20% Wind Energy by 2030...
and the transmission grid required for our carbon constrained future

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Growth Path to 20% Wind by 2030

Only a fraction of total wind potential would be needed to reach 20%.

Total capacity would grow to nearly 305,000 MW, or an additional 293,000 MW over the 11,600 MW installed at the end of 2006.

Annual installations would increase to over 16,000 MW per year by 2018.
Wind Resource Supply Curves

Wind Resource Potential in the U.S.

Once existing transmission availability of 10% and integration costs are included, over 600 GW of wind is still available at competitive levels.
Wind capacity would be installed across **46 states** in the 20% wind scenario.
The 20% Wind Scenario would decrease generation from natural gas by 50% and generation from coal by 18%.
Estimated Electric System Costs

Cumulative Discounted Electric System Cost through 2030 (Millions of 2006 Dollars)

- Approximately a 2% increase in cost, or $43 billion in net present value.
- Equivalent of 50 cents per month per household, not accounting for positive, offsetting impacts.
20% Wind Scenario: Projected Impacts

- **Environment**: Avoids air pollution, reduces GHG emissions, and reduces water use in electricity generation. Reduces electric sector CO₂ emissions by 825 million metric tons.

- **U.S. energy security**: Diversifies our electricity portfolio and represents an indigenous energy source with stable prices not subject to fuel volatility

- **Energy consumers**: Wind potentially reduces demand for fossil fuels, in turn reducing fuel prices and stabilizing electricity rates

- **Local economics**: Creates new income source for rural landowners and tax revenues for local communities in wind development areas.

- **American workers**: Generates well-paying jobs in sectors that support wind development, such as manufacturing, engineering, construction, transportation, and financial services. The new manufacturing will cause significant growth in the wind industry supply chain.

- **Water savings**: Reduce cumulative water use in the electric sector by 8% (4 trillion gallons)

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Projected Impacts and Major Challenges

20% Wind Scenario: Major Challenges

- Investment in the nation’s transmission system so the power generated is delivered to urban centers that need the increased supply;

- Larger electric load balancing areas, in tandem with better regional planning, so that regions can depend on a diversity of generation sources, including wind power;

- Continued reduction in wind capital cost and improvement in turbine performance through technology advancement and improved manufacturing capabilities; and

- Addressing potential concerns about local siting, wildlife, and environmental issues within the context of generating electricity.
Today’s balkanized grid limits renewables

140 separate Balancing Areas
Transmission Superhighways and Regional Grid Operation Needed for High Wind Penetration

This map shows the wind resource data used by the WinDS model for the 20% Wind Scenario. It is a combination of high resolution and low resolution datasets produced by NREL and other organizations. The data was screened to eliminate areas unlikely to be developed onshore due to land use or environmental issues. In many states, the wind resource on this map is visually enhanced to better show the distribution on ridge crests and other features.

<table>
<thead>
<tr>
<th>Wind Power Class</th>
<th>Resource Potential</th>
<th>Wind Power Density at 50 m W/m²</th>
<th>Wind Speed* at 50 m m/s</th>
<th>Wind Speed* at 50 m mph</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fair</td>
<td>300 - 400</td>
<td>6.4 - 7.0</td>
<td>14.3 - 15.7</td>
</tr>
<tr>
<td>4</td>
<td>Good</td>
<td>400 - 500</td>
<td>7.0 - 7.5</td>
<td>16.7 - 16.8</td>
</tr>
<tr>
<td>5</td>
<td>Excellent</td>
<td>500 - 600</td>
<td>7.5 - 8.0</td>
<td>16.8 - 17.9</td>
</tr>
<tr>
<td>6</td>
<td>Outstanding</td>
<td>600 - 800</td>
<td>8.0 - 8.8</td>
<td>17.9 - 19.7</td>
</tr>
<tr>
<td>7</td>
<td>Superb</td>
<td>800 - 1600</td>
<td>8.8 - 11.1</td>
<td>19.7 - 24.8</td>
</tr>
</tbody>
</table>

* Wind speeds are based on a Weibull k value of 2.0