IEEE-USA

POSITION STATEMENT

NATIONAL ENERGY POLICY RECOMMENDATIONS

FEBRUARY 2011

This statement was developed by the IEEE-USA Energy Policy Committee and represents the considered judgment of a group of U.S. IEEE members with expertise in the subject field. IEEE-USA advances the public good and promotes the careers and public policy interests of 210,000 engineering, computing and technology professionals who are U.S. members of IEEE. The positions taken by IEEE-USA do not necessarily reflect the views of the IEEE or its other organizational units.

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ENERGY underlies three converging challenges facing the United States today: prosperity, security and the environment. Electricity is a key enabler in addressing these challenges, but substantial changes in how we manage our energy resources will be required. We need an integrated and balanced approach to increase energy efficiency, transform transportation, green the electric power supply, and build a stronger and smarter electric infrastructure, which will require a cultural shift in the way we think about and use energy.

The strategic goals are clear: To ensure that we can reliably and securely meet our growing energy needs, we must use energy resources more efficiently; transform our transportation systems; transition our energy systems and our economy to one that can better manage our environment and emissions; and upgrade and expand our electrical generation and delivery systems.

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 recommends to both public and private institutions to reach these goals.

Inside

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, but efforts to increase efficiency across all 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 secure high-speed communications networks and information technologies to substantially improve access to information, 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. Oil will continue to be a major fuel for decades, but our ability to substantially reduce its use will be essential to address challenges to national security and prosperity.

A radical transformation of the transportation sector is needed, not only to reduce our dependency on oil, but also to reduce emissions in the transportation sector. However, directly mitigating emissions in the many millions of mobile sources is impractical. The proposed response is a two-pronged effort: to electrify transportation, focusing on plug-in electric and hybrid technologies — and in parallel, pursue replacing conventional fuels with alternative fuels, particularly biofuels.

1. 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 the potential of this approach. The introduction and widespread use of plug-in electric vehicles (PEV) with an all-electric range sufficient to meet average daily travel needs could reduce per-vehicle petroleum consumption by 50 percent, or more.

Because transportation emissions are widely dispersed, it is unlikely that they could ever be captured and stored. Electrifying the transportation sector will reduce greenhouse gas and other emissions, even with the current generation fuel mix. In addition, further reductions become possible through greater use of generating technologies, such as wind and nuclear that produce minimal greenhouse gases and other emissions.

IEEE-USA recommends:

- Developing and pursuing a general strategy to electrify transportation, including mass transit, passenger and commercial vehicles, buses, and short- and long-distance rail
- Reducing the use of oil by promoting the rapid deployment of PEVs
- Promoting the development and deployment of battery charging infrastructure
- 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

- Promoting research on the integration of PEVs on the electric grid and the development of industry consensus standards to realize their full potential benefits
- Encouraging the development of secure communication and control systems that permit full realization of all the potential benefits of vehicle-to-grid energy exchange functions

2. Developing and Using Alternative Transportation Fuels

Alternative transportation fuels, including biofuels and natural gas, offer the possibility of further reducing oil consumption, particularly if deployed in conjunction with the greater use of electricity in transportation. 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

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 renewables (approximately 20 percent and nine percent, respectively). To respond to environmental concerns, the future of electric power should be green (i.e., using energy resources that produce less greenhouse gases, including CO2 and NOx; or where the carbon emissions are captured and reused as feedstock for useful products; or stored for geological time). Simple and predictable economic signals must be in place to inform investments in these technologies.

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, as well as 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. The implementation of these policies 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.

1. 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

2. 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 fundamental R&D in industry, academia and government to continue exercising world leadership in nuclear fission and fusion science
- 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

3. 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 (CO2) emissions. Only the use of petroleum in transportation is a comparable source of CO2 within the United States.

The capture, transport and storage (or sequestration) of CO2 produced from combustion is a daunting challenge — because of the enormity of the necessary infrastructure, the loss in efficiency and plant output, and the cost. Yet, because coal is our most extensive energy resource, the effort is essential, if we are to address the challenge of mitigating greenhouse gas emissions.

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 approximately 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 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 increase physical and cyber security of the grid. It is critical that market design and grid expansion programs work together to maintain adequate levels of grid reliability.

1. Transforming the Network into a Smart Grid

Adding intelligence — sensors, communications, optimal controls 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 flexible 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 electrified transportation.

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 IEEE's Standards Association and other SDOs to improve the timely development of Smart Grid standards and promote 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 customer 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 to benefit 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

2. 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 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

3. 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 that can be reconverted to electricity when needed,

enabling the storage system to act as a load leveler, to 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. However, the expanded use of this technology is limited by the availability of suitable geography. A variety of other energy storage technologies currently exist and there is great potential for further developing these and other new technologies.

IEEE-USA recommends:

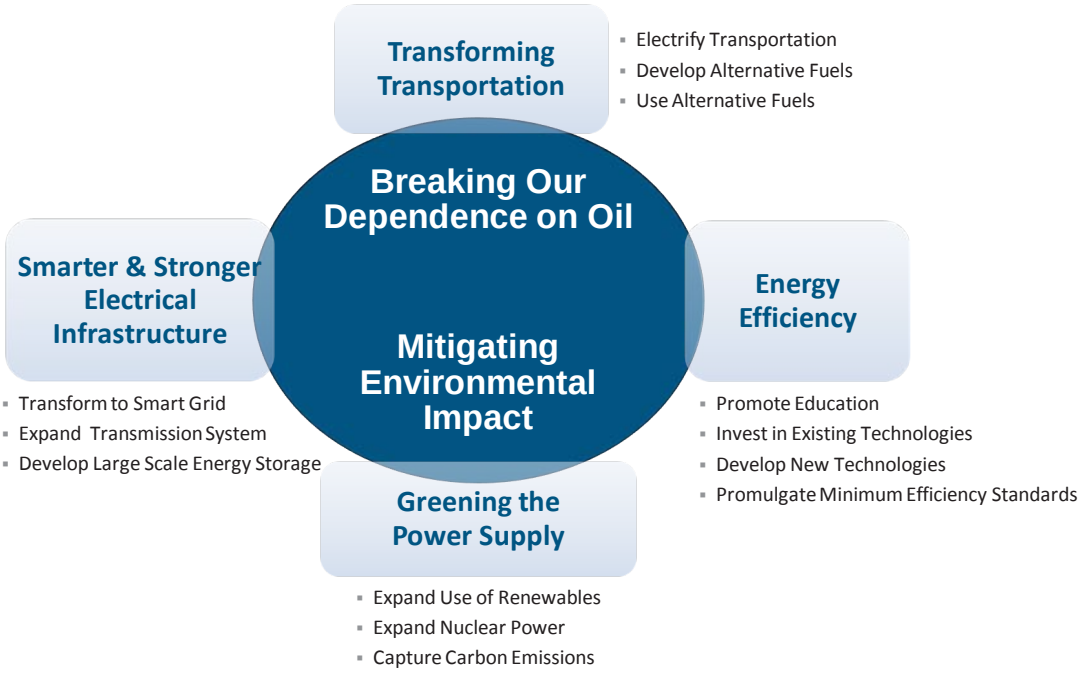
- Expanding R&D initiatives to develop energy storage technologies to increase utilization of renewable generation resources, and of the grid itself
- That Congress fully fund the energy storage R&D program authorized in the Energy Independence and Security Act of 2007
- That the regulatory treatment 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 environmental degradation 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.

IEEE-USA Recommendations



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