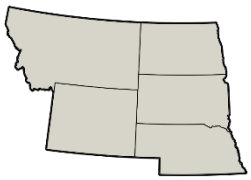
Northern Great Plains

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



Summary in Brief

The Northern Great Plains is home to less than 2% of the U.S. population but is a major supplier of critical energy resources used throughout the nation. These resources include coal from the Powder River Basin, electricity exported via interstate transmission lines, and rapidly growing oil production from the Bakken formation. Extensive rail and pipeline networks transport energy resources across the region. Major climate change impacts projected to increasingly threaten the region's energy infrastructure include the following:

Downpours

Climate change is projected to increase both the frequency and severity of heavy precipitation events in northern states, increasing heavy runoff and the risk of flooding. Floods threaten low-lying assets such as power plants and rail lines located in flood plains, and they can disrupt delivery of fuels and damage infrastructure.

Temperatures

Average temperatures are projected to increase, and extremely hot days are projected to occur more frequently. Heat waves are likely to become more frequent, more severe, and longer-lasting. Extreme heat can delay or disrupt rail service, affecting fuel shipments. As air and water temperatures rise, thermoelectric power plants operate less efficiently, and electricity demand for cooling increases. Higher temperatures also cause sag and increase resistance in transmission lines. Together, these effects may reduce available power supply during the hottest months when demand is highest.

QUICK FACTS

Northern Great Plains States:	Montana, Nebraska, North Dakota, South Dakota, Wyoming		
Population (2013)		5,036,423	(1.6% of U.S.)
Area (square miles)		464,000	(13% of U.S.)
Energy expenditures			$33 billion

ENERGY SUPPLY & DEMAND		Annual Production	Annual Consumption	*% for electric power*
Electric power	*TWh*	160	88	*n/a*
Petroleum	*MMbbls*	333	166	*1%*
Coal	*million tons*	466	85	*88%*
Natural gas	*Bcf*	2,280	528	*3%*

ELECTRIC POWER	Annual Production (TWh)	*% of Total Production*	Capacity (GW)	Power plants >1 MW*
Natural gas	2	*1%*	4	55
Coal	114	*71%*	18	42
Nuclear	6	*4%*	1	2
Hydroelectric	22	*14%*	5	55
Wind	15	*9%*	5	72
Biomass	<1	*<1%*	<1	4
Solar	0	*0%*	0	0

CRITICAL INFRASTRUCTURE

Petroleum		**Electric Power**	
Wells (>1 boe/d):	15,900	Power plants (> 1 MW):	277
Refineries:	11	Interstate transmission lines:	18
Liquids pipelines:	29	**Coal**	
Ports (>200 tons/yr):	0	Mines:	28
Natural Gas		**Waterways**	
Wells:	29,000	Coal and petroleum routes:	1
Interstate pipelines:	26	**Railroads**	
Market hubs:	1	Miles of freight track:	13,500

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.

Droughts

Decreasing water availability is projected in the summer for parts of the region as a result of seasonal changes in precipitation patterns from climate change and competing uses for water. Limited water availability may reduce the availability of thermoelectric power generation and affect biofuel production and oil and gas operations. Power plants, biorefineries, and agriculture are all major water users and require more water as temperatures increase. Competing uses for water, such as crop irrigation, may also contribute to limited availability.

Examples of important energy sector vulnerabilities and climate resilience solutions in the Northern Great Plains

Subsector	Vulnerability	Magnitude	Illustrative Resilience Solutions
Fuel Transport	Increased disruption from roadbed washouts and erosion from heavy precipitation and flooding	From the Bakken fields, rail accounts for more than 70% of total oil shipments and 100% of deliveries to the West Coast	Preventive maintenance, track inspection, and reliability standards
	Increased disruption of coal and oil by rail from extreme heat and rail buckling	Almost 50% of the coal produced in the United States travels along a small number of central rail lines in the region	Improved detection of track defects including buckling and weak points
Thermoelectric Power Generation	Reduced efficiency from increasing air and water temperatures and decreasing water availability	The region exported over 70 TWh of electricity in 2012, so reductions in available generation may also affect neighboring regions	Alternative water sources, recirculating, dry, or wet-dry hybrid cooling systems
Electricity Demand	Increased electricity demand in the summer from higher temperatures	An additional 200–800 CDDs per year is projected by mid-century for most of the region	Capacity expansion, energy efficiency, and demand-side management programs