SMALL STEPS SAVE BIG IN ENERGY

Mark D. Levine

It is time for policy makers to recognize they can play a more active role in encouraging consumers to invest in and gain from energy efficiency. Steps taken by many individuals can save vast amounts of energy and boost both local markets and the national economy.

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Energy efficiency is usually regarded as a personal activity that can be recommended to individuals but has limited impact on a nation. This is a regrettable misperception. Energy efficiency is not only a tool for achieving energy security; it is the most potent of all the tools in our arsenal. Well-designed and implemented energy efficiency policies can not only substantially reduce energy demand but also give a boost to an economy.

Energy Conservation Versus Energy Efficiency

Energy conservation has come to mean actions taken by individuals to use less energy in carrying out their everyday tasks or even not doing certain activities so as to save energy. There has been only one time when energy conservation was implemented as a serious policy in the United States. This was during the electricity crisis in California in 2001. The state was in a desperate situation: There was no time to build more power plants, and importing electricity from outside the state was not viable. Energy efficiency—as defined below—could not come into play fast enough.

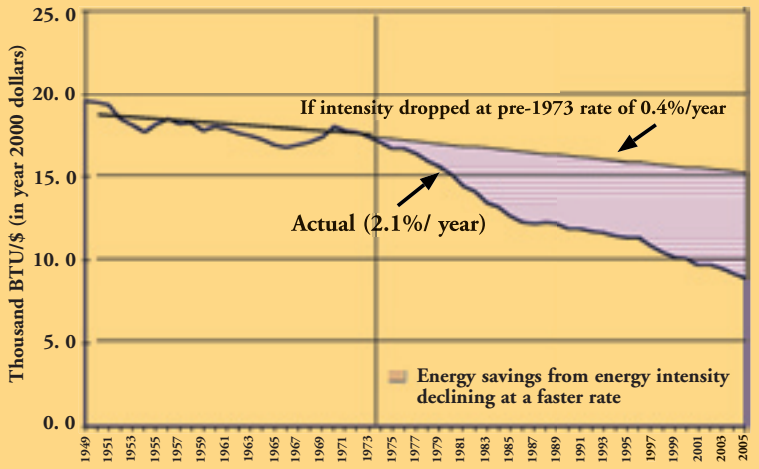
California came up with creative ways of inducing energy conservation, especially the 20/20 program, which gave consumers a 20 percent rebate on their electricity bills if they cut electricity use by 20 percent. During the crucial summer months of 2002, conservation yielded 11 percent electricity and 16 percent peak power savings. The state paid for the savings. But the money stayed in California, going to electricity consumers, and the rebate cost was a fraction of the supply cost, especially at the very inflated prices prevailing at the time.

Energy conservation is not a favored policy except in crisis. The more effective approach involves investment in energy efficiency. Please note the word "investment." Energy efficiency is an investment strategy, and government policy is as important to its success as the decisions of a country's central bank are to its macroeconomic policy. Energy efficiency is not a short-term policy; it is, in fact, effective only if carried out consistently over years and decades.

The Economics of Energy Efficiency

To many people, energy efficiency is either ethereal or so small as to make little difference. People easily relate

Figure 1
Energy Intensity in the United States, 1949 - 2005



Note: British Thermal Unit (BTU) is the amount of heat necessary to raise the temperature of one pound of water by one degree Farenheit.

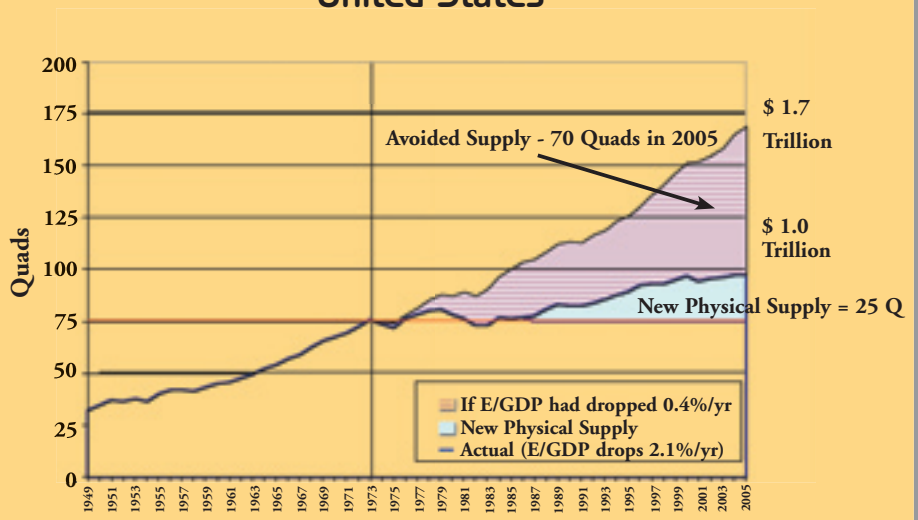
Source: Derived from data at http://www.eia.doe.gov/emeu/aer/overview.html.

to solar energy installations (for example, photovoltaic on rooftops) or wind energy. But energy efficiency does not lend itself to visualization. And it is achieved through the implementation of many measures, each of which contributes a small amount to reducing energy use.

Because policy makers typically do not recognize the importance of energy efficiency as a policy measure, it often gets ignored. Figures 1 and 2 clarify these points for the United States as a whole. Figure 1 compares energy intensity [energy consumption per unit of gross domestic product (E/GDP)] as it evolved during the three-plus decades after 1973 to what would have occurred if previous trends had prevailed.

Figure 2 shows the dramatic results of this change in energy intensity. If energy demand had continued its earlier growth patterns, we would today be using 75 percent more energy than we are.

Figure 2
Energy Consumption in the United States



Note: Quad is an energy unit equal to 10^{15} BTU.
Source: Derived from data at http://www.eia.doe.gov/emeu/aer/overview.html.

The reduction in energy intensity is the result of structural change in the U.S. economy. The shift away from manufacturing toward services such as banking and information technology has contributed about one-third of the intensity gains. Two-thirds is from investment in energy efficiency. This means, remarkably, that energy efficiency contributed almost four times as much as new energy supply in the United States to meeting demand for energy services during the three decades since the 1973 oil embargo. For something virtually invisible and rarely addressed in high circles dealing with energy-security matters, energy efficiency has been a potent force.

The Five Major Energy Efficiency Policies

The energy efficiency gains in the United States have resulted from four explicit policies and one implicit policy. The four explicit policies have involved these:

- appliance efficiency standards;
- utility demand-side management (DSM) programs (utility investments to increase customers' energy efficiency);
- building-energy standards;
- corporate automobile fuel economy (CAFE) standards.

The implicit policy has been one by which the federal government does not stand in the way of modest energy price increases. That is, unlike other industrialized countries in which energy prices are much higher, the United States does not tax oil to reflect a broad range of external costs.

Of the four explicit policies, three are very actively pursued in the United States. The Energy Policy Act of 2005 set levels that led to 15 appliance standards. The U.S. Department of Energy, under judicial court order, is aggressively pursuing standards that will be issued over the next two to five years for 17 additional products.

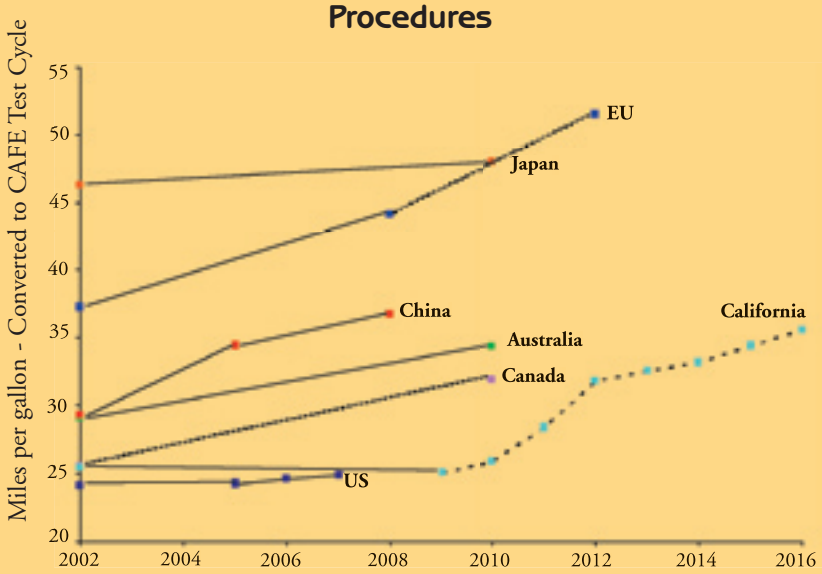
DSM—utility programs working to increase energy efficiency on the customer side of the meter—appeared for a time to be stalled because of utility restructuring, but has come roaring back. One of the most successful of the utility DSM programs carried out by many utilities has involved rebates for replacing inefficient fluorescent lighting with efficient lamps.

California utilities will invest $2 billion over three years in DSM, almost double the previous level and quadruple the average over the last decade. According to the utility forecasts, this will cut electricity demand growth from 2 percent per year to 0.5 percent per year over the next decade. California is among the most

aggressive states in promoting energy efficiency. Electricity demand growth is expected to be reduced by about 85 percent over the next decade, compared to a projection without the appliance/building energy efficiency and utility DSM programs. As shown by this state's pursuit of electricity end-use efficiency for at least two decades, good energy efficiency investment policies can bring significant results over the long term. This is not widely recognized by the public or by public policy makers.

The third policy involves energy efficiency standards for buildings. Like utility demand-side management, building standards are generally set at the state level and implemented at the local level. As such, performance varies greatly among states. In part because of important achievements in federal research and development (R&D) programs, energy use in new buildings is two-thirds to one-half that of existing buildings, resulting in an assurance of savings over the lifetime of the building.

Figure 3
Comparison of Auto Fuel Economy Standards Among Countries, Normalized to U.S. Test Procedures



Note: Dotted lines denote proposed standards.
Source: Feng An and Amanda Sauer, "Comparison of Passenger Vehicle Fuel Economy and GHG Emission Standards Around the World," Pew Center on Global Climate Change, October 27, 2004.

There are two critical factors necessary to continue this success story: (1) revitalization of the federal R&D effort on energy efficiency in buildings, an effort that produced technology that enabled the energy efficiency improvements; and (2) strengthening of the building energy standards. Several states—especially those on both U.S. coasts—have programs for updating and strengthening standards, but most states do not.

The fourth policy—and the one that is directly related to oil supply security—is auto fuel economy standards. In the long term, the solution to oil imports will require an economically and environmentally viable replacement for oil. But this will not happen soon. Oil imports will continue to rise for the coming decades. While there is universal agreement that the United States needs to cut imports, the problem is not being addressed. This increases our peril in the world.

The problem is not intractable, except perhaps from a political viewpoint. Strengthening corporate auto fuel economy standards, much like appliance efficiency standards, has the beauty of simplicity: It applies to only a small number of manufacturers who can make the required investment to achieve higher efficiency and pass the cost on to consumers. This is also a weakness in the sense that a few strong manufacturing companies can oppose the policy in the U.S. Congress and win the battle. Manufacturers are concerned that stronger fuel economy standards will make consumers unhappy at losing important amenities—in the case of autos, size, safety, and power (acceleration). In fact, prior experience, including the original CAFE standards in the United States in 1975, shows that the industry has been able to innovate and meet what were thought to be tough standards without compromising these characteristics.

Such improvements in auto fuel economy can be achieved to the satisfaction of tens of millions of consumers in other countries. Figure 3 shows the fuel economy standards in the United States and several regions. One wonders, looking at this figure, if there may be some clouds on the horizon for U.S. auto manufacturers in world markets.

The United States can aim to achieve the 2005 European Union level of fuel economy standards by 2015 with all vehicles, including sport utility vehicles

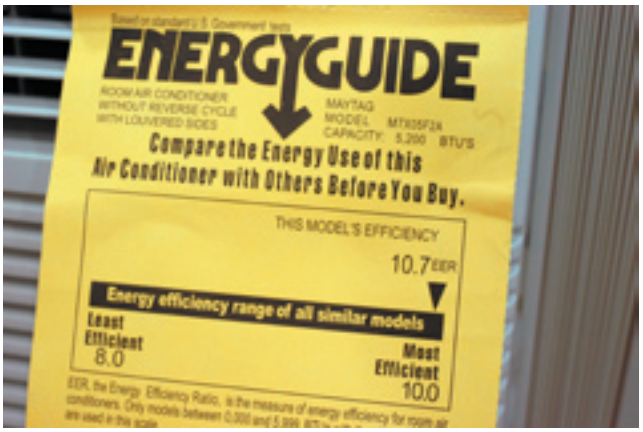
and other light and heavy-duty trucks, having the same percentage increase as automobiles. It could also agree to meet the European 2012 standard by 2020. Although either goal is unlikely to be set by policymakers, the result of such policies, which would still leave us well behind the Europeans, would be to decrease our dependence on imported oil from a projected 56 percent in 10 years to about 40 percent and from 62 percent in 20 years to 25 percent.

For many, the primary motivation for auto fuel economy is energy security. There are other economic, environmental, and safety benefits. The policy is almost certainly cost effective—the energy efficiency investment pays a healthy return. Much like the energy efficiency gains shown for the whole economy in figure 2, such investments in more efficient autos result in very significant benefits to the entire U.S. economy—annual returns of 20 percent or more compared to supply investments that provide no net benefits.

Role for Public Policy

Policies addressing energy efficiency are not adequately recognized as the major tools for increasing energy security. Even though the policies have had only limited attention and support, savings from energy efficiency over the past three decades have yielded four times the impact in meeting demand as new energy supply. Today, America's annual energy bill is $1 trillion. Without earlier energy efficiency, it would be $1.5 trillion!

Energy efficiency is an investment with a well-understood payback. The return on investment is generally high, as long as the policy is well designed and implemented. The financial return from this policy is every bit as certain as the return from an investment in a new oil well or coal mine, only generally better. The big difference between the supply and demand investments is that the former goes to companies that have strong incentives to pursue them. The latter generally are spread among millions of consumers. These consumers are often not aware of the benefits.



William Thomas/Getty Images

A retail store label provides energy-efficiency information on an air conditioner.

Because the energy efficiency investments often are not made without strong policies to promote them and because energy demand growth has very large impacts on the nation, there is a strong case to be made for the role of public policy. Proper policy on energy demand can induce investments from consumers and thus not require government subsidies, unlike some policies that affect energy supply.

It is desirable for energy policy to become a priority for government decision makers, especially those concerned about the energy security of the nation. ■

The opinions expressed in this article do not necessarily reflect the views or policies of the U.S. government.

U.S. HOMEBUILDERS GO "GREEN"

By incorporating off-the-shelf, energy-efficient technologies, homeowners and building managers could cut up to 80 percent of the cost of heating, cooling, and lighting their buildings, according to the U.S. Department of Energy. The potential benefits of using these technologies in the roughly 2 million houses constructed in the United States each year is huge: Nearly 25 percent of U.S. energy consumption is used to power homes.

In 2007, two-thirds of U.S. homebuilders will "build green" in 15 percent of their projects, according to a June study by McGraw-Hill Construction. The study defines building green as going beyond accepted building codes to increase energy efficiency, conserve water, develop building lots in a way that preserves trees and uses the sun, incorporate earth-friendly materials, and reduce job-site waste.

Not long ago, green houses were the province of custom builders. But no more. Pardee Homes, a large-scale builder putting up hundreds of houses in the U.S. Southwest, conforms to high environmental standards in one-third of its projects.

Homebuilders say the biggest reason for building green is customer concern about energy costs. Gasoline prices have increased 86 percent in the last three years in the United States, according to the Bureau of Labor Statistics. Joyce Mason of Pardee says her customers live in suburbs, far from their jobs, and drive a lot. As gas prices rose and they could not easily change their commutes, they looked to save on home energy bills. Mason says her company offers photovoltaic solar systems that might cost as much as $18,000 but will reduce bills by about 70 percent.

The McGraw-Hill study emphasizes builders' use of passive solar heating—situating a home to maximize use of the sun's energy and planting trees to provide shade. Deciduous trees offer shade during summer and lose leaves in winter to allow sun to enter windows.

Builders also are increasingly using low-emissivity windows. According to Donald Albrecht, the lead curator of a year-long National Building Museum exhibit on green houses that opened in May 2006, there are several types of new windows on the market that lock heat or sunscreens between layers of glass. Yet houses featured in the exhibit apply ancient principles in addition to the new technologies. For example, some have bamboo flooring because, unlike wood from hardwood forests, bamboo is a renewable, fast-growing grass.

Thermal mass, another tried-and-true construct, is evident in the thick, rammed earth walls of architect Rick Joy's Tucson Mountain House featured in the exhibit. The walls—like heat sponges—absorb heat during day and release it at night.

A recently built green apartment building in Washington, D.C., requires no advertising, according to designer Russell Katz, because tenants are aware of its financial benefits. "Some people think of living in a green home as being a 'do-gooder,' " says Katz. "In fact, it is business savvy—you really save money."

Undine Pröhl/Courtesy National Building Museum

The Tuscon Mountain House with rammed earth walls designed by Rick Joy.

Katz's tenants pay less than most do for hot or cool air. During construction, Katz cut out such luxury features as marble in bathrooms and stainless steel kitchen appliances in favor of a geothermal system that pipes water from below ground (where the temperature remains a constant 18 degrees Celsius) and blows air over the pipes to heat or cool apartments. "The temperature underground doesn't cost anything," Katz says. The building also has a roof garden that insulates it and manages storm water.

Retailer Home Depot reports that individual U.S. consumers are also renovating homes to conserve. Some of the store's popular items are tank-less water heaters, which save energy and space by heating water as it is used; compact fluorescent lightbulbs, which last 10 times longer and use 66 percent less energy than standard bulbs; programmable thermostats, which save $100 a year on energy costs when used correctly; and additional insulation, an inexpensive way to reduce energy bills.

Some office-tower builders are using the same energy-saving features that homebuilders have recently gravitated toward. "In Germany and Austria, there has been legislation to go more sustainable; as a result they are more advanced and spur innovation," says Albrecht. But citing green high-rises going up in New York City, he notes that "little by little ... Americans are coming on." ■

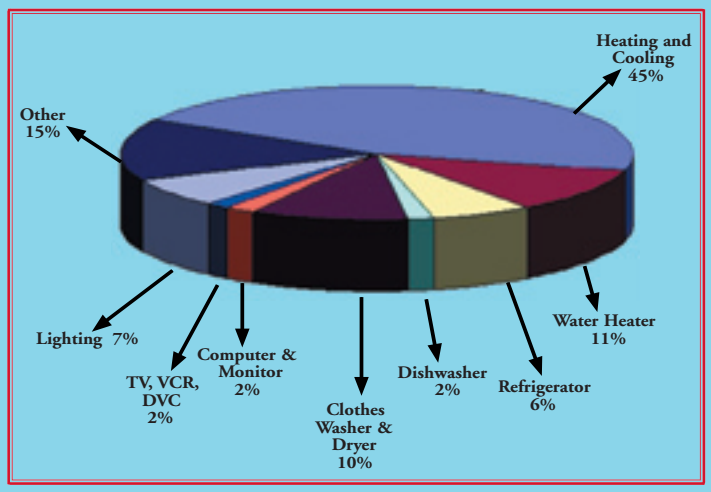
SAVING ENERGY
An Individual Choice

Over the last several decades, energy prices have been on a roller coaster, often affecting everyday decisions on work, play, and growth. U.S. federal, state, and local governments; businesses; and consumer groups have responded by working together to better educate the public about what individuals can do at a personal level to reduce energy costs.

Following are a few tips for individuals.

Housing

- In hot climates, plant shade trees to cool roofs, walls, and windows. Close blinds or shades in south- and west-facing windows. In cooler climates, allow sun to reach south-facing windows.
- Seal air leaks around doors and windows.
- Use ceiling fans in the summer and winter. By reversing the direction of the blades, warm air is pushed down, helping to keep rooms warm in winter.
- Lower house thermostats in winter; just a one-degree-Fahrenheit reduction can reduce heating costs by about 4 percent. Regularly clean or replace filters in air conditioners and furnaces.
- Consider switching to fluorescent lightbulbs, which last 6 to 10 times longer than incandescent bulbs; add more natural lighting with additional windows.
- Put reflective tiles on roofs and adequate insulation in attics.
- Use low-flow aerating showerheads. Lower the thermostat on the water heater to 49 degrees Celsius (120 degrees F).



Distribution of electricity consumption in an average U.S. home.

Courtesy the Senate Republican Committee

Consumer Products

- When looking for major appliances, buy those labeled with the highest efficiency rating. The electricity savings from today's refrigerator model with a high rating compared to a 1990 model would save enough electricity to light a home for almost five months.
- Use renewable products: bamboo or linoleum in flooring, for example.
- Wash only full loads of clothes. Wash clothes in cooler water, using cold-water detergents. Clean the lint filter in dryers after loads to improve energy efficiency.
- Turn off your computer, monitor, and other electrical devices when not in use.

Transportation

- Avoid erratic driving—quick stops and starts can decrease gas mileage by 33 percent on the highway and by 5 percent in the city.
- Maintain your car. Clean air filters can improve gas mileage by as much as 10 percent. Properly inflated and aligned tires will increase mileage by as much as 3 percent. But using the wrong grade of oil can reduce mileage by 1 to 2 percent.
- Observe the speed limit. In general, every 8.05 kilometers per hour over 96.6 kilometers per hour increases the cost per gallon of gas by 5 to 18 cents per liter at mid-2006 gas prices.
- Avoid carrying extra weight. Every 45 kilograms decreases fuel efficiency by 2 percent.
- Consider buying a hybrid car. The increased gas mileage relative to gasoline-only cars can reduce fuel use by 50 percent or more. ■

Sources: Smithsonian Institution, U.S. Department of Energy, American Society of Interior Designers, Alliance to Save Energy.