Southern Great Plains

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

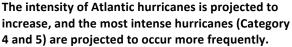


Summary in Brief

The Southern Great Plains region, comprising Kansas, Oklahoma, and Texas, contains oil and gas infrastructure critical to the nation's energy supply, including numerous offshore platforms, onshore oil and gas wells, oil refineries, natural gas processing plants, pipelines, and shipping terminals. Many of these assets are located near the Texas Gulf Coast. Key climate change impacts projected for the region include the following:



Sea level rise



Associated storm surge impacts may be enhanced by higher sea levels. Sea level rise is expected to be greater in some areas because of local land subsidence. Critical oil and gas infrastructure, power plants, and transport infrastructure such as bridges and pipelines located along the Texas Gulf Coast may be at risk of damage from more powerful hurricanes and storm surges amplified by sea level rise. High winds from more intense hurricanes may increase risk of damage to power lines.



Average temperatures are projected to increase, and extremely hot days are likely to occur more often.

Heat waves are projected to become more severe and last longer. By mid-century, the average number of cooling degree days (CDDs) may increase by 600–1,000 per year. Increasing air and water temperatures in the Southern Great Plains will reduce the efficiency and available capacity of power plants and transmission

lines while also increasing average and peak electricity demand for electricity for cooling in the summer.



Precipitation is projected to decrease across most of the region, with the largest declines occurring in the summer. Dry spells may become longer. These changes may lead to more frequent droughts. Combined with increasing demand and competition for water from other sectors, climate change may further limit the availability of water for energy. This includes withdrawals for critical operations such as power generation, oil refining, and the region's growing unconventional oil and gas production.

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

Subsector	Vulnerability	Magnitude	Illustrative Resilience Solutions
Oil and Gas Exploration and Production	Heightened exposure to damage and disruption from an increasing intensity and frequency of the most intense hurricanes	Increasing numbers of Category 4 and 5 hurricanes by the end of the century	Infrastructure hardening and elevation, improved operations protocols, restoration of coastal habitats
Electricity Demand	Increased demand for cooling energy in the summer, coinciding with reduced available capacity of power generation and transmission	Increasing CDDs by as much as 1,000 degree days by mid-century compared to historical averages	Energy efficiency, demand-side management programs and policies new peak load capacity
Thermoelectric Power Generation; Electric Grid	Reduced available generation capacity from higher temperatures and decreased water availability, and reduced capacity of electric lines from higher temperatures	Increasing air temperatures by 3.5°F–8.5°F and decreasing summer rainfall by 10%–30% by the end of the century	Alternative water sources and water-efficient power generation technologies, new generation and transmission capacity

QUICK FACTS					
Southern Great Plains States: Kansas, Oklahoma, Texas					
Population (2013))		33,000,000 (:	11% of U.S.)	
Area (square miles	s)		412,000 (12% of U.S.)	
Energy expenditures				\$190 billion	
ENERGY SUPPLY		Annual	Annual	% for	
& DEMAND		Production	Consumption	electric	
& DEIVIAND		Production	Consumption	power	
Electric power	TWh	552	465	n/a	
Petroleum	MMbbls	861	1,460	<1%	
Coal	million tons	45	135	99%	
Natural gas	Bcf	9,800	4,800	39%	
ELECTRIC POWER	Annual Production (TWh)	% of Total Production	Capacity (GW)	Power plants >1 MW*	
Natural gas	256	46%	95	257	
Coal	195	35%	36	35	
Nuclear	47	8%	6	3	
Hydroelectric	2	<1%	2	36	
Wind	46	8%	18	146	
Biomass	2	<1%	<1	30	
Solar	<1	<1%	<1	6	
CRITICAL INFRAST	RUCTURE				
Petroleum		Electric Pow	er		
Wells (>1 boe/d)	133,000	Power plants (> 1 MW):		555	
Refineries: 36		Interstate transmission lines:		s: 24	
Liquids pipelines: 32		Coal			
Ports (>200 tons/yr): 13		Mines:		20	
Natural Gas		Waterways			
Wells:	161,000	Coal and pe	troleum routes:	11	
Interstate pipelin	es: 41	Railroads			

8 Miles of freight track:

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.