4 Energy Supply, Delivery, and Demand

Linemen working to restore power in Puerto Rico after Hurricane Maria in 2017

Key Message 1

Nationwide Impacts on Energy

The Nation's energy system is already affected by extreme weather events, and due to climate change, it is projected to be increasingly threatened by more frequent and longer-lasting power outages affecting critical energy infrastructure and creating fuel availability and demand imbalances. The reliability, security, and resilience of the energy system underpin virtually every sector of the U.S. economy. Cascading impacts on other critical sectors could affect economic and national security.

Key Message 2

Changes in Energy System Affect Vulnerabilities

Changes in energy technologies, markets, and policies are affecting the energy system's vulnerabilities to climate change and extreme weather. Some of these changes increase reliability and resilience, while others create additional vulnerabilities. Changes include the following: natural gas is increasingly used as fuel for power plants; renewable resources are becoming increasingly cost competitive with an expanding market share; and a resilient energy supply is increasingly important as telecommunications, transportation, and other critical systems are more interconnected than ever.

Key Message 3

Improving Energy System Resilience

Actions are being taken to enhance energy security, reliability, and resilience with respect to the effects of climate change and extreme weather. This progress occurs through improved data collection, modeling, and analysis to support resilience planning; private and public–private partnerships supporting coordinated action; and both development and deployment of new, innovative energy technologies for adapting energy assets to extreme weather hazards. Although barriers exist, opportunities remain to accelerate the pace, scale, and scope of investments in energy systems resilience.

Executive Summary

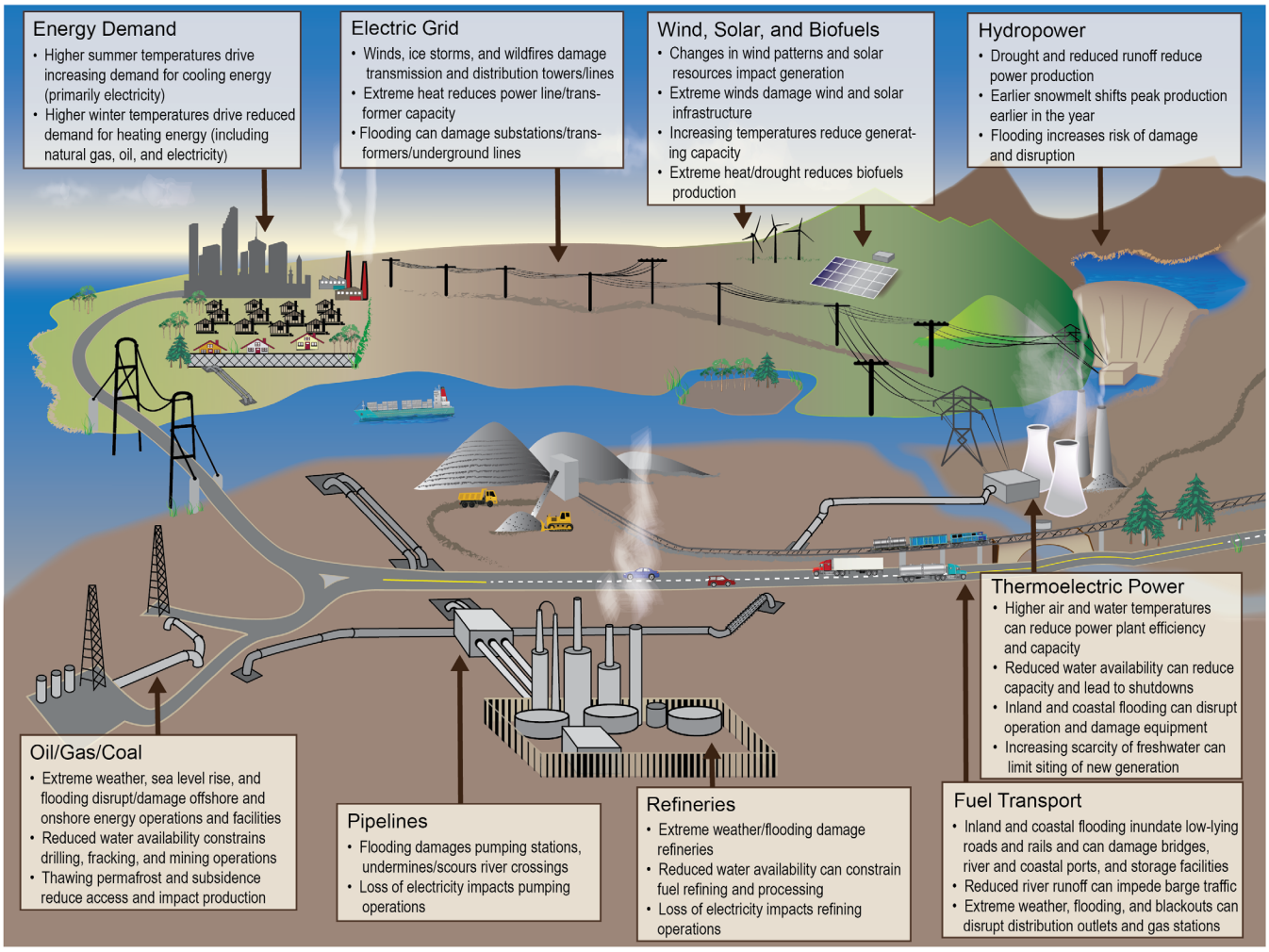
The Nation's economic security is increasingly dependent on an affordable and reliable supply of energy.[1,2] Every sector of the economy depends on energy, from manufacturing to agriculture, banking, healthcare, telecommunications, and transportation. Increasingly, climate change and extreme weather events are affecting the energy system, threatening more frequent and longer-lasting power outages and fuel shortages. Such events can have cascading impacts on other critical sectors, potentially affecting the Nation's economic and national security. At the same time, the energy sector is undergoing substantial policy, market, and technology-driven changes that are projected to affect these vulnerabilities.

The impacts of extreme weather and climate change on energy systems will differ across the United States.[3] Low-lying energy facilities and systems located along inland waters or near the coasts are at elevated risk of flooding from more intense precipitation, rising sea levels, and more intense hurricanes.[4,5,6,7,8] Increases in the severity and frequency of extreme precipitation are projected to affect inland energy infrastructure in every region. Rising temperatures and extreme heat events are projected to reduce the generation capacity of thermoelectric power plants and decrease the efficiency of the transmission grid.[9,10] Rising temperatures are projected to also drive greater use of air conditioning and increase electricity demand, likely resulting in increases in electricity costs.[8,11,12,13,14,15,16,17,18,19] The increase in annual electricity demand across the country for cooling is offset only marginally by the relatively small decline in electricity demand for heating. Extreme cold events, including ice and snow events, can damage power lines and impact fuel supplies.[20] Severe drought, along with changes in evaporation, reductions in mountain snowpack, and shifting mountain snowmelt timing, is projected to reduce hydropower production and threaten oil and gas drilling and refining, as well as thermoelectric power plants that rely on surface water for cooling.[3,21,22,23,24] Drier conditions are projected to increase the risk of wildfires and damage to energy production and generation assets and the power grid.[3,8]

At the same time, the nature of the energy system itself is changing.[1,2,22,25,26,27,28,29,30,31,32,33,34] Low carbon-emitting natural gas generation has displaced coal generation due to the rising production of low-cost, unconventional natural gas, in part supported by federal investment in research and development.[35] In the last 10 years, the share of generation from natural gas increased from 20% to over 30%, while coal has declined from nearly 50% to around 30%.[36] Over this same time, generation from wind and solar has grown from less than 1% to over 5% due to a combination of technological progress, dramatic cost reductions, and federal and state policies.[2,33]

It is possible to address the challenges of a changing climate and energy system, and both industry and governments at the local, state, regional, federal, and tribal levels are taking actions to improve the resilience of the Nation's energy system. These actions include planning and operational measures that seek to anticipate climate impacts and prevent or respond to damages more effectively, as well as hardening measures to protect assets from damage during extreme events.[3,37,38,39,40,41,42] Resilience actions can have co-benefits, such as developing and deploying new innovative energy technologies that increase resilience and reduce emissions. While steps are being taken, an escalation of the pace, scale, and scope of efforts is needed to ensure the safe and reliable provision of energy and to establish a climate-ready energy system to address present and future risks.

Potential Impacts from Extreme Weather and Climate Change



Extreme weather and climate change can potentially impact all components of the Nation's energy system, from fuel (petroleum, coal, and natural gas) production and distribution to electricity generation, transmission, and demand. *From Figure 4.1 (Source: adapted from DOE 2013* [23]*)*.