Renewable Energy

Our Approach

Renewable energy sources play a vital and growing role in our energy supply and our future plans for meeting customer energy needs. Increasingly, many of our customers and the communities we serve want energy from clean, renewable sources.

We are fortunate to operate in regions considered rich in wind and sun for producing electricity, which we are putting to use. Not only are we responding to customer interests, but we are reducing carbon emissions and other environmental impacts, diversifying our energy supply, and even, saving customers money. Under our ‘steel for fuel’ strategy, we are building new wind farms that will result in billions of dollars in future fuel savings for customers. The savings are currently so significant because of low wind prices and available tax credits.

We are able to capitalize on low-cost wind in part because of our extensive experience integrating wind on our system. For more than a decade, the American Wind Energy Association has ranked Xcel Energy the nation’s No. 1 provider of wind energy. With more wind capacity than any other U.S. utility, we have invested in advanced forecasting and operating practices that make wind energy more predictable and easier to manage.

We are approaching solar with same level of commitment as wind. By the end of 2016, we had increased universal solar capacity on our system fourfold, compared to 2013. Today, these large-scale solar projects are the most cost-effective option for meeting customer needs. They cost half as much as private, rooftop solar because of economies of scale, technology and the ability to locate panels in the sunniest places. At the same time, we know that some customers want additional choices, including community and privately owned rooftop solar options, and we have a growing number of renewable solutions to offer, including Windsources®, Solar*Rewards®, Solar*Rewards® Community®, Renewable*Connect® and Solar*Connect Community®.

Renewable energy is a vital and growing part of Xcel Energy’s energy supply

- **2005**: 9%
- **2010**: 13%
- **2016**: 25%
- **2021**: 41%
Recent Wind and Solar Additions

In 2016, Xcel Energy completed its 2013 commitment to grow the wind portfolio by 40 percent, adding 1,900 megawatts of capacity through nine cost-effective, new wind projects. This includes three wind farms in the Upper Midwest that Xcel Energy now owns and operates: Pleasant Valley, Border and Courtenay.

Located in Stutsman County, North Dakota, the Courtenay Wind Farm was the first wind project that we managed through construction. The project provides significant economic development for the area, including 200 construction jobs, eight permanent jobs and $850,000 in annual tax revenue. Participating landowners will collectively receive $26.5 million in lease payments over the next 20 years.

In addition to wind, we added 600 megawatts of solar capacity in 2016 that includes nearly 500 megawatts of large, universal solar in three states, all under power purchase agreements. This includes the 120-megawatt Comanche Solar project in Pueblo, Colorado, which is the largest solar project east of the Rocky Mountains, comprised of more than 450,000 solar panels.

The Nation’s Largest Multi-state Investment in Wind Energy

Xcel Energy announced plans for 11 new wind farms in seven states, totaling 3,380 megawatts of new wind capacity in early 2017. If approved, the projects will grow our wind portfolio by 3,380 megawatts or 50 percent. This includes investing at least $3.5 billion in company-owned wind farms, increasing or wind ownership from 850 megawatts today to 3,600 megawatts by 2021. By taking advantage historic low wind prices and the full production tax credit, the cost to build these projects will be offset by billions of dollars in future fuel savings.

- We already have approval to build, own and operate the Rush Creek Wind Farm in Colorado. The 600-megawatt facility is among the largest in the state. Construction began in spring of 2017 and will be complete in 2018. It is expected to save customers $1.1 billion over the life of the project.
- In the Upper Midwest, we have proposed 1,550 megawatts in four states—Minnesota, North Dakota, South Dakota and Iowa. This includes 750 megawatts of self-build projects, plus an additional 400 megawatts of build-own-transfer projects and 400 megawatts through power purchase agreements. Our proposal will save customers about $4 billion over the life of the projects and grows our wind portfolio by 60 percent in the Upper Midwest.
- We have proposed adding 1,230 megawatts of wind in the Southwest, with plans to build two new wind farms for a combined 1,000 megawatts and buy 230 megawatts of wind energy from another facility through a long-term contract. Our proposal is expected to save customers $2.8 billion over the life of the projects.

Wind Forecasting

Xcel Energy has used WindWX since 2009—one of the most advanced wind-production forecasting systems in the world. Through a multi-year research and development project with Global Weather Corp. (GWC), an affiliate company of the National Center for Atmospheric Research (NCAR), we helped develop this highly detailed wind-forecasting system.

Wind generation is difficult to forecast due to its variability. Most weather forecasting models are designed to generate information about winds near ground level rather than at 200 to 300 feet, where turbine hubs are typically located. Also, landscape features such as hills and trees can reshape wind speeds and directions, causing turbulence in ways that can greatly influence the amount of energy produced.

The WindWX system uses real-time, turbine-level operating data and applies sophisticated algorithms to forecast the amount of wind power that will be produced. Through ongoing work with GWC, forecasts for a 168-hour period are provided every 15 minutes across Xcel Energy’s entire service territory—from the hills of western Minnesota to the plains of eastern Colorado and the Texas Panhandle.

The forecasts, now available worldwide through GWC, are designed to help utilities make better commitment and dispatch decisions, including opportunities to power down less efficient power plants when sufficient winds are forecasted to help meet customer electric demands. So far, we have improved our wind forecasting accuracy by nearly 39 percent, and better forecasting and other operational improvements have saved our customers a total of $66.7 million in fuel costs through end of 2016.

We continue to set new system records for wind generation because of our significant capacity and ongoing efforts to improve integration. Our most significant milestone occurred on March 6, 2017 when we achieved a daily record—wind generation provided more than 45 percent of our customers’ energy for 24 hours throughout our service territory.
Although improved forecasting helps to manage the cost, wind generation is still challenging to operate and integrate on the electric system. Xcel Energy continues to improve processes and seek additional opportunities to lower integration costs, including:

- Cycling coal units offline to accommodate more wind generation and reduce fuel costs, which helped to avoid nearly 690,000 tons carbon dioxide emissions in 2016
- Using set-point controls for wind farms in combination with automatic generation control of thermal units that lets wind farms operate at peak levels while fossil-fuel production is reduced
- Establishing a 30-minute flexibility reserve, which dramatically reduced reserve costs while maintaining system reliability
- Adding more flexible generating resources to more efficiently work with variable wind generation

Xcel Energy’s Colorado system is somewhat unique in that it is small and serves a limited geographic area, which presents greater challenges for integrating high levels of variable wind energy. Wind made up 23 percent of our energy supply in Colorado in 2016. For system reliability reasons, we curtailed about 3.3 percent of our total wind generation for the year. Our objective is to always operate the system as cost effectively, efficiently and reliably as possible. We estimate that we used wind to help regulate our Colorado system about 17 percent of the time in 2016. Wind equipped with automatic generation controls can quickly ramp up or down to help balance and respond to generation needs on the system.

Here are steps we continue to take to improve system operations with wind in Colorado:

- Conducting a special screening as part of the resource planning process to account for curtailment costs as we evaluate future resources
- Exploring opportunities to increase the flexibility of our Colorado system by developing a larger, organized market in the West. As a step in this direction, the company received approval from the Federal Energy Regulatory Commission to begin the joint dispatch of its resources with the resources of other Colorado utilities to allow for more efficient and cost-effective, real-time system operations. This is set to begin in June of 2017.

**Compliance with State Renewable Energy and Portfolio Standards**

Xcel Energy is on pace to surpass renewable energy requirements in the states we serve through at least 2030. New Mexico is an exception, where the company anticipates meeting the state’s wind energy requirement through 2024 and has requested a waiver for acquiring additional solar energy from large, universal solar power plants due to constraints under the state’s Reasonable Cost Threshold.

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<thead>
<tr>
<th>State</th>
<th>2016</th>
<th>Next Increase</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Colorado Renewable Energy Standard</td>
<td>20 percent</td>
<td>30 percent by 2020</td>
<td>30 percent of retail sales by 2020, with 3 percent from distributed generation (DG), including at least 1.5 percent from retail net-metered DG resources and up to 1.5 percent from wholesale DG resources (defined as resources ≤30 megawatts located in Colorado)</td>
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<td>Michigan Renewable Portfolio Standard</td>
<td>10 percent</td>
<td>12.5 percent by 2019; 15 percent by 2021</td>
<td>Goal of 35 percent by 2025</td>
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<td>Minnesota Renewable Portfolio Standard</td>
<td>25 percent</td>
<td>31.5 percent by 2020</td>
<td>30 percent of retail sales by 2020, with at least 24 percent from wind, plus 1.5 percent of retail sales from solar by 2020, with at least 10 percent of this from on-site solar under 20 kW</td>
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<td>New Mexico Renewable Portfolio Standard</td>
<td>15 percent</td>
<td>20 percent by 2020</td>
<td>Solar 20 percent by 2020, Wind 30 percent by 2020, Other 5 percent by 2020, DG 3 percent by 2020 (Xcel Energy is not required to procure additional solar energy because it has already exceeded the state’s Reasonable Cost Threshold)</td>
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<td>North Dakota Renewable and Recycled Energy Objective</td>
<td>10 percent</td>
<td>Voluntary</td>
<td>Goal of 10 percent by 2015</td>
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<tr>
<td>South Dakota Renewable, Recycled and Conserved Energy Objective</td>
<td>10 percent</td>
<td>Voluntary</td>
<td>Goal of 10 percent by 2015</td>
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<td>Texas Renewable Generation Requirement</td>
<td>Statewide Goal</td>
<td>5,800 MW statewide by 2015 (non-wind: 500MW)</td>
<td>Xcel Energy’s portion is approximately 3.6 percent of the statewide goal (the 3.6 percent is based on Xcel Energy TX Electric retail sales as a percentage of the total TX electric retail sales)</td>
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<td>Wisconsin Renewable Portfolio Standard</td>
<td>12.89 percent</td>
<td></td>
<td>Statewide goal of 10 percent by year-end 2015, and each utility must increase renewable energy 6 percent over its baseline; for Xcel Energy, this is 12.89 percent in 2016</td>
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Renewable Energy Credits

A renewable energy certificate or credit (REC) is created for every megawatt-hour of renewable electricity generated (1 REC = 1 MWh). RECs are created by statute or voluntary trading programs to promote market-based, cost-effective development of renewable energy. RECs can be disaggregated or separated from the underlying renewable energy and sold separately to utilities and other consumers.

Xcel Energy uses RECs to confirm or validate compliance with state renewable energy standards throughout our service territory. Our company carefully tracks its REC ownership and works to comply with the rules and best practices around renewable energy claims. Only parties that own or retire RECs can claim to use the renewable energy, according to the Federal Trade Commission’s Green Guides. Although, renewable energy separated from or without the associated REC can retain its value and be used for compliance with environmental regulations.

We continue to look for ways to increase the value of the renewable energy on our systems through the sale of RECs. In several states, Xcel Energy has more renewable energy on its system than is needed for compliance with renewable energy standards. Based on market opportunities and the anticipated expiration of RECs, we sell some of our RECs. In 2016, we sold nearly four million RECs, about three million more than in 2015. The renewable energy that generated these RECs came from Colorado, New Mexico, Texas and the Upper Midwest. Our customers benefit by sharing in any profits associated with the sales. REC sales make up a minor portion of our REC holdings.

Consistent with The Climate Registry protocols, Xcel Energy does not presently adjust its carbon dioxide emissions reporting for REC sales. However, because the treatment of carbon dioxide attributes associated with REC sales under future greenhouse gas reporting protocols is uncertain, we have calculated that under an alternative carbon-reporting scenario, emissions associated with REC sales would add approximately 1.5 percent of emissions to our total carbon dioxide emissions for 2016. This alternative assumes the avoided carbon emissions related to renewable energy are added back to the company’s overall emissions when RECs are transferred.