IEEE POWER ENGINEERING SOCIETY
POLICY STATEMENT ON ENERGY & ENVIRONMENT

(Prepared by the IEEE-PES Policy Development Coordinating Committee)

STATEMENT

This policy statement is concerned with the increase in the production, delivery and use of electrical energy, and its effect on the environment.

Abundant and economic energy is a key part of modern society. The harnessing of energy, and in particular the use of electrical energy to replace human effort, has led to the high standard of living today in the developed countries. Continued growth in the services that energy can provide will allow for new levels of improved quality of life, particularly in developing countries. Because of these factors, energy is a global and commercial priority.

The IEEE Power Engineering Society encourages governments to promote research, development, commercialization, and utilization of energy as parts of comprehensive, national energy strategies based on:

- Developing economic new sources of supply and innovative technologies
- Developing the delivery infrastructure to meet changes in demand and supply
- Improving energy efficiency and reliability in production, delivery, and customer end use
- Having due concern for the environmental impacts of energy developments.

While energy use will grow, prudent development must seek methods to minimize the negative effects of energy production, delivery and use, and must aim to reduce global dependence on fossil fuels. No single solution fits all situations. A comprehensive energy policy must consider all of the available options in an appropriate manner. The role of the customer in energy choice and usage should be recognized. The value of diversity of energy resources and of technologies must be recognized, and over-dependence on any single fuel or energy source should be avoided where reasonable. The finite nature of environmental and ecological resources must also be recognized. These resources must be managed wisely for current and future generations.

This statement was developed and approved by the Technical Council of the IEEE Power Engineering Society, and represents the considered judgment of a group of IEEE members with expertise in the subject field. IEEE Power Engineering Society is an organizational unit of the Institute of Electrical and Electronics Engineers, Inc.

1-4244-1298-6/07/$25.00 ©2007 IEEE.

BACKGROUND

For the foreseeable future, fossil fuels will make up by far the greatest proportion of the global energy supply. Burning fossil fuels produces emissions to the atmosphere and water bodies that impact the environment and may affect human health. While the evidence connecting the observed rising concentration of carbon dioxide and the apparent increase in global temperatures is regarded by some as not yet conclusive, it is surely prudent to adopt strategies that strive for balance between carbon dioxide production and its consumption.

Furthermore, fossil fuel reserves are finite and likely to be significantly depleted sometime during this century. The present trend of increase in fossil fuel usage is therefore unsustainable. There is a window of opportunity for a managed transition to reducing global dependence on fossil fuels by increasing non-fossil energy sources.

1. Decision Criteria

Energy decisions should include the evaluation of as many of the life cycle costs and benefits as are reasonably obtainable. These include the fixed and variable costs associated with energy sourcing, conversion, delivery and usage as well as the benefits to the economy, environment, and well being of society. In addition, environmental impacts, to the extent possible and practicable, should be evaluated on a full life cycle basis and added to these costs. Fuel evaluation should include consideration of abundance and the costs of extraction, procurement, movement, waste disposal, and site restoration. Included in these evaluations should be the risks associated with security breaches and system failures. It must be recognized that some alternatives will be more economical and practical in certain geographical areas. It must also be recognized that priorities in developing countries will differ from those in the industrialized world.

2. Energy Options

The IEEE Power Engineering Society urges support for programs that encourage the development of the following energy sources. The development should focus on options that are economical, practical and have minimal environmental impact such as:

- biomass energy
- “clean” coal
- geothermal energy
- hydroelectric energy
- nuclear energy
- oil and natural gas
- solar energy
- tidal and wave energy
- wind energy

Environmental impact concerns can be a source of disagreement, yet there can be no doubt that a prudent policy towards carbon emissions is appropriate. The issue can be addressed in many ways. We urge that in growing our energy systems, consideration be given to:

- energy efficiency, of both supply and demand, including use of heat and other by-products

- energy use reduction and demand-shifting based on incentives
- distributed resources that are closer to the point of energy usage
- energy storage options, to increase the capability of power systems to absorb the output of intermittent sources, such as wind and solar
- carbon capture and storage, whereby the carbon of fossil fuels is not emitted to the atmosphere
- economic tools such as carbon taxes, emission trading, and customer incentives

Energy storage options, such as hydro inter-seasonal storage, hydro pumped storage, compressed air, flywheels, superconducting magnets, super capacitors, and batteries, should be considered where appropriate and environmentally acceptable. Such systems can increase the capability of power systems to absorb the output of renewable (and intermittent) sources, such as wind and solar, and improve the economy of power system operations. Under the umbrella of energy storage options, research and development of the hydrogen economy and infrastructure is also to be encouraged, with the caution that hydrogen alternatives should be carefully analyzed to ensure that the net environmental (and economic) benefits are positive.

Energy efficiency should be recognized as an effective means of minimizing the needs for new energy sources as well as negative impacts on the environment. Energy efficiency includes supply-side (for example, conversion efficiency, delivery system efficiency and combined heat and power) as well as demand-side end use efficiency improvements.

Customer demand response and **c**ustomer involvement can only be fully achieved through improved information infrastructure, user-friendly appliances, and market-driven tariffs. If customers can be included in the decision-making process of energy consumption, primarily through incentives to reduce or shift usage to a different time period, then these patterns would contribute to conservation and increased efficiency.

3. Power Delivery Systems

Power delivery systems are already technically advanced, but should not be overlooked in the development of energy resources. Many of the sources of energy that will contribute to future supply are not located close to the places where the energy is needed, so that the energy must be moved, often in electrical form, over sometimes very large distances. (Hydro and wind power, for example, cannot be moved by pipelines.) A well maintained energy transport infrastructure that includes both a power delivery system to connect generation resources with loads and comprehensive monitoring and control systems to manage the power system will generally be needed.

4. Research & Development

Increased funding for research and development (R&D) in both the public and private sectors is needed and strongly recommended. R&D should be focused on accelerating the advancement of technology and environmental solutions for the priority strategies of increasing energy sources, improving delivery performance and improving energy efficiency. This is particularly important for those options that have high commercial potential to improve fundamental energy economics and reduce dependence on fossil fuels.

Renewable energy technologies still need R&D efforts not only for fundamental research, but increasingly for development and implementation issues.

Nuclear energy represents a significant portion of current global energy supply and is one of the most economical energy sources today. In order to improve this source of non-carbon emitting base-load generation, continued research should be committed toward passively safe advanced reactor designs and the long-term management of used nuclear fuel.

Fossil fuel reserves is another research area that is vitally important to energy strategy and the planning of a comprehensive and credible assessment of the remaining global reserves that are commercially viable is critical.

Terms:

Energy: *includes fuel extraction, production, transmission, distribution and end-use of energy.*

Environment: *includes the natural and social environment.*

Energy Efficiency: *includes supply-side efficiency (e.g. conversion efficiency; combined heat and power; delivery efficiency) and demand side efficiency (e.g. high-efficiency lighting, appliances, equipment) and the reduction of waste.*

Energy Storage: *includes options such as hydro pumped storage; compressed air; supermagnetic energy storage; super capacitors, super-speed flywheels; and batteries. The production of hydrogen for fuel cells is also a form of energy storage.*

Customer Demand Response: *includes customer participation in reducing and/or shifting energy usage based on financial or other incentives.*

Distributed Resources : *sources of electric power that are not directly connected to a bulk power transmission system. Distributed Resources includes both generators and energy storage technologies. (Taken from IEEE P1547 Standard for Interconnecting Distributed Resources with Electric Power Systems)*

Renewable Energy: *options include wind, solar photovoltaic, solar-thermal, hydro (particularly small hydro up to 50 MW), biomass, geothermal, tidal and wave energy.*

Carbon dioxide: *gas is produced by (among other things) combustion of hydrocarbon fuels. Burning coal releases the largest quantity of carbon dioxide to the atmosphere for a given amount of heat; petroleum-based fuels release less, and natural gas least, with biomass fuels falling somewhere in the middle. Carbon dioxide and methane (another gas released through fossil fuel acquisition and use), are considered "greenhouse" gases, affecting the atmosphere's transmission and retention of heat energy.*

The Carbon Cycle: *The carbon cycle is essential to all human, animal and plant life on the planet. A key part of this cycle, carbon dioxide (CO_2), is characterized as a greenhouse gas. The concentration of CO_2 in the atmosphere is one factor in moderating global temperatures and climate. There are also many other natural phenomena and factors affecting global temperature levels and cycles, some of which are not yet fully understood by climate scientists. However, measured atmospheric concentrations of CO_2 have shown definite worldwide increases since the start of the Industrial Revolution. There is also evidence that temperatures in major parts of the northern hemisphere have risen in the latter part of the twentieth century. While there is inconclusive evidence and much uncertainty that the rising concentration of CO_2 is the primary driver for this upward cycle in temperatures, it is prudent to achieve a better balance between carbon dioxide production and its consumption, so as to stabilize CO_2 concentrations in the atmosphere.*

Policy Statement is posted as part of the Society News section of the May/June 2007 Issue of Power & Energy at:- http://www.ieee.org/organizations/pes/public/2007/may/pessocietynews.html