GENERAL POSITION PAPER





Securing America's Energy Future

PS14-24 | NOVEMBER 2014

ASME GOVERNMENT RELATIONS

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SECURING AMERICA'S ENERGY FUTURE

Clean, reliable, affordable, and secure sources of energy are essential for America's economic prosperity and national security. Vulnerability to extreme events, both natural and man-made, price volatility, dependence upon politically unstable regimes for oil and gas, and concerns over global climate change have brought the critical nature of energy into the public eye and underscore the need for a comprehensive energy strategy to ensure a dependable supply of energy for the United States.

Major energy and environmental challenges, however, call on engineers and policymakers to take decisive steps towards more efficient and innovative energy technologies with the understanding that it will be necessary to reconcile the need for energy security with those of energy sustainability and environmental stewardship. In response to these needs, ASME, the American Society of Mechanical Engineers, offers the following recommendations to support a technologically based and economically sound national energy policy that will ensure a secure, reliable and environmentally friendly supply of energy for America.

GUIDING PRINCIPLES

1. For the economic health and security of the nation, the United States must be assured an adequate, readily available supply of energy.
2. All efficiency, conservation and energy development efforts must be based on sound science, engineering and economic principles.
3. The nation must maintain a balanced energy supply mix, which currently includes coal, petroleum, nuclear, natural gas, biomass, municipal solid waste, solar, wind and hydroelectric power, and accelerate the development of advanced energy technologies for transportation, heating and cooling, and for centralized and distributed electric power generation.
4. To ensure the selection, development, and use of the best energy technologies, systems, and markets, a national energy policy must promote and rely on standardized, technically rigorous methods for calculating net energy contributions, life cycle costs, production processes, and environmental impacts of all energy sources.
5. The nation must encourage energy conservation and efficiency, and modernization of older, less efficient equipment, particularly in energy intensive applications, to increase the efficient use of energy resources.
6. The national energy policy must decrease the nation's dependence on petroleum by increasing supplies of non-petroleum-derived fuels, continuing to raise standards for automotive fuel efficiencies, and encouraging development and implementation of new transportation technologies.
7. The U.S. must establish a leadership position in international energy policy that addresses energy security and environmental issues.
8. Federal and state governments should encourage and expedite socially and technically responsible licensing and permitting processes that result in the

development, installation and continued operation of energy technologies from a broad portfolio of energy resources.

9. State governments and regulatory bodies must strive to adopt and update laws, rules, and regulations that keep pace with national policy and availability of new and better energy choices.
10. The national energy policy must encourage and enable U.S. industries to capture and maintain leadership positions in key energy technologies to maintain robust and diversified domestic energy equipment industries and avoid future dependence on foreign suppliers of critical energy equipment.
11. The national energy policy must prioritize basic energy-related research and educational programs across a broad spectrum of energy-related sciences and technologies.
12. To ensure energy security, the U.S. must actively cultivate a highly trained and capable domestic workforce to design, build, operate and maintain the national energy infrastructure.

In order to achieve these goals, ASME offers technical recommendations in nine different areas: energy efficiency and technology development; coal; natural gas; nuclear; renewable energy; transportation fuels; energy infrastructure; energy workforce; and the next generation of energy technologies.

ENERGY EFFICIENCY AND TECHNOLOGY DEVELOPMENT

Energy efficiency and conservation continue to represent the least expensive, lowest risk, and most effective means of immediately reducing energy consumption and our dependence on imported fossil fuels. Continuous technological development increases the efficiency of energy usage. The U.S. made great strides in energy efficiency beginning in the 1970s, with many of those programs still bearing fruit. Though institutionalized programs exist, such as EnergyStar appliance standards, and Corporate Average Fuel Economy (CAFE) standards, to support energy conservation, the per capita energy consumption in the U.S. has not dropped significantly in the last 30 years and remains far higher than the global average for industrialized countries[1]. World markets, global and regional politics, and environmental priorities are changing. U.S. energy policy should provide stable, agile, outcomes-based objectives through both conservation and technical development.

ASME recommends:

- Establishing visible and substantial national energy efficiency goals which are technologically and economically sound, with an emphasis on the transportation sector and commercial and residential buildings.
- Building on and contributing to the activities of successful, national and regional energy efficiency initiatives that have been implemented by federal and state agencies, nongovernmental organizations and utilities.
- Incorporating energy conservation as part of the mission of every government

[1] EIA Monthly Energy Review, July 2014

agency to demonstrate to all Americans what can be achieved with conservation.
- Increasing energy efficiency awareness in education, primarily through higher education and in the workplace.

COAL

Coal is the nation's most plentiful domestic fossil fuel resource. Coal supplies the U.S. with 45 percent of its electric power at relatively low cost. Power generation from coal has increased almost as dramatically as the emissions from coal combustion have decreased over the last 30 years[2]. Coal represents a stable bridge to a secure energy future by providing a long term domestic energy source with increasingly efficient equipment and the potential for zero carbon emissions as demonstrated by small scale carbon sequestration technologies. New coal-fired power plants are essential to the future of reliable U.S. base-load power supply. In the coming decades, new coal-fired capacity will be needed to replace older, less-efficient plants and to support increasing U.S. energy demand. Coal-to-liquids R&D may also provide significant opportunities in the area of liquid fuels for transportation.

ASME recommends:

- Continuing government and private industry R&D to develop and demonstrate clean coal technologies including:
  - Gasification and liquefaction of coal
  - Hybrid power plants; i.e., partnering coal with renewable energy sources
  - Mercury removal from flue gas combined with efficient sulfur dioxide, nitrogen oxides, and particulate removal systems
  - Capture and sequestration of carbon dioxide from coal fired power plants
- Continuing cooperation between government and private industry to develop stable regulatory requirements that are essential for predicting financial risk and attracting prudent investment in new coal-fired power plants.
- Increasing R&D and education to improve the efficiency, safety and environmental impact of coal mining and production to support increased use of coal.

NATURAL GAS

The U.S. relies on clean-burning, domestically produced natural gas for 27 percent of electric power generated[3] and 26.7 percent of energy consumed across all sectors of the economy[4], including home heating, power generation, industrial processes, and transportation. Recent innovations in shale gas technology have allowed for production to increase and prices to drop. Domestic production currently accounts for more than 96 percent of U.S. consumption[5]. This percentage is predicted to increase as the U.S. enters the liquefied

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[2] IER: http://instituteforenergyresearch.org/media/pdf/the-facts-about-air-quality-and-coal-fired-power-plants-final.pdf

[3] EIA Short-term Energy Outlook, 2014: http://www.eia.gov/forecasts/steo/report/electricity.cfm

[4] EIA Annual Energy Outlook 2014

[5] Ibid

natural gas (LNG) export market assuming the industry is successful in expanding production of unconventional natural gas from the shale sources[6]. The projected increased demand for natural gas underlines the need to improve the storage and distribution infrastructure, increase exploration and production efforts, increase the capability to export LNG, and improve energy use efficiency for this important fuel.

ASME recommends:

- Encouraging the distribution and use of natural gas primarily for home heating and industrial processes including use as chemical feedstocks.
- Encouraging domestic production of natural gas from unconventional sources such as deep wells (both on- and offshore), tight gas beds, shale gas beds, coal beds, and methane hydrates.
- Encouraging consumers and industries to replace aging and inefficient gas burning equipment and appliances with modern, high efficiency equipment.
- Supporting the expansion and modernization of natural gas infrastructure including pipelines, compressor stations, storage facilities, and distribution networks to enable increasing the reliable and safe use of natural gas and to reduce supply disruptions due to aging equipment and facilities.
- Increasing federal and private support for R&D to improve the efficiency of natural gas exploration, extraction, distribution, storage, and end use. Research is needed to explore the environmental impact of hydraulic fracturing for natural gas.

NUCLEAR

Nuclear power currently provides about 8 percent of total U.S. energy consumption, or about 20 percent of U.S. electric power generation[7]. Nuclear power contributes to U.S. energy security by providing a large share of reliable, emission free, base load electric power generation to diversify the sources from which the U.S. generates its electric power. Nuclear power already supplies approximately 63 percent[8] of the emission-free energy in the U.S., with industry poised to provide more in the coming decade. In 2012, the U. S. Nuclear Regulatory Commission approved both Southern Company and South Carolina Electric & Gas Company's application to build and operate two new reactors at each of their sites. These new reactors are expected to come online by 2019[9]. The U.S. has about one billion pounds of uranium reserves, with Wyoming and New Mexico holding about two thirds of all domestic uranium reserves[10]. In 2012 the U.S. purchased 58 million pounds of uranium, with 83 percent of that being imported from foreign suppliers[11]. Continued development of a domestic nuclear fuel storage repository and reprocessing facilities, along

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[6] EIA 2014: http://www.eia.gov/naturalgas/crudeoilreserves/
[7] EIA Annual Energy Outlook 2014
[8] NEI http://www.nei.org/Master-Document-Folder/Multimedia/Graphs-And-Charts/Sources-of-Emission-Free-Electricity-InfoGraphic-(
[9] http://www.eia.gov/energy_in_brief/article/nuclear_industry.cfm
[10] http://www.c2es.org/energy/source/nuclear
[11] http://www.eia.gov/todayinenergy/detail.cfm?id=12731

with continued improvements in nuclear energy utilization, will preserve and maintain the energy security that nuclear energy provides in the U.S. energy mix.

ASME recommends:

- Resolving the issue of spent fuel storage by expediting the completion and use of a central waste repository while also encouraging near-term investment in compact, secure on-site dry cask storage of spent nuclear fuel. Expedient resolution of this issue is critical to the continued viability of nuclear power.
- Deploying technology to reprocess spent fuel to enable maximum energy extraction from the nuclear materials.
- Encouraging the development of new nuclear technologies, fuel systems, and future generation reactor designs.
- Expediting construction of new nuclear power plants in the U.S. by continuing to streamline the regulatory process at federal, state, and local levels to ensure on time completion of the projects.
- Encouraging continued industrial development of various plant sizes and plant types that are economical, safe, and technically viable, including fast spectrum reactors.
- Continuing re-licensing of older nuclear plants that meet rigorous safety standards.
- Encourage the development of recycling spent fuel and regeneration of waste fuel.

RENEWABLE ENERGY

Renewable energy technologies that convert energy from solar, wind, biomass, and water resources commonly represent the most environmentally benign energy conversion technologies. Currently, renewable energy technologies provide 13 percent of the electricity generated in the U.S. Of this, 52 percent is attributable to hydroelectric power, 32 percent to wind, 12 percent to biomass, 3 percent to geothermal, and 2 percent to solar. In total, the percentage of U.S. electricity produced by non-hydro renewable energy sources was roughly 6 percent in 2013, but electricity generation from non-hydro renewable sources, largely due to investments in wind and solar technologies, has quadrupled since 1990[12].

Renewable resources can and should meet a larger portion of the national energy needs in order to lessen the nation's dependence on finite supplies of other energy producing resources and secure the nation's energy future. Renewable energy contributes to energy security because it is domestically produced and relies only on naturally recurring phenomena as the energy sources. Once the infrastructure is in place, there are no critical supply chains or international relationships required to produce more sunlight, wind, or water.

Market barriers to renewable energy deployment such as high cost and infrastructure availability can be overcome through timely and effective government policies that address the true cost of each energy source, including environmental and health costs. In addition,

[12] EIA Energy in Brief, February 2014

significant gains can be made by using hybrid technologies that integrate renewable energy technologies into the existing energy infrastructure. The potential to reduce the production of greenhouse gases and to meet the growing demand for energy in the U.S. and abroad justifies a major investment in renewable energy technologies.

ASME recommends:

- Increasing funding to support R&D of new and improved renewable energy and storage technologies such that funding levels are comparable to other energy technologies.
- Encouraging wider implementation of distributed solar systems, including domestic hot water, to dramatically offset net energy consumption at a local level.
- Supporting the construction and operation of renewable energy commercial demonstration projects.
- Promoting extraction of energy value from agricultural and forest residues, municipal solid waste, and other low-cost, low-impact material as valuable renewable energy resources.

TRANSPORTATION FUELS

According to the EIA, transportation accounts for 27.5 percent of total energy consumption[13]. Continued reliance on foreign sources of petroleum, particularly as applied to transportation fuels, is of great concern to ASME. The U.S. must maintain and increase a secure, domestic source of transportation fuels to maintain the economic health of the nation. Increasing fuel efficiency and conservation combined with increased development of domestic petroleum production and refining facilities as well as the development of non-petroleum derived fuels will reduce the nation's dependence on foreign oil. CAFE standards for vehicles can provide an important complement to any policy to reduce consumption. The use of many special mix (boutique) fuels in various areas results in a lack of flexibility to use the fuels in regions other than where the particular fuel is produced or required, limiting supply and increasing costs.

ASME recommends:

- Supporting policies to increase environmentally responsible petroleum and natural gas exploration on U.S. owned lands both public and private.
- Supporting the development, application and use of new technologies that enable safe, domestic drilling and production from deep water fields, particularly in the Gulf of Mexico, Alaska and the continental shelves.
- Supporting efforts to encourage petroleum conservation measures to reduce the use of gasoline, by continuing to increase the CAFE standards for vehicle fleets and encouraging automotive manufacturers to continue to introduce, produce and promote more electric, hybrid, and high mileage vehicle models.

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[13] EIA Annual Energy Outlook 2014

- Encouraging research, development, demonstration and production of biofuels including biodiesel and, preferably, cellulosic ethanol, which, to the extent possible, should mimic traditional fuels in order to avoid expensive changes in infrastructure, e.g., engines and pipelines.
- Reducing the number of boutique fuels currently produced in order to reduce nationwide costs to distribute fuels to end-users.
- Investing in the next generation of roads, bridges, and highways to more effectively accommodate the 255 million vehicles in the U.S. as well as reducing the commute time for people who work near major metropolitan areas.
- Encouraging states to accelerate the infrastructure development needed to enable greater use of alternative fuels for vehicles.
- Encourage the development of advanced vehicles including robotic automobiles.

ENERGY INFRASTRUCTURE

The U.S. currently maintains 160,000 miles of electrical transmission lines and 2.5 million miles of gas and oil pipelines, and transports massive amounts of liquid and bulk solid fuels, e.g., coal and biomass, over the nation's highways and railways each year. These key resources combined with commercial and industrial distribution outlets form the U.S. energy infrastructure. The energy infrastructure must be updated and modernized in order to accommodate substantial growth in the type and amount of energy usage and generation, as well as the number of discrete locations where usage and generation occur.

This modernization is necessary to improve reliability and performance through the use of modern equipment and system design, and to proactively respond to advanced threats to U.S. energy security.

The 2010 oil spill in the Gulf of Mexico highlights the immediate and drastic effects that even a relatively isolated disruption in U.S energy infrastructure can have on the U.S. population, economy, and environment. Energy storage is also a key facet of modern energy infrastructure. Without substantial and economical means of storing and parsing out energy when it is needed, the energy security and environmental benefits of intermittent renewable energy technologies may never be properly realized. A successful transition into a new energy economy will require infrastructure that reflects the evolving usage and needs of the U.S. and will, by its design, defend the U.S. from energy security threats focused around disruption of this infrastructure.

ASME recommends:

- Encouraging both public and private investment in modernization of the electrical grid, including additional capacity, transformers, and a more reliable monitoring data on energy requirements for energy control centers; as well as continued replacement and expansion of the nation's gas and oil pipelines.
- Supporting continued deployment of mature large and medium scale energy storage technologies including pumped storage hydropower, compressed air energy storage,

and flywheel energy storage.
- Accelerating research and development for advanced energy storage technologies, including advanced batteries and chemical energy storage.
- Supporting domestic energy technology development and manufacturing;
- Supporting research and development of more advanced systems to protect the electrical grid and transmission pipelines from cyber security threats.

ENERGY WORKFORCE

U.S. energy security relies on maintaining a highly trained and capable domestic workforce to design, build, operate and maintain the U.S. energy infrastructure. Recent studies suggest that the nation is facing a looming deficit in the energy workforce that can successfully meet future energy generation and infrastructure challenges[14]. A report issued by the National Commission on Energy Policy stated that up to half of the nation's energy workforce would be eligible for retirement beginning in 2013[15]. A national survey conducted by the Center for Energy Workforce Development concluded that within five to ten years the energy industry may need to replace up to half of all pipefitters, engineers, non-nuclear plant operators, and line workers[16]. The Bureau of Labor Statistics at the Department of Labor projects a double digit percentage decline in the number of energy workers in non-government utilities by 2018[17]. Additionally, the U.S. Department of Labor estimates that more than half of the current energy sector workforce will be eligible for retirement within the next decade[18]. Technical high schools and colleges, trade schools, and university programs will foster the next generation of energy workforce talent to power the nation well into the next century.

ASME Recommends:

- Leveraging the technical talent within the nation's universities and national laboratories with the capital of the private sector to collectively train and deploy the next generation of the energy workforce.
- Placing a national emphasis on technical high and trade schools, workforce or job training programs, trade groups, and other skilled or semi-skilled labor positions to encourage young skilled workers to enter energy related fields.
- Supporting education and training initiatives that help ensure the competitiveness of U.S. manufacturing of energy technologies.
- Working with utilities on a state and local level to attract, train, and retain talent to meet growing energy demands, and to accelerate employment as large percentages of the workforce approach retirement.
- Coordinating efforts through the Secretaries of Labor and Energy, and principals

[14] CEWD http://www.cewd.org/Documents/USPowerEnergy.pdf
[15] BPC http://bipartisanpolicy.org/library/report/task-force-americas-future-energy-jobs-executive-summary-and-policy-recommendations
[16] CEWD http://www.cewd.org/Documents/2013CEWDSurveyExecutiveSummary.pdf
[17] BLS, NAICS 22 http://www.bls.gov/iag/tgs/iag22.htm
[18] BLS http://www.bls.gov/ooq/2008/fall/art02.pdf

within the energy industry to identify gaps in the workforce, and propose solutions through a federal roadmap that can be implemented, in part, through federal investment and by the forging of public-private partnerships to improve STEM education outcomes.

NEXT GENERATION OF ENERGY TECHNOLOGIES

While the technologies supported in this paper are very important for the nation's near-term energy future, U.S. Energy Policy must also determine what R&D is needed today to meet the nation's long-term energy needs. As the primary supporter of high-risk, high-potential basic research, the federal government should embark on a focused effort to identify and develop the next generation of energy technologies. To maintain a balanced technology development pipeline, funding should continue to support commercial demonstrations of more promising emerging technologies. Such investments can contribute significantly to managing greenhouse gas emissions and producing affordable sources of power and fuel. Additionally, the energy water nexus must not be ignored. Secure water resources are critical to all energy production either directly as with thermal cycles, some forms of natural gas production, or hydroelectric power; or indirectly as with solar for cleaning of panels and reflectors. All discussion of future energy technologies must include evaluation of water related impacts.

ASME Recommends:

- Launching bold initiatives in all scientific and engineering disciplines in government, industrial, and academic institutions to foster long-term breakthroughs that can further U.S. energy security, diversity, and efficiency.
- Supporting scientific discovery and innovation including increased research and development in new technologies, such as plasma and fusion energy sciences, to the point where a determination of commercial feasibility is possible.
- Prioritizing water resources necessary to maintain and increase energy production to secure America's energy future.

Moving forward, public policy should be tailored to account for water use as a metric related to overall sustainability of a particular energy system, or an energy resource roadmap. Similarly, better data on current water use in all sectors of the economy, including energy, is necessary in order to better educate the public about their use of water and allow stake holders to make better informed decisions regarding this resource. Coordination at federal, state and local levels will be crucial, as will innovation in the energy sector. Creative policies can enable industrial best practices that will ultimately lead to lower water consumption without disruptions in energy delivery or service.

CONCLUSION

The United States faces difficult security, economic, and environmental issues intricately tied to its energy supply. Tackling these challenges will require that government, academia, and the private sector work together to identify and implement solutions based on sound scientific research and engineering principles. Public policy and education can play a critical role in allowing the U.S. to help its citizens use our current resources more effectively and facilitate the research and development that can lead to more advanced energy technologies.

ASME's energy policy recommendations will help our country achieve a more secure energy future by promoting a diverse energy mix while meeting our current and future energy challenges. We look forward to a continuous dialogue with local and national political and business leaders on these vital issues.