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Energy-Efficiency: The Best Option for a Secure, Clean, Healthy Future

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The risks of dependence on traditional fuels have never been greater or more obvious. Modern civilization and the world economy are facing imminent and clear threats of worldwide terrorism. The oil producing countries of the Middle East are increasingly unstable, confronting the world with potentially calamitous energy and economic disruptions. Domestically, our limited refining capacity creates shortages when demand is high and increases prices even when petroleum supplies are plentiful. Yet most of the world is in a state of denial, happy to bask in the illusory security of temporary Saudi oil production increases. Moreover, these new dangers sit on top of the imperatives of addressing the formidable consequences of global warming and pollution that emanate from use of these traditional fuels.

This somnolence is beyond comprehension, particularly when all these vulnerabilities can be significantly and economically ameliorated by use of energy-efficiency measures. Indeed, there are sensible, proven, cost-effective ways in the short term to alleviate our dependence on traditional fuels and, most particularly, oil we now have to import from the Middle East. Energy-efficiency is the most economically, technologically, and rapidly achievable option. However, there are legal and nonlegal barriers to achieving these savings. Lawyers must be alert to them and be prepared to represent clients at the federal, state, and local level to both remove barriers to investment and to promote legal and regulatory approaches that will encourage energy-efficient investments.

It will take many years and many billions of investment dollars for the world to convert from traditional fuels to an economy driven primarily by safe, environmentally sound renewable energy resources of solar, wind, geothermal, small hydro, oceans, and biomass, even though these renewables are the fastest growing energy media. Energy experts touting a hydrogen economy acknowledge that the improvements required to make it technologically and economically feasible will take at least twenty years and, unless economic means are found for producing hydrogen on-site, a hydrogen distribution system hardly will be less secure from terrorism than natural gas pipelines or LPG/LNG distribution centers; and presently, economic production of hydrogen is dependent on increasingly scarce natural gas resources. Indeed, we should pursue these objectives with the same kind of priority we give to other measures to combat terrorism or that we gave to going to the moon.

The most dramatic energy savings can be made in vehicle oil use that accounts for about 70 percent of U.S. oil consumption. After the 1973 Arab boycott of oil exports to the United States that caused soaring gasoline prices and long lines at the gas station pumps, Congress passed the Energy Policy and Conservation Act of 1975 (EPCA), 114 Stat. 129. It established the so-called CAFÉ standards for vehicles, requiring that the corporate average fuel efficiency of all cars produced by any manufacturer be no less than 27.5 miles per gallon, and for light trucks, 20.7 miles per gallon, with heavy penalties for compliance failure.

The results from the adoption of these CAFÉ standards were that from 1977 to 1985, while GDP rose 27 percent, oil use fell 17 percent, net oil imports fell 50 percent (by 4.28 million barrels a day—72 percent greater than U.S. imports from the Persian Gulf), and gross imports from the Persian Gulf fell by 87 percent. That saving took away from OPEC one-seventh of its market. The entire world oil market shrank by one-tenth. OPEC's output fell by 48 percent, breaking its pricing power for a decade. If we had continued to achieve such rapid oil savings starting in 2000, then Persian Gulf net imports (at the 2000 rate), would have been entirely displaced in twenty-eight months—in other words we could have been free of Persian Gulf imports by now. Amory B. Lovins, *Energy Security Facts (for a typical year, 2000)*, Rocky Mountain Institute, June 2, 2003, *available at* www.rmi.org/sitepages/pid1010.php. The most important part of these 1977–1985 oil savings came from a 7.6 mpg improvement in new domestically made cars. On average, each new car used 20 percent fewer gallons, achieving 96 percent of that efficiency from smarter design and only 4 percent from smaller size. Contrary to fears expressed by the auto industry, neither auto safety nor auto prices were affected.

Thus, vehicle efficiency has been proven to achieve enormous savings in practice, with a very positive effect on our economy and national security. And those results can be duplicated now. "If 27% of cars in 2000 were the popular 48-49-mpg hybrid-electric models, or 15% were ultra-light hybrid SUVs, they could displace Gulf imports." By

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"[g]iving the owner of an average 1990 car (23mpg) a $4,900 rebate—4 times the average trade-in value—for scrapping it and replacing it with a new $21,000, 48-mpg, 5-seat compact hybrid car, its owner would save enough gasoline to repay the rebate over its life at $1.25 a gallon." Lovins, at 1. Since Lovins wrote in 2003, the second generation Toyota hybrid cars now achieve 61-mpg, and the cost of gasoline is around $2.00 per gallon, making the economic return that much quicker.

While vehicle efficiency standards are the quickest method of reducing our dependence on traditional fuels with proven technology, they are not the only proven energy-efficiency measure. Appliance efficiency is another good example. Furnaces, boilers, air conditioners, heat pumps, refrigerators, water heaters, washers and dryers, ranges and dishwashers consume 85 percent of energy consumption in the residential sector. Sixty-five percent of energy use in the commercial sector is used for heating, cooling, lighting, water heating, refrigeration, and office equipment. In the industrial sector, lighting equipment and electric motors account for more than 75 percent of electricity consumption. The tasks desired from these appliances can be furnished by much more efficient appliances, often using a fraction of the electricity used by less efficient, widely used models, and offering substantial savings to companies, consumers, and society, including reductions of carbon dioxide and other health-damaging pollutants.

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Legislated standards for appliance efficiency are particularly needed because most appliances are bought, not by the bill payers, but by landlords, home builders, and public housing authorities who have no economic interest in saving energy in selecting them; quite to the contrary, they are more likely to buy appliances that have the lowest first-cost regardless of energy consumption. While incentives and appliance labeling for energy-efficiency (which is required in the United States and many other countries), can be helpful in exceeding standards, only standards can assure that at least the most inefficient models will be removed from the market.

Lighting efficiency also can create great fuel and cost savings. In countries that have grid electricity, replacement of incandescent light bulbs with compact fluorescent bulbs that last four times longer and use one-quarter as much electricity achieves great savings to the consumer and to society. Task lighting, reflectors, and use of daylight also result in significant savings at low or no cost. In many countries and U.S. states, utilities or energy service companies (ESCOs) invest in lighting efficiency measures for residential and business customers, sometimes repayable out of the savings from the conversion. Many countries have started to produce compact fluorescent bulbs for domestic use and for export, creating important business, revenue, and job creation opportunities. In China, for example, it is now nearly impossible to buy an ordinary incandescent bulb—only compact fluorescent bulbs are produced and stocked for sale. Conversion of incandescent street lighting to sodium vapor or other efficient alternatives again creates considerable savings to municipal taxpayers and to the environment, and produces much improved lighting to boot.

Buildings themselves consume large amounts of electricity and traditional fuels. Building codes can address efficiency measures that produce substantial fuel and cost savings. Most developed countries have adopted energy-efficiency standards for construction of new buildings. All the European countries have energy requirements as a part of their building codes and many recently are strengthening them. For example, France is adopting more stringent thermal regulations for new residential and commercial buildings with the aim of improving energy-efficiency by 25 percent.

Building energy standards usually require all new residential, commercial, and industrial construction to be built to a minimum energy-efficiency level that is cost-effective and technically feasible. "Good Practice" residential energy codes, as defined by the 1992 Model Energy Code (now known as the International Energy Conservation Code), have been adopted in the United States by thirty-two states, and "Good Practice" commercial energy codes, as defined by the American Society of Heating, Refrigerating and Air-Conditioning Engineers' ASHRAE 90.1-1989 model standard, have been adopted by twenty-nine states. The Energy Policy Act of 1992 (EPAct), 42 U.S.C. § 6834, requires all states to adopt this commercial building code standard and to consider upgrading their residential codes to meet or exceed the 1992 Model Code. Experience in the United States has shown that building codes can reduce space conditioning energy use in new buildings by 25 percent or more.

Heating and cooling existing buildings, accounting for approximately two-thirds of the energy used in the buildings sector, also can be substantially reduced through cost-effective retrofits. For example, an evaluation of the U.S. national weatherization assistance program found that retrofits of low-income housing carried out during 1990–1996 typically reduced natural gas consumption for space heating by 34 percent. Also, retrofits of fifteen office buildings as a part of EPA's Energy Star Showcase Buildings partnership reduced energy consumption by 30 percent on average. The technologies that can be used to upgrade efficiency include adding insulation to walls and attics, replacing older windows with energy-efficient windows, sealing leaky heating and cooling air ducts, sealing air leaks in the building envelope, upgrading heating and cooling systems, replacing inefficient lighting, and installing heating and cooling automatic control systems. Ordinances requiring retrofits of existing buildings have been adopted in U.S. cities such as San Francisco, Minneapolis, and Burlington, Vermont. Energy audits of buildings also have been adopted in various jurisdictions, for example in Luxembourg on a voluntary basis.

A recent study by the American Council for an Energy-Efficient Economy (ACEEE) in eleven U.S. states and regions of technical and economic potential energy savings from efficiency measures in the electricity and natural gas sectors found a median technical potential of 33 percent savings for electricity and 40 percent for gas, and median economic potentials of 20 percent and 21.5 percent, respectively, for electricity and gas. The "achievable potential" of adopting building and appliance codes was slightly less than the economic potential, though several studies confused the two. Across the studies examined, the median technical potential for electricity was 32 percent for the residential sector, 36 percent for the commercial sector, and 21 percent for the industrial sector. For gas, it was 48 percent in the residential sector and 20 percent in the commercial sector. These studies are comparable to actual savings achieved by recent efficiency programs in a number of states. The largest example of what can be achieved in practice is demonstrated by California's efforts after its energy crisis in 2001; California adopted very aggressive efficiency programs and achieved 6% electricity savings in that year alone. Steven Nadel et al, *The Technical, Economic and Achievable Potential for Energy Efficiency in the United States: A Meta-Analysis of Recent Studies* (ACEEE 2004).

Recycling household waste products economically saves consumers and municipal taxpayers the costs and pollution of waste incineration. The recycled waste is often convertible into useful products that can create revenues and jobs. In the industrial and commercial sectors, the recycling of wastes is also economically and environmentally advantageous. For example, the United States throws away enough aluminum to rebuild the country's commercial aircraft fleet every three months, even though recycling aluminum takes 95 percent less energy than manufacturing it. Interface, the world's largest carpet-tile maker, estimates it cuts its materials flow by about tenfold by leasing floor-covering services instead of selling carpet and by remanufacturing old carpet. Land and coalbed methane gas recovery turns heat trapping and hazardous methane emissions into a voluble fuel that displaces electricity from fossil-fueled power plants.

Much energy is lost simply delivering it to the end-user. In many developing countries the transmission and distribution systems are inadequate, causing large losses of the power generated also resulting in frequent blackouts or brownouts that are very costly to businesses. Even in developed countries, these transmission and distribution systems are often neglected, resulting in outages at times of system stress—as with the blackout in the Midwest and much of the Northeast last summer. Upgrading inadequate transmission or distribution systems should be a high priority in these cases. Usually, these costs are borne by the utility company and paid for in electricity charges, but financing assistance usually will be needed in developing countries.

Most power plants in the U.S. and around the world also are grievously inefficient, converting most of their fuel into waste heat rather than power production. The United States' average power plant efficiency has increased from about 23 percent in 1949 to about 35 percent. However, the new generation of efficient combined cycle natural gas power plants achieve 52 percent efficiency. If all plants were that efficient, energy use and power sector pollutants in 2010 would decline about 30 percent.

Electric motors consume more than half of the electricity in the United States and almost 70 percent of manufacturing-sector electricity. Replacement of standard electric motors with smaller variable speed drive motors (as with the gear shift in a vehicle) and matching the motor output to the load, produces large electricity and pollution savings and economic benefits. Industry also can achieve substantial energy savings by relamping, replacing their incandescent lights with compact fluorescents, reflectors, and task lighting, as with residential lighting users.

The biggest industrial energy savings, though, frequently occurs in improving the efficiency of industrial processes themselves (e.g. using continuous casting of steel or utilizing waste products for electricity and heat generation, as is often done in paper, lumber and plywood manufacturing in the United States). The U.S. chemical industry saved nearly half its energy per unit of product from 1973–1990 by plugging steam leaks, installing insulation, and recovering lost heat.

The industrial sector in the United States accounted for about 36 quadrillion Btus of primary energy use in 1997, which comprised 39 percent of U.S. energy consumption, with manufacturing in six sectors (petroleum refining; chemicals; primary metals; paper and pulp products; food products; and stone, clay, and glass products) dominating the use. Yet, there is great potential for cost-effective improvement. For example, an in-depth analysis of forty-nine specific energy-efficiency technologies for the iron and steel industry in 1999 found a total cost-effective energy savings potential of 18 percent.

Utilization of the waste heat from electricity generation for industrial or district heating purposes converts as much as 90 percent of fuel input into useful energy, compared to 30 percent to 35 percent for a conventional power plant, thus saving significant amounts of fuel and pollution. Conversely, some manufacturing facilities that produce substantial high-temperature fluid or steam wastes have used this waste heat for electricity production. Roughly 52 GW of combined heat and power (CHP) was installed in the United States as of 1998 (the equivalent of fifty-two giant power plants), providing about 9 percent of total electricity production. Europe is far ahead of the United States in CHP installation, exceeding 30 percent in the Scandinavian countries, and being used widely in the climate strategies of the United Kingdom, Denmark, Sweden, the Netherlands, and Germany.

There is enormous potential to expand the use of CHP. For example, the chemicals industry uses only about 30 percent of its CHP potential and has used only 10 percent of useable sites. A CHP plant in Stockholm has a net overall efficiency of 86 percent compared to an average efficiency of just 36 percent for non-CHP plants in the European Union. Unfortunately, a variety of legal and nonlegal barriers, including hostile utility policies, lack of regulatory recognition of CHP benefits, and unfavorable tax treatment, limit CHP growth in the United States. Legislative and regulatory action to remove these barriers could result in an additional 50 GW of installed CHP by 2010 and 144 GW by 2020 in the United States, with an average net savings that pays back the initial cost in four to five years.

Governments are also major users of energy. The U.S. government is the world's largest single buyer of energy-using products, accounting for more than $10 billion of such purchases each year. The U.S. government during the Carter administration required that all federal agencies use 30 percent less energy per square foot in their buildings than they consumed in 1985 and 35 percent less in 2010. In implementing these requirements, the Federal Energy Management Program requires the use of energy-efficient lights and appliances in all its buildings and has adopted strict energy-efficiency requirements for the construction of its buildings. Federal agencies now are required to purchase only products that qualify for the Energy Star label or, where there is no label, are among the 25 percent most efficient products on the market. Renewable resources must be acquired wherever cost-effective. The program has saved the government agencies, and thus taxpayers, hundreds of millions of dollars in energy costs, while simultaneously helping public health and the environment by reducing the pollution that would be produced to make the energy. The U.S. government also is including energy-efficiency specifications in its contracting guide specifications used for construction and renovation projects. For example, by adopting efficiency criteria, the U.S. Navy, with just one year's effort (1998), began saving an estimated $1.2 million per year in reduced electricity use by installing five hundred thousand efficient (T-8) fluorescent lamps, tow hundred thousand electronic ballasts, and twenty thousand light-emitting diode (LED) exit signs.

Government procurement programs involve payment of a slight premium up front for purchase of more efficient products, but result in very substantial long-term savings. Governments can also require the purchase of clean and efficient vehicles for their vehicle fleets. Many U.S. municipalities are now purchasing electric and natural gas turbine buses. Los Angeles led the way with a program to purchase a fleet of electric cars for municipal use and installedecharging stations for the public throughout the city. Until recently, many state regulatory commissions required the utilities they regulated to undertake integrated resource planning (IRP), including energy-efficiency demand-side management (DSM) and renewable resources, when evaluating and planning how to meet future energy demand. Many state regulatory commissions also required utilities to provide incentives to their customers to purchase energy-efficient lighting and appliances and to provide free or low-cost energy audits to residential, commercial, and industrial customers to help them identify efficiency opportunities. These utility incentives were very effective in a regulated environment, but with the prospect of deregulation, the states allowed the utilities to cut back on these incentive programs for fear that their costs would make the utilities uncompetitive with those without incentive requirements—even though efficiency investments were made profitable for the utilities by the regulators and the efficiency investments save energy at a cost far less than new power plant construction. Utility spending on energy-efficiency programs has declined from about $1.4 billion in 1992 to about $1.2 billion in 1996, and despite the efficacy of these energy efficiency investments continuing to decline even though only a handful of states have passed restructuring legislation.

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In the states that have deregulated their utility generation, environmental advocates have been quite successful in getting utility regulators or legislators to impose a systems benefit charge on the distribution utility, which remains a regulated monopoly, to fund efficiency, renewable, and other public benefit investments; the revenues from these charges often are placed in independently administered public benefit funds. At least fifteen U.S. states have adopted utility system benefit charges and benefit funds.

All the efficiency measures described in this article, and many others also available, achieve substantial fuel and energy savings, usually with similarly substantial long-term economic savings. Laws in place at the federal, state, and local levels can promote energy-efficient decisions and investments, or act as barriers. Thus, in advising clients about how best to insulate themselves from the vulnerabilities of reliance on traditional energy resources, the energy-efficiency measures outlined above should be valuable in pointing the way to achieving economies in the quickest and most cost-effective way. As importantly, lawyers can act on behalf of their clients by identifying where legal and regulatory barriers exist, and then work to remove them. The end result will be more prosperous clients and a more secure, healthy and economically sound nation.