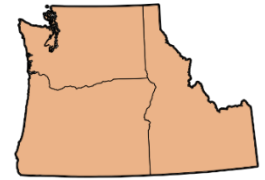


Northwest

Climate Change and the U.S. Energy Sector: Regional vulnerabilities and resilience solutions



Summary in Brief

The Northwest has a diverse topography with rocky shorelines, lush forests, mountains, farmlands, and arid regions. Major climate change impacts projected to increasingly threaten the region's energy infrastructure include the following:



Temperatures

Higher temperatures may increase the amount of precipitation falling as rain rather than as snow and cause mountain snowpack to melt earlier in the spring. Combined with projected declines in summer precipitation, these changes may lead to reduced summer streamflow. The Northwest is highly dependent on hydroelectric power to supply its electricity. Together, these changes may contribute to higher streamflows in the winter and spring and decreased streamflows and hydropower generation in the summer.



Temperatures

Average temperatures are projected to increase by 3°F–10°F over the course of the century, and annual cooling degree days (CDDs) for some areas could increase by 400 by mid-century. The region is also projected to experience longer and more severe heat waves and higher overnight low temperatures. Greater seasonal demand for electricity for cooling could occur simultaneously with reduced availability of hydropower in the summer.



Wildfires

Wildfire activity is projected to increase, with median burn area projected to quadruple by the 2080s. Wildfires in the region's forests threaten to disrupt or damage critical transmission infrastructure. Fires can burn poles, and smoke and fire retardants can foul lines, increasing the chance of arcing to ground.



Sea level rise

Sea levels are projected to rise more slowly in the Northwest than in other regions because of tectonic uplift, which has elevated much of the Northwestern coast. The uplift is not consistent, however, and infrastructure in the Puget Sound may be more vulnerable than in other areas.

QUICK FACTS					
Northwest States:		Washington, Oregon, Idaho			
Population (2013)		13,000,000 (4% of U.S.)			
Area (square miles)		245,000 (7% of U.S.)			
Energy Expenditures		\$49 billion			
ENERGY SUPPLY & DEMAND		Annual Production	Annual Consumption	% for electric power	
Electric power	TWh	193	163	n/a	
Petroleum	million barrels	0	232	<1%	
Coal	million tons	0	5	89%	
Natural gas	Bcf	1	569	24%	
ELECTRIC POWER		Annual Production (TWh)	% of Total Production	Capacity (GW)	Power plants >1 MW*
Natural gas		19	10%	9	39
Coal		6	3%	2	4
Nuclear		9	5%	1	1
Hydroelectric		140	72%	32	209
Wind		15	8%	7	87
Biomass		3	2%	1	48
Solar		<1	<1%	<1	6
CRITICAL INFRASTRUCTURE					
Petroleum		Electric Power			
Wells (>1 boe/d):	0	Power plants (> 1 MW):	394		
Refineries:	5	Interstate transmission lines:	10		
Liquids pipelines:	5	Coal			
Ports (>200 tons/yr):	6	Mines:	0		
Natural Gas		Waterways			
Wells:	27	Coal and petroleum routes:	10		
Interstate pipelines:	3	Railroads			
Market hubs:	3	Miles of freight track:	7,200		
Note: Table presents 2012 data except number of oil wells, which is 2009 data. *Some plants use multiple fuels, and individual generating units may be <1 MW.					

Examples of important energy sector vulnerabilities and climate resilience solutions in the Northwest

Subsector	Vulnerability	Magnitude	Illustrative Resilience Solutions
Hydroelectric Power	Reduced availability of summer power generation due to declining summer streamflow	Summer hydropower generation may decrease by 18%–21% by the 2080s	Water conservation, integrated water management, water availability forecasting, energy storage
Electricity Demand	Increased summer demand due to warmer air temperatures	Peak load may increase by almost 3,200 MW (about 8%) by 2030 due to temperature alone	Capacity expansion, energy efficiency, demand management, energy storage
Electric Grid	Increased risk of damage from more frequent and severe wildfires	Recent wildfires have burned through transmission and distribution lines and threatened the critical Pacific Intertie	Vegetation management, improved design standards for transmission equipment, redundant systems
Coastal Infrastructure	Threats from rising sea levels to power plants, terminals, and other low-lying assets	Four power plants are at or below four feet above sea level	Hardening and elevating structures, incorporating sea-level rise projections into infrastructure project planning