Electricity
U.S. electricity generation and share from selected fuels and renewable sources

U.S. electricity generation from selected fuels
AEO2021 Reference case
billion kilowatthours

- 2010: 1,000
- 2020: 2,000
- 2030: 3,000
- 2040: 4,000
- 2050: 5,000

- 2020 history: 2,000
- 2020 projections: 3,000

- Natural gas: 36%
- Renewables: 40%
- Nuclear: 21%
- Coal: 19%

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

- 2010: 500
- 2020: 2,500
- 2030: 5,000
- 2040: 7,500
- 2050: 10,000

- 2020 history: 1,000
- 2020 projections: 2,000

- Solar: 47%
- Wind: 34%
- Geothermal: 7%
- Hydroelectric: 21%
- Other: 8%

### U.S. electricity use growth rate, three-year rolling average

#### AEO2021 economic growth cases

- **High Economic Growth**
- **Reference**
- **Low Economic Growth**

#### Percentage growth

<table>
<thead>
<tr>
<th>Year</th>
<th>1990</th>
<th>2020</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td>-2%</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>Projections</td>
<td>0%</td>
<td>1%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Note: Onsite generation is electricity produced onsite for own use.

### U.S. electricity use by end-use sector

#### AEO2021 Reference case

<table>
<thead>
<tr>
<th>Sector</th>
<th>1990</th>
<th>2020</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>400</td>
<td>1,200</td>
<td>1,600</td>
</tr>
<tr>
<td>Commercial</td>
<td>800</td>
<td>1,200</td>
<td>1,600</td>
</tr>
<tr>
<td>Industrial</td>
<td>400</td>
<td>1,200</td>
<td>1,600</td>
</tr>
<tr>
<td>Transportation</td>
<td>0</td>
<td>1,200</td>
<td>1,600</td>
</tr>
</tbody>
</table>


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U.S. electricity generation levels from selected fuels and renewable sources

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

Reference case
billion kilowatthours

2020 projections

Low Oil and Gas Supply case
billion kilowatthours

2020 projections

High Oil and Gas Supply case
billion kilowatthours

2020 projections

Note: Renewables category includes electricity generation from wind, solar, hydroelectric, geothermal, wood, and other biomass sources.
U.S. electricity generation levels from selected fuels and renewable sources

U.S. electricity generation, AEO2021 renewables cost cases

Reference case
billion kilowatthours

Low Renewables Cost case
billion kilowatthours

High Renewables Cost case
billion kilowatthours

Note: Renewables category includes electricity generation from wind, solar, hydroelectric, geothermal, wood, and other biomass sources.

U.S. retiring and new generating capacity

Annual electricity generating capacity additions and retirements
AEO2021 Reference case

Source: Form EIA-860M, Monthly Update to the Annual Electric Generator Report, July 2020
U.S. cumulative retiring and new generating capacity

Cumulative electricity generating capacity additions and retirements (2021–2050)
AEO2021 selected cases

gigawatts

<table>
<thead>
<tr>
<th>Case</th>
<th>Solar</th>
<th>Wind</th>
<th>Oil and natural gas</th>
<th>Nuclear</th>
<th>Other</th>
<th>Coal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference case</td>
<td>435</td>
<td>114</td>
<td>375</td>
<td>26</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Low Oil and Gas Supply</td>
<td>563</td>
<td>200</td>
<td>253</td>
<td>94</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>High Oil and Gas Supply</td>
<td>385</td>
<td>105</td>
<td>466</td>
<td>6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Low Renewables Cost</td>
<td>657</td>
<td>237</td>
<td>297</td>
<td>97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Renewables Cost</td>
<td>206</td>
<td>121</td>
<td>446</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

additions

- solar
- wind
- oil and natural gas
- nuclear
- other
- coal

retirements


Electricity prices by components and long-term average electricity prices

Components of U.S. Electricity Prices
AEO2021 Reference case
2020 cents per kilowatthour

<table>
<thead>
<tr>
<th>Year</th>
<th>Generation</th>
<th>Transmission</th>
<th>Distribution</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>5.83</td>
<td>5.42</td>
<td>1.35</td>
<td>12.60</td>
</tr>
<tr>
<td>2030</td>
<td>4.99</td>
<td>4.68</td>
<td>1.51</td>
<td>11.28</td>
</tr>
<tr>
<td>2040</td>
<td>3.48</td>
<td>3.34</td>
<td>1.58</td>
<td>8.40</td>
</tr>
<tr>
<td>2050</td>
<td>4.68</td>
<td>3.40</td>
<td>1.54</td>
<td>9.62</td>
</tr>
</tbody>
</table>

U.S. average electricity price
AEO2021 selected cases
2020 cents per kilowatthour

- History
- Projections

- Low Oil and Gas Supply
- High Renewables Cost
- Reference Cost
- Low Renewables Cost
- High Oil and Gas Supply

Hybrid versus stand-alone solar photovoltaic (PV) and energy storage systems

U.S. solar PV generating capacity, all sectors
AEO2021 Reference case
gigawatts

- hybrid solar PV, power sector
- stand-alone solar PV, end use
- stand-alone solar PV, power sector

U.S. storage energy capacity, power sector
AEO2021 Reference case
billion kilowatthours

- hybrid storage
- stand-alone storage

Renewable capacity by source and region

Total renewables capacity in all sectors, 2019 and 2050
AEO2021 selected side cases
gigawatts

Northeast | PJM | Southeast | Mid-Continent | ERCOT | CAISO | West

- **solar photovoltaic, power sector**
- **solar photovoltaic, end use**
- **onshore wind**
- **offshore wind**
- **stand-alone energy storage**
- **other**
- **hydro**

HC: High Renewable Cost; LC: Low Renewable Cost; HOGS: High Oil & Gas Supply; LOGS: Low Oil & Gas Supply; other: geothermal, biomass, municipal waste


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Economic cost competitiveness of generating technologies

Levelized avoided cost of electricity (LACE) and levelized cost of electricity (LCOE) by technology, 2026 online year, AEO2021 Reference case
2020 dollars per megawatthour

Economically attractive builds are shown above the diagonal breakeven line for each technology.

The solid, colored circles on the figure indicate that projects tend to be built in regions where revenue (LACE) exceeds costs (LCOE).

Note: CCGT = natural gas combined cycle, PV = solar photovoltaic

Total qualifying renewables generation required for combined state renewable portfolio standards and projected total generation from compliant technologies

AEO2021 Reference case

<table>
<thead>
<tr>
<th>Year</th>
<th>Additional Projected Generation</th>
<th>Required Compliant Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>0</td>
<td>500</td>
</tr>
<tr>
<td>2030</td>
<td>1,000</td>
<td>2,000</td>
</tr>
<tr>
<td>2040</td>
<td>1,500</td>
<td>2,500</td>
</tr>
<tr>
<td>2050</td>
<td>2,000</td>
<td>3,000</td>
</tr>
</tbody>
</table>
U.S. nuclear capacity and annual capacity changes

U.S. nuclear electricity generating capacity
AEO2021 oil and gas supply cases

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>120 gigawatts</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>100 gigawatts</td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>80 gigawatts</td>
<td></td>
</tr>
<tr>
<td>2040</td>
<td>60 gigawatts</td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td>40 gigawatts</td>
<td></td>
</tr>
</tbody>
</table>

Year-over-year nuclear capacity changes
AEO2021 Reference case

- **History**
- **Projections**
- **Additions**
- **Retirements**
- **Assumed uprates**
- **New reactors**
- **Actual or announced retirements**
- **Projected retirements**
U.S. coal-fired generation, capacity, and capacity factors


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**U.S. electric generating capacity**

**AEO2021 oil and gas supply cases**

- **Gigawatts**
  - **History**
  - **Projections**
  - **Low Oil and Gas Supply**
  - **Reference**
  - **High Oil and Gas Supply**

**U.S. total electricity generation**

- **Billion kilowatthours**
  - **2020**
  - **4,000**

**U.S. capacity factor for coal-fired generation**

- **Percentage**
  - **2020**
  - **100%**

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High Oil and Gas Supply

Reference

Low Oil and Gas Supply

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U.S. coal-fired generating capacity relative to natural gas prices

U.S. electric generating capacity
AEO2021 oil and gas supply cases
gigawatts

Average delivered natural gas prices to the electric power sector
2020 dollars per million British thermal units

2020
history | projections

Low Oil and Gas supply
Reference
High Oil and Gas supply

www.eia.gov/aeo
Coal production by U.S. region

U.S. coal production by region, AEO2021 oil and gas supply cases

Reference case

Low Oil and Gas Supply case

High Oil and Gas Supply case

million short tons

2020

projections

2020

projections

2020

projections


www.eia.gov/aeo
Capacity factor for U.S. fossil fuel-fired plants
AEO2021 Reference case

Note: New combined-cycle (natural gas) plants are assumed to come online in 2023. New builds as shown are multi-shaft combined-cycle units. Existing combined cycle units include both multi-shaft and single-shaft; 12 gigawatts of new single-shaft combined-cycle units are included in existing.