exercise. His own house, built in 1983, is perched at 7,100 feet, or 2,200 meters, in the Rocky Mountains in Colorado, where outside temperatures can drop as low as minus 47 degrees Fahrenheit (minus 43.8 Celsius). The 4,000 square foot, or 372 meter, house has no heating system. Yet, "In the middle of the house I've harvested 28 banana crops so far, with no furnace," Lovins said. "And it was cheaper to build that way."

"We can do a lot better now," he added, noting that technologies used in the project have not yet been included in the California building code which, by law, it is supposed to include everything that is cost effective.

Although the state updates the code every two years, it is "always fighting with building lobbies that don't want to innovate as much as they could, to their own economic advantage," he said.

Retrofitting old buildings has not received the same level of attention as new construction, but that is set to change. The energy commission is beginning to inventory all commercial buildings in the state, looking at their utility bills per square foot. It will give awards to the best 10 percent, and the worst 20 percent will get attention.

Rosenfeld said: "We plan to have enough buildings audited so we can tell building owner A, 'Did you realize that you're in the worst 20 percent of buildings that are the same age, with the same sort of energy use, in the same ZIP code, with the same weather?'" The commission will provide these owners with lists of energy service companies in their areas and of incentives for which they are eligible. If persuasion fails, the state may impose standards.

One simple improvement that has been garnering buzz in efficiency circles is to put white roofs on buildings. Several states, including Florida and Georgia, give incentives for building owners to install white or light-colored roofs and, since 2005, California has mandated white materials for all flat roofs.

White roofs reduce the need for air conditioning, and scientists have recently discovered that they "actually cool the world directly," Rosenfeld said. Solar radiation bounces off a white roof back into space, while a dark roof traps heat and warms the planet. "Every 1,000 square feet of white roof instead of colored roof is equivalent to avoiding the emissions of 10 tons of CO2 annually," he said.

McMahon, at Lawrence Berkeley, said: "We've done some studies for Los Angeles showing that having white roofs and white pavement could have enormous benefits" in energy savings, smog reduction and general health improvement.

Rosenfeld said that, between roof replacements and new construction, it would be feasible to whiten most roofs worldwide over the next quarter century, with a saving in energy - and CO2 emissions from energy production - comparable to taking a third of the billion cars in the world off the road for 18 years.

Another new idea is to save water to save energy. A 2004 study by the energy commission found that the state could save energy by conserving cold water - using low-flow toilets or irrigation systems to decrease the amount of energy required to move and treat water and wastewater.

"The cost of saving water, in terms of the amount of energy you save, is lower than the things we're already doing to save energy directly," McMahon said.

Additionally, promoting solar hot water heaters could have a major impact. "Water heating is the largest use of energy that's related to water," McMahon said.

Solar heaters, popular in many countries around the world, have yet to take off in the United States because natural gas had been widely available and cheap. But as it grows more expensive, solar hot water becomes more attractive. "Every new house in Southern California should have solar hot water," Rosenfeld said.

Lovins, whose organization works in 50 countries, said that a quarter of global development capital goes to make and deliver electricity. Spending on energy saving, rather than electricity production, costs a

thousand times less in capital investment, with a 10 times faster return. "That 10,000-fold capital leverage is the biggest macroeconomic opportunity in the world to free up money for other development needs," he said.

Correction:

Notes:

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