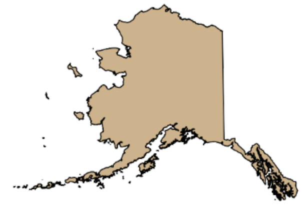
Alaska

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



Summary in Brief

Alaska consists of a vast, sparsely populated land area with over 30,000 miles of ocean coastline. Diverse ecosystems span the state, ranging from Arctic tundra in the far north to temperate continental in the interior to maritime coastal in the south. The state is a major oil and gas exporter, with critical oil production assets, pipelines and roads, and export facilities. Key climate change trends that may affect the energy sector in the region include the following:

Temperatures

Air temperatures in Alaska have increased rapidly over the last half-century and are projected to continue rising at a rate faster than anywhere else in the United States. Permafrost across much of the state is thawing, and permafrost loss is expected to continue in the future. Thawing permafrost alters the foundations of much of Alaska's infrastructure, such as the Trans-Alaska Pipeline System (TAPS), roads and airstrips, transmission lines, fuel storage tanks, and generators, and it can increase the vulnerability of riverbanks and coastlines to erosion.

Temperatures

Arctic sea ice is retreating and is projected to decline substantially in the future. Sea ice protects coastlines from erosion and reduces the height of storm surge, reducing coastal flooding. Erosion of coastlines undercuts the structural footing of energy infrastructure, including barge landings, power lines, and fuel storage tanks. Reduced sea ice can increase the offshore oil drilling and shipping season but also increases the vulnerability of coastal communities to flooding during autumn storms.

Wildfires

Wildfires may burn more extensively and frequently as projected higher temperatures, longer growing seasons, and drier conditions enable fires. Fire threatens infrastructure across Alaska's interior, including roads, transmission and distribution lines, and the TAPS. Wildfires and associated changes in vegetation cover can also lead to rapid, lasting permafrost thaw in some areas.

Downpours

Precipitation is projected to increase, and glaciers are expected to continue receding at increasing rates, likely increasing streamflow in the near term but causing long-term reductions. The continuing increase in river discharge from glaciers in southeastern and south central Alaska may increase hydropower potential but may also increase challenges associated with sedimentation and affect seasonal variability, complicating hydropower planning. In the long term, increases in rain (rather than snow) and associated changes in mountain snowpack, as well as the decline of glaciers, may reduce hydropower resources.

QUICK FACTS

Population (2013)	740,000	(<1% of U.S.)
Area (square miles)	571,000	(16% of U.S.)
Energy expenditures		$8 billion

ENERGY SUPPLY & DEMAND		Annual Production	Annual Consumption	*% for electric power*
Electric power	*TWh*	7	6	*n/a*
Petroleum	*million barrels*	188	45	*2%*
Coal	*million tons*	2	1	*43%*
Natural gas	*Bcf*	351	332	*10%*

ELECTRIC POWER	Annual Production (TWh)	*% of Total Production*	Capacity (GW)	Power plants >1 MW*
Natural gas	4	*52%*	1	13
Coal	1	*10%*	<1	5
Nuclear	0	*0%*	0	0
Hydroelectric	2	*23%*	<1	28
Petroleum	1	*15%*	<1	89
Wind	<1	*1%*	<1	4
Biomass	<1	*<1%*	<1	1
Solar	0	*0%*	0	0

CRITICAL INFRASTRUCTURE

Petroleum		**Electric Power**	
Wells (>1 boe/d):	1,284	Power plants (> 1 MW):	130**
Refineries:	6	Interstate transmission lines:	0
Liquids pipelines:	5	**Coal**	
Ports (>200 tons/yr):	7	Mines:	1
Natural Gas		**Waterways**	
Wells:	185	Coal and petroleum routes:	13
Interstate pipelines:	0	**Railroads**	
Market hubs:	0	Miles of freight track:	506

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.
**Total is less than sum of plants by fuel as some plants use more than one fuel.

Examples of important energy sector vulnerabilities and climate resilience solutions in Alaska

Subsector	Vulnerability	Magnitude	Illustrative Resilience Solutions
Fuel Transport and Storage	Increased risk of damage to foundations of transportation infrastructure from thawing permafrost, erosion of coastal and riparian fuel systems	Average annual shoreline erosion rates of 68 feet per year for the period 1954–2003 in Newtok, Alaska, due to reduced sea ice and thawing permafrost	Maintenance of support structures and embankments, rerouting around permafrost, protection of shorelines, or relocation of assets
Oil and Gas Exploration and Production	Reduced load-bearing of drilling pads due to permafrost thaw, shorter work season due to later freeze-up and earlier thaw of tundra	Reductions of continuous permafrost load-bearing capacity of up to 20%; 100 fewer working days per year in 2002 compared to 1970s	Appropriate structures for construction on “continuous permafrost,” including insulation to protect from thaw
Hydropower Generation	Possible changes to snowpack, streamflow timing, and sediments; long-term decline of glaciers	Glacier meltwater comprises approximately half of all streamflow volume in Alaska	Water resource management practices, including monitoring and forecasting snowmelt availability