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U.S. POLICY EXPERIENCE IN PROMOTING ENERGY EFFICIENCY AND RENEWABLE ENERGY

Prepared for
National People's Congress
P.R.China

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August, 2005

U.S. Policy Experience in

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Summary

U.S. policy interest in sustainable energy defined as energy efficiency and renewable energy dates to the 1970s. The oil embargo of that decade spurred national policy responses aimed at reducing energy intensity in all sectors of the society. Major legislation included the National Energy Policy Act of 1975, National Energy Act of 1978 including Public Utility Regulatory Practices Act of 1978, National Appliance Energy Conservation Act of 1987, Energy Policy Act of 1992 and Energy Policy Act of 2005.

The cumulative effect of these policies and market-driven technology and behavioral change has been a significant reduction in energy use. As Figure 1 indicates, energy efficiency actually saved an amount of energy approximately equal to national consumption of oil and natural gas from 1970-2000 (Byrne et al, 2004). This reduction in energy use occurred while the U.S. economy grew by 149% in the same period (U.S. Bureau of Economic Analysis).

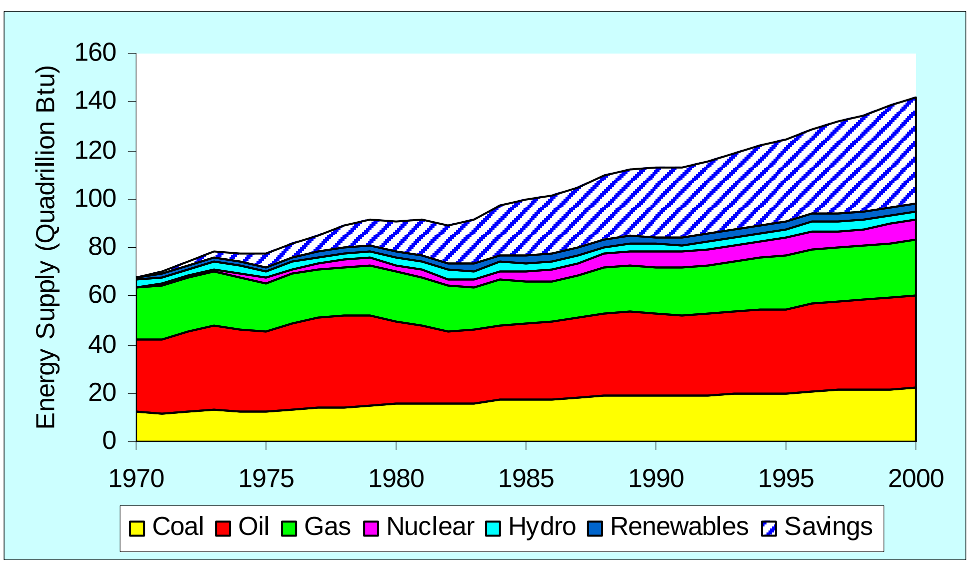


Figure 1: A Comparison of U.S. Fuel Consumption and Energy Efficiency (Quadrillion Btu) 1970-2000

U.S. policy has focused on five energy end uses as follows:

- Appliance and Equipment
- Buildings
- Manufacturing Processes
- Transportation
- U.S. Government Energy Consumption

Energy labels and standards have been the principle tools to affect energy use from appliances and equipment.

In the building sector, building codes and market-driven initiatives such as the Leadership in Energy and Environmental Design (LEED) Program of the U.S. Green Buildings Council (USGBC) have proved to be effective mechanisms for the improvement of building envelope efficiency.

The transportation sector accounts for 27% of annual U.S. energy consumption and passenger vehicles, light trucks and SUVs are approximately 55% of the sector's energy use. The principal policy tool used by the U.S. to affect vehicle energy use has been Corporate Average Fuel Economy (CAFE).

The largest consumer of energy in the U.S. is the industrial sector (33%). Nine manufacturing sub-sectors are highly energy-intensive and contribute more than 50% of industrial energy demand. The key tool used by the U.S. government to improve energy efficiency among high energy-intensive manufacturers is the Industries of the Future (IOF) program.

The U.S. government recognized that it should provide national legislative and financial support, but that it should also "lead by example." For this reason, it created the

Federal Energy Management Program (FEMP) to reduce the energy costs and environmental impacts of federal facilities.

Recently, the U.S. has focused on the role of renewable energy in building a sustainable energy future. At this time, a mix of federal and state policies are promoting a rapid increase in the use of solar, wind and bioenergy.

Federal policy has mainly relied on tax credit strategies to stimulate the entry of renewable energy producers and purchasers. In one case (ethanol), standards have been set to speed the entry of renewable energy. Policies have taken the following forms.

- Wind Production Tax Credit — apply to investor only
- Solar Tax Credit — apply to investor or user
- Ethanol Standard

In addition to federal legislation, states have become active in the promotion of renewable energy. The most popular tool among states has been the renewable energy portfolio standard (RPS). Twenty-two states with 50% of the U.S. population and accounting for 47% of the U.S. energy consumption now require electricity providers to obtain a designated percentage of their generation from qualifying renewable sources. Targets set in the state law steadily increase with most requiring 10-15% of electricity generation to come from renewable energy by 2020.

This report examines the range of sustainable energy polices described above. Estimated impacts on appliance, equipment, building, transport, energy-intensive industry and U.S. governmental sector energy use are reported.

1. US Energy Policy in the Past Half Century

1.1 A Profile of U.S. Energy Policy from the 1970s to Present

Prior to the 1970s, energy policy received little consideration in the United States. In 1973, the Organization of Petroleum Exporting Countries (OPEC) voted to cut its oil production by 5 percent on a monthly basis until Israel made fundamental changes in relations with its neighbors. In response to the OPEC oil embargo, President Nixon took important steps toward the development of a comprehensive national energy plan. The Federal Energy Office (FEO) was created within the White House in late 1973. And, with the reliability of oil supplies called into question after 1973, both the federal and state governments made greater efforts to encourage conservation and efficiency use through a variety of taxation and regulatory actions. In 1975, U.S. President Ford signed the Energy Policy and Conservation Act (EPCAct), extending price controls on oil, establishing automobile fuel efficiency standards, and authorizing the creation of a Strategic Petroleum Reserve. Additional legislation, including the Energy Conservation and Production Act (1976), identified opportunities for societal efforts to lower national vulnerability to energy supply interruptions by conserving energy.

The Carter Administration created the U.S. Department of Energy and passed several innovative energy-related policies. The DOE consolidated federal agencies involved in energy policy, research, and development programs into a single organization. In 1978, National Energy Act was passed and signed, which included the National Energy Policy and Conservation Act (NEPCA), the Power Plant and Industrial Fuel Use Act (PIFUA), the Public Utilities Regulatory Practices Act (PURPA), the Energy Tax Act (ETA), and the Natural Gas Policy Act (NGPA). NEPCA called for the development of appliance efficiency standards for household appliances and charged the Federal Trade Commission with issuing appliance energy efficiency labeling rules. PURPA required states to introduce new pricing mechanisms to encourage energy conservation and obligated electric utilities to purchase power from cogeneration plants and small power production facilities using renewable and waste fuels. NGPA began the deregulation of “new gas” supplies while continuing price regulation of “old gas” supplies. ETA provided tax breaks for domestic energy supplies and energy efficiency improvements. PIFUA restricted the use of natural gas to generate electricity in an effort to alleviate natural gas shortages.

The passage of these laws and accompanying regulations established the country's first institutional commitment to energy efficiency and renewable energy development and led to lower energy demand and less dependence on international energy conditions to meet domestic needs. Slower economic growth and a decline in older and inefficient heavy industries also contributed to reduced energy demand. By the late 1980s, American industry used only 70 percent of the energy needed in 1973 to produce the same amount of economic output (Kraft, 2004)

Government support for energy conservation and the use of alternative energy sources was dramatically reduced under the Reagan Administration in the early 1980s. Energy conservation policies and programs were cut as part of a general effort to reduce the size of the federal budget. Notably, the Reagan Administration and its Congressional allies were philosophically committed to deregulation of most government-controlled markets such as airlines and energy. Falling energy prices led to decreased public interest in the sector and the U.S., Congress was able to repeal tax breaks for energy conservation and renewable energy development. Between 1980 and 1990, the U.S. Department of Energy's budgets for energy conservation fell by 91 percent (Kraft, 2004).

Energy issues reappeared on the political agenda in late 1980s as the nation's dependence on oil imports rose once again and concern began to mount about global climate change following the hot and dry summer of 1988. However, the policymakers were still reluctant to push the public to change its energy habits through either higher efficiency standards or significant increases in the energy taxes. Until the early 1990s political gridlock prevented action on energy issues. The 1992 Energy Policy Act renewed policy efforts to address the country's continuing energy problems. EPACT sets higher efficiency standards for electric appliances, buildings, lighting, plumbing, commercial and industrial motors, and heating and cooling systems. It also required electricity regulators in the individual states to adopt "integrated resource planning" methods, in which demand-side efficiency could be compared to traditional supply options. The Act also introduced tax and production incentives for renewable energy development.

The Clinton administration's energy policy centered on the reduction of energy use and more rapid development of renewable energy voluntary efficiency program were created that included Energy Star and Green Lights. Importantly, these programs were established under the direction of the Environmental Protection Agency (EPA). The administration also encouraged automobile manufacturers to develop alternative fuel vehicles. Its Clean Car Initiative(later renamed the Partnership for a New Generation of Vehicles (PNGV) helped to promote new low-emission, high efficiency vehicles in the American automobile market).

The present administration of George W. Bush announced its idea for America's energy future in a document developed under the direction of Vice President Cheney call "National Energy Policy" (2001). The foundation of the policy is aggressive exploitation of conventional energy resources and technologies. While mention was made of energy efficiency and renewables, the plan was heavily weighted toward increasing supply. The U.S. Congress recently passed the National Energy Policy Act of 2005, which embraces several goals of the 2001 position paper, but it also continues modest commitment to energy efficiency and renewables.

As described above, with the change of presidents, U.S. energy policy can vary significantly. This variability has hindered energy conservation and renewable energy development efforts, but several polices continue to play important, positive roles in reducing energy use and improving renewable energy's use.

1.2 Major Energy Conservation and Efficiency Policies and Programs

- Clean Air Act (1970)

Clean Air Act (CAA) for the first time in U.S. policy identified the detrimental air quality effects of burning coal and oil. In order to improve air quality, CAA highlighted the role that energy efficiency and conservation could play, and focused interest on the development of renewable energy sources in United States.

CAA was the first of the major federal environmental laws and launched an ambitious set of federal goals that cold only be met by installing pollution control technology requirements on new and existing power plants and new vehicles. Major amendments to the CAA enacted in 1977 and 1990 gave further impetus to the development of energy efficiency and renewable energy solutions

The primary goal of CAA is to achieve national ambient air quality levels protective of public health and welfare by limiting air pollutant emissions from both stationary and mobile sources. The Environmental Protection Agency (EPA) strives to meet the goals of the CAA through a combination of its own standards and plans developed by the states with EPA oversight.

The Clean Air Act directs EPA to develop primary and secondary national ambient air quality standards (NAAQS) for "criteria pollutants." The primary standards are necessary to protect public health with what EPA calls "an ample margin of safety," while secondary standards are intended to protect against environmental and property damage.

Costs are not allowed to be considered in setting primary standards. Instead, standards are designed to protect sensitive sub-populations from continuous exposure to health threats, while also promoting long-term ecological sustainability. A geographic area that meets the primary standard for a criteria pollutant is called an “attainment area,” while an area that exceeds the primary standard is called a “non-attainment area”. EPA has promulgated NAAQS for six criteria pollutants: sulfur dioxide, particulate matter, nitrogen dioxide, carbon monoxide, ozone and lead.

To reduce air pollution and acid rain, one of the most important measures is to reduce the use of fossil energy use and to improve demand-side efficiency.

- National Energy Policy and Conservation Act (1975)

This Act was one of the first U.S. laws intended to regulate and reduce energy consumption. The Act also created the Strategic Petroleum Reserve in the Gulf of Mexico. Successive reauthorizations have clarified when and how the president can draw from the

Reserve, provided for a national inventory of onshore energy sources, and established a home-heating oil reserve in the Northeast. In addition, it established Corporate Average Fuel Economy (CAFE) standards to improve the fuel economy of automobiles and light trucks, and it also called for energy-efficiency labeling of certain appliances, including refrigerators, freezers, dishwashers, water heaters, room air conditioners, washing machines and furnaces.

- Public Utility Regulatory Practices Act of 1978 (PURPA)

PURPA provided important momentum for the adaptive energy-efficient equipment and the development of commercial-scale energy production. PURPA defined a new class of energy producer called a qualifying facility (QF). QFs were either small-scale producers using conventional energy to generate electricity who normally self-generated energy for their own needs but who had occasional surplus energy, or renewable energy producers who generate usable electric energy. When a facility of this type met the Federal Energy Regulatory Commission's requirements for ownership, size and efficiency, utility companies were obliged to purchase energy from these facilities based on a pricing structure referred to as "avoided cost" rates. These rates tended to be favorable to the small producer, and were intended to encourage more production of renewable and conventional energy. Reducing emissions and dependence on imported sources of energy were goals. PURPA also introduced regulatory incentives for energy efficiency programs. When demand-side reductions through upgrade in efficiency cost less than a utility's costs to generate electricity, PURPA encouraged investment in alternatives.

- Clean Air Act Amendment of 1990(CAAA 1990)

CAAA 1990 sought to improve national air quality. Through this legislation, the U.S. government encouraged the use of low-sulfur fuels as well as alternative fuels as a means of reducing sulfur dioxide in the atmosphere (which is a main component of acid precipitation). Also, it mandated the installment of the "best available control technology" (BACT) to reduce the volume of air toxics released into the atmosphere. Reformulated gasoline and diesel fuel were benefited by the new Amendments. CAAA

1990 required fleets in 22 urban regions to begin operating clean fuel vehicles by the end of the 1990s. By 1998, 30% of new fleet vehicle purchases were to be clean fuel vehicles. This increased to 50% by 1999 and 70% by 2001. These clean fuel vehicle mandates, however, were changed to voluntary standards in 1995 (EPA, 2002).

- The Energy Policy Act of 1992 (EPACT)

EPACT addressed several sustainable energy issues, including alternative fuels, electric vehicles, and renewable energy. It also recognized the need to respond to potential global climate change and sought to reduce the country's oil vulnerability. The primary purpose of EPACT was to increase U.S. energy security through increased use of alternative fuels, including bioenergy (especially ethanol) and natural gas.

EPACT was revolutionary in that it marked a serious attempt to restructure U.S energy policy. It is a comprehensive and complex law that attempts to provide a coherent energy policy for the United States anchored on renewable energy and increased energy efficiency (Kubasek & Gary, 2005).

One interesting provision is a clause allowing for mortgage incentives on energy-efficient homes. These energy-efficient mortgages(EEMs) allow homeowners to receive a larger mortgages than they would have been able to based on their risk as an investment, provided that the increased mortgage is used for energy efficiency improvements in the home. EEMs ensure lower energy bills that allow homeowners higher net incomes from which to pay increased mortgages.

- The Energy Policy Act of 2005

The Energy Policy Act of 2005 places increased production of energy and greater efficiency into national energy policy. The Act includes incentives for energy efficiency and conservation and promotes the development of new technology and alternative energy sources, including conventional fissile fuel and renewable energy, such as offering tax incentives for producers of ethanol and biodiesel with a renewable fuel standard to increase the amount of ethanol and biodiesel in U.S. fuel supply.

This Act diversifies U.S. energy supply by promoting alternative and renewable energy sources. It extends tax credits for wind, biomass, landfill gas and other renewable electricity sources. The Act offers new incentives to promote clean, renewable geothermal energy.

1.3 Summary

U.S. energy policy has experienced shifts in focus over the last 35 years. This reflects conflicts in policy philosophies. On the one hand, there are interests in the U.S. that favor continued reliance on conventional energy options and oppose the use of government powers to encourage renewable energy and increased energy efficiency. On the other hand, there is the view that non-renewable energy cannot serve the country's long-term needs and a transition to new energy sources and technologies is needed. The level of national effort on energy efficiency and renewable energy development depends upon which philosophy is dominant in a period.

Energy policy in the U.S also reflects whether crisis or stability in conventional energy supply is present. Two energy supply crises in the 1970s resulted in the creation of much of what exists of U.S. energy policy today. Energy efficiency and renewable energy initiatives gain ground when instability is perceived to exist.

Although the U.S. government's overall energy efficiency and renewable energy efforts are far from consistent, gradual achievements appear to be embedded in the sector in the form of technical improvements and improved conservation awareness. Energy efficiency and renewable energy are widely recognized as nation's long term interest. This report focuses on several successful programs and policy in the U.S. (including Energy Labeling, Energy Star, FEMP and LEED program, CAFE, IOF and renewable energy portfolio standards (RPS) that represent what can be termed a *sustainable energy policy infrastructure* in the American energy and social order. The strengths and weakness of this policy infrastructure are examined below.

2. Informed Choices: Improving Energy Information

In U.S, there are generally two approaches to reach the goal of energy efficiency, regulatory and voluntary. The important distinction between voluntary energy ratings and mandatory energy codes is that codes provide minimum acceptable requirements while voluntary energy rating systems are intended to spur innovation and achieve energy efficiency improvements above the minimum energy code. The regulatory approaches sets the bottom-line energy efficiency standards as a kind of law and regulations, and stipulate that all the producers met such a standard, such as EnergyGuide Labeling. Unlike the regulatory approach, the voluntary approach encourages the producers and users to set their own efficiency standards, and abide by these standards as a voluntary act, such as the program of Energy Star, Green Lights. EnergyGuide and Energy Star are the two primary federally funded programs for consumer products and appliances.

2.1 Energy Labeling

Energy labeling program is principally designed to show the energy efficiency of appliances compared with similar models, which is a mandatory program in the United States. The label shows the energy consumption of the appliance/equipment in energy unit under standard test conditions, and contains additional information such as the capacity of water heater in gallon, the refrigerator/freezer in cubic feet and, the wash and spin performance of washing machines. For example, a current natural gas water heater in U.S. has the energy guide label like this:

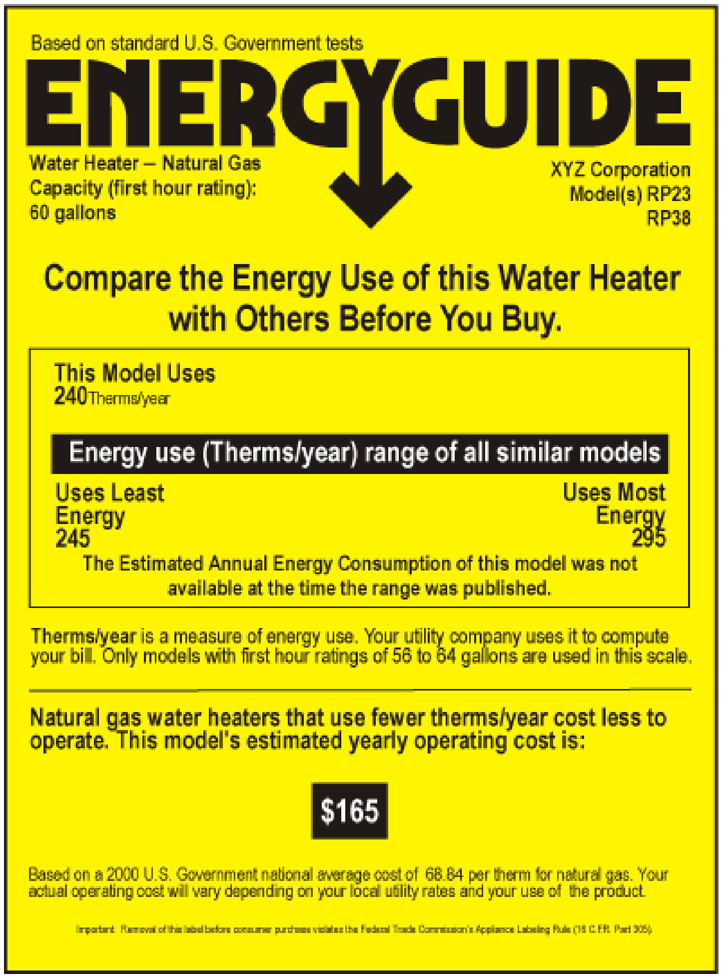


Figure 2: Current Energy Label of Natural Gas Heater

Note: National average cost of natural gas in 2005: $1.02 per therm (source: EIA).

In United States, energy labeling was widely used to improve energy efficiency. U.S. labeled all the products which meet a certain minimum level of energy efficiency. These endorsement labeling programs are operated by both government agencies and non-governmental organizations. Mandatory energy labeling of appliances was authorized by the Energy Policy and Conservation Act (EPCA) in 1975; the related Energy-Guide program took effect in May 1980. Labels were required on refrigerators, freezers, dishwashers, water heaters, room air conditioners, clothes washers and furnaces. Later on labels have been required on fluorescent lamp ballast, fluorescent lamps, compact fluorescent lamps (CFLs), and general service incandescent lamps.

The National Appliance Energy Conservation Act (NAECA) set efficiency standards and established schedules for mandatory review in 1987. Standards came into force for most major types of residential energy equipment really during the 90s. Residential products covered under NAECA were almost similar to the labeled appliances. Some standards set minimum energy efficiency levels while others were prescriptive.

First significant national appliance standards took effect under NAECA in 1990. These were for refrigerators, freezers, water heaters and room air conditioners. They were updated effective in 1993. New standards for refrigerators and freezers is effective in July 2001.

- Objective of the program

The labeling program provides consumers with information on a product's relative energy use, operating cost, or efficiency. With labeling system, consumers have easy access to reliable energy performance comparisons, and then they could make better-informed decisions and select more energy efficient products. By setting a minimum efficiency level, inefficient products will be removed from the market. The efficiency improvements are incorporated into all new products with energy labeling.

Both energy labeling and standards stimulate technological change. With standards, manufacturers are obliged to increase products' efficiency in order to conform to legislation. Energy labeling also stimulate innovation. Some manufacturers seek to differentiate from competitors on energy efficiency attribute.

- Impacts and Evaluation of the Program

Department of Energy (DOE) periodically reviews and updates the efficiency standards according to the transformation of the market. With the new process rules for standards setting, market analysis, national benefit analysis, and analysis of impacts on consumers, utilities and manufacturers will be carried more systematically.

Refrigerators and freezers are the appliances for which standards have been the most successful. The average rated electricity use of new refrigerators declined from about

2000 kWh/yr in 1972 to about 690 in 1993, and to 436 kWh/yr in 2003 (Pierce, 2003). This large decline in electricity use was accompanied by a 10% increase in average refrigerator size and a greater penetration of feature such as automatic defrost. It is estimated that minimum efficiency standards have played a critical role in stimulating these efficiency improvements.

Table 1: Comparison of Energy Consumption of Old and New Refrigerators

Year Refrigerator Manufactured	Annual Electrical Consumption	Annual Cost of Electricity*
1972	2000 kWh	$270.00
1990	900 kWh	$121.50
1993	690 kWh	$93.15
2001	485 kWh	$65.47
2003	436 kWh	$58.86

* Cost of Electricity is calculated at $0.135 per kilowatt-hour, the average cost of electricity in New York State for residential consumers. Electrical consumption levels for 1972 – 1993 refrigerators obtained from Lawrence Berkeley Labs Summer 1995 Newsletter.

The 1990 standards required a 10% improvement in efficiency; many models available in 1989 already met this standard but they forced the least efficient models out of the marketplace. However, the 1993 standards were set at a level (30% improvement) that no products available in 1989 could meet. Manufacturers had to introduce an entire generation of new products in order to meet the 1993 standards (WEC, 2001).

This improvement in energy efficiency did not lead to an increase of prices. Consumer Price Index for refrigerators and freezers only increased 1.4 % per year between 1982/84 and 1993 (1.25% when taking into account increases in size), while the overall CPI for all goods increased 40 % and previously observed increases in current prices of refrigerators was 1.1% between 1948 and 1983 (WEC, 2001).

Impacts of energy labeling on market transformation cannot be isolated from the impacts resulting from the introduction of efficiency standards. As the results of energy labeling are generally considered mixed, direct energy savings are supposed to be limited compared to general impact of efficiency standards.

For appliance efficiency standards set from 1987 to 1997, the estimated energy savings were bout 88 TWh/yr in 2000 and 232 TWh/yr in 2010. Corresponding peak capacity saved will be respectively 21 GW and 60 GW.

In 2001, DOE published three final rulings on appliance and equipment minimum efficiency standards (on clothes washers, central air conditioners, transformers, furnaces and boilers, fluorescent ballast, water heaters, etc.). It could produce additional energy savings of 21 TWh in 2010 and 64 TWh in 2020. The overall savings from all Federal appliance and equipment efficiency standards would eliminate the need for almost 66 GW capacity in 2010 and 120 GW in 2020. Corresponding carbon emission savings are 61 MtC in 2010 and 75 Mtc (Geller, 2001).

- Label Revision

Until 1994, the label (EnergyGuide) focused primarily on energy costs (in US $). The labels showed the products' estimated annual energy costs and the range of energy costs of similar models. Given the different energy prices in different States, the label also showed the operating cost of the appliance that could be expected under various energy rates. As a consequence, it was not easily understandable for consumers. A sample of old label is shown as Figure 3.

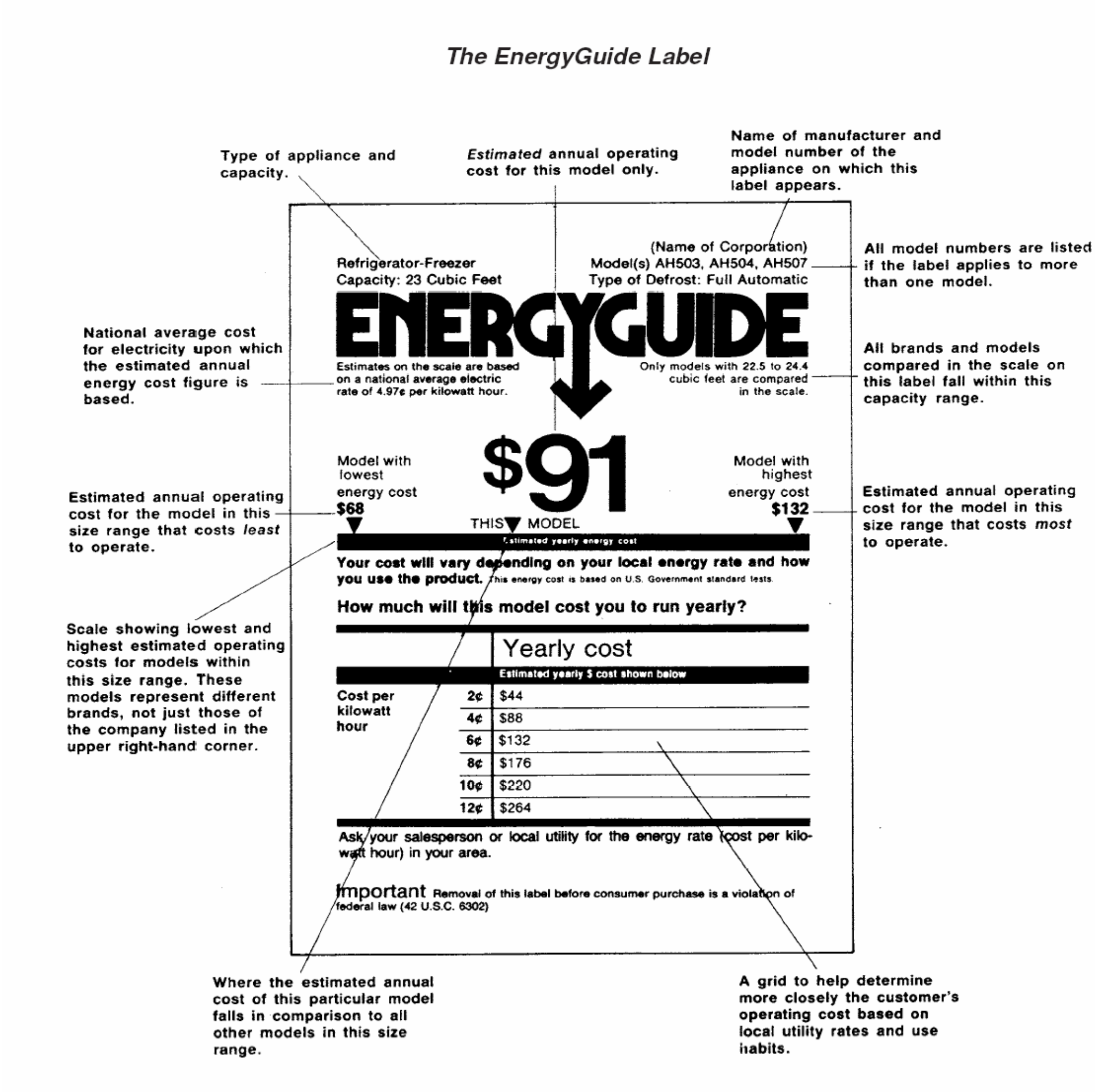


Figure 3: Sample of an Old EnergyGuide Label

In 1994, the labels were revised to improve their readability and usefulness to consumers. New labels emphasize energy use in physical units (kWh). The intent was to make the labels easier to read and more useful to consumers in comparing the energy efficiency of the appliances. But this gain may have come at the expense of replacing a highly visible, easily understood and perhaps more salient number, dollar operating cost, with a "technical" term such as kWh, similar as Figure 2.

DOE encountered serious organizational, budgetary and analytical problems in reviewing and updating of standards in the early 90s. Responding to manufacturers concerns, the Congress issued a one-year moratorium in 1996 on proposing or issuing energy conservation standards. DOE subsequently reformed the standards setting process by making the decision making process more open and understandable but as a consequence; the program has fallen terribly behind schedule.

Apart from energy labeling, several programs seek to accelerate the adoption of more energy efficient appliances, Energy Star (computers, office equipment) and Green Lights (energy efficient lighting equipment), for example. Another successful program in U.S is Energy Star.

2.2 Energy Star Program

Energy Star is a government-backed program, sponsored by the U.S. EPA and DOE, which helps businesses and consumers protect the environment through superior energy efficiency. Products, services, businesses and new homes meet designed criteria for energy efficiency earn the Energy Star label. Energy Star is also a dynamic government/industry partnership that offers businesses and consumers energy-efficient solutions, making it easy to save money while protecting the environment for future generations.

In 1992 EPA introduced Energy Star as a voluntary labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. Computers and monitors were the first labeled products. Through 1995, EPA expanded the label to additional office equipment products and residential heating and cooling equipment. In 1996, EPA partnered with the DOE for particular product categories. The Energy Star label is now on major appliances, office equipment, lighting, home electronics, and more. EPA has also extended the label to cover new homes and commercial and industrial buildings.

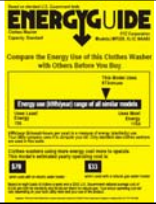
Through its partnerships with more than 8,000 private and public sector organizations, Energy Star delivers the technical information and tools that organizations and consumers need to choose energy-efficient solutions and best management practices. Energy Star has successfully delivered energy and cost savings across the country, saved businesses, organizations, and consumers about $10 billion in 2004 alone (EPA, 2004). Over the past decade, Energy Star has been a driving force behind the more widespread use of such technological innovations as LED traffic lights, efficient fluorescent lighting, power management systems for office equipment, and low standby energy use.

The overall goal of Energy Star is to reduce global warming, by reducing and preventing greenhouse gas emissions. In the United States, Energy Star now labels and qualifies products in more than 40 product categories.

The overall achievements of Energy Star are quite impressive. In 2004, with the help of Energy Star program, $8 billion saved in the U.S.. It also saved enough energy to power 20 million homes. More than 1 billion Energy Star qualified products have been purchased to date. Energy Star among consumers jumped from 40 percent to more than 60 percent nationally. (EPA, 2004)

Energy Star is now a quite popular program in U.S. It provides a trustworthy label on over 40 product categories (and thousands of models) for the home and office. These products deliver the same or better performance as comparable models while using less energy and saving money. Energy Star also provides easy-to-use home and building assessment tools so that homeowners and building managers can start down the path to greater efficiency and cost savings. For example, a refrigerator-freezer’s EnergyGuide label with energy star looks like as Figure 4.

Table 2: EnergyGuide vs Energy Star

	EnergyGuide	Energy Star
Logo/Label		
Program Type	Mandatory	Voluntary
Label Type	Comparison (continuous)-label compares the energy use of a given model to other similar models by providing a range (with a low-end and a high end) of energy use of similar models	Endorsement – label indicates that product meets certain levels of performance
Year Started	1980	1992
Responsible federal agency	FTC (labeling) and DOE (testing)	EPA and DOE
Underlying legislation	EPCAct 1975 NECPAct 1979 FTC Appliance Labeling Rule 1980	Voluntary government/industry partnership
Products covered	• Refrigerators • Freezers • Dishwashers • Cloths washers • Room air conditionings • Water heaters • Furnaces • Boilers • Central air conditions • Heat pumps • Pool heaters * Other products (e.g. lighting) are required to display energy-efficiency information directly on their product labels/packaging	Products in more than 40 categories • Appliances (Clothes Washers, Dehumidifiers, Dishwashers, Refrigerators, Room Air Conditioners) • Heating & Cooling (Air-source Heat Pump, Boilers, Central AC, Ceiling Fans, Dehumidifiers, Furnaces, Geothermal Heat Pump, Home Sealing (Insulation), Light Commercial Programmable Thermostats, Room AC, Ventilating Fans) • Home Electronics (Cordless Phones, Combination Units, DVD products, Home Audio, Set-top Boxes, TV VCRs) • Lighting (CFL, Residential Light Fixtures, Ceiling Fans, Exit Signs, Traffic Signals) • Office Equipment (Computers, Printers, Copiers, Faxes, Mailing Machines)

Source: Hardy et al, 2004.

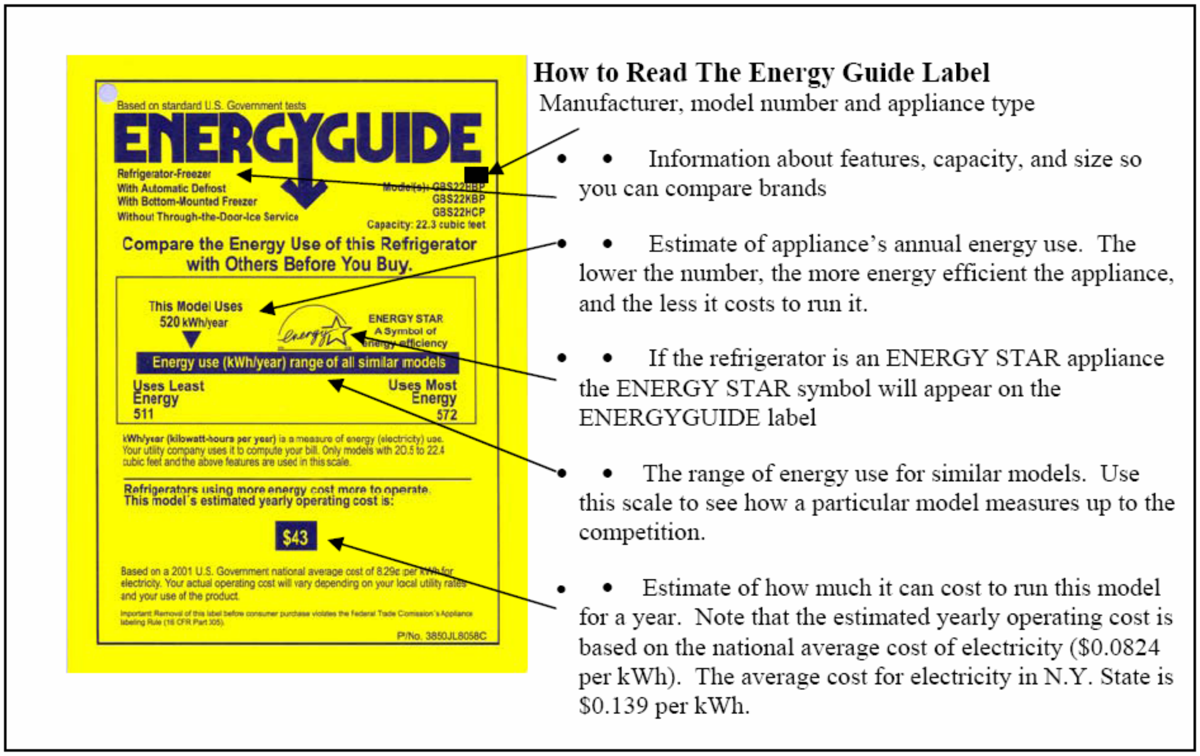


Figure 4: Sample of a Current Energy Label

Energy Star is a very successful voluntary energy efficiency program. To sustain its effectiveness, the challenge is to sustain the energy savings by defining sets of new products, creating test procedures, and selecting the appropriate Energy Star product specifications (Meier, 2003). Energy Star program is expected to be steadily expanded and achieved more in the future. Table 2 summarizes some additional information about these two programs.

3. Building Energy Conservation - The LEED Program

3.1 An Overview of LEED Program

The U.S. Green Building Council (USGBC) is the founder of the Leadership in Energy and Environmental Design (LEED) program. USGBC created the LEED program in 1994 in response to major environmental impacts associated with commercial and residential buildings. This was particularly important in the context of building energy usage. In U.S., about 65.2 percent of total electricity consumption is associated with buildings resulted in 30 percent of total U.S. greenhouse gas emissions (Refocus, 2003).

LEED Building Rating System® is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. It's structure is illustrated as Figure 5.

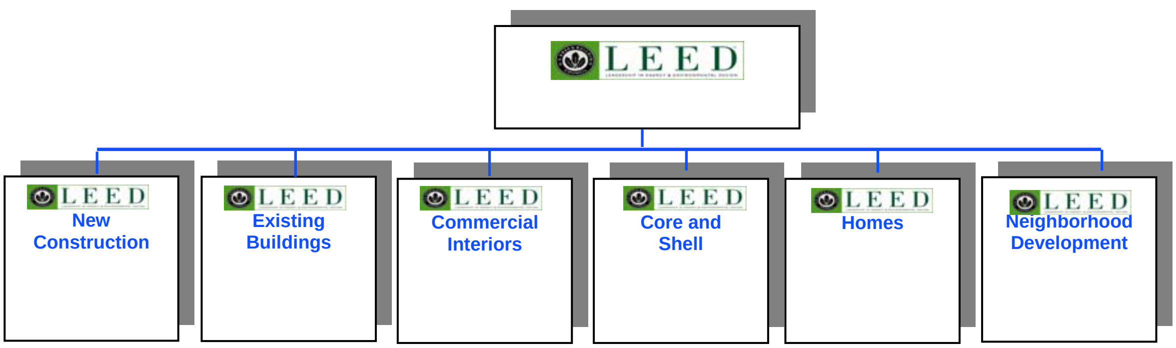


Figure 5: LEED Suite of Building Rating Systems

The purpose of LEED is to:

- define "green building" by establishing a common standard of measurement
- promote integrated, whole-building design practices
- recognize environmental leadership in the building industry
- stimulate green competition
- raise consumer awareness of green building benefits
- transform the building market

LEED provides a complete framework for assessing building performance and meeting sustainability goals. Based on well-founded scientific standards, LEED emphasizes state-of-the-art strategies for sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. LEED recognizes achievements and promotes expertise in green building through a comprehensive system offering project certification, professional accreditation, training and practical resources.

The LEED rating system is divided among five categories, each representing specific criteria within the building process. The categories include:

- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Research
- Indoor Environmental Quality

The benefits of designing, building and operating a green building represent a strong argument towards their implementation and overall acceptance within the building industry and the public as a whole. As a major contributing factor to the environments overall health and longevity, the building industry must embrace these new sustainable opportunities put before it. If successful it can provide long term benefits not only to the global environment but also to the economic vitality of the individual businesses and consumers who are at the core of this environmental re-awareness. Benefits include:

Environmental:

- Reduced destruction of natural areas, habitats, and preserve biodiversity
- Reduce air pollution, water pollution, and solid waste creation
- Reduce depletion of finite resources
- Energy independence

Economic:

- Reduced operating costs
- Enhanced asset value & increased profits

- Reduced or neutral first costs
- Optimized life cycle economic performance
- Improved productivity
- Reduced absenteeism and & maintained occupant health
- Reduction in liability

3.2 Program Impacts

More than 1450 buildings in the United States are registered to pursue LEED certification; 176 have been certified by 2004. The California EPA headquarter in Sacramento, California is the first building certified Platinum under LEED existing building in November 2003. It is a 25-story, 950,000 square foot office building with state-of-the-art green building practices, such as floor by floor HVAC, dual glazed windows with a low-emissivity coating, rooftop BIPV system etc. Day janitorial services save $100,000 in annual energy costs. The whole building operates by 26% more efficient than California Energy Code. And the operation cost of this building is at $1.00/sq. ft which is below average operating costs and has added over $10,000,000 in value as a result.

4. Sustainable Transportation (CAFE program)

4.1 An Overview of CAFE Program

The 1973 Arab oil embargo and the ensuing quadrupling of oil prices by OPEC prompted Congress to enact the Corporate Average Fuel Economy (CAFE) program in 1975 as part of National Energy Policy and Conservation Act. The aim of this program was to reduce the consumption of gasoline and thus the need for oil imports. Beginning with the 1978 auto model year, the program required all auto manufacturers to maintain certain minimum fuel economy averages for their fleets of vehicles sold in the Untied States. The U.S. fuel economy standards are based on a two-tier system of cars and light trucks as defined by vehicle specifications (not including weight). Under CAFE program, each manufacturer is currently required to meet a fleet average of 27.5 mpg (which was initially set at 18 miles per gallon in 1978) for cars and 20.7 mpg for trucks. The standards for trucks will be increasing to 21.0 mpg in 2005, 21.6 in 2006 and 22.2 in 2007, representing a 7 percent increase over three years (Sauer and Wellington, 2004).

The CAFE standards apply to any manufacturer, domestic or foreign, that sells over 10,000 cars per year in America. These manufacturers must satisfy CAFE requirements for each of several vehicle categories. For instance, vehicles manufactured abroad are considered separately from those manufactured in the U.S. Thus, a manufacturer with a 30 mpg average for its combined output of foreign and domestically produced passenger automobiles nonetheless would fall short of CAFE requirements if its domestically built passenger cars taken separately averaged only 25 mpg. The standards are the same for foreign and domestic fleets, but different standards apply to different types of vehicles. A lower mpg level is required for light trucks, for example, whether foreign or domestically produced, than for passenger vehicles. The mpg performance of each model vehicle is calculated from the combined average of city and highway mileage, according to tests conducted by the Environmental Protection Agency. If a manufacturer's average for a particular fleet falls below the mandated levels, a penalty is imposed amounting to $5 per vehicle for each one-tenth of a mpg by which the fleet average falls below the required

CAFE level. Significantly, the penalty applies to all cars sold in the fleet in question, not just the particular models that bring the average below the minimum level.

Thus if a manufacturer produced one million cars per year and its fleet CAFE average was 27.4 mpg instead of 27.5 mpg, it would pay a fine of $5 million to the federal government. The Bryan bill would increase these penalties. Beginning with the 1996 model year it would: 1) index fines for inflation, and 2) double the fine for any manufacturer that failed to meet the applicable standard by one-half mile per gallon or more three years in a row.

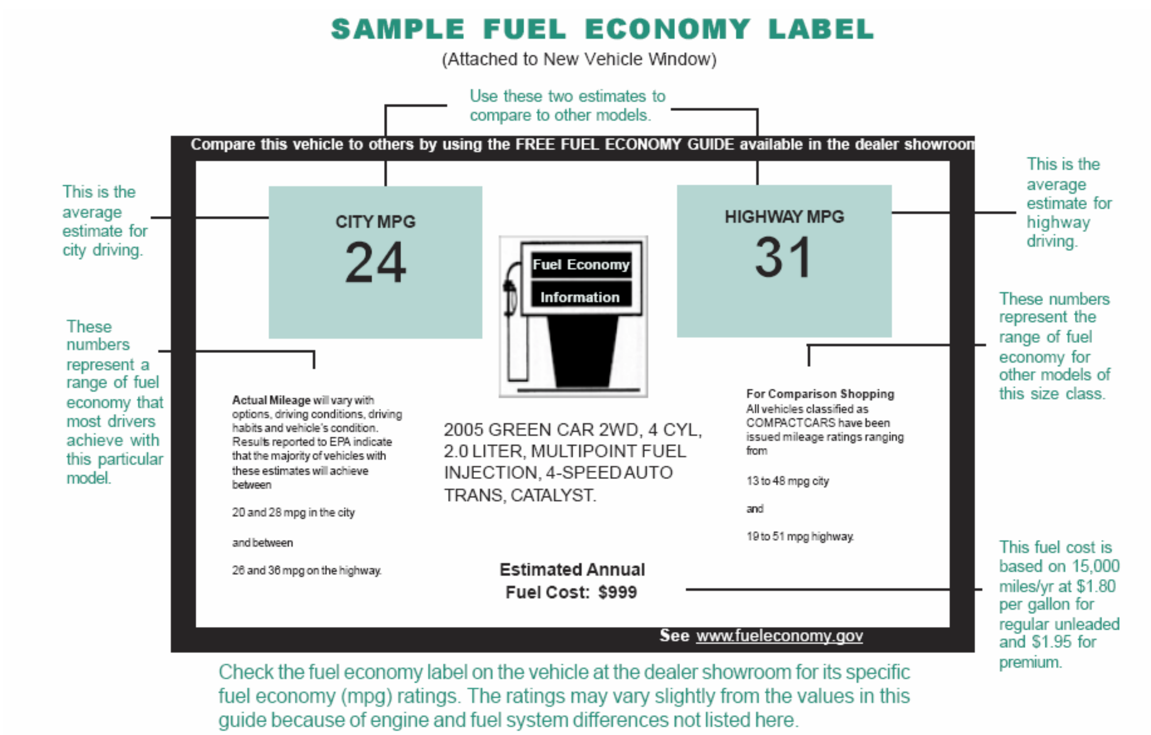


Figure 6: Sample of Fuel Economy Label in United States

4.2 Program Impacts

The CAFE program has clearly contributed to increased fuel economy of the U.S. nation's light-duty vehicle fleet during the past period. During the 1970s, high fuel prices and a desire on the part of automakers to reduce costs by reducing the weight of vehicles contributed to improved fuel economy. CAFE standards reinforced that effect. Moreover, the CAFE program has been particularly effective in keeping fuel economy above the levels to which it might have fallen when real gasoline prices began their long-decline in the 1980s. Improved fuel economy has reduced dependence on imported oil, improved the nation's terms of trade, and reduced emissions of carbon dioxide, a principal greenhouse gas. The CAFE standards, together with significant fuel price increases from 1970 to 1982, led to a near doubling of the fuel economy of new passenger cars and a 50 percent increase for new light trucks (NRC, 1992). It is questionable whether the 1970s CAFE standards did much to increase the fuel efficiency of American cars. What actually did boost mileage per gallon for American-made cars was the searing competition from the high mileage imports and the sustained high gasoline prices. CAFE standards have played a leading role in preventing fuel economy levels from dropping as fuel price declined in 1990s. Oil prices have risen considerably since 2001. If the growing demand for oil sustained, high oil prices will act as a stimulus to the production of more fuel-efficient vehicles, for the simple reason that people will demand better fuel economy.

In 2003, new standards for light trucks and SUVs were set. The standards gradually increase from the 20.7 mpg in 2003 to 22.2 mpg in 2007. It is estimated that there would be additional 144 million gallons of gasoline each year.

However, past improvement in the overall fuel economy of the nation's light-duty vehicle fleet have entailed very real, albeit, costs. The downweighting and downsizing that occurred in the late 1970s and early 1980s, some of which was due to CAFE standards, probably resulted in an additional 1,300 to 2,600 traffic fatalities in 1993. In addition, the diversion of carmaker's efforts to improve fuel economy deprived new-car buyers of some amenities they clearly value, such as faster acceleration, greater carrying or towing capacity, and reliability.

The new technologies that might be used to improve future fuel economy include gasoline-electric hybrids or diesel-powered passenger cars and light-duty trucks. Hybrid vehicle sales have grown faster than anyone expected — to 86,000 in the United States in 2004. According to industry experts, hybrid sales could amount to 400,000–500,000 by the 2008–2009 model year, with significant penetration in both the passenger car and light-duty truck segments of the market. Similarly, considerable progress is being made in the development of much cleaner diesel engines; this is important because diesel-powered vehicles get 30 percent better fuel economy than conventional internal combustion gasoline engines. If the cost penalty associated with hybrids falls significantly because of larger-than-expected volumes, and if carmakers find a way to produce diesel engines that are capable of meeting tougher emissions standards in California and the rest of the United States for the lifetime of vehicles, things could be different. That is, it might be possible to meet more stringent fuel economy standards at lower costs for less (Portney, 2005).

4.3 Summary

1. The enactment of CAFE standards in 1975 resulted in a near doubling of cars' average fuel economy, measured in miles per gallon (mpg), over the ensuing decade and an increase for light trucks of over 50%.

2. Fuel economy standards for passenger vehicles save the United States over 55 billion gallons of fuel annually Without CAFE, total U.S. carbon dioxide emissions would be more than 10% higher than they are today.

3. CAFE standards have been met largely through cost-effective measures such as engine efficiency improvements and weight reduction, with no decline in vehicles' interior volume or safety. The safety of new vehicles, as measured by highway fatalities per mile driven, improved substantially at the same time that fuel economy increased over the past 25 years.

4. The 1985 average fuel economy standard of 27.5 mpg for cars has not been raised in the intervening 16 years, and the light truck standard increased only about 1 mpg in the same period. Congressional action has frozen CAFE standards since fiscal year 1996, and the fuel economy of the combined light duty fleet has now dropped to 24 mpg from its 1986–87 high of 25.9 mpg. Because SUVs are held to the less stringent light truck standard, their growing popularity has led to the decline in average fuel economy for the entire passenger fleet.

A menu of next generation policies to increase the fuel economy of light duty vehicles is as follows.

1. Performance-based tax credits for advanced technology, fuel-efficient vehicles. These credits would help jumpstart the introduction and purchase of these advanced vehicles. Once the new technologies become widely available and produced on a significant scale, costs should decline and the tax credits could be phased out.

2. Millions of inefficient light trucks (including SUVs) are used as passenger vehicles, yet are not subject to the "gas guzzler" tax (ranging from $1,000 to $7,700) that is imposed on inefficient cars. Applying the tax to new gas-guzzling passenger vehicles in all classes would "pull up"the bottom end of the vehicle fleet and generate tax revenue that could be used to offset the incentives offered to buyers of high-efficiency vehicles.

3. The federal government could extend Energy Star labeling to high-efficiency and low-emitting vehicles. This would make it easier for consumers to identify "greener vehicles" and for manufacturers to promote them.

5. Energy Efficiency Manufacturing: Meeting the Needs of Energy Intensive Industries

5.1 An overview of the Industries of the Future program

The U.S. DOE is charged with helping energy intensive industries to improve their resource efficiency. The Industries of the Future strategy creates partnerships between industry, government, and supporting laboratories and institutions to accelerate technology research, development, and deployment. Led by the Department of Energy's Industrial Technologies, the Industries of the Future strategy is being implemented in nine energy intensive manufacturing sub-sectors.

1. Aluminum
2. Agriculture
3. Chemicals
4. Forest Products
5. Glass
6. Metalcasting
7. Mining
8. Petroleum Refining
9. Steel

As the Industries of the Future (IOFs) program delivers energy efficiency, it also means reducing waste, enhancing environmental performance, lowering production costs and increasing productivity and boosting competitiveness. The Industries of the Future strategy seeks to improve industrial energy efficiency and productivity with two primary thrusts.

(1) Provide support of collaborative R&D planning and implementation to give industry the advanced technologies it will need in the future and

(2) Help plants select and implement the best practices and technologies available today — such as enhancing current operations through improved motor and pump systems.

In reality, Industries of the Future is a collaboration at the intersection of industry’s long-term needs and the goal of energy efficiency leading to improved environmental performance and increased productivity, and a partnership of the combined resources of industry, academia, and government to tackle tough technical challenges, requiring advanced science and technology options.

The IOFs and crosscutting R&D programs tend to focus on projects in the mid- to long-term stage of development, though some projects have moved to the demonstration stage. The "emerging technology" programs focus on more near-term applications and deployment of technologies. The "best practices" programs focus on helping industry make better use of technologies that are available today.

The IOF process is an industry-led process. All parts of an industry come together to define their current situation, identify key challenges, and describe what they need and want to be like 20 years from now in order to be sustainably competitive. Each industry defines its own goals (vision), creates a research agenda (roadmap), and then forms public-private R&D partnerships. The process brings together high-level decision makers — many of them competitors — to identify their common technology challenges. The process underscores shared needs and lays the groundwork for collaboration on mutually beneficial projects. Industry gains a strong voice in the leveraged allocation of federal research dollars. In fact, state governments across the U.S. are also using this model to develop strategies to help strengthen industries within their states and regions.

Specifically, in a plant, there exist a number of ways for technology to provide solutions to achieve, for example, lower energy costs, increased productivity, reduced NOx control costs and single digit NOx.

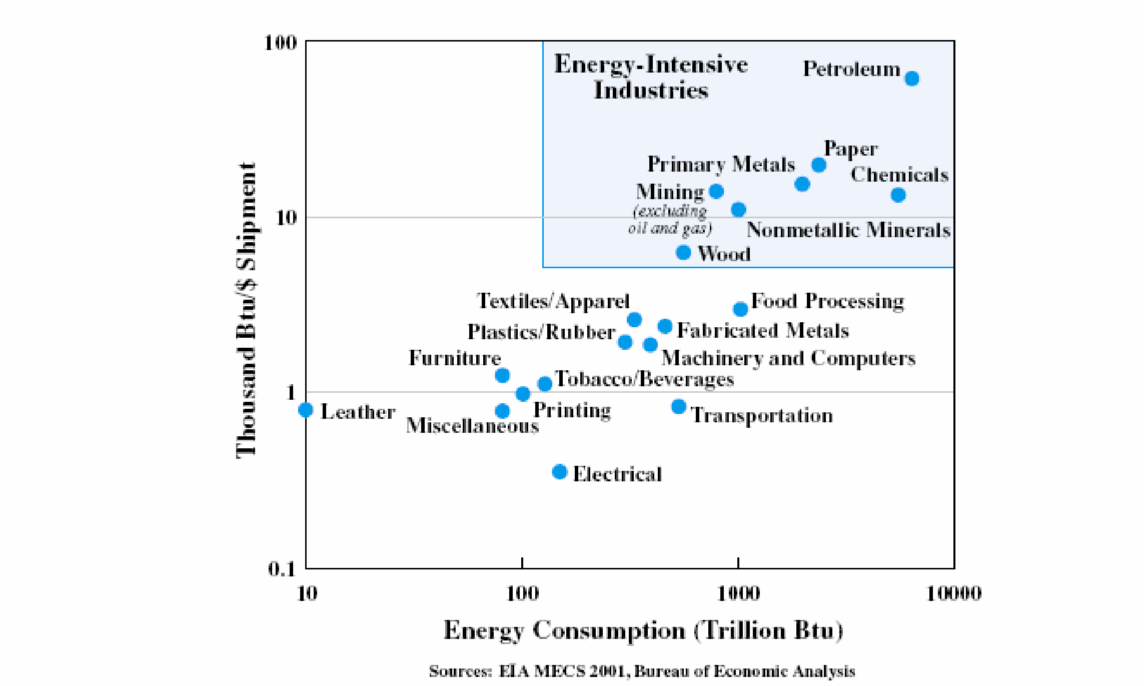


Figure 7: Energy Intensity of Manufacturing Industries

IOFs program has assessed the progress of the technologies supported by its research programs for more than 20 years. IOFs program managers have long recognized the importance of developing accurate data on the impacts of their programs. Such data are essential for assessing IOF program past performance and can help guide the direction of future research programs. When a technology's full-scale commercial unit is operational in a commercial setting that technology is considered commercially successful and is placed on the active tracking list. When a commercially successful technology unit has been in operation for about ten years, that particular unit is then considered a mature technology and typically is no longer actively tracked. The active tracking process involves collecting technical and market data on each commercially successful technology, including details on the following:

- Number of units sold, installed, and operating in the
- United States and abroad (including size and location)
- Units decommissioned since the previous year
- Energy saved Environmental benefits
- Improvements in quality and productivity achieved
- Any other impacts, such as employment and effects on health and safety

- Marketing issues and barriers.

Information on technologies is gathered through direct contact with either the technology's vendors or end users. These contacts provide the data needed to calculate the technology's unit energy savings, as well as the number of operating units. Therefore, unit energy savings are calculated in a unique way for each technology. Technology manufacturers or end users usually provide unit energy savings or at least enough data for a typical unit energy savings to be calculated. The total number of operating units is equal to the number of units installed minus the number of units decommissioned or classified as mature in a given year – information usually determined from sales data or end-user input. Operating units and unit energy savings can then be used to calculate total annual energy savings for the technology.

The cumulative energy savings measure includes the accumulated energy saved for all units actively tracked. These energy savings include the earlier savings from now mature and decommissioned units.

5.2 Program Impacts

Cumulatively, since 1976 ITP technologies and programs have saved 3.99 quad and $20.4 billion. In addition the ITP programs have cumulatively reduced emissions of carbon by 79 million tons, of nitrogen oxides by 608 thousand tons, and of sulfur dioxides by 1.2 million tons, as Table 3 shows.

Between 2002 and 2020, with the assumption of 20 percent versus 0.75 percent reduction (BAU) in energy intensity in the energy-intensive industries, the total energy savings of IOF program would be 0.94 Quads by 2010 and 3.80 Quads by 2020; correspondingly, the cost savings are $5.0 billion by 2010 and $17.8 billion by 2020, see Figure 8.

Table 3: Energy Savings from IOFs in United States

Sectors	Cumulative Energy Savings (10^{12} Btu)	2003 Energy Savings (10^{12} Btu)	Cumulative Pollution Reductions (10^3 tons)				
			Particul_ates	VOCs	SOx	NOx	Carbon
Agriculture	0.811	0.112	0	0	0.011	0.004	17.181
Aluminum	8.633	2.262	0.02	0.03	0.963	1.204	154.101
Chemicals	9.082	1.505	0.008	9.965	0.411	1.137	150.792
Forest Products	13.285	4.891	0.01	0.047	0.53	1.647	219.227
Glass	-	-	-	-	-	-	-
Metal Casting	0.005	0.005	-	-	0.001	0.001	0.105
Mining	2.501	1.556	0.011	0.009	0.54	0.403	49.106
Petroleum	1.93	0.306	0.014	0.009	1.12	0.298	42
Steel	0.989	0.209	0	0.003	0.008	0.118	15.834
others	920	110	7	4	530	151	20,752
Commercial Technologies Total	957	121	7.18	14.1	534	156	21,400
Industrial Assessment Centers Total	1,030	131	4.87	3.83	327	155	20,300
Best Practices Total	201	100	0.97	0.755	65.5	30.3	3,990
Historical Technologies Total	1,800	0	5.24	5.82	282	266	33,200
Grand Total	3,988	352	18.3	24.5	1,210	608	78,900

Source: DOE, 2005

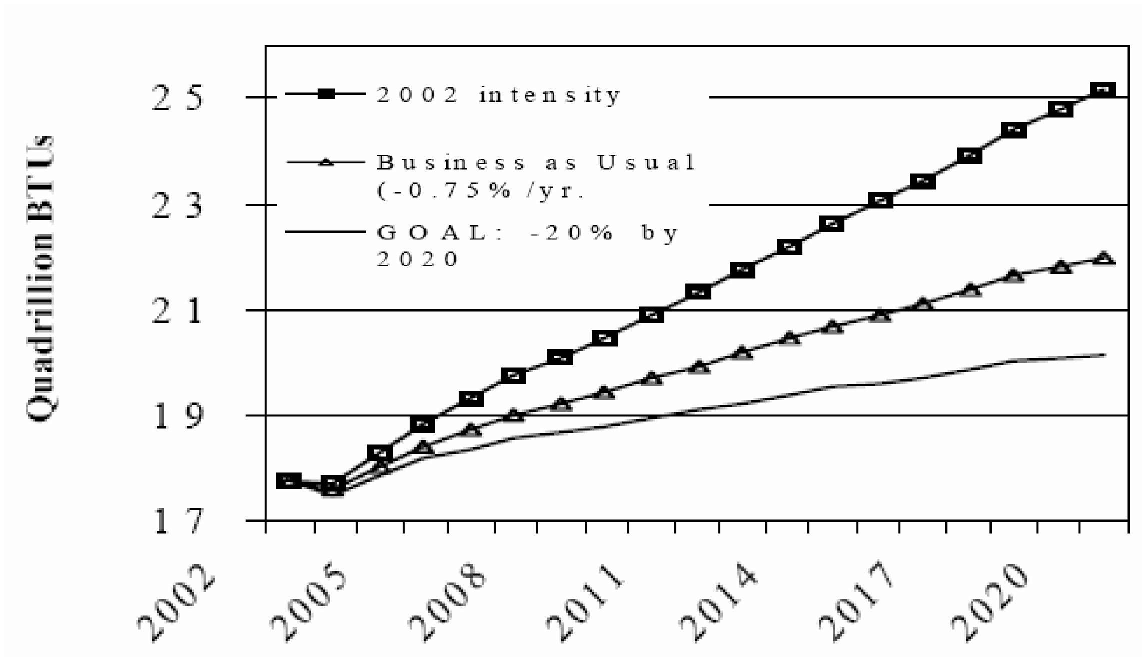


Figure 8: Energy Savings Projection of IOF Program from 2002 to 2020

6. Public Sector as Catalyst: The Federal Energy Management Program

The Federal Energy Management Program (FEMP) is offered as an exemplary model of a public sector-led energy management program that other countries such as China can learn from. A number of legislative and executive directives issued over the last two decades have contributed towards the establishment of FEMP. The major legislative instruments that have helped shape the direct of FEMP are the EPAct of 1992 and the Executive Order 13123 signed in June of 1999.

6.1 An Overview of FEMP

The opportunities for energy efficiency in the U.S. Federal Government are tremendous. The federal government is the single largest consumer of energy in the U.S. In 1996 it consumed nearly 1.2 quads of energy or 1.7% of total national consumption, at a cost of almost $8 billion (DOE, 1999). Federal faculties also consume 54 billion kWh of electricity each year, costing taxpayer more than $3.1 billion annually. The high level of consumption provides the federal government with significance opportunities to cut its energy-use, reduce its cost of operations and save taxpayers millions of dollars. Federal buildings are also one of the largest emitters of greenhouse gases, mainly carbon dioxide, due to its huge energy consumption. Through the implementation of energy management program in federal government, energy use and emissions could be largely reduced. Furthermore, an effort of federal government on energy conservation has a big influence on the state government and the public moving towards energy efficiency. The Energy Policy Act of 1992, recent Executive Orders, and Presidential Directives all regulate federal agencies for energy efficiency strategies adoption. Specifically, the Executive Order 13123 called on all federal agencies to reduce their energy use by 30% by 2005 and by 35% by 2010 in comparison to 1985 levels (FEMP, 2000). In order to help federal agencies to achieve their energy use and emission reduction goals, the Federal Energy

Management Program has following focuses:

- Annual Report to Congress and the President
- Interagency Federal Energy Management Task Force
- Policy guidance and
- Legislative updates and tracking.

Working closely with the Office of Management and Budget and the Office of the Federal Environmental Executive, FEMP develops, disseminates and refines policy related to federal energy management. FEMP also develops guidance materials to assist Federal agencies in meeting legislative and executive order requirements. The Federal Interagency Energy Management Task Force, with representatives from all major agencies, is central in helping FEMP inform the development of energy management policy, identify customer needs, establish priorities, and coordinate communications across Federal agencies.

In addition, each agency has a senior energy official, at the Assistant Secretary level or above, who is responsible for meeting the goals and requirements of Executive Order 13123, including preparing an annual progress report to the President (EERE, 2005). This high level group of officials is brought together periodically by the Office of Management and Budget to discuss agency progress in addressing a variety of energy management challenges.

FEMP aims to reduce the cost and environmental impact of the Federal government by advancing energy efficiency and water conservation, promoting the use of distributed and renewable energy, and improving utility management decisions at Federal sites (EERE, 2005). FEMP helps agencies find innovative solutions to their most difficult energy challenges and address their full range of energy management responsibilities, including:

- Equipment procurements;
- New construction and building retrofits;
- Operations and maintenance; and
- Utility management

With other organizations, FEMO has provided a wide range of materials such as publications, software, videos that can be downloaded or ordered to help federal agencies and product vendors on sustainable building design, efficient product purchasing, and research and development on new technologies. This wealthy resources have helped energy and facility managers find smart solutions to today's energy and water management challenges.

FEMP also provides assistance for project financing and technology improvement. For example, agencies need dollars to make projects happen. FEMP provides expert assistance to agencies seeking project financing through methods such as Energy Savings Performance Contracts (ESPCs), Utility Energy Services Contracts (UESCs), Rebates, or Public benefits funds.

With ESPCs and UESCs, agencies can take advantage of private sector capital to fund energy- and water-saving equipment and renewable energy systems at federal facilities. FEMP assists agencies throughout all stages of these contracts, from project identification to measurement and verification of savings. FEMP also help agencies with obtaining state- or utility-sponsored rebates for energy-efficient improvements, and in applying for public benefits funds set aside to promote energy efficiency (EERE, 2005).

Although there are several core elements that made up of the FEMP, for our purpose in this paper, only strategies related to energy efficiency will be discussed below:

- Equipment Procurement

The public sector – including federal, state, and local agencies – purchases at least 10% of all energy-using products in the US. The federal government alone is the largest buyer in the world for many products (Harris and Johnson, 2000). The Federal government spends about $10 billion annually on energy-using products and services for its buildings, operations, and transportation. To promote an energy-efficient governmental purchasing, FEMP has provided a list of resources for federal governmental buildings to seek for.

Federal buyers are directed by Federal Acquisition Regulations (FAR) Part 23 and Executive Orders 13123 and 13221 to purchase products that are ENERGY STAR labeled or products that are designated to be in the upper 25% of energy efficiency in their class as well as products with low standby power (EERE, 2005). FEMP's Buying Energy Efficient Products program helps Federal purchasers identify these types of highly efficient products, as well as helps vendors to sale their products.

Specifically, FEMP has information provided for companies who want to sell products to federal agencies. To encourage the energy efficient product sales to federal governments, FEMP offers two publications to individual companies: Selling Energy-Efficient Products to the Federal Government and Federal Procurement Opportunities for "Green" Vendors. Both of them can be downloaded from the FEMP website.

- New Construction / Retrofits

The Federal government spends billions of dollars each year on new construction and major renovation projects (FEMP, 2000). These projects represent a great opportunity for the government to lead by example with energy efficiency, renewable energy, water efficiency, and other sustainable design principles. FEMP offers technical information about how to incorporate efficient technologies into the project, evaluate the life-cycle costs of investments, select an energy-wise design firm; and draft appropriate specifications.

FEMP has taken a leading role in promoting sustainable design by providing information and conducting training sessions. To help federal project managers consider sustainability at each step of the building delivery process, FEMP provides the guidebook, which is also available on the FEMP website, Procurement of Architectural and Engineering Services for Sustainable Buildings to maximize federal agencies' leverage to convert sustainable design principles into effective design practices.

- Operations and Maintenance

Operations and Maintenance is one of the most cost-effective methods for ensuring reliability, safety, and energy efficiency. Inadequate maintenance of energy-using systems is a major cause of energy waste in both the Federal government and the private sector. Energy losses from steam, water and air leaks, uninsulated lines, maladjusted or inoperable controls, and other losses from poor maintenance are often considerable (EERE, 2005). Good maintenance practices can generate substantial energy and dollar savings. Moreover, improvements to facility maintenance programs can often be accomplished immediately and at a relatively low cost.

FEMP aided operational efficiency represents the life-cycle cost-effective mix of preventive, predictive, and reliability-centered maintenance technologies, coupled with equipment calibration, tracking, and computerized maintenance management capabilities all targeting reliability, safety, occupant comfort, and system efficiency (EERE, 2005).

6.2 Program Impacts

The US government spends $9.5 billion in energy in all its operations and $3.9 billion to operate 500,000 buildings. Federal buildings represent 1.4% of all space in the country. They contain a full range of typical buildings, from office space and warehouses to a space launch center. FEMP goals are to reduce energy consumption 30% over a 1985 baseline by 2005 and 35% by 2010. Industrial facilities must reduce consumption 20% over a 1990 baseline by 2005 and 25% by 2010. There are also requirements to expand renewable energy use to be 2.5% of all energy purchases by 2005, implement water conserving practices in 80% of Federal facilities by 2010, and reduce greenhouse gas emissions 30% over a 1990 baseline by 2010.

6.3 Summary

According to the Office of Energy Efficiency and Renewable Energy under U.S. Department of Energy (DOE, 2005), through the implementation of FEMP, the federal government spent almost $4.4 billion for buildings and facilities energy during FY 2003, a 0.9 percent decrease ($38.4 million) from FY 2002 expenditures; the government reduced the energy intensity of its standard buildings by 24.8 percent in FY 2003 versus the FY 1985 baseline year; seven agencies, the Departments of Commerce, Defense, Energy, Justice, and Transportation, as well as the National Aeronautics and Space Administration and the Tennessee Valley Authority, achieved reductions of more than 25 percent in buildings energy use per gross square foot from 1985; carbon emissions from energy used in federal facilities declined 19.0 percent in FY 2003 as compared to FY 1990.

7. Renewable Energy Strategy: Toward Long-term Energy Change

The United States imports more than 50 percent of its oil, up from 34 percent in 1973. Renewable energy could help U.S. develop energy independence and security toward a sustainable energy development. Energy from renewable resources reduces the use of fissile fuels. Further development of renewable resources will also reduce emissions of pollutants that cause poor air quality.

We will provide an overview of the key policies that are driving renewable energy development in the U.S.: net metering, voluntary green power markets, renewable portfolio standards, and public benefits funds.

- Net Metering

Net metering is a policy aimed at encouraging customer-sited distributed generation by crediting the excess output of onsite energy systems. There are a wide variety of net metering laws and regulations in the U.S. In some states all utilities are required to net meter, while in other states, net metering is limited to certain types of utilities, or individual utilities. Net metering regulations also differ in the types of renewable resources that are eligible, the rate at which utilities buy back or credit excess generation, the amount of net metered capacity permitted in the state, and the maximum eligible system size (Forsyth et al., 2002; Hughes & Bell, in press). Despite utility resistance to the policy in some states, net metering has expanded rapidly around the country. In 1998, there were 22 net metering laws (Wan & Green, 1998). As of January 2005, the number of states with net metering had grown to 38 (UCS, 2004). Of those, 24 have statewide requirements, nine states require only one class of utilities (i.e. investor-owned utilities) to offer net metering, and five states have at least one utility that has established net metering independently. The regulatory framework for net metering remains dynamic, with frequent expansions and adjustments to regulations around the country.1

- Voluntary Green Power Markets

Responding to surveys that indicated customers would pay more for green power, utilities began to offer their retail customers green power at a premium in the 1990s. The success of these programs sparked the spread of voluntary green power offereings across

[1] These additions are tracked by the Interstate Renewable Energy Council in a monthly newsletter available at http://www.irecusa.org/connect/enewsletter.html

the country, and the US now hosts the world's largest and most active customer-driven green power market (Bird et al., 2002). The voluntary market consists of three distinct segments: green pricing, competitive green power products, and retail renewable energy credit (REC) sales. Green pricing refers to premium green power products offered primarily by regulated utilities. Over 500 utilities in 34 states have green pricing programs, and these programs have supported the development of 520 MW of new capacity (Bird & Swezey, 2004a, 2004b).

While many of these green pricing programs have emerged in response to consumer demand, five states require their utilities to provide customers with a green power option. Of the 17 states that have introduced retail competition, 9 have active green power marketers. These marketers either compete for retail electricity customers or sell green power in partnership with incumbent utilities. There is also a thriving market for RECs sold directly at the retail level, independent of utility-based products. Non-residential demand has emerged as an important driver for these RECs, with large customers using green power purchases to improve public image, reduce regulatory risks, meet corporate environmental goals, and differentiate their products (Hanson & Van Son, 2003; Holt et al., 2001). The competitive green power and retail REC markets have supported a combined total of 1,126 MW of new renewable capacity (Bird & Swezey, 2004b).

- Renewable Portfolio Standards

In addition to the voluntary markets, a number of states have mandated that utilities supply a baseline amount of green power to their customers. These policies, known as Renewable Portfolio Standards (RPS), establish a renewable energy procurement quota for utilities. As of January 2005, 19 states and the District of Columbia have enacted renewable portfolio standards, while another fifteen states are considering RPS regulation . No two laws share the same design characteristics, and some RPS regimes have performed better than others (Wiser et al., 2004). Generally speaking, however, there is a distinct trend towards stronger RPS policies and regional market integration. First, states are tending to require mandatory, rather than voluntary, compliance. Illinois and Minnesota, the only two states with voluntary targets, have their RPS regulations under review. Minnesota revised its RPS in 2003 so that utilities must develop compliance plans, while Illinois is considering a mandatory target of 10% by 2012 (DSIRE, 2005; HB 4479). Hawaii upgraded its voluntary goal of 9% by 2010 to a mandatory standard of 20% by 2020 in 2004 (Hawaii Energy Resources Coordinator, 2004).

Most other RPS states, aside from the six that enacted new standards in 2004/2005,2 also strengthened their laws, accelerated their compliance schedules, or proposed new targets during the last year. New Jersey, for example, accelerated its compliance schedule in 2004, and is currently considering an additional expansion to 20% by 2020 (Miller et al., 2004). Utilities in Wisconsin have over-complied with the current 2.2% by 2012 goal, and the state is considering an increase to 10% by 2015 (Governor's Task Force, 2004). California is also considering an accelerated RPS schedule. With one utility on track to meet its 20% requirement in 2004, the State is evaluating whether to accelerate its RPS schedule from 20% by 2017 to 20% by 2010 (Doughman et al., 2004). Though Texas accounted for 51% of the 2,335 MW of capacity installed in RPS markets (Petersik, 2004), it is likely that renewable installations will be more evenly distributed as new and strengthened RPS regimes mature during the next several years. The Union of Concerned Scientists (2005) projects that 25,550 MW of new renewable capacity will need to be added to the grid by 2017 to satisfy current RPS mandates.

Another sign of the growing maturity and momentum of state RPS policies is the trend toward regional coordination and integration. In order to minimize rate impacts, encourage supply diversity, and avoid conflicts with the U.S. Constitution's interstate

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[2] Colorado, District of Columbia, Maryland, New York, Pennsylvania and Rhode Island.

commerce clause, almost every RPS permits its utilities to procure renewable resources from neighboring states. As a result, regional markets for tradable renewable energy credits (RECs)[3] have emerged to facilitate compliance. To support these markets, regional authorities have developed credit tracking systems in the Northeast and Texas. Similar systems are also under development for the states of the West, the East Coast, and the upper Midwest (Porter & Chen, 2004; Wingate & Lehman, 2003). These systems will streamline compliance, facilitate the function of both the RPS and voluntary green power markets, discourage fraud, and encourage non-RPS states to develop resources for participation in regional RPS markets.

- Public Benefits Funds

Many states have supplemented their market-based renewable energy policies with direct incentives like production credits and rebates. These incentives are typically funded by a systems benefit charge (SBC) that is assessed for every kilowatt-hour (kWh) of electricity sold in the state. The revenues from these charges, which typically range between $0.001 and $0.003 per kWh, are collected in accounts known as public benefits funds (PBFs) (Kushler et al., 2004). These funds are then disbursed in support of energy efficiency, clean energy research, low-income household weatherization, and renewable energy projects. As of January 2005, there are 24 PBFs in the US, of which 14 have dedicated funds for renewable energy development. The total annual income of the renewable energy funds is close to $300 million, and the PBFs will spend $4.03 billion on renewables by 2017 (UCS, 2004b). At present, the majority of state spending has been in support of wind energy systems. In a survey of 163 utility-scale projects, 112 were wind projects. These projects accounted for over 60% of the $344 million obligated by 8 different funds over the past several years (Bolinger et al., 2004).

[3] Also known as Tradable Green Credits, or TGCs in Europe

8. Policy Design for a Sustainable Energy Future

While the United States is much more energy efficient today than it was 30 years ago, there is still significant potential for additional cost-effective energy savings and greater use of renewable energy. Well-established measures such as high-efficiency lighting and appliances are installed in less than one-quarter of feasible applications (Geller, 2003). Newer energy efficiency measures such as hybrid gasoline-electric vehicles have only begun to be adopted. A study estimates that increasing energy efficiency throughout the economy could cut national energy use by 10 percent or more in 2010 and approximately 20 percent in 2020, with net economic benefits for consumers and business (Interlaboratory Working Group, 2000)

Renewable energy sources, such as wind power, solar thermal and electric technologies, bioenergy sources, and geothermal energy, are rapidly improving in performance and declining in cost (Short 2002, Turkenburg 2000). Wind and solar photovoltaic (PV) power are the fastest growing energy sources in the world, and are forecasted to continue their rapid growth.

In sum, ample opportunities remain for the United States to increase energy efficiency and expand the share of renewable energy in its fuel mix. A next generation of policies will be needed to spur faster movement toward a sustainable energy future. A common menu for this purpose is the following (Geller, 2003).

- Increase passenger vehicle fuel economy standards
- Establish a national system benefits trust fund
- Adopt voluntary agreements to reduce industrial energy use
- Establish a renewable portfolio standard for power generators
- Adopt new appliance efficiency standards and stronger building codes

- Provide tax incentives for innovative renewable energy and energy-efficient technologies
- Expand federal R&D and deployment programs
- Remove barriers to combined heat and power systems
- Strengthen emissions standards on coal-fired power plants
- Establish renewable energy or carbon content standards for vehicle fuel

A menu that focuses on specific energy end uses and renewable energy options would include:

1). EnergyGuide and Energy Star

- Redesign EnergyGuide Label
- Extend EnergyGuide to More Products
- Display Quantitative Efficiency Information on Energy Star Products
- Establish an Automatic Specification Revision Process

2). FEMP

- Expanded use of O&M 'best practices' methods
- Increased green power purchase
- Greater use of sustainable design standards in new federal construction
- Increases role for CHP and DG to improve energy security

3). LEED for Neighborhood Development

- Healthier indoor air
- Decreasing energy and water consumption
- Decreasing utility bills

4). CAFE

- Raise overall fuel economy and safety- set all vehicles' fuel economy to at least 33 mpg by 2010, saving 2 million barrels of oil per day by 2020
- Encourage technology innovation - increased use of hybrid and other improved efficiency technologies

- Performance-based tax credits
- Apply Energy Star Labeling

5). IOF

- Expanded public-private partnerships
- Identify "Grand Challenges" — next generation manufacturing concepts often involve one or more core technical challenges
- Implement balanced portfolio of R&D, validation, dissemination
- Perform process-specific and crosscutting R&D to improve long-term energy efficiency

6). Renewable Energy

- RPS and SBC policies establish minimum public support levels for renewable energy supply.
- Through voluntary purchases, green pricing programs enable customers to support higher levels of renewable energy development.
- Financial incentives compliment other policy approaches by lowering production costs.
- Multi-dimensional policies that combine several proven tools are likely to result in the highest and most effective investments in a sustainable energy future.

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Appendix Framework of Energy Policy Policymaking in U.S.

1 Procedures

Energy-related laws, as others in the United States, have come through a very complicated cycle before legislation. Generally speaking, there are six distinct, if not entirely separate, stages in policymaking: agenda setting, policy formulation, policy legitimation, policy implementation, policy and program evaluation and policy change (Kraft, 2004: 67).

In the first stage, agenda setting, energy problems will be brought to attention of both public and government. Activities in this stage including perceive and define problems, develop public opinions, organize concerns and ideas for governmental actions. For policy formulation, scientific research would be conducted on the causes and consequences of problems, and possible solutions would be identified. Economic, technical, political and social assessments would be carried out at this stage. The following stage is policy legitimation, public meeting or hearings would be held during this stage. If both houses of Congress (The U.S. Senate and The U.S. House of Representatives) approve a bill, it goes to the President who has the option to either approve it or veto it. If approved, the new law is called an act, and the text of the act is known as a public statute. Once an act is passed, the House of Representatives standardizes the text of the law and publishes it in the United States Code, which is the official record of all federal law (U.S. EPA, 2005). Laws often do not include all the details; Congress then authorizes specific government agencies, such as the Department of Energy, or the Environmental Protection Agency to implement the policies. Usually this specific agency would translate the policy into a regulation or program for implementation. The proposed regulation is listed in the Federal Register for public comments. Based on feedback comments, the agency will revise the regulation accordingly until it reaches a final rule. Twice a year, each agency publishes a comprehensive report that describes all the regulations it is working on. Once implemented, an evaluation of policy and program would be conducted by congressional committees, internal agency review bodies, or environmental and industry interest groups (Anderson, 2000). The last stage in the cycle is policy change. In particular if the outcomes are not satisfactory, policies may be revised and another round of this cycle would be went through.

2 Inter-Governemntal Coordination

Several federal agencies are specifically oriented in energy-related policies. As a major agency in charge of energy issues, the Department of Energy (DOE) has authority for the major energy use statutes. The Office of Energy Efficiency and Renewable Energy (EERE) under DOE lead the Federal government's research, development, and deployment efforts in energy efficiency (U.S. DOE, 2005a). Program activities of EERE include energy efficiency for buildings, homes, industries, transportation, and power utilities. Once programs are initiated, regional offices of EERE catalyze the implementation of energy efficient and renewable energy strategies at the state and local level by working with states and communities to promote EERE programs, identifying and engaging community and state partners, and integrating EERE programs with public and private sector activities (U.S. DOE, 2005b).

In addition to the DOE, other cabinet departments have significant roles in energy policy. As all most energy use is related to the environment, the Environmental Protection Agency (EPA) has specific role in energy efficiency improvement. As a matter of fact, the Energy Star Program is a joint effort of DOE and EPA. The Department of Transportation (DOT) also has a comparable effect on energy efficiency through their implementation of research and management programs dealing with mass transit, highways, oil pollution, and coastal zones such as the CAFÉ standards. Executive offices of the president – the Council on Environmental Quality, Office of Management and Budget, Council of Economic Advisors, and Office of Science and Technology Policy – are also regular participants in formulating and implementing energy efficiency policies.

Federal government promote energy efficiency and conservation by including the dissemination of timely and accurate information, setting standards for products, and encouraging industry to develop more efficient products. Besides, federal government also goes through programs and search for more innovative technologies that improve efficiency and conservation through research and development. The Department of Energy can raise the minimum energy efficiency standards if certain criteria are met, such as cost, technological feasibility, and the impact on competition among appliance manufacturers. In addition, the Department can set energy efficiency standards for appliances not covered by these laws (Cheney et al., 2001: 4-1).

The existing Federal regional office structure was established in 1969 during the Johnson administration. This structure included 10 regions covering the 50 States and U.S. territories. The 10 regions are divided into New England; the Northeast and Caribbean; the Mid-Atlantic; Southeast; Great Lakes; Heartland; Greater Southwest; Rocky Mountain; Northwest Arctic; and Pacific Rim (U.S. Congress, 2002). Regional federal governments work closely with local officials to help the problems is forwarded efficienciently to high officials at the federal level.

3 Federal vs. State and Local Policy-makings

The American administrative system is a much decentralized one. While federal government make national laws and regulations, state and local governments are also formulate their own state laws and energy efficiency programs. The New York state has launched energy efficiency programs through its New York State Energy Research and Development Authority (NYSERDA). Vermont has several energy efficiency projects including Efficiency Vermont, Residential Building Energy Standards (RBES code), Commercial Building Energy Standards Development, Act 250 Energy Review and Vermont Gas Systems. State and local governments have unique opportunities for energy savings in schools, transportation, state buildings, and building codes. The state and local partnerships that take place through the Regional Offices is the primary vehicle through which the Department of Energy meets the needs of individual citizens, cities, counties, and states across the nation.