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# U.S. electricity generation outlook



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*For*

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*By*

*Lori Aniti, Senior Industry Economist*

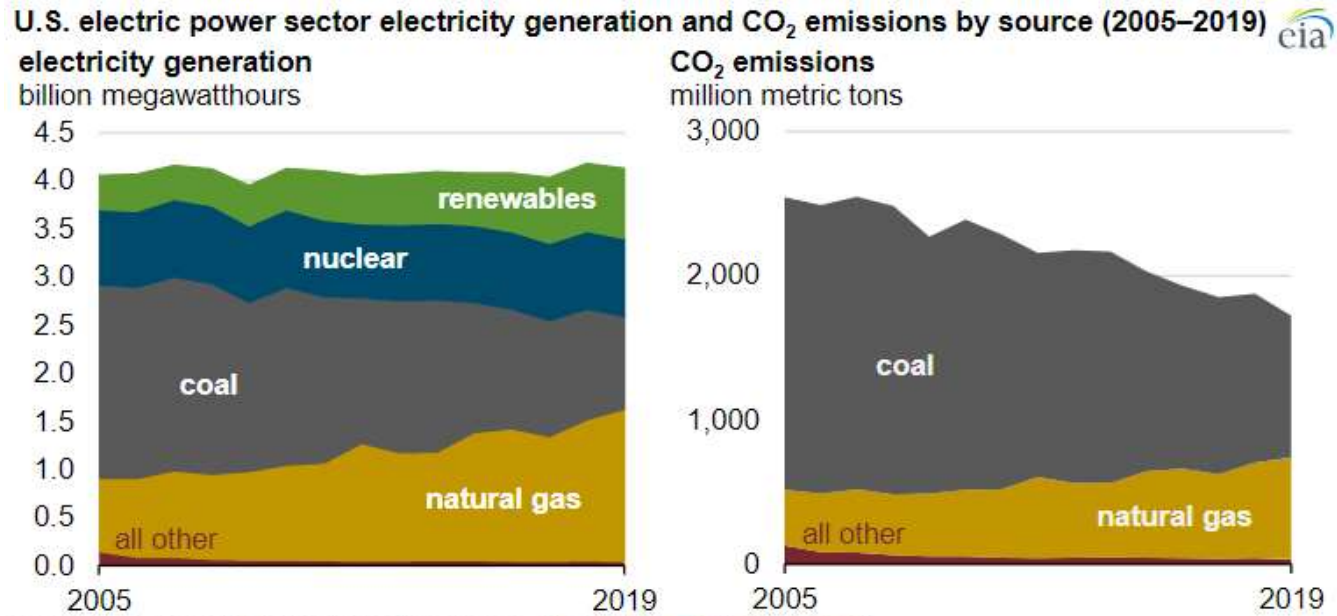
*Office of Energy Production and Markets Analysis*



U.S. Energy Information Administration

Independent Statistics & Analysis | [www.eia.gov](http://www.eia.gov)

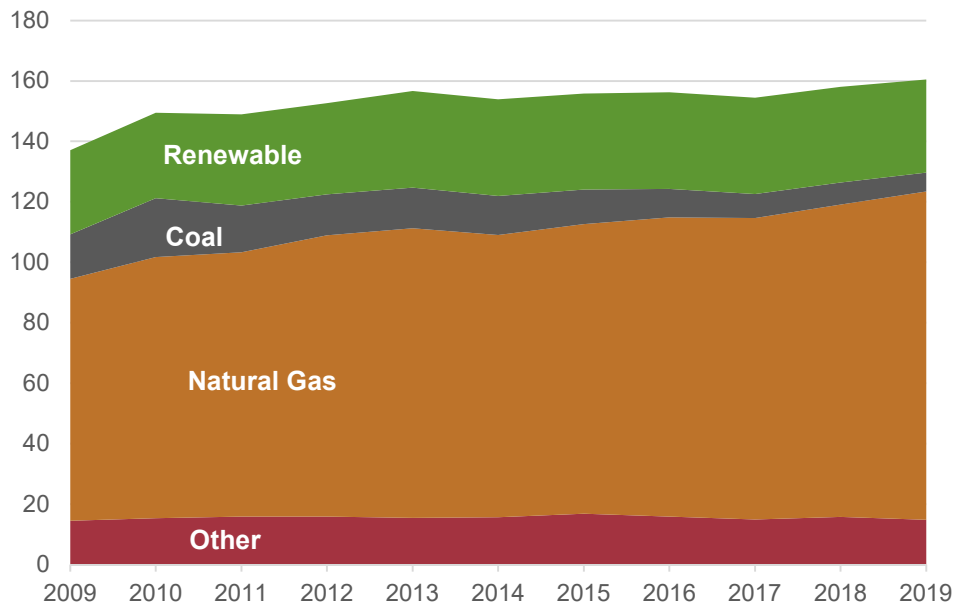
# Electric power sector CO<sub>2</sub> emissions drop as generation mix shifts from coal to natural gas and renewables



Source: U.S. Energy Information Administration, *Power Plant Operations Report*  
<https://www.eia.gov/todayinenergy/detail.php?id=48296>

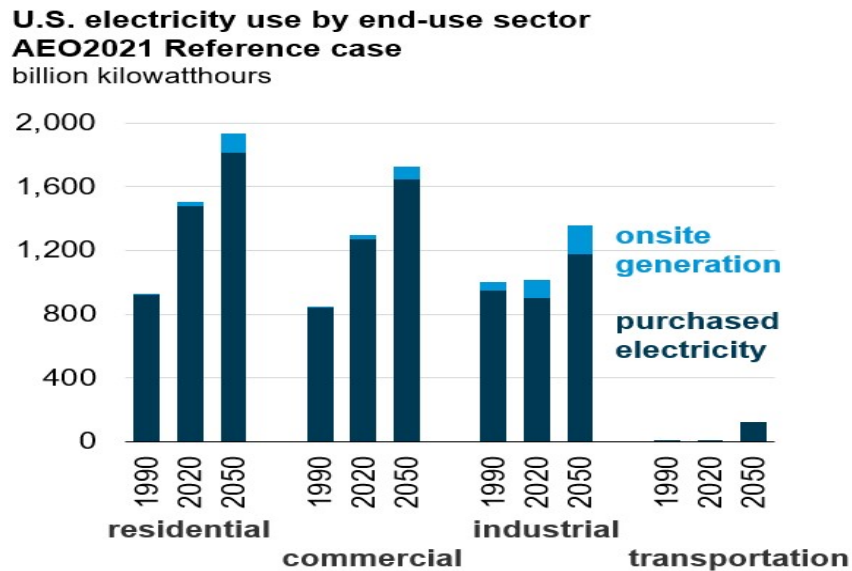
## Non-utility generation reflects a similar generation shift

**Net Generation—Commercial and Industrial Sectors (Billion KWh)**



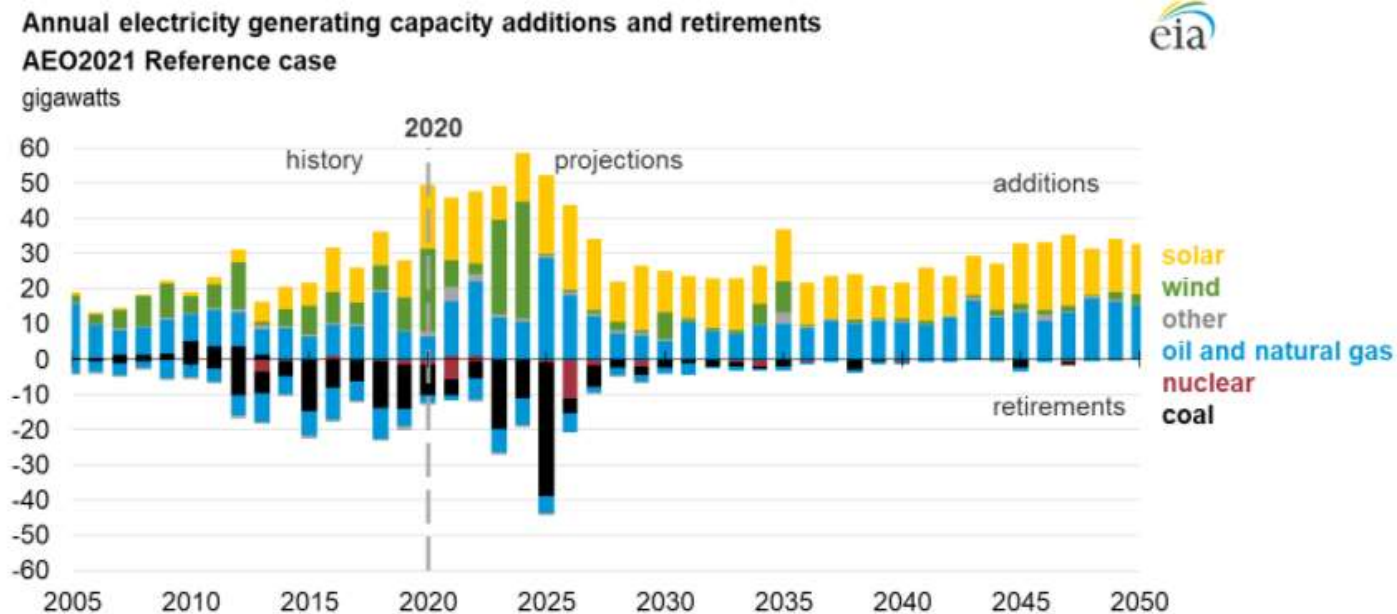
Source: U.S. Energy Information Administration, *Electric Power Annual*

## The share of on-site electricity generation increases across residential/commercial/industrial sectors



Source: U.S. Energy Information Administration, Annual Energy Outlook 2021

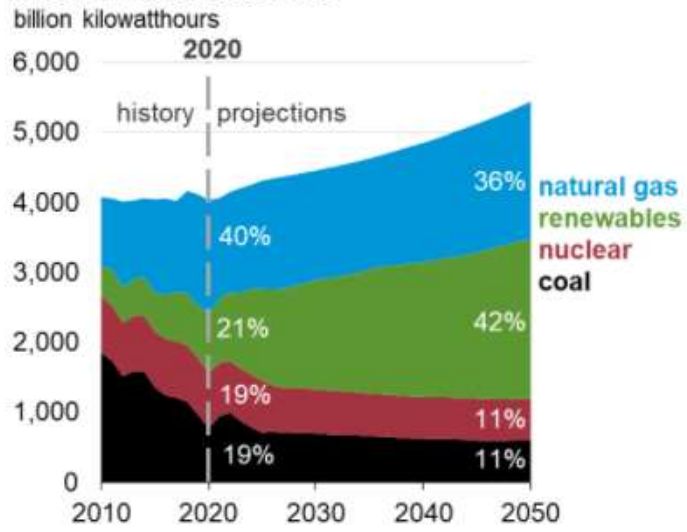
# As coal and nuclear generating capacity retires, new capacity additions come largely from natural gas and renewable technologies



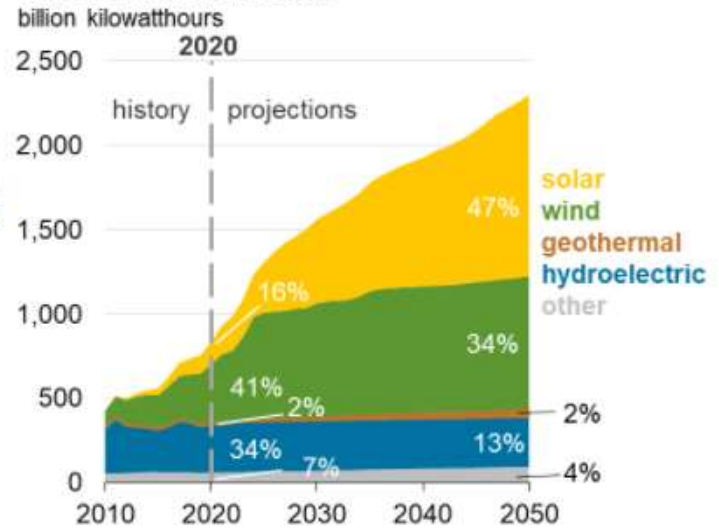
Source: U.S. Energy Information Administration, *Annual Energy Outlook 2021* (AEO2021) Reference case and July 2020 Form EIA-860M

# Renewable electricity generation increases more rapidly than overall electricity demand through 2050

**U.S. electricity generation from selected fuels**  
AEO2021 Reference case



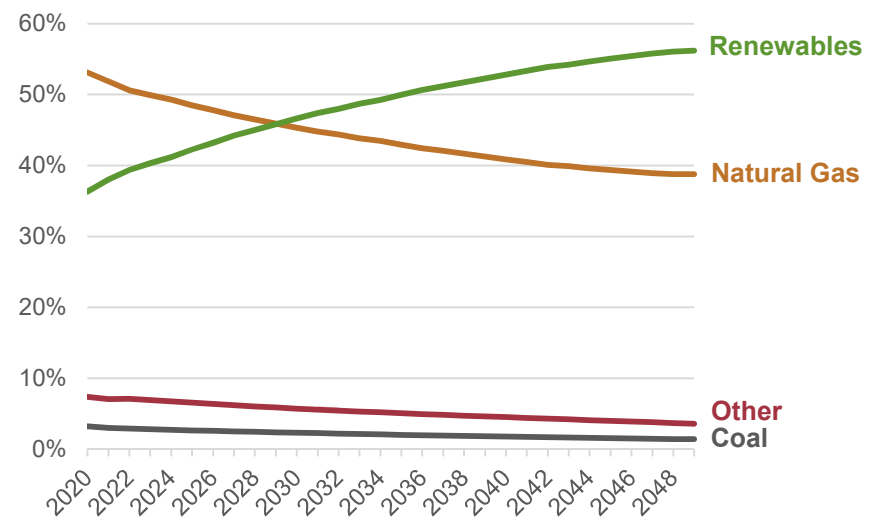
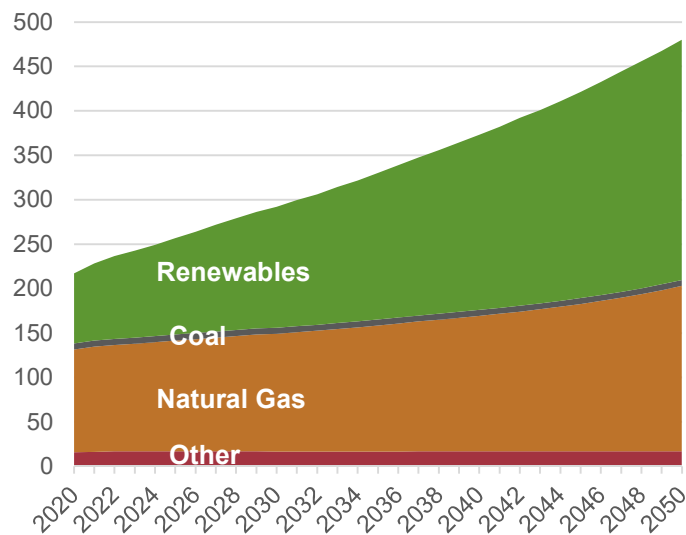
**U.S. renewable electricity generation, including end use**  
AEO2021 Reference case



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2021 (AEO2021)* Reference case

# Renewable energy also projected to grow for non-utility generators

**Total non-utility generation by fuel source (billion kWh and % shares)**

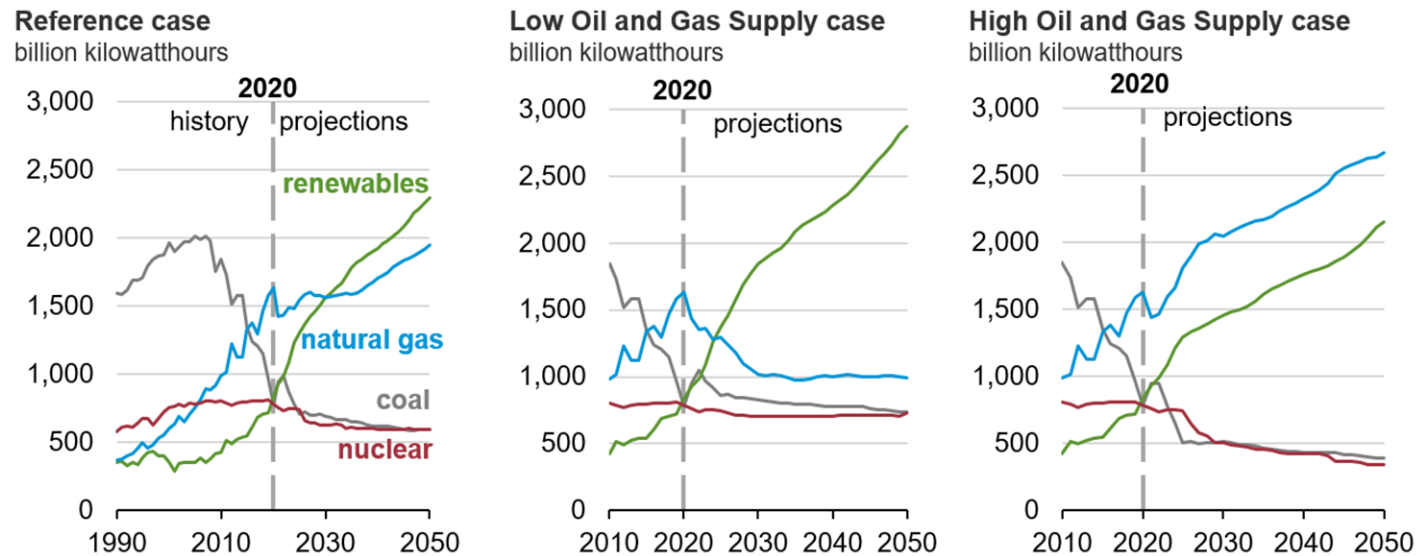


\*Includes combined heat and power plants and electricity-only plants in the commercial and industrial sectors that have a non-regulatory status; and small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation,



# Electricity generation increases by a third; natural gas prices influence competition with renewables

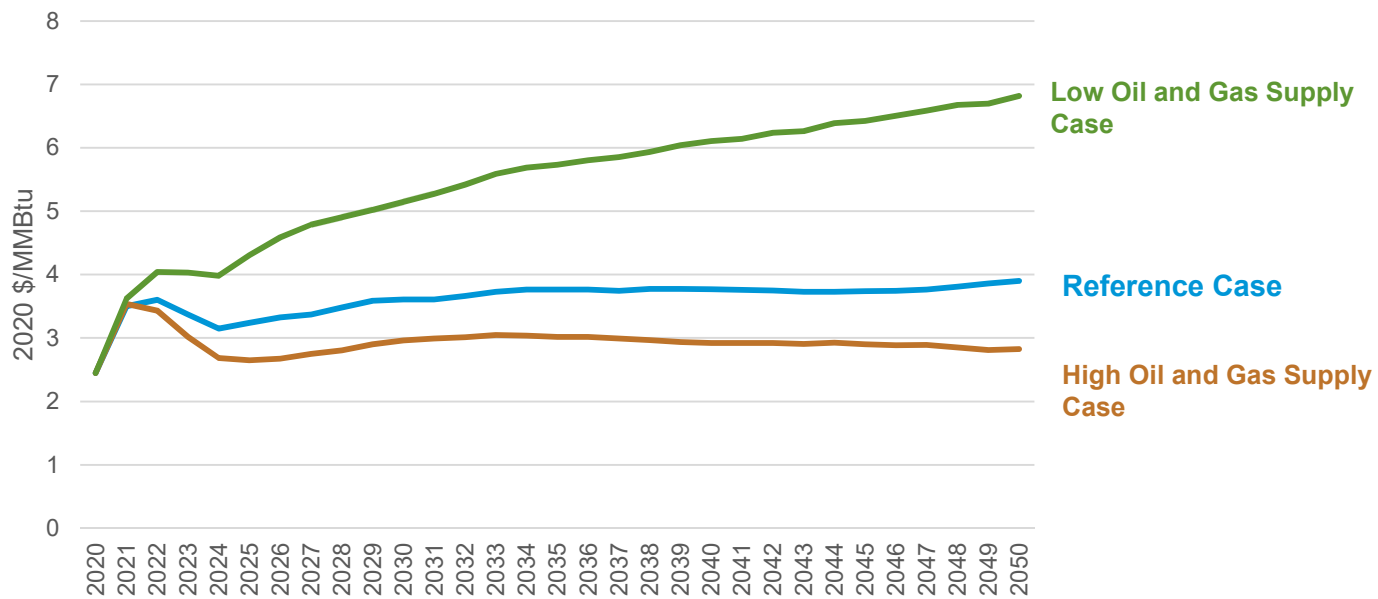
U.S. electricity generation, AEO2021 oil and gas supply cases



Source: U.S. Energy Information Administration, Annual Energy Outlook 2021

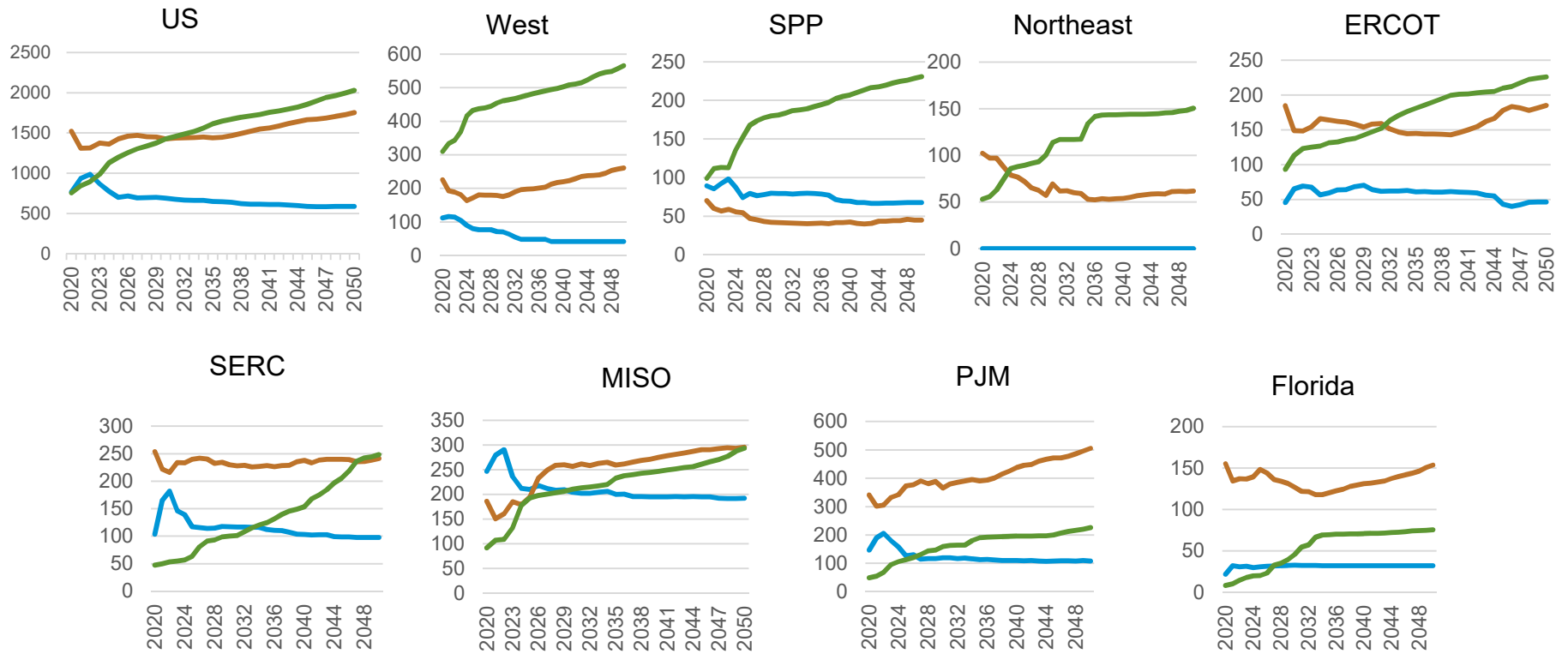


# Availability of natural gas sets prices to the electric sector



Source: U.S. Energy Information Administration, Annual Energy Outlook 2021

# Projected coal, natural gas, and renewables generation varies by region



Source: U.S. Energy Information Administration, Annual Energy Outlook 2021



## Key determinants for projected generating capacity additions: LCOE, LACE, and other considerations

- All levelized costs include levelized capital, fixed O&M, and variable O&M costs, costs to hook up transmission based on generator type, tax credits for specific generating technologies, and take capacity factors of the various technologies into consideration
- EIA calculates all levelized costs and values based on a 30-year cost recovery period, using a real after tax weighted average cost of capital (WACC) of 5.4%
- LACE accounts for the differences in the grid services that each technology provides, and recognizes that intermittent resources, such as wind or solar, have substantially different duty cycles than the baseload, intermediate, and peaking duty cycles of conventional generators.
- When the LACE (avoided cost) of a particular technology exceeds its LCOE--it has a positive value-cost ratio--that technology would generally be economically attractive to build.
- EIA's National Energy Modeling System (NEMS), also takes policy legislation and fuel price variability into consideration

## Regional variation in levelized avoided cost of electricity (LACE) for new resources entering service in 2026 (2020 dollars per megawatthour)

Plant type	Minimum	Simple average	Capacity-weighted average <sup>1</sup>	Maximum
<b>Dispatchable technologies</b>				
Ultra-supercritical coal	\$30.82	\$35.59	<i>NB</i>	\$40.05
Combined cycle	\$30.68	\$36.35	\$34.58	\$44.85
Combustion turbine	\$66.86	\$90.95	\$93.59	\$119.43
Advanced nuclear	\$30.75	\$35.41	<i>NB</i>	\$39.79
Geothermal	\$37.44	\$40.89	\$41.48	\$44.52
Biomass	\$30.92	\$36.60	<i>NB</i>	\$45.17
Battery storage	\$66.86	\$90.95	\$97.53	\$119.43
<b>Non-dispatchable technologies</b>				
Wind, onshore	\$26.17	\$31.87	\$30.71	\$47.42
Wind, offshore	\$28.50	\$33.19	<i>NB</i>	\$42.63
Solar, standalone <sup>2</sup>	\$27.45	\$31.66	\$30.63	\$38.78
Solar, hybrid <sup>2, 3</sup>	\$28.74	\$42.74	\$44.45	\$55.48
Hydroelectric <sup>3</sup>	\$29.41	\$34.74	<i>NB</i>	\$43.49

Source: U.S. Energy Information Administration, *Annual Energy Outlook 2021*

# Value-cost ratios of new generating technologies in NEMS

Plant type	Average capacity-weighted <sup>1</sup> LCOE or LCOS <sup>2</sup> with tax credits (2020 dollars per megawatthour)	Average capacity-weighted <sup>1</sup> LACE <sup>2</sup> (2020 dollars per megawatthour)	Average value-cost ratio <sup>3</sup>
<b>Dispatchable technologies</b>			
Ultra-supercritical coal	<i>NB</i>	<i>NB</i>	<i>NB</i>
Combined cycle	\$34.51	\$34.58	1.00
Combined turbine	\$107.83	\$93.59	0.87
Advanced nuclear	<i>NB</i>	<i>NB</i>	<i>NB</i>
Geothermal	\$34.16	\$41.48	1.22
Biomass	<i>NB</i>	<i>NB</i>	<i>NB</i>
Battery storage	\$121.84	\$97.53	0.80
<b>Non-dispatchable technologies</b>			
Wind, onshore	\$31.45	\$30.71	0.98
Wind, offshore	<i>NB</i>	<i>NB</i>	<i>NB</i>
Solar, standalone <sup>4</sup>	\$29.04	\$30.63	1.06
Solar, hybrid <sup>4, 5</sup>	\$42.18	\$44.45	1.06
Hydroelectric <sup>5</sup>	<i>NB</i>	<i>NB</i>	<i>NB</i>

Source: U.S. Energy Information Administration, *Annual Energy Outlook 2021*

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# Questions?

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## Sources, upcoming product releases, and contact information

- Form EIA-923 Power Plant Operations Report | <https://www.eia.gov/electricity/data/eia923/>
- Electric Power Annual | <https://www.eia.gov/electricity/annual/>
- Annual Energy Outlook 2021 | [www.eia.gov/outlooks/aeo/](http://www.eia.gov/outlooks/aeo/)
- International Energy Outlook 2020 | <https://www.eia.gov/outlooks/ieo/>
- October 2021 Short-Term Energy Outlook | October 13, 2021
- International Energy Outlook 2021 | October 2021
- Annual Energy Outlook 2022 | January 2022
- Lori Aniti | [lori.aniti@eia.gov](mailto:lori.aniti@eia.gov)