IMPACT

Energy: Supply, Demand, and Impacts

"Thirteen San Francisco Bay Area power plants are at risk from the impact of a hundred-year flood—a phenomenon that will become more frequent by projected sea-level rise."

Wind-energy density studies suggest that current and planned wind power facilities are not in danger of experiencing reductions in their ability to generate electricity.

Key Messages

1

Climate warming in the region is expected to increase peak-period electricity demands for summer cooling and possibly increase peak winter heating electricity demand as well.

2

Delivery of electricity may become more vulnerable to disruption due to climate-induced extreme heat and drought events.

3

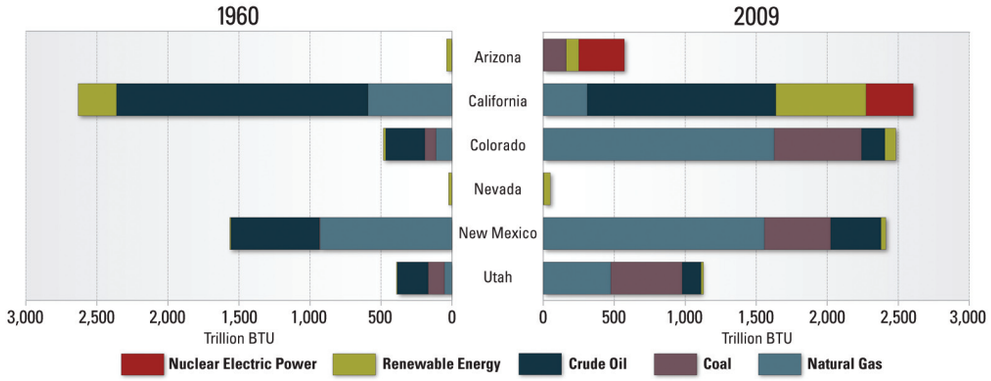
Climate-related policies have the potential to significantly alter the energy sector. The vulnerability of the energy system in the Southwest to climate change depends on how the energy system evolves over this century.

The twelfth chapter of the *Assessment of Climate Change in the Southwest United States* describes the potential effects of climate change on the production, demand, and delivery of energy. "Energy: Supply, Demand, and Impacts" describes climate effects on peak energy production and examines the vulnerability of infrastructure to climate change. The chapter describes direct and indirect climate effects on the generation of electricity, with analyses of different methods, such as natural gas turbines, hydropower, and thermoelectric. The chapter concludes with an assessment of the evolution of fuel mixes for energy generation and transportation and offers mitigation strategies for the present and future.

For more information about *Assessment of Climate Change in the Southwest United States*, see: www.swcarr.arizona.edu, www.cakex.org, www.islandpress.org/NCAreports.
This fact sheet developed by Institute of the Environment, University of Arizona.

Current Energy Mix

Three southwestern states—California, Colorado, and New Mexico—are among the nation's top ten energy-producing states. The Southwest region produces 12.7 percent of the nation's energy and consumes 12.1 percent. In 2009, 87 percent of total consumption was met with fossil fuels. Any change or disruption to the supply of energy is likely to have significant impacts on energy demand, generation, distribution, infrastructure, economics, and policies in the region.



Natural gas represents 43 percent of the primary energy production in the Southwest, followed by crude oil (21 percent), coal (19 percent), renewable energy (10 percent), and nuclear electric power (7 percent).

Vulnerabilities

There are a number of ways in which the Southwest's energy infrastructure could be affected by climate change, such as by increased peak electricity demand for cooling, damage to energy infrastructure by extreme weather, disruption of hydroelectric and thermoelectric generation, and changes in fuel choices (such as the use of more renewable sources).

Climate warming is expected to increase peak period electricity demands for cooling in the Southwest. In California for example, peak energy demands are projected to increase between 10 and 20 percent by the end of the century due to the effects of climate change on summer afternoon temperatures. The increased demand for electricity is predicted to decrease the carrying capacity of transmission lines owing to increased resistance over the lines.

Natural gas represents 43 percent of the primary energy production in the Southwest. A warming climate would decrease the capacity and efficiency of certain natural gas turbines. Projections suggest that natural gas thermal power plant capacity in California could drop on average between 2 and 5 percent, and as much as 6 percent during hot summer afternoons by the end of the century.

Increases in the size and frequency of wildfires in the Southwest will increasingly affect electricity transmission lines.

Technology & Policy Options

One option for coping with the impacts of climate change on the distribution system is decentralized generation: producing a larger fraction of the power at or near the end-use to reduce the line capacity requirements. Examples are low-pressure methane and the use of windmills. Another option for avoiding the impacts of higher temperatures would be to place transmission lines underground.

The policies adopted to address climate change are likely to cause a shift in the fuel mix used to generate electricity. A shift from the traditional fossil fuel economy to one rich in renewable energy sources could have significant effects on water use, land use, air quality, national security, and the economy. For example, emission standards could lead to greater use of renewables and away from coal and petroleum. Higher cooling needs could lead to technological improvements in cooling and energy efficiencies or higher energy prices, which would reduce electricity demand.

Delivery of electricity may become more vulnerable to disruption due to climate-induced extreme heat and drought events as a result of:

- Increased demand for home and commercial cooling,
- Reduced power-plant efficiencies due to high temperatures,
- Reduced transmission-line, substation, and transformer capacities due to elevated temperatures
- Potential loss of hydropower production
- Threatened thermoelectric generation due to limited water supply
- Increased risk of wildfire damage to transmission infrastructure.

Information from: Tidwell, V. C., L. Dale, G. Franco, K. Averyt, M. Wei, D. M. Kammen, and J. H. Nelson. 2013. "Energy: Supply, Demand, and Impacts." In *Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment*, edited by G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy, 240–266. A report by the Southwest Climate Alliance. Washington, DC: Island Press.