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Public Policy Statement
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ENERGY POLICY

The availability of abundant, clean, sustainable, and affordable energy is critical to the United States' societal, environmental, and economic well-being and our national security. Fossil fuels remain a primary source of energy in the U.S. Developing a diverse portfolio of advanced clean energy sources will mitigate energy's contribution to climate change even as U.S. energy demand increases. Energy policy must balance short-term goals, such as affordability and reliability to encourage economic growth and foster U.S. competitiveness, with long-term goals that ensure equity, environmental protection, national security, and infrastructure resilience. Renewable energy sources, including solar, wind, geothermal, and biomass have steadily made progress towards replacing fossil-based energy. Developments in both technology and policy are necessary to ensure our transition to a low-carbon economy.

The ACS believes the following core objectives should drive energy policy and use in the United States:

- Provide a stable and sustainable supply of energy from low-carbon and net-zero technologies
- Guide investment decisions with life cycle and technoeconomic analyses
- Modernize energy generation, distribution, storage, efficiency, and security infrastructure
- Support responsible land use, environmental protection, and environmental equity
- Create a resilient, circular materials supply chain to build an advanced energy infrastructure.

Electricity Generation, Electric Grid, Electrification, and Energy Storage

U.S. electric power demand is projected to increase by 1-1.5% annually due to increasing electrification and economic growth. To respond to this growth, energy infrastructure must accommodate the intermittency of diverse generation sources and storage demands and impart grid resilience to minimize disruptions from natural disasters and other events. Doing so requires coordination between government and the private sector to update physical and cyber security, resiliency, grid flexibility, and transmission lines to enable the distribution and transmission of renewable and decentralized sources of energy. Decentralization, moving away from massive generating plants and toward smaller on-site generators, may be advantageous in some cases. Robust electrochemical (including large-scale batteries and fuel-cells), chemical, and mechanical storage options must be developed. Investments in and incentives for electric vehicles, low-carbon charging sources, and efficient, low-cost electrified replacements for technologies such as heat pumps and other appliances will continue to lower our carbon footprint. Efforts must also be made to decarbonize industrial processes. However, electrification is sustainable only when electricity is produced from renewable sources. In the short term, upgrading fossil-based power plants can reduce the environmental impact of energy generation by increasing efficiency through technologies such as waste-heat recovery.

Low Carbon and Renewable Energy Generation

Government support and declining capital costs drive investments in renewable technologies for electricity generation, including solar, wind, and geothermal. Despite considerable growth in wind and solar energy generation in the U.S., the growth rate is not sufficient to replace fossil fuel-based sources in the near term, in part because of high costs. To ensure long-term sustainability of these renewable sources, we must develop a resilient, circular materials supply chain from processing through reclamation and recycling. Combining wind and solar electricity with agriculture (agrivoltaics) can restore ecosystems, provide income to rural communities, decrease freshwater withdrawals, improve public health, and sequester carbon in soils to contribute to net-zero emissions.

Biomass-based energy can lower the carbon footprint of difficult-to-electrify sectors (e.g., heavy-duty transport, aviation). This coupled with carbon capture and storage technologies could lead to overall negative carbon emissions. Research is needed to improve the efficiency and sustainability of biomass conversion processes to increase the energy return on investment. Incentivizing biofuel production will accelerate research and commercialization of low-carbon fuels.

The vast majority of produced hydrogen comes from fossil fuels, primarily natural gas via steam/methane and autothermal reforming that generate considerable amounts of CO_2. Research and development are needed to enable the safe, efficient, and environmentally sustainable production of hydrogen as a net-zero energy source. Widespread use of hydrogen faces barriers due to its flammability and the energy required to compress and liquify it for transport. On-demand, geographically focused generation of hydrogen could address these barriers. There is considerable uncertainty surrounding the full life cycle costs, technological barriers, and safety considerations for hydrogen to be a near-term energy option.

Nuclear reactors produce electricity without greenhouse gas emissions, but mining and processing fuel, and storage and disposal of spent fuel remain challenging. Large gigawatt plants take decades to design, site, permit, and build before they become operational. Smaller (50-100 MW), modular, mass produced, standard design reactors have the potential to reduce design and build times and simplify site requirements. These smaller reactors might be useful sources of energy in the short-term as the need to reach net-zero emissions is imminent.

Fossil-Based Energy

Fossil fuels, especially oil and natural gas, remain vital to the global economy. Yet climate change motivates the overarching goal to precipitously decrease our global dependence on fossil fuels, which are major contributors to methane and carbon dioxide in the atmosphere. The mining and burning of coal release considerable quantities of sulfur oxides, mercury, and other trace metals. The disposal of coal fly ash threatens waterways and communities, exacerbating environmental justice issues.

Currently, the U.S. is the world's largest producer and a net exporter of oil and gas, largely due to hydraulic fracturing. Fracking releases fugitive methane into the atmosphere and utilizes vast amounts of produced water, which contains relatively high concentrations of critical elements. Newly developed separation processes could purify produced water and increase our critical materials stockpile. Enhanced oil recovery (EOR) can decrease water use and sequester CO_2 underground, potentially approaching a net zero condition. Advances in CO_2 capture at refineries and power plants fueled by natural gas, oil, or coal can reduce the impact of fossil fuel use on global warming in the short term. Realistically, fossil fuels will continue to be part of the energy transition for years to come, but their extraction and use can be made more efficient by reducing waste, implementing new and developing technologies and factoring in environmental, economic and security costs into market prices and national energy decision-making.

Overarching Recommendations

- Prioritize long-term, coordinated support across government, academia and industry for the research, development and deployment of low-carbon energy technologies and processes.
- Implement consistent, long-term policies to increase competitiveness of (1) electrified technologies and (2) low carbon and renewable energy generation to reduce greenhouse gas emissions.
- Invest in the development and application of carbon capture, mitigation, sequestration, and conversion technologies, and improvements in the efficiencies, distribution, and transmission of industrial processes, infrastructure, transportation systems, and the electrical grid.
- Advance efforts, including R&D, to improve the energy efficiency of existing buildings and new construction to reduce overall energy use.
- Reduce the environmental impact of enhanced oil and natural gas recovery processes, including water purification, emissions capture, and methane leakage reduction.
- Use life cycle and technoeconomic analyses (LCA-TEA) and full cost accounting to inform research, development, and deployment of energy technologies.
- Develop a holistic approach to support a hydrogen economy that considers LCA-TEA and engineering requirements for safe and efficient distribution.