IEEE-USA

IEEE-USA POLICY 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 addiction to oil, a dependence that 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.

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 the controls, access to information and system efficiencies***

Breaking our addiction to 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. There are currently no really affordable alternatives to break our national addiction to oil, although technologies exist to change this.

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 transportation, focusing first on plug-in hybrid technologies and then replacing the remaining need for fuels to alternative carbon-neutral biofuels.

1. Electrifying Transportation: Plug-In Hybrid 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 hybrid electric vehicles (PHEVs) 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 gasses 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 PHEVs can be provided through greater use of generating technologies, such as wind and nuclear, which produce minimal greenhouse gases. And, if technologies for carbon capture and storage can be deployed economically on a large scale, coal and natural gas can also help provide the increased electric power capacity that will be necessary.

IEEE-USA recommends:

- ***Deve loping and pursuing a general strategy to electrify transportation (rail, transit, freight, trucks and personal vehicles)***
- ***Reducing the use of oil by promoting the rapid deployment of PHEVs as quickly as economically and technically possible***

- ***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 PHEVs on the electric grid and the development of industry consensus standards to realize their full potential benefits***
- ***Promoting the deployment of battery charging infrastructure***

2. 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. These fuels may produce less greenhouse gas than petroleum or coal. Liquid fuels made from coal and natural gas may also be attractive from an economic perspective, but their production is typically a strong source of greenhouse gas, 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 non-food stock biomass (e.g., wood, grasses and crop residues) and algae to fuels usable in fuel-flexible vehicles. The R&D should aim at finding fuels and utilization pathways to allow lowest-cost, most-rapid commercialization and highest efficiency***
- ***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[1], and the rest coming from nuclear and various renewables (approximately 20 percent and 9 percent, respectively). With the exception of solar and geothermal heating and biofuels, the new renewables are all best used by conversion of the energy resource into electricity. To respond to the threat of 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 renewables in the form of wood and wastes via direct combustion in dedicated facilities, or co-firing in coal power plants, and nuclear plants. Nuclear is well established but no new plants have been built in the United States in more than 10 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.

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 solar and 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 gasses. They have the ability to provide continuous base-load generation regardless of the time of day or weather conditions. They also have a high

1 Use of petroleum in electric power is approximately 1 percent to 2 percent.

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 base-load 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 new reprocessing technologies to improve economics and reduce proliferation concerns***
- ***Supporting industry and academia in exercising world leadership in nuclear science and technology***
- ***Continuing to support provisions of the*** **Energy Policy Act of 2005** ***pertaining to the construction of the next generation of nuclear power plants***
- ***Developing regulations for the interstate transportation of nuclear waste that includes omnibus rules for safety and security to facilitate reprocessing and storage***
- ***Supporting the use of nuclear process heat applications to the chemical and petroleum industry, e.g., the 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 (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 conversion, or capture and storage, 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***

Building a stronger and smarter electrical energy infrastructure

Electrification was characterized by the National Academy of Engineering 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 line, millions of miles of lower-voltage distribution lines and more than 12,000 substations.

Over recent decades, the grid has been severely stressed by an increase in electric demand and a declining rate of construction. Since 1982, growth in peak demand for electric power has exceeded growth in transmission capacity by almost 25 percent every year. The result is grid congestion and higher transmission losses, which can result in higher rates for electricity and lower reliability. The Department of Energy estimates that the cost of power outages ranges from $25 billion to $180 billion annually.

The increasingly complex and competitive bulk power market is adding additional stress to the grid. Inadequate capacity, control and reliability could seriously impede the deployment of new sources of electric power, and the new demand anticipated from normal growth and increased use of electricity in transportation.

1. 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 expected to be addressed in the Smart Grid are: transmission, distribution, home-to-grid, industry-to-grid, buildings-to-grid, and 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 National Association of Regulatory Utility Commissioners, and the Federal Energy Regulatory Commission 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 to address issues in access to Smart Grid functionality and benefits by technologically challenged and economically challenged residential customers***
- ***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***

2. Developing an Expanded Transmission System

Much of the affordable renewable energy potential in the United States lies 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 difficult issues such as the siting of facilities and the routing of new transmission lines.

IEEE-USA recommends:

- ***Providing incentives to develop a national transmission system with the needed additional capacity capable of cost-effective and environmentally sensitive electric delivery from major new generation sites and existing generators to major population centers and loads***
- ***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, through 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 Massive 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 Massive Electricity Storage (MES) systems convert electric energy to other forms of energy, which can be reconverted to electric energy when needed.

Today, the only well-established technology for MES 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. It has been estimated that more than 30 such systems are currently in use in the United States and about 150 in other countries. Expanded use of this technology depends on the availability of suitable geography. Efficiency, typically 70 percent, is a further limitation. Thus, other types of storage must be developed.

IEEE-USA recommends:

- ***An R&D initiative to develop affordable energy storage technologies to integrate intermittent renewable energy into the electric system***
- ***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 addiction to 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, while reducing damage to the environment. Electricity has a role to play in reaching these goals.

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 the more than 215,000 engineers, scientists and allied professionals who are U.S. members of the 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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