Emissions from Electricity Supply

- **Electric Power**: 24%
- **Transportation**: 32%
- **Industrial**: 21%
- **Buildings**: 13%
- **Agriculture**: 10%
- **Coal**: 58%
- **Natural Gas**: 37%
- **Petroleum**: 1%
- **Other**: 4%

*For DOE Internal Use Only*
RE in the Current Generation Mix

U.S. electricity generation from renewable energy sources, 1950-2020

billion kilowatthours

Note: Electricity generation from utility-scale facilities. Hydroelectric is conventional hydropower.
And must continue to expand 2035-2050 to reach net zero

In IEA net zero pathway, renewables make up nearly 90% of electricity generation in 2050,
By 2050 Clean Electricity Will Need to Supply Most Energy Needs

Data from NREL Solar Futures Study, 2021
Electrification is critical to decarbonization goals

Aggressive electrification yields an additional reduction of **1.4 Gt Co2/yr by 2050** – the equivalent of over half of all power sector emissions in 2005 – and this is not yet net zero.

Additional decarbonization through electrification
Renewable generation must expand dramatically by 2035
Overall Priorities in Renewable Power

RDD&D efforts in solar, wind, water, and geothermal power to help reduce the costs and accelerate the use and integration of renewables in a reliable, secure, and resilient grid.

**Accelerate Deployment**
Accelerate deployment of existing technologies by:
- Addressing market and regulatory barriers,
- Minimizing environmental and social impacts
- Ensuring projects provide equitable and local benefits

**Sustain Cost Reductions**
Drive continued cost reductions to:
- Ensure renewable energy is a least-cost generation option across the entire country by 2035
- Ensure growth continues to accelerate through 2050 to match newly electrified loads

**Increase Resource Flexibility & Diversity**
Maximize flexibility and reliability of generation & load through:
- New short and long-duration storage
- Enhance flexibility of variable generation and load
- Ensuring sufficient firm, flexible generation

**Support a Modernized Grid**
Optimize grid infrastructure & mgmt. to an RE-led system, through:
- Expanded transmission
- Enhanced power system planning, operations, and resilience
- Advanced grid technologies
- Updated regulations and market design

**Support U.S. manufacturing and secure supply chains**
Ensure renewable energy technologies benefit workers and communities by
- Supporting clean energy workforce and new careers,
- Ensuring RE revenues and benefits are equitably distributed
- Minimizing life-cycle emissions
- Eliminating dependence on vulnerable or unsustainable materials
Solar Power: Deployment to Meet Net Zero

Solar Deployment 2020–2050

- Decarbonized Grid
- Decarbonized Energy System

Solar Capacity by Census Division in 2020, 2035, and 2050

- Solar Capacity (GW)
- 2020
- 2035
- 2050

- Installed Capacity (GW, AC)
- 2020
- 2025
- 2030
- 2035
- 2040
- 2045
- 2050

- Solar Capacity (GW)
- <5
- 5-10
- 10-20
- 20-30
- 30-70
- 70-140
- 140-280
- 280<
Impact of Further Wind Cost Reductions

The combination of cost-reduction, solutions to environmental siting barriers, and enhanced grid adequacy and access, enables wind energy to become the competitive option of choice on land and offshore.
## Ambitious New 30 GW Offshore Wind Deployment Target by 2030

### Challenges

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost of Energy</strong></td>
<td>Policy incentives</td>
</tr>
<tr>
<td><strong>Siting and Permitting</strong></td>
<td>R&amp;D to reduce cost</td>
</tr>
<tr>
<td><strong>Grid Connections, Transmission Adequacy</strong></td>
<td>Decreased permitting timeframes</td>
</tr>
<tr>
<td><strong>Supply Chain</strong></td>
<td>Increased leased areas</td>
</tr>
<tr>
<td><strong>(with DOI, DOD, DHS)</strong></td>
<td>Access to onshore and offshore transmission</td>
</tr>
<tr>
<td><strong>(with FERC)</strong></td>
<td>R&amp;D to support grid reliability</td>
</tr>
<tr>
<td><strong>(with Commerce)</strong></td>
<td>Financial and policy support to enable:</td>
</tr>
<tr>
<td></td>
<td>• U.S. turbine component manufacturing and materials</td>
</tr>
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<td></td>
<td>• U.S. flagged installation vessels</td>
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<td>• Port expansion</td>
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<td>• Workforce development</td>
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### U.S. Offshore Wind Project Activity as of 7/15/20

- **BOEM Wind Energy Lease Areas**
- **Wind Energy Call Areas**

### Bathymetry Depth (meters)

- < 30
- 30-45
- 45-60
- 60-90
- ≥ 90

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Atlantic offshore wind lease and call areas (DOI/BOEM)

Source: DOE Press Release/S-1 Joint Announcement – March 29, 2021
Emissions Reductions Potential from Geothermal

Electric Sector ➔ up to 516 MMT of avoided CO2e

Heating & Cooling Sector ➔ up to 1,281 MMT of avoided CO2e

8% of ALL U.S. generation by 2050

America could potentially achieve a 26-fold increase in geothermal generation, representing 60 GWe capacity.

Potential rise in geothermal heat pump installations from 2.5 million to 28 million.

Potential increase in district heating installations from 23 to 17,500 installations nationwide.

Emissions Reductions = removal of 26 million cars per year