POSITION STATEMENT

National Energy Policy Recommendations

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ENERGY underlies three converging challenges facing the United States today: prosperity, security and the environment. Electricity can play a key role in resolving these challenges, but substantial changes in how we manage our energy resources will be required.

The strategic goals are clear:

- To ensure that we can reliably meet energy needs, we must upgrade our electrical generation and delivery systems.
- We must break our dependence on oil, which threatens the U.S. economy, national security and environmental health.
- We must mitigate the adverse effects of climate change by transforming our energy systems and our economy to one that is carbon free, carbon neutral or which successfully captures and stores carbon emissions. This will require a cultural shift in the way we use energy, a modernizing and strengthening of the electrical infrastructure and changes in the way costs are recovered.
- Finally, we must ensure that the cost of energy does not diminish our economy or impede its development.

Established and new technologies must be applied at unprecedented scale and on an accelerated schedule. Bold actions and substantial investments will be required. This statement outlines the key actions and investments that IEEE-USA thinks are necessary to achieve these goals.

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IEEE-USA, 2001 L Street, N.W., Suite 700 Washington, D.C. 20036-5104 USA
Office: +1 202 785 0017 ■ Fax: +1 202 785 0835 ■ E-mail: ieeeusa@ieee.org ■ Web: www.ieeeusa.org

INCREASING ENERGY EFFICIENCY

Increasing efficiency in the conversion, delivery and use of energy is something all Americans can participate in to address the energy challenges our country faces. Educating the country on the importance of energy efficiency and making energy efficiency a way of life are necessary to help meet the challenges of prosperity, security and the environment. This makes energy efficiency an essential element in any comprehensive national energy policy.

Federal, state and local governments are substantial consumers of energy. They must improve energy efficiency in the public sector and become leaders in promoting it in the private sector. The electric utility industry has significant market incentives to continuously improve energy efficiency, and efforts to increase efficiency across these components of the economy need to continue.

IEEE-USA urges federal, state, and local governments, along with quasi-governmental and private sector organizations, to work toward improving energy efficiency by:

- Promoting education and user awareness of energy efficiency opportunities
- Promoting capital investment in energy-efficient technologies and processes for residential, commercial, transportation and industrial sectors
- Promulgating minimum efficiency standards for products and buildings consistent with life cycle analysis
- Developing, commercializing and using efficient electric technologies in transportation systems
- Adopting intelligent transportation systems to reduce energy consumption
- Developing system designs and technologies to further reduce energy losses in electric power generation, transmission and distribution
- Promoting the use of high-speed communications networks and information technologies to substantially improve access to information, system controls and efficiencies

BREAKING OUR DEPENDENCE ON OIL BY TRANSFORMING TRANSPORTATION

Today, more than 96 percent of the energy used in transportation comes from oil. The transportation sector consumes about two-thirds of all petroleum used in the United States. Emerging technologies can help our dependence on oil, which will require acceptance and wide deployment of these technologies

A radical transformation of the transportation sector is needed, because directly mitigating carbon emissions in the many millions of mobile sources is impractical. The proposed response is a two-pronged effort to electrify surface transportation, focusing on plug-in electric and hybrid technologies and in parallel pursuing replacement of conventional fuels with alternative carbon-neutral biofuels.

ELECTRIFYING TRANSPORTATION:

Plug-In Electric Vehicles

Greater use of electricity as an energy source for transportation could substantially reduce oil consumption. Electric motors are inherently more efficient than internal combustion engines; they do not consume energy while vehicles are stationary (idling); and they provide the opportunity to recover energy from braking. Current hybrid electric vehicle technology demonstrates some of the potential of this approach. The introduction and widespread use of plug-in electric vehicles (PEVs) with an all-electric range sufficient to meet average daily travel needs could reduce per-vehicle petroleum consumption by 50 percent, meaning half of the energy would come from electricity.

Electrifying the transportation sector may also provide opportunities to reduce greenhouse gas emissions. Today, 28 percent of greenhouse gases are produced in transportation. Because these emissions are widely dispersed, it is unlikely that they could ever be captured and stored. Instead, the additional electric power required for PEVs can be provided through greater use of generating technologies, such as wind and nuclear, which produce minimal greenhouse gases.

IEEE-USA recommends:

- Developing and pursuing a general strategy to electrify surface transportation (especially buses and commercial and personal vehicles)
- Reducing the use of oil by promoting the rapid deployment of PEVs as quickly as economically and technically feasible.
- Accelerating and diversifying research to improve battery technologies to extend vehicle all-electric range; increasing energy storage density; decreasing cost, improving life and safety; and optimizing the associated power electronics and controls
- Encouraging the development of communication and control systems that permit full realization of all the potential benefits of vehicle-to-grid energy exchange functions
- Promoting research on the integration and impact of PEVs on the electric grid and the development of industry consensus standards to realize their full potential benefits
- Promoting the deployment of battery charging infrastructure

Developing and Using Alternative Transportation Fuels

Particularly in conjunction with the greater use of electric energy in transportation, alternative transportation fuels, including biofuels and natural gas, offer the possibility of further reducing oil consumption. Liquid fuels made from coal and natural gas may also be attractive from an economic perspective, but a by-product of their production is greenhouse gases, which must be mitigated if these fuels are to be used in large quantities.

To help meet our transportation fuel demand from secure, domestic sources as soon as possible and at reasonable cost, IEEE-USA recommends:

- Passing legislation to mandate fuel flexibility
- Promoting fuel flexibility in the fuel distribution system and advanced control technologies to maximize efficiency and minimize emissions across the spectrum of fuels
- Pursuing aggressive new R&D to convert sustainable biomass (including algae) to transportation fuels.
- Promoting aggressive R&D on new gas-to-liquid fuel technology

GREENING THE ELECTRIC POWER SUPPLY

Electricity generation is dominated by fossil fuels, with coal and natural gas making up about 70 percent of the input energy, and the rest coming from nuclear and various renewables (approximately 20 percent and nine percent, respectively). To respond to concerns about climate change, the future of electric power should be green, i.e., using energy resources that are carbon-free or carbon-neutral, or where the carbon emissions are captured and stored for geological time.

Technologies ready for deployment include geothermal, wind, solar, and nuclear and direct combustion of biomass. Nuclear is well established but no new plants have been built in the United States in many years. However, the industry is commercially ready to proceed with federal leadership and public and private commitment. Continued fossil fuel use should be joined with policies to remove carbon before combustion, or capture the carbon or carbon dioxide after combustion. This is more problematic because the technology has yet to be demonstrated on either the necessary scale or for geological time. The next sections address each of these.

Expanding the Use of Renewable Electric Generation

Renewable electric generating technologies, particularly those that emit minimal greenhouse gases, must be deployed to the extent that they are technologically and economically practical and have an acceptable impact on the environment and aesthetics. Such technologies include electricity generated from wind, sunlight, waves, tides and underground heat (geothermal).

IEEE-USA recommends:

- Supporting funding for R&D activities in renewable electric power technologies to accelerate their adoption
- Promoting the use of renewable energy because of its security of supply, distributed and modular nature, and reduced greenhouse gas emissions
- Supporting programs for education on, and early deployment of, emerging renewable power technologies

Expanding Nuclear Power Generation

Nuclear power plants are the largest capacity power generation sources that emit negligible greenhouse gases. They have the ability to provide continuous base-load generation regardless of the time of day or weather conditions. They also have a high energy density and small footprint, thus permitting locations nearer to demand centers. The 104 nuclear plants in the United States have proven to be cost competitive with both conventional fossil fuels and renewable sources and, through license renewal, will operate for many decades. Nuclear power is, and must remain, an important part of a balanced portfolio of energy sources.

As part of a comprehensive energy policy that emphasizes safe, reliable and environmentally- friendly generation, IEEE-USA recommends:

- Supporting a comprehensive spent nuclear fuel management program that would close the fuel cycle and develop a disposal facility as mandated by the Nuclear Waste Policy Act of 1982
- Developing and deploying nuclear fuel reprocessing technologies to improve economics and reduce proliferation concerns
- Supporting industry, academia and government in exercising world leadership in nuclear science and technology, including the Generation IV International Forum (GIF)
- Continuing to support provisions of the Energy Policy Act of 2005 pertaining to the construction of new power plants and the Next Generation Nuclear Plant (NGNP)
- Supporting the use of nuclear process heat/cogeneration applications to the chemical and petroleum industries, including enhanced oil recovery, coal to liquid and production of hydrogen

Capturing Carbon Emissions from Fossil Power Plants

Coal is our nation's most plentiful, and one of its lowest-cost, domestic fossil fuel resources. It provides more than 20 percent of U.S. energy supplies and 50 percent of total electrical energy. Coal, however, is also one of the major sources of carbon dioxide (CO_2) emissions. Only the use of petroleum in transportation is a comparable source of CO_2 within the United States.

The capture, transport and storage (or sequestration) of CO_2 produced from combustion is a daunting challenge because of the following factors: the enormity of the necessary infrastructure, the loss in efficiency and plant output, and the cost. Yet, because this is our most extensive energy resource, the effort is essential if we are to address the challenge of mitigating greenhouse gas emissions effects on climate change.

IEEE-USA recommends:

- Continuing the R&D initiative to develop economical carbon capture and storage or conversion technologies that would make coal a viable energy resource in a carbon-emission-constrained world
- Continuing public and private R&D to develop and demonstrate clean fuel technologies including conversion and large scale demonstration projects for carbon capture and storage at fossil fueled power plants.

BUILDING A STRONGER AND SMARTER ELECTRICAL ENERGY INFRASTRUCTURE

The National Academy of Engineering classified electrification as the number one engineering achievement of the 20th century. Today, the U.S. electric grid is a network of 10,000 power plants, 150,000 miles of high-voltage (>230 kV) transmission lines, millions of miles of lower-voltage distribution lines and more than 12,000 substations.

The primary objective of transmission system expansion is to meet load growth reliably and efficiently. However, over recent decades, the grid has been severely stressed by an increase in electric demand and a declining rate of system construction. Further the increasingly complex and competitive bulk power market is adding stress to the grid. These conditions can result in grid congestion and higher transmission losses, which can result in higher rates for electricity. Reinforcing the grid and deploying advanced technologies will help address some of these concerns and provide advantages for the nation. It is critical that market design and grid expansion programs work together to maintain adequate levels of grid reliability.

Transforming the Network into a Smart Grid

Adding intelligence – sensors, communications and computers – to our electric grid can substantially improve its efficiency and reliability through increased situational awareness, reduced outage propagation and improved response to disturbances and disruptions. This so-called “Smart Grid” can also enable real-time pricing of electricity that will allow consumers to reduce their energy costs and facilitate distributed generation and redundancy, opening the door to wider use of intermittent renewable generation sources.

The federal government recognized this potential by implementing the Energy Independence and Security Act (EISA) of 2007. Title XIII of the Act mandates a Smart Grid that is focused on modernizing and improving the information and control infrastructure of the electric power system. Among the areas being addressed in the Smart Grid are: transmission, distribution, home-to-grid, industry-to-grid, building-to-grid, vehicle-to-grid, integration of renewable and distributed energy resources (such as wind and solar, which are intermittent), and demand response.

The Smart Grid is essential to support the related goals of price transparency, clean energy, grid reliability and vehicle/transportation electrification.

IEEE-USA recommends:

- Fully funding previously authorized EISA legislation to support the Smart Grid effort
- Supporting development of reference implementations of Smart Grid standards to help rapidly resolve technical issues and ambiguities either prior to or immediately following adoption by Standards Developing Organizations (SDOs)
- Working with SDOs to address issues in SDO practices that delay development of Smart Grid standards or act as barriers to their widespread deployment
- Working with state regulators, the Federal Energy Regulatory Commission, the National Association of Regulatory Utility Commissioners, and their joint Smart Grid Collaborative to resolve issues of ratepayer involvement, especially for standards having benefits focused on national security, energy independence or difficult-to-quantify issues
- Providing R&D funding to address access to and use of Smart Grid functionality and benefits by consumers
- Coordinating Smart Grid efforts with advanced broadband deployment
- Devoting adequate attention and resources to the cyber security of critical Smart Grid control systems and software and addressing state and federal jurisdictional boundaries

Expanding the Transmission System

Much of the renewable energy potential in the United States is located in areas that are remote from population centers, lack high demand for energy, and are not connected to our national infrastructure for transmission of bulk electrical power. Sufficient cost-effective transmission capacity must link on-shore or off-shore wind farms, solar plants and other renewables to customers to make the resources accessible to homes and businesses, and to replace significant portions of the oil used today in vehicle transportation.

To tap these renewable energy resources, the necessary electrical infrastructure must be installed, requiring both significant financial investments and cooperation at all levels on politically challenging items such as the siting of facilities and the routing of new transmission lines.

IEEE-USA recommends:

- Enhancing the nation's transmission system to provide the capacity needed to deliver electricity from major new local and remote generation sites and existing generators to population centers and loads in a reliable, cost-effective and environmentally sensitive manner.
- Reforming the state-by-state approval process for routing and siting to ensure that delays in transmission construction do not also delay progress in expanding

the use of renewable energy and achieving national clean air goals
- Revising and optimizing rate structures and cost allocation policies. Current utility rate recovery criteria need to be revised to ensure they support implementation of a strategic expansion plan for the national grid in a way that is equitable to all energy consumers
- Directing the industry, in coordination with the North American Electric Reliability Corporation (NERC), to undertake a national power system survey at five-year intervals to provide long-range guidance on the need for a stronger and smarter electrical energy infrastructure

Developing Large-Scale Electricity Storage Systems

Unlike many energy resources, electric power is generated and consumed instantly. If intermittent sources of electric power, such wind and solar, are to reach their full potential to contribute to the nation's power requirements, technologies for large scale energy storage must be developed and deployed. Such large-scale energy storage systems convert electric energy to other forms of energy, which can be reconverted to electric energy when needed. This enables the storage system to act as a load leveler, facilitate more efficient utilization of the grid, and to be used in response to system contingencies.

Today, the only well-established large-scale storage technology is pumped hydroelectric storage in which electric power is used to pump water into a reservoir where it can later be reconverted to electricity using a turbine. These systems have typically been used to store electric energy generated when demand is low and to make it available quickly when demand is high. Expanded use of this technology depends on the availability of suitable geography. A variety of other energy storage technologies currently exist and there is great potential for further development of these and other new technologies. However no single energy storage solution is likely to address the full range of electrical system needs, because of the variations in the application and use of these grid connected technologies.

IEEE-USA recommends:

- Expanding R&D initiatives to develop energy storage technologies to increase utilization of renewable generation resources and of the grid itself
- That Congress fully fund the energy storage R&D program authorized in the Energy Independence and Security Act of 2007
- That the regulatory treatment of energy storage takes account of its special benefits

THE NEED TO TAKE ACTION NOW

Urgent action is needed now because, with each passing year, U.S. dependence on imported oil is increasing and the threat to the economy and national security is growing. We cannot allow low prices to lull our country into complacency again. The dual threats of dependence on oil and climate change to the United States are real and no longer just important, but urgent.

Now is the time to invest in new and established technologies to help our nation become better energy stewards and reduce environmental impacts. Electricity has a major role to play in reaching these goals