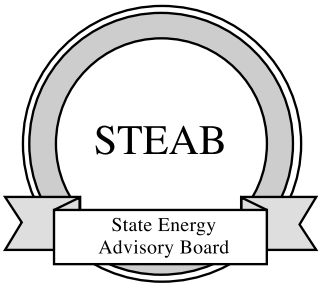
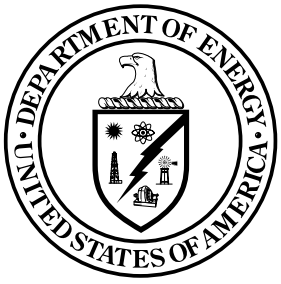
Tenth Annual Report of the State Energy Advisory Board
U.S. Department of Energy

Homeland Security: Safeguarding America's Future With Energy Efficiency and Renewable Energy Technologies

August 2002





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EXECUTIVE SUMMARY

The State Energy Advisory Board (STEAB) presents this 10th annual report following the one-year anniversary of the September 11, 2001 terrorist attacks on the World Trade Center and the Pentagon. This event has had profound impacts on all segments of American society, not the least of which is this country's energy sector. Long before September 11, a number of energy issues grabbed the nation's attention, including opening the Arctic National Wildlife Refuge to oil and natural gas exploration, the power crisis in California, nationwide natural gas and gasoline price increases, and the administration's May 2001 *National Energy Policy*. However, the events of September 11 refocused attention on the prominent role energy plays in the country's homeland security. For the most part, the energy aspects of homeland security have focused on the physical security of critical energy emergency planning and energy infrastructure, such as power plants, refineries, and power and fuel transmission systems. While STEAB recognizes the importance of protecting our existing energy infrastructure, this should not be the sole focus of homeland security as it relates to energy.

The country needs to move beyond the question of "How do we protect our energy infrastructure?" to "How do we make our energy infrastructure more resilient and less vulnerable?" Developing of a balanced and diverse national energy portfolio is the best way to answer this new question, and increased emphasis on energy efficiency and renewable energy technologies is the best way to achieve a balanced and diverse national energy portfolio.

In this report, STEAB offers an overview of America's existing natural gas, oil, and electric infrastructure. This overview provides a glimpse of choke points in the nation's energy infrastructure and demonstrates how energy efficiency and renewable energy technologies can break down these choke points to add resilience and reliability. Technologies such as fuel cells, Stirling engines, combined heat and power applications, and micro-turbines as well as renewable energy resources like wind, solar, geothermal and biomass all add to the reliability of our energy system. These technologies are well suited to distributed generation applications, which adds resiliency. Ultimately, effective use of energy efficiency and renewable technology adds up to a more secure homeland.

STEAB maintains that energy efficiency and renewable energy technologies offer the most cost-effective, short- and long-term routes to a safer, more reliable and more resilient energy infrastructure. Development of an abundant domestic renewable resource base provides important energy diversity, protects the environment, protects public health, and promotes economic development, while making our country's energy systems less vulnerable. A secure America requires an energy policy that reflects creative and innovative use of all of America's energy resources. This can be achieved through sustained investments in America's traditional centralized energy technologies, as well as energy efficiency and renewable technologies. STEAB proposes the following priorities and recommendations for the Department of Energy's (DOE) Energy Efficiency and Renewable Energy programs.

Priorities and Recommendations

STEAB recommends that Congress and the Administration promote energy security by expanding the available portfolio of energy resources and involve not only the federal government, but state and local governments as well. STEAB suggests that the following programs and initiatives should be considered priorities. They offer the most effective means for Congress, the Administration, and DOE to foster growth and diversity in the nation's energy portfolio through energy efficiency and renewable energy, and to ultimately secure the nation's energy future.

1. **State Energy Program (SEP) and SEP Special Projects**: Two of the most important mechanisms by which state energy offices deliver energy efficiency and renewable energy programs and technologies to their citizens.

2. **Weatherization Assistance Program (WAP)**: Insulates America's most vulnerable populations against energy disruptions and other crises.

3. **EERE Regional Offices (ROs)**: An extremely valuable resource for states to communicate with DOE.

4. **Homeland Security**: A diversified energy portfolio that includes significant levels of energy efficiency and renewable energy technologies, so that America's security is never at risk because of a threat to or loss of one of the more traditional sources of energy.*

5. **FreedomCar and Transportation Initiatives**: Existing technology and attainable goals for renewable fuel-powered fuel cell and hydrogen technologies.

6. **Hydrogen**: Hydrogen research and development (R&D) efforts that include important sectors such as transportation, distributed energy and fuel cell development, with particular attention to developing hydrogen from renewable sources.

7. **Federal Energy Management Program (FEMP)**: FEMP use of existing technology to reach attainable goals for introducing energy efficient and renewable technologies in federal buildings, and seizing opportunities to work with state governments to improve the efficiency of state government facilities.

8. **Industries of the Future (IOF)**: Expansion of IOF categories to include the service sector and the small business community.

9. **Regional Biomass Energy Program**: Restoration of this program as a means of developing biomass energy resources, with the goal of reducing dependence on imported fuels.

10. **Distributed Energy Resources (DER)**: Renewable DER as an attainable goal to achieve a penetration rate of 20 percent of expected new generation capacity by 2010.

11. **Buildings Program**: Initiate a sustained public education program for energy efficiency, as recommended by the Administration's National Energy Policy Development Group.

12. **EnergySmart Schools Program**: Not only can this program save schools money on energy costs and improve the learning environment for students, but it can also turn schools into living laboratories promoting energy efficiency and renewable energy.

* STEAB supports the Administration's Homeland Security objective of tearing down unwarranted "stovepipes" within the federal government. Consistent with this overall objective, but largely unrelated to security concerns, the proposed reorganization of DOE's Office of Renewable Energy and Energy Efficiency (EERE) looks promising. Although the time line suggested to achieve this reorganization is aggressive, STEAB recommends that the reorganization be fully funded. EERE is encouraged to update STEAB on the status of the reorganization after the first year of implementation. The expertise within STEAB can help EERE evaluate midcourse progress and provide invaluable input on refinements to further enhance the effectiveness of the reorganization.

I. INTRODUCTION

Homeland security is of paramount importance to Americans. On September 11, 2001, the energy priorities of our nation changed in significant and largely unanticipated ways. Terrorists struck on American soil, crashing hijacked commercial airliners into New York's World Trade Center complex and the Department of Defense Headquarters at the Pentagon in Washington, D.C. More than 3,000 Americans lost their lives as a result. For the second time since STEAB was created in 1990, the United States of America is at war.

As with the Gulf War in 1990–1992, the implications for U.S. energy policy are far-reaching. This relatively new threat of terrorism at home has forced the U.S. Congress and the Administration to carefully scrutinize our energy infrastructure. Heightened security concerns have exposed the vulnerability of the energy infrastructure. Government officials at the local, state, and federal levels will never look at a large centralized power station quite the same way again.

Homeland security has become the responsibility of numerous agencies within the federal, state, and local government. A new cabinet level Department of Homeland Security is slated to begin operation in 2003. One of its principal responsibilities will be to plan and coordinate national energy security—physical security of critical energy emergency planning and energy infrastructure, such as power plants, refineries, and power and fuel transmission systems.

Few will argue against the fact that the nation's exposed energy infrastructure and growing oil dependence present sizeable security risks to our citizens and our economy. On the White House South Lawn in February 2002, President Bush acknowledged that dependence on foreign oil is a matter of national security, and that investments in new technologies are the best way to address this dependence, especially in the transportation sector. Believe it or not, we are actually more dependent on foreign oil today than we were in 1973. We now import close to 60 percent of our petroleum. This dependence on foreign oil imposes staggering direct and indirect costs to American consumers. For example, the Washington, D.C.-based Sustainable Energy Coalition estimates that the United States spends $50–$70 billion annually on the military expense of protecting Middle Eastern oil shipping lanes.

It took more than the events of September 11, 2001 to bring national energy policy to the forefront again. The Administration's proposal to open the Arctic National Wildlife Refuge to oil and natural gas exploration; increased tensions in the Middle East that directly and indirectly threaten U.S. oil supply channels; a slowing U.S. economy; the widely publicized power crisis in California; electricity reliability concerns in New England, the Mid-West, and Pacific Northwest; and gasoline and natural gas price increases played major roles as well. The effects of these issues culminated in the release of the Administration's *National Energy Policy* in May 2001. This year, the U.S. House of Representatives and U.S. Senate each passed energy legislation that addressing our country's energy needs, and they are currently reconciling the differences between the two bills.

DOE has a vital role in addressing these energy security functions, as does each state. It is essential for Congress and the Administration to work in conjunction with DOE and the states to critically evaluate all energy resource options and make critical choices to support those

efforts that best serve our national energy security interests, protect our environment, enhance public health, and promote local economic development.

To meet these needs, there must be unwavering support from this country's leadership for energy efficiency and renewable resources and technologies. This level of support is essential to a strong and, by definition, diverse energy portfolio. There is strength in diversity, as U.S. investors learned this year.

Long before the September 11 terrorist attacks, state energy offices developed formal plans to respond to energy emergencies. Under DOE's State Energy Program (SEP) and predecessor programs, states have had energy emergency plans in place for more than a decade. In 1998, the Atlanta Regional Office of DOE's Office of Energy Efficiency and Renewable Energy (EERE) published model guidelines for incorporating energy emergency plans. SEP continues to play a critical role in helping states with their energy programs. DOE, in coordination with state energy offices and other state and local agencies responsible for energy and emergency planning, must continue to enhance the role of energy efficiency and renewable energy in meeting the nation's homeland security challenges.

Emergency Energy Supplies

Solar-electric/battery and wind/battery systems can be used for stationary and mobile emergency applications as uninterruptible power sources. In natural disaster situations, such as the 1992 Northridge, California earthquake and Hurricane Andrew, these systems are uniquely suited to provide power when conventional sources have been crippled. Typical applications include powering critical infrastructures such as emergency control centers, medical facilities, and communications substations.

Source: National Renewable Energy Laboratory, "Strengthening Our Energy Security – A Sampling of Renewable Energy Technologies." February 2002

It is the charge of STEAB to develop recommendations for the U.S. Congress and Administration officials regarding energy efficiency and renewable energy policy. This 10th annual report provides perspective for a time such as this, when unique and almost unbelievable events have converged. STEAB strongly urges the U.S. Congress and the Administration to seek out the national security benefits associated with a sustained increase in energy efficiency and renewable energy research, development and deployment. Energy efficiency and renewable energy technologies have critical roles to play in the security of America's energy infrastructure and energy resources, including:

- Reducing our dependence on imported fuels
- Improving the reliability and resilience of our power supply
- Distributing our generation facilities
- Increasing the flexibility of our energy supply
- Providing more generating options for a diverse energy base
- Decreasing our demand for electricity
- Strengthening other infrastructures

Letters From The Trenches: How California Survived An Energy Crisis By Using Energy Efficient and Renewable Technologies

In 2001, California was facing a massive shortage of energy resources. Mobilizing a diversified energy portfolio, California weathered the storm and demonstrated that energy efficiency and renewables technologies are a complement to traditional energy resources.

To meet the challenges of summer 2001, California undertook a statewide, multi-agency effort to reduce peak demand by 5,000 MW. By June 2001, California had 5,570 MW of demand reduction in place, with an additional 3,200 MW available through voluntary, temporary curtailments. As of October 2001, about 6,360 MW of demand reduction were achieved, attributed to demand responsive and rebate programs (3,743 MW) and voluntary conservation (2,626 MW). An additional 200 MW were realized in peak reduction from measures mandated in new construction by the summer of 2002, with that number growing by an additional 200 MW annually. The record reduction of summer peak demand was recorded in June 2001—14 percent of the previous year's peak.

California adopted a portfolio approach to accomplish the most aggressive and comprehensive energy efficiency and conservation effort in the State's history. Six major initiatives comprised the strategy. They were:

- Incentive programs
- Energy conservation media and education campaigns
- Voluntary efforts
- 20/20 program
- Building efficiency improvements
- State facility improvements

A recent report by researchers at Lawrence Berkeley National Laboratory, *California Customer Load Reductions During the Electricity Crisis: Did They Help Keep the Lights On?*, documents that a preexisting energy efficiency services infrastructure can help policymakers respond quickly to short-term power shortage emergencies. California had spent years promoting energy efficiency and renewables technologies as a complement to traditional energy resources and, therefore, had policies and programs in place to deal with the crisis. America should expect no less from the federal government.

While each state is in the best position to determine which technologies are best suited to the demographics, climate, and energy needs of its population, the federal government plays the largest role in determining whether technology will be developed and deployed. The national laboratories are a prime factor in this equation.[1]

States are already doing their part. The network of state energy offices has become an important element of our national energy scene. State energy office programs match energy innovations to local conditions and economies. The state energy offices are naturally suited to crafting, testing, and demonstrating solutions to today's energy security challenges. States also are important laboratories and learning vehicles for an array of policy initiatives and innovative programs that could be replicated at the state and national levels.

[1] The wind turbine is one of the products that successfully made it from DOE national laboratories to the marketplace. The cost of generating a kilowatt-hour of electricity with wind turbines over the last 15 years has fallen from 35 cents to 4 cents because U.S. government officials worked closely with industry to set priorities and goals. STEAB urges the Bush Administration to fund additional collaborative research like that managed by DOE's wind program.

II. REFRAMING THE DEBATE—HOMELAND SECURITY: A NEW PARADIGM

The horrific events of September 11, 2001 attacked America's way of life and redefined the premise for developing energy resources. No longer is the question "How do we protect an aging energy infrastructure through increased law enforcement and protection of energy facilities?" We must now answer the question, "How do we make our energy infrastructure more resilient and less vulnerable through investments in existing energy efficiency and renewable energy technologies?" The answer has both short- and long-term ramifications.

Where Are We Now? America's Traditional Energy Infrastructure

The traditional energy infrastructure in America consists primarily of natural gas, petroleum, and electricity. Each of these is essential to the day-to-day operation of business and industry, as well as to the home and recreational activities that Americans have come to enjoy.

How do these energy sectors really work? The following overview of the country's existing natural gas, oil, and electric infrastructure provides a glimpse into choke points in the nation's energy infrastructure. Only by acknowledging these weaknesses can policy makers interested in creating and strengthening homeland security begin to understand the importance of energy efficiency and renewable technology to a secure America.

Natural Gas and Petroleum

Pipelines transport the bulk of natural gas, crude oil, and petroleum products in the United States. Specifically, pipelines carry nearly all of the natural gas and about 65 percent of the crude oil and refined oil products. Three primary types of pipelines form an oil and natural gas network of nearly 1.4 million miles.

1. Natural gas transmission pipelines transport natural gas over long distances from the source to communities nationwide. These pipelines—about 270,000 miles—are primarily interstate.[2]
2. Natural gas distribution pipelines continue to transport natural gas from transmission pipelines to residential, commercial, and industrial customers. These pipelines—about 952,000 miles—are primarily intrastate.[3]
3. About 156,000 miles of primarily interstate pipelines transport crude oil to refineries and transport refined oil products, such as gasoline, to product terminals and airports.

In addition, pipelines include several components that aid in the collection and transportation of products. For example, gathering pipelines collect natural gas or crude oil from producing wells and carry the product to a natural gas transmission or hazardous liquid pipeline. Compressor stations (for natural gas) and pumping stations (for liquids) keep the product flowing smoothly.

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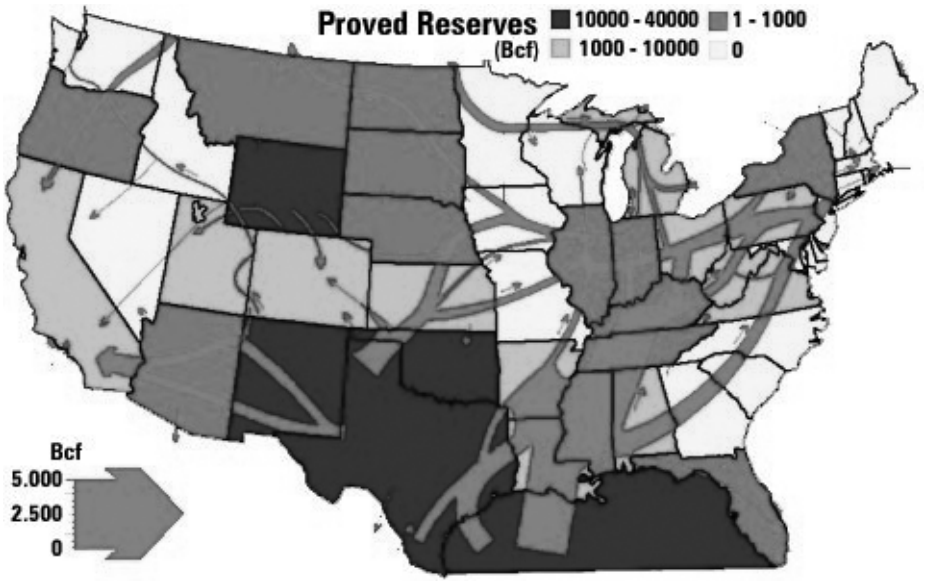
[2] National Petroleum Council, *Meeting the Challenges of the Nation's Growing Natural Gas Demand, Summary Report, p. 49. Washington, D.C., December 1999.*

[3] *Ibid*

Natural Gas

Approximately 1.22 million miles of pipelines now supply natural gas to over 175 million industrial and residential customers. The volume of gas moved through this system of pipelines is projected to grow at over 2 percent per year, from presently around 22.8 trillion cubic feet to over 34 trillion cubic feet by 2020.[4] With gas demand in the United States expected to grow by over 50 percent by 2020, and an increasing dependence of electricity generation on natural gas, the nation's natural gas infrastructure, including storage, is a critical link to energy reliability. Consolidation and competition within the natural gas industry have resulted in industrial research and development (R&D) being focused on near-term projects that offer immediate pay back.

As the figure below illustrates, the majority of the natural gas consumed in the United States is produced at remote sites, especially the Gulf coast and the Rocky Mountains. About 15.4 percent of the natural gas consumed in the United States, or 3.5 trillion cubic feet,[5] is imported, with Canada being by far the largest source of imported natural gas.



An expansion of the existing infrastructure will be required to accommodate the projected growth in demand for natural gas. The National Petroleum Council predicts that roughly 40,000 miles of new gas transmission lines and almost 275,000 miles of distribution mains will be needed by 2015. This new infrastructure will be needed to move gas from remote sources being developed, like deep water supplies in the Gulf of Mexico and coal bed methane production in the Rocky Mountains.

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[4] Energy Information Administration, *Annual Outlook 2002 with Projections to 2020.* (http://www.eia.doe.gov/oiaf/aeo/index.html)

[5] *Ibid*

Gas storage is an integral part of the nation's natural gas transmission system. Existing storage facilities represent roughly four trillion cubic feet of storage capacity for deliverability. This storage allows peak loads in excess of pipeline capacity to continue receiving service, typically during the winter and, more recently, summer months.[6] From April to November each year, operators inject excess summer production into approximately 410 storage reservoirs across the country. Most of these facilities are located near major eastern and mid-continent markets. They account for almost four trillion cubic feet of storage capacity, or over 15 percent of one year's national gas consumption.

This storage system serves the market place in several ways. Most importantly, it allows consistent delivery of natural gas resources to consumers. Second, it stabilizes supply by sustaining production levels in the summer and eliminating shortages in the winter. Third, it eliminates the need for expensive, additional pipeline transmission capacity that would be necessary to supply peak demand.

Oil

U.S. petroleum consumption is projected to increase by 6.9 million barrels per day between 2000 and 2020. Most of the increase is in the transportation sector, which accounted for two-thirds of U.S. petroleum use in 2000. In studies of petroleum use for transportation purposes, petroleum use increases by 6.0 million barrels per day in the reference case, 4.9 million barrels per day in the low economic growth case, and 7.1 million barrels per day in the high economic growth case. In the industrial sector, which currently accounts for 25 percent of U.S. petroleum use, consumption in 2020 is projected to be higher than in 2000 by 1.3 million barrels per day. About 95 percent of the growth is expected in the petrochemical, construction, and refining sectors. Petroleum used for heating and electricity generation is expected to decline as oil loses market share to natural gas for both uses, and to electricity for heating.

For electricity generation, oil-fired steam plants are being retired in favor of natural gas combined-cycle units. About 94 percent of the projected growth in petroleum consumption stems from increased consumption of "light products," including gasoline, diesel, heating oil, jet fuel, and liquefied petroleum gases, which are more difficult and costly to produce than heavy products. Although refinery investments and enhancements are expected to increase the ability of domestic refineries to produce light products, imports of light products are expected to more than triple by 2020. Gasoline continues to account for almost 45 percent of all petroleum used in the United States. Between 2000 and 2020, U.S. gasoline consumption is projected to rise from 8.5 million barrels per day to 11.8 million barrels per day. Consumption of distillate fuel is projected to be 1.7 million barrels per day higher in 2020 than it was in 2000, with diesel fuel accounting for 94 percent of the projected increase, as demand for freight transportation grows. With air travel also expected to increase, jet fuel consumption is

[6] Natural gas is stored in two basic ways – compressed in tanks as liquefied natural gas (LNG) or in large underground storage facilities such as depleted gas wells, salt or rock caverns, abandoned mines, and aquifers. The greatest volume of gas is stored by this second method, usually in depleted gas wells. New storage technologies include lined rock caverns, refrigerated mined caverns, and basalt aquifer storage.

projected to be 1.1 million barrels per day higher in 2020 than in 2000. Consumption of other petroleum products—including petrochemical feedstocks, still gas used to fuel refineries, asphalt and road oil, and other miscellaneous products—is projected to grow by 1.2 million barrels per day. Consumption of liquefied petroleum gas (LPG), included in "other" petroleum, is projected to increase by about 482,000 barrels per day between 2000 and 2020. Residual fuel use is projected to decline from 1.1 million barrels per day in 2000 to 750,000 barrels per day in 2020. Most of the projected decline is in residual fuel use for electricity generation.

Natural Gas and Oil Infrastructure Security

Numerous reports have highlighted general security issues for the nation's gas and oil infrastructure.[7,8] Gas and oil pipelines are generally buried and often are hardened to withstand normal operating conditions and natural events. However, specific critical components of the infrastructure are potentially vulnerable. These include some storage facilities, compressor/pumping stations, city gates, and supervisory control and data acquisition (SCADA) systems. Both industry and government are addressing these security issues to assure the continued security and reliability of the nation's gas and oil infrastructures.

The National Energy Policy Report of the National Energy Policy Development (NEPD) Group concluded that recent natural gas system failures highlight the need to develop technologies and policies that protect people, the environment, and the safety of the nation's energy infrastructure.

> The federal government has an important role in ensuring and improving the safety of the nation's energy infrastructure. New technologies need to be developed to improve monitoring and assessment of system integrity, improve data quality for system planning, extend the serviceability and life of the national natural gas transmission and distribution network, provide safer transport of energy products, and lessen the impacts of the energy infrastructures on the environment.

The NEPD Group recommends that the President support legislation to improve the safety of natural gas pipelines, protect the environment, strengthen emergency preparedness and inspections, and bolster enforcement. The NEPD Group also recommends that the President direct agencies to continue interagency efforts to improve pipeline safety and expedite pipeline permitting in an environmentally sound manner, and encourage the Federal Energy Regulatory Commission (FERC) to consider improvements in the regulatory process governing approval of interstate natural gas pipeline projects.

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[7] *Securing Oil and Natural Gas Infrastructures in the New Economy*, National Petroleum Council, June 2001.

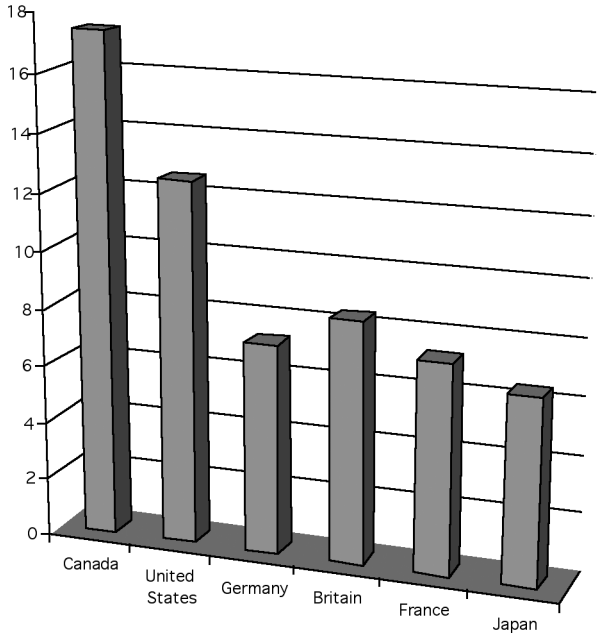
[8] *Making the Nation Safer: The Role of Science and Technology in Countering Terrorism*, Committee on Science and Technology for Countering Terrorism, National Research Council.

Electricity

Dynamic change is occurring in the electric industry. Developments at every level, including federal, state, and regional, continue to emphasize the complexity and the importance of electricity to the United States. Americans use electricity every day in residential, commercial, and industrial applications. It is a key building block for trade and commerce.

The critical nature of electricity reinforces the need to address this energy resource as part of a diversified energy portfolio. The efficient use of electricity is as critical as the development and delivery of new generation. The continued development of aggressive energy efficiency programs will reduce an out-of-balance reliance on any single energy resource. Increased energy efficiency will help reduce the need to build new generation and infrastructure to deliver electricity, and will help reduce the energy intensity of the U.S. economy.[9] The chart below illustrates the energy intensity for the United States as compared with other select countries.

Energy Intensities of the U.S. and Competing Countries 1999



Source: 2002 Iowa Comprehensive Energy Plan Update, Iowa Department of Natural Resources, Graph 13, p. 21 (derived from EIA International Total Primary Energy and Related Information 1999; EIA International Gross Domestic Product Information 1999).

[9] Energy intensity shows the relationship between total energy consumption and real gross economic output. It represents how much energy is used to produce a dollar's worth of output. Energy intensity is calculated by dividing total energy use by the gross domestic product. Lower energy intensities are usually more desirable because they suggest a more efficient economy in which less energy is needed to produce a dollar's worth of output. Over time, this is a useful measure to estimate how well an economy has been able to reduce the amount of energy needed to produce an equivalent dollar amount of economic output. Canada is the most energy intensive country, followed by the United States. The U.S. economy consumed 94 percent more energy per dollar of output than Japan.

Policymakers must find ways to reduce energy intensity in the electricity sector because delivery systems in many areas are nearly at their limit. Many of these systems are vulnerable to disruptions and are difficult and expensive to expand and improve. Yet, opportunities clearly exist to improve delivery systems.

The expansion of energy efficiency and demand-side management programs can relieve the load on the generation and interstate transmission system to improve reliability and allow room for further growth with new generation systems.[10] This will do little to reduce system vulnerability, but with appropriate policy decisions, can serve as a way to reduce system reliability issues.

Continued attention also is needed to address and improve the operation of the nation's transmission network. National energy security depends upon the ability to develop the nation's abundant energy resources and efficiently deliver that energy to the point of end use. Originally, electric transmission systems were designed to allow neighboring utilities to improve electricity generation reliability through load sharing. Subsequently, it was discovered how interdependent and vulnerable the interstate transmission system is. Currently, much of the interstate transmission system is close to design limits because of current market activity and is inadequate to support an increasingly competitive and broadening electricity market. Moreover, the natural gas and electric transmission infrastructure is old and poorly maintained. The following table shows the per-mile cost to install or rebuild electric transmission lines of various voltages using conventional technology. Substantial capital investment is and will be required to maintain and expand the existing system, unless a more economical solution is found to improve the electric transmission system.

Construction Costs of New and Rebuilt Transmission Lines

	Cost Per Mile [1,2]	
Voltage Level in kV	New	Rebuilt [3]
69	$185,000	$122,000
115	$235,000	$155,000
138	$250,000	$165,000
161	$270,000	$178,000
230	$295,000	$195,000
345	$425,000	$281,000

Notes:
1. Based on construction in rural areas.
2. Add 50 percent to cost in urban and suburban areas
3. Rebuilt costs are assumed to be 66 percent of the new cost

Source: *Delivering 2,000 MW of Wind Energy to the Metropolitan Centers in the Midwest*, March 2002, Iowa Department of Natural Resources, p. 16, Tom Factor, Iowa Wind Energy Institute and Tom Wind, P.E. Wind Utility Consulting.

[10] IUB Report titled "Facts Concerning the Consumption and Production of Electric Power in Iowa", August 2000, page 67.

In creating a diverse energy portfolio that includes electricity resource, policymakers must contend with key issues, such as:

- Transmission constraints have contributed to electricity disruptions in several states. Electricity supply reliability issues have been a major concern as well. Problems experienced in California in 2001 demonstrated the difficulties in moving power effectively across large regions. Recent problems experienced in New York City, such as the loss of a transformer that resulted in a loss of power for lower Manhattan, highlight how sensitive the transmission network may be to isolated events.
- Regional Transmission Organizations (RTO) will be responsible for operating the national transmission infrastructure. They are currently in varying stages of development. This has resulted in uncertainty about how efficiently the nation's transmission system will be operated in the future, which adds uncertainty to the planning for new resource development.[11]
- Upgrades to the existing transmission network or the addition of new facilities require financing. The lack of certainty regarding future operational requirements and the mechanisms for repayment has limited investment in new transmission.
- The lack of consistent interconnection standards limits the ability to connect new resources, and results in uncertainty for transmission owners regarding adequacy of transmission resources. Work continues on the development of interconnection standards to facilitate the connection of new distributed and renewable energy generation facilities to the transmission network.[12]
- Major renewable energy resources exist that have been largely untapped to date. These resources typically are not located near the load centers that are experiencing the greatest load growth. For example, the Upper Great Plains is well recognized for the wind energy potential in the region. The states in that region with the greatest development potential are experiencing low growth in electricity demand. Load centers such as Minneapolis and Chicago are experiencing extremely high growth in demand. Those high growth areas have significant environmental issues to address, partly as a result of population growth. Texas is rich with wind resources, but they are located in remote areas as well. The development of environmentally sound renewable energy resources that can be delivered to satisfy new load growth in these areas would address multiple priorities. Unfortunately, the transmission network has only sufficient reserve capacity to achieve minimal increases in electricity transport.

[11] On July 31, 2002, the Federal Energy Regulatory Commission issued a Notice of Proposed Rulemaking that is designed to further competition in the electricity sector. *Remedying Undue Discrimination Through Open Access Transmission Service and Standard Electricity Market Design*, Docket No. RM01-12-000. FERC stated its intent to "remedy undue discrimination, enhance competition, remove economic inefficiencies and ensure just and reasonable rates, terms and conditions (*sic*) transmission of electric energy …" Ibid. at 4. One of the primary goals of the proposed rule is "to standardize wholesale electric market design" so that customers can "receive the benefits of lower-cost and more reliable electric supply." *Ibid*. at 6.

[12] *Ibid*.

Electricity Security

National energy security planning must address how to effectively diversify energy supplies and eliminate or secure protection of system choke points that present security threats to the integrity of the national grid. Changes to the electricity infrastructure must reflect federal, regional, and state identification and elimination of transmission constraints that restrict the ability to develop renewable energy resources.

- RTO development must include mechanisms to ensure that new renewable energy resources can be brought on line and are not disadvantaged as a result of the rates and cost for transmission service.[13]
- Reasonable interconnection standards should be established and implemented as soon as possible to provide certainty both for existing system operators and for renewable and distributed generation developers.
- Financial mechanisms must be established that provide financial certainty and guarantees of financial recovery of transmission investments.[14]

Improving and expanding the existing electricity generation and transmission system to meet competition and future growth of electricity supply should be considered in determining the range of options to increase the nation's energy portfolio. However, it is clear that the existing system will not support future needs and is not secure against regional power disruption.

The seemingly simple solution of upgrading and expanding the existing transmission network may not be the best and most economical way to go. The electric transmission system in many areas has reached the limit of its design capacity and will not support significant future increases. Consequently, the expansion of an increasingly interdependent and already vulnerable system seems to be a poor choice without the application of costly safeguards.

The reliability of the nation's electric system can be significantly improved through cost-effective investment in load management, efficiency and distributed generation. These investments would also create efficient and competitive electricity markets, and lower the cost of service.[15] In addition, effective efficiency programs can reduce the need for new and costly transmission and distribution infrastructure.

Consideration should be given to alternatives to the traditional centralized electricity generation and transmission system that should improve the security and reliability of interstate electricity service.

- Reducing existing system loads by more effectively using electricity and by maintaining (not expanding) the existing system. Although this option eliminates many of the disadvantages of simply improving and expanding the existing generation

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[13] The application of system-wide "postage stamp" rates should be considered as a means to eliminate pancaking of rates that add unnecessarily to the delivered cost of renewable energy. The development of system-wide "postage stamp" pricing is one such mechanism, ensuring cost recovery.

[14] Only through the provision of certainty of financial recovery will investments be made for new transmission infrastructure.

[15] *See* Distributed Resources and Electric System Reliability, Cowart, Richard, 2001, p. 32.

and transmission system, it also falls short of the mark to secure against regional power disruption. This alternative could serve as an interim step toward the following option.

- Development of a decentralized generation and transmission system, including distributed generation and a micro-grid system.[16] Ultimately this should reduce significant dependence on the existing centralized generation, macro-grid system. This alternative eliminates the regional interdependency of the existing grid, is secure against regional power disruption, and is often much more efficient. For example, the efficiency of a typical power plant is about 35 percent. The electric generation efficiency of small fuel cells can be 50 percent and generate heat that can be used on site, thereby further raising the overall efficiency.

The Future: A Diverse Energy Portfolio

Homeland security requires strategic planning and technology development. Energy efficiency and renewable energy technologies must play a key role as part of America's energy resource arsenal. Energy efficiency and renewable energy technologies must be included in all future homeland security initiatives.

STEAB urges the U.S. Congress and Administration officials to commit to innovative energy technology. Shell Oil and British Petroleum (BP), two major international energy companies, have taken the lead among energy industry giants to reshape the energy landscape.

Shell Oil, known as the best strategic planning organization in the world and one of the most profitable companies in the world, is investing billions of dollars in solar energy because it believes renewable energy is the future. BP is doing the same. To its credit, BP's marketing department recently implemented the concept that BP means "Beyond Petroleum." An entire advertising campaign has been launched to influence the thinking of Americans about the corporate focus of BP.

Over the years, STEAB has supported the call for independent energy research and applied research, conducted in collaboration with leading companies that are likely to commercialize new technologies and penetrate existing and new markets. Homeland security requires that Congress and the Administration make budget decisions in FY 2004 that maximize the likelihood that products will make it "from the shelves" of national laboratories to the marketplace. In addition, STEAB urges the federal government to develop renewable resource assessments on the state and regional levels. These resources are just as critical to our energy reserves as oil, natural gas, or coal.

Federal Leadership Required: Investing in the Marketplace

Federal leadership is essential to an effective partnership with the states in the effort to

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[16] An improved generation and transmission system is needed to meet market demand and to guard against the probability of threats that could affect service to large areas of the country. Through distributed generation, it may be possible to avoid the costly upgrades to the transmission system noted above. Distributed generation can relieve system overload.

complement America's use of fossil fuel-based energy resources with energy efficiency and renewable technologies.

Most electric utilities are experimenting with energy efficiency and renewable energy technologies through a host of business strategies, including green power pricing, time-of-day pricing, smart metering, flexible pricing for large customers, and diversification into non-regulated energy service businesses. However, they are not mainstreaming these technologies.

Additionally, electric utility restructuring in the states has stalled in all but a few cases, due in part to the recent energy company accounting scandals. Kurt Yeager, chief executive officer for the industry-funded Electric Power Research Institute, recently said, "[w]e do not have deregulation today. We have reregulation." Mr. Yeager added, "[w]e believe we could put an energy infrastructure in place over the next decade that could increase the productivity and efficiency of the U.S. energy system by at least 30 percent, with a similar level of pollution reduction. This would be achieved not through stringing more wires around the country but by applying the technology we have available to us today to the existing infrastructure. This would enable distributed generation to become an integral part of the infrastructure."

Efficiency Programs in Massachusetts Save Electricity

While energy efficiency programs are often referred to as "investments", they usually cost substantially less than new energy supply. For example, the State of Massachusetts invested $159 million in energy efficiency programs in 1999, and calculated that the cost of conserved (saved) electricity was 4.2 cents/kWh, compared to the average retail price of electricity of 10.2 cents/kWh. This 60 percent net savings is typical and is being experienced in other states as well.

STEAB strongly agrees with Mr. Yeager, and urges the Congress and this Administration to support aggressive application of *existing* energy efficiency and renewable energy technologies to America's current energy infrastructure *now*.

National Research Council Results: Investment of $7 Billion Returns $30 Billion

For the first time since DOE was formed in 1977, the outcomes of energy efficiency and renewable energy programs were evaluated and carefully scrutinized by the independent National Research Council. In 2001, the National Research Council released the report, *Energy Research at DOE: Was it Worth It?*

A multidisciplinary committee of national experts looked at the costs and benefits of energy efficiency and renewable energy research between 1978–2000 and determined that:

> DOE investments in RD&D programs in both the fossil energy and energy efficiency programs during the past 22 years have contributed to the well being of U.S. citizens by producing economic benefits, options for the future, and knowledge benefits. It is the committee's judgment that the benefits of these programs substantially exceed the programs' costs and contribute to improvements in the economy, the environment, and national security.

The National Research Council concluded with the following:

> The committee estimated that the total net realized economic benefits associated with the energy efficiency programs that it reviewed were approximately $30 billion (valued in 1999 dollars), substantially exceeding the roughly $7 billion (1999 dollars) in total energy efficiency RD&D investment over the 22-year life of the programs. This $30 billion figure does not take into account the additional $60–$90 billion in environmental benefits that it 'conservatively' estimates result from these programs.

Clearly, federal research dollars spent on energy efficiency and renewable energy research, development and demonstration return huge benefits to the American public.

The U.S. Congress and the Administration Must Think Long Term: U.S. Competitiveness and U.S. Jobs Are at Stake

A strong federal investment in energy efficiency and renewable energy research can make a huge difference to the private sector and the public good as technologies move from the research and development stage to commercialization. Funding levels for energy efficiency and renewable energy accounts in FY 2004 send a very important message to private sector partners working with DOE and the public regarding the importance of energy efficiency and renewable energy to the federal government. The effects of inconsistent and/or reduced government funding as products near the commercialization stage (the research "valley of death") are well documented. The best example of devastating economic effects resulting from a lapse in research funding is videocassette recorder (VCR) technology.

It is a little-known fact that VCR technology actually started here in the United States. Many years ago, faced with shrinking government research funds and little support from leaders within the U.S. government as the product neared commercialization, VCR researchers left the U.S. and finished their product research in Japan. Now, America imports VCRs at a considerable loss to our economy. This lesson is worth remembering, as one that should not be repeated on the energy front. It magnifies the impact of a commercial and economic mistake that was entirely avoidable.

Another infamous research decision occurred at AT&T 20 years ago when the chairman of AT&T turned down further development of cellular phone technology because "consumers wouldn't pay for it" and it was "ridiculous to think that people would communicate without wires."[17]

STEAB strongly urges the U.S. Congress and this Administration to think long-term. Leaders should be prepared to steady the course for sustained research, development and deployment of energy efficiency and renewable technologies. Reducing funding for energy efficiency and renewable energy accounts in FY 2004 is tantamount to turning down cellular phone and VCR research. Hindsight as to VCR and cellular phone research should provide the foresight for research, development, and deployment of energy efficiency and renewable technologies.

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[17] U.S. Department of Energy Assistant Secretary of Energy Efficiency and Renewable Energy speech to the U.S. Conference of Mayors, 1996.

Energy Efficiency Means More Jobs

In October 2001, the Tellus Institute and MRG & Associates delivered a report, Clean Energy: Jobs for America's Future, to the World Wildlife Fund. They looked at the national and state-by-state job implications of implementing a "broad suite of clean energy policies" over the next 20 years. For example, improvements in state building codes and appliance and equipment standards were considered important major contributors within this suite of policies. They found that with increased energy efficiency in the commercial, residential, transportation, and industrial sectors this suite of clean energy policies would lead to a net increase of 1.3 million jobs in national employment over the next 20 years.

Energy efficiency and renewable energy markets represent a $500 billion ***annual*** global market to American businesses. Investments in U.S. companies that conduct energy efficiency and renewable energy research, development and demonstration will result in an increase in local jobs. It is essential that these new and innovative markets be nurtured into mature and reliable resources for America's energy and economic security.

Invest in Energy Efficiency and Renewables: Avoid Costly Environmental Regulations

U.S. industry is said to spend more than $40 billion annually to comply with "end-of-pipe" environmental regulations. Most of this is spent by industry to control air pollution emissions. Investing in renewable energy and energy efficiency technologies that reduce the energy/emissions balance will reduce "end-of-pipe" compliance costs, and lead to a synergy between business development and growth, energy efficiency and self-reliance, a clean environment, and a thriving economy. Balance in these relationships support the Administration's mandate to strengthen homeland security.

III. AMERICAN INGENUITY: POWERED BY ENERGY EFFICIENT AND RENEWABLE TECHNOLOGIES

The Congressional Budget Office reports that one-third of the $22 billion appropriated for homeland security in FY 2002 will be spent to protect nuclear materials, military installations, and other government facilities. The federal government will spend another 22 percent on vaccines and grants to local law enforcement; 21 percent will be devoted to intelligence and federal law enforcement.

With respect to the nation's energy infrastructure, until very recently most federal attention and resources were directed at protecting energy production facilities (*e.g.*, a nuclear reactor) and distribution sites (*e.g.*, relay stations and transmission lines). While the importance of such monitoring and protection cannot be minimized, limited federal dollars should also be allocated to increase energy efficiency and to increase the number of (new) renewable energy generating sites. An increase in such energy efficiency will help decrease the number of critical "choke" points in the nation's energy production and delivery infrastructures. Furthermore, these actions will ultimately make America's energy infrastructure more resilient and reliable.

New federal investments in research, development, and deployment to diversify and protect U.S. energy supplies are an equally important budget item. Energy efficiency and renewable energy provisions are a natural and important addition to all homeland security initiatives. Moreover, energy efficiency and renewable energy technologies are less costly and take less time to develop and deploy than new transmission and distribution infrastructures. They also help protect the environment and public health. What follows is a sampling of energy efficiency and renewable energy programs and policies *currently in use throughout the country* that contribute in very real ways to homeland security.

Effective Use of Distributed Generation Technologies

Distributed generation (DG) technologies are receiving renewed interest from policymakers and industry. Financial markets find distributed generation technologies to be appealing. New and improved DG technologies are less expensive and allow power to be produced closer to the customer, have shorter lead times, and carry a decreased risk of overbuilding (which reduces financial costs and risks). Distributed generation and micro-grids can improve the reliability and security of electric transmission and delivery systems. In addition, several new and emerging technologies that can be used for distributed generation installations are more efficient than simple cycle steam generation systems in use by utilities.

Distributed generation offsets the need for an equivalent amount of central station power generation and the related wires to distribute it. Generation of electricity near load centers can

Banks Lend Money for Efficient Products

Investing in energy efficiency is solid public policy. Most banks now lend money for the purchase of energy efficient products, using the payback from anticipated energy savings in their financial models. It is not a risky enterprise. It is one of the safest, most proven investments of public capital a policymaker can support. This level of predictability and reliability is hard to find anywhere else in the energy policy area.

avoid the inefficiency and expense associated with line loss and upgrading power lines, and alleviate constraints of limited space or the physical intrusion of these facilities. Emerging technologies such as fuel cells, sterling engines, combined heat and power applications, and micro-turbines, as well as renewable energy resources like wind, solar, geothermal, and biomass, provide opportunities for distributed generation and improved reliability.[18]

California is one state in the forefront of using distributed generation technologies. On June 12, 2002, the California Energy Commission (CEC) adopted a Strategic Plan for Distributed Generation for the State of California. Three basic principles underlie the strategies that comprise CEC's Strategic Plan for Distributed Generation:

1. Deploy distributed generation only in ways that preserve and enhance the environment in which people live.
2. Recognize the need for private investment. Without it, a self-sufficient distributed generation industry will never develop.
3. Provide consumers more choices about how to meet their energy needs, including opportunities to gain more control over energy use and expense.

CEC adopted five policy objectives to guide its distributed generation efforts:

1. Emphasize end-use efficiency improvements
2. Promote resource planning at the state and local level
3. Promote cogeneration
4. Diversify technologies
5. Diversify energy sources

High-Performance Buildings

In the United States, buildings use 65 percent of the electrical energy consumed annually. However, a high-performance building, utilizing a variety of design features to lessen its energy impact, uses at least 50 percent less energy than a conventional building. High-performance buildings such as the Zion National Park Visitor Center use bio-climatic designs, solar-electric arrays, and natural systems for heating cooling, lighting, and ventilation. If high-performance buildings were used on a much larger scale, the country would experience significant reductions in national energy demand and reduce the need for additional energy and power resources, thereby improving national security. High performance buildings also are an important step toward "zero energy buildings.

Source: National Renewable Energy Laboratory, "Strengthening Our Energy Security – A Sampling of Renewable Energy Technologies." February 2002.

As these emerging technologies become available to broader segments of the population, U.S. competitiveness, national security, the economy, and environmental quality will benefit. Consider the fact that an on-site commercial building fuel cell can convert fuel to electricity at high efficiency without combustion, and with negligible emissions. Benefits are immediate. The fuel cell company, the building owner, tenants and the general public benefit from reduced emissions. Homeland security is enhanced because the fuel cell is a less vulnerable "target" to potential terrorists.

[18] For information on state, local, utility, and selected federal incentives that promote renewable energy, see the Database of State Incentives for Renewable Energy (DSIRE), http://www.dsireusa.org/.

Biofuels

Conversion of existing combustion technologies to biofuels[19] and greater penetration of new biofuels-based generation will mitigate America's increasing dependence on imported fuels. The transportation sector will be a primary beneficiary of biofuels technology.

According to DOE's National Renewable Energy Laboratory (NREL), there are approximately 185 million vehicles in the United States, and they consume almost 70 percent of all oil used in the country.[20]

Recognizing the abundance of renewable biomass resources in the United States,[21] NREL acknowledges the great potential for biofuels in this country:

> The U.S. has an abundance of renewable biomass resources. We send more than 200 million tons of waste to landfills each year, and have over 50 million acres of idle farmland – land ideally suited for growing energy crops. If fully utilized, these resources could produce enough biofuels to power all our cars, trucks, and buses. While this level of market penetration isn't realistic in the foreseeable future, biomass resources could eventually provide over 50 percent of our transportation fuel.

NREL is optimistic that in the next decade, "advanced technologies could make biofuels as affordable as gasoline."[22]

Biofuels are also used to generate electricity. NREL estimates that utilities in the United States "use biomass to generate more than 7,500 megawatts of electricity—enough power to meet the energy needs of several million households."[23]

Weatherization Contributes To Homeland Security

DOE's Weatherization Assistance Program has led to the installation of energy efficiency measures in low-income households for over 25 years, reducing the energy bills and improving the health and safety of five million American families. Weatherization is a sound public program that has advanced technologically in the past decade. The program saves 80 percent more energy per weatherized dwelling and is more cost effective now than it was in 1989. The major sources of progress for the program are the implementation of procedures and measures associated with higher energy savings and the adoption of new technologies. Expansion of the Weatherization Assistance Program to include electric base load components such as lighting and refrigeration provides additional opportunities for savings.

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[19] Biofuels include ethanol, methanol, biodiesel and additives for reformulated gasoline.

[20] *NREL Facts – Biofuels Research*, http://www.nrel.gov/documents/biofuels.html.

[21] Biomass resources include grasses, trees, trash, and agricultural and industrial waste. According to NREL, approximately 64 percent of biomass energy is produced from wood and wood waste; 24 percent is produced from municipal solid waste, 5 percent is attributable to agricultural waste; and another 5 percent is produced from landfill gases. *NREL Facts – Biomass Energy*.

[22] *NREL Facts – Biofuels Research*.

[23] *NREL Facts – Biomass Energy*.

The Weatherization Assistance Program makes an important contribution to our national security by reducing the impact of energy supply disruptions on the nation's most vulnerable consumers—those on fixed incomes, the poor, elderly, and disabled. These groups are the least able to deal with a price explosion or an energy supply disruption. When a low-income home is weatherized, both its energy bill and fuel consumption are reduced each year for many years to come. In the event of future energy supply and price problems, weatherization recipients will be better able to cope with rising prices. For example, in the event of a $2.00 per MBtu price spike for natural gas and home heating oil, the five million weatherized households will experience an additional aggregate decrease of $1.2 billion due to conservation from weatherization. Weatherization, therefore, not only insulates low-income homes but helps to insulate low-income budgets as well.

Weatherization Success Stories

In Topeka, Kansas, a resident could no longer afford to heat her home due to spiraling energy prices a year and a half ago. Community Action, Inc., conducted an energy audit, air-sealed her house, and installed insulation in the attic and walls. At a total cost of only $1,780 for labor and materials, this work reduced air infiltration levels (measured by the blower door) to nearly one-half of the pre-weatherization level. As a result, the resident saw her December 2000 heating bill drop below the previous year's bill, dramatically illustrating weatherization's positive impact on a family's budget.

In Oklahoma, high propane bills were overwhelming an elderly homeowner, who was spending $350 out of her $500 monthly income for propane. The house needed extensive repairs that were outside the scope of the weatherization program. The local community-based weatherization agency first leveraged resources and secured donated materials so the repairs and weatherization work could be completed. After weatherization, the homeowner spent less than $150 over three months for propane, not only lowering her fuel consumption but also protecting her from continued price fluctuations. The long-term impact of this work was even more significant. The following winter, the carbon monoxide detector installed by the agency sounded a warning. The agency-installed detector prevented a potentially fatal outcome by assisting the gas company to identify an obstruction in the home's fuel line, which was spilling a dangerous level of carbon monoxide into the home.

IV. CONCLUSIONS AND RECOMMENDATIONS

There is a tangible cost to any delay in funding the research, development, and deployment of energy efficiency and renewable technologies. The cost is real, not virtual. Its effects are imminent, not distant. Although not easily quantifiable, as through a standard cost-benefit analysis, the cost of delay has dire consequences for the future of this country, particularly if America's traditional centralized energy structure is attacked, crippled, or destroyed.

STEAB maintains that energy efficiency and renewable energy technologies offer the most cost-effective, short- and long-term routes to a safer, more reliable and more resilient energy infrastructure. Development of an abundant domestic renewable resource base provides important energy diversity, protects the environment (including greenhouse gas emission reductions), protects public health, and promotes economic development, while making our country's energy systems less vulnerable. It will be too late to sufficiently fund energy efficiency and renewable technology research and commercialization when the need for such technology is imminent. America should be deploying these technologies now to offset our existing vulnerability to security and economic threats heretofore believed to be impregnable. If Congress and the Administration fail to provide adequate funding for research, development and deployment in annual budgets for energy efficiency and renewable energy, it sets the stage for unnecessary energy crises across the nation at great cost and disruption to people's lives and the economy. It would also undermine America's security and increase our vulnerability. The future is now, and the Congress and the Administration have a duty to act.

A secure America requires an energy policy that reflects creative and innovative use of ***all*** of America's energy resources. This can be achieved only if sustained investments are made in energy efficiency and renewables technologies and in America's traditional centralized energy technologies. STEAB recognizes the need for, and supports, a balanced and diverse national energy portfolio.

APPENDIX A: LEGISLATIVE CHARGE OF THE STATE ENERGY ADVISORY BOARD

The State Energy Advisory Board was established by Public Law 101-440 (The State Energy Efficiency Programs Improvement Act of 1990) to advise DOE on the operation of its federal grant programs. The board also advises on energy efficiency and renewable energy program in general and on DOE's effort relating to research and market deployment of energy efficiency and renewable energy technologies.

The specific responsibilities of the board, as mandated by statute, are:

1. To make recommendations to the Assistant Secretary for the Office of Energy Efficiency and Renewable Energy (EERE) with respect to:
    a. The energy efficiency goals and objectives within the federal grant programs
    b. Programmatic and administrative policies designed to stimulate and improve federal grant program effectiveness
2. To serve as a liaison between federal and state governments on energy efficiency and renewable energy resource programs
3. To encourage the transfer of research and development results from activities carried out by the federal government with respect to energy efficiency and renewable energy technologies
4. To submit an annual report to the Secretary of Energy and the Congress concerning the Board's activities for the prior fiscal year.

The Board met regularly throughout FY 2001. Its first meeting was in Washington, D.C., on November 30–December 1, 2000. The Board's second meeting also was in Washington, D.C., on April 12–13, 2001. The third meeting took place in Seattle, Washington, on July 12-13, 2001. The Budget Committee met twice in FY 2001. The first meeting was in Washington, D.C., on February 23, 2001. The second meeting was held in Seattle, Washington on July 13, 2001, in conjunction with the July 12–13, 2001, full Board meeting. The Board's other committees also conducted business via conference calls throughout the year.

APPENDIX B: BOARD MEMBERSHIP

The State Energy Advisory Board consists of 18–21 members appointed by the Secretary of Energy. Membership regulations are outlined in Public Law 101-440, Section 365(g)(1)(A) as follows:

> *At least eight of the members for the Board shall be persons who serve as directors of the State agency, or a division of such agency, responsible for developing State energy conservation plans pursuant to Section 362. At least four members shall be directors of State or local low-income weatherization assistance programs. Other members shall be appointed from persons who have experience in energy efficiency or renewable energy programs from the private sector, consumer interest groups, utilities, public utility commissions, educational institutions, financial institutions, local government energy program, or research institutions. A majority of the members of the Board shall be state employees.*

The following is a membership listing of the State Energy Advisory Board, as well as DOE contacts and contract staff support.

State Directors

Maurice Kaya
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State of Hawaii Department of Business,
Economic Development and Tourism
Honolulu, Hawaii

MaryAnn Manoogian
Director
Governor's Office of Energy and
Community Services
State of New Hampshire
Concord, New Hampshire

William Nesmith
Division Administrator
Oregon Office of Energy
Salem, Oregon

John Nunley
Manager, State Energy Programs
Wyoming Business Council
Cheyenne, Wyoming

Robert Pernell
Commissioner
California Energy Commission
Sacramento, California

Anita Randolph
Director
Division of Energy
Missouri Department of Natural Resources
Jefferson City, Missouri

Peter Smith
Vice President for Programs
New Your State Energy Research and
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William (Dub) Taylor
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Weatherization Directors

Lisa Capen-Kesecker
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George Burmeister
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APPENDIX C: 2001 TRAVEL EXPENDITURE REPORT

In accordance with Sector 365(g)(1)(B)(I)(7)&(8) of Public Law 101-440, which requires a reporting of federal reimbursement of Board member expenses (including travel expenses) incurred in the performance of their duties, the following accounting is provided:

> *For FY 2001, travel expenses of $51,626.00 were incurred and reimbursed for State Energy Advisory Board meetings.*