Renewable energy

Xcel Energy operates in some of the country’s best regions for producing wind and solar power, and we are putting these resources to work for customers.

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

As wind and solar technologies continue to improve, prices decline, making it possible to operate a reliable, affordable power grid with significant levels of renewable generation. When it comes to managing cost and reliability, scale matters. We are focused on increasing the use of large-scale, universal wind and solar energy because these resources are significantly more economical and can provide energy for all customers at half the cost compared to smaller, distributed resources.

We also recognize that some customers want more renewable energy, beyond what is currently in our energy supply, including some of our business customers and communities that have set goals for up to 100% renewable energy. To meet this need, we continue to expand and improve our voluntary renewable choices, enabling customers to achieve their goals.

2018 Results

- Since 2005, we have been a national leader in wind energy, and according to the American Wind Energy Association, are ranked the No. 2 utility wind provider with nearly 8% of the country’s wind capacity on our system.

- Our new, 600-megawatt Rush Creek wind project was completed and is estimated to produce enough electricity to power approximately 325,000 homes annually. It is the largest project we have built and is among the largest in Colorado, with 300 Vestas wind turbines manufactured in the state. The project injected $1 billion into Colorado’s economy and is projected to help avoid 1 million tons of carbon per year.
• At year-end, we had 762 megawatts of large-scale, universal solar capacity and 7,288 megawatts of wind capacity — enough to power approximately 3.8 million homes. This includes 1,440 megawatts at wind farms we own.

• After its 2017 debut in Minnesota, our Renewable*Connect® program quickly sold out during its 2018 launch in Colorado. Early in 2019, we successfully transitioned 100% of Windsource® subscribers in Wisconsin to Renewable Connect, demonstrating high engagement and satisfaction with this new option. As customer demand for Renewable*Connect grows, we have proposed expanding the program in Minnesota and expect to propose an expansion in Colorado.

• Nearly 190,000 customers participate in renewable choice programs. Plus, we achieved a milestone of more than 1 gigawatt of distributed solar installed on our system since the programs began.

• The City of Eau Claire, Wisconsin, recognized Xcel Energy for making a difference and helping the city to become more sustainable through the company’s efforts to increase renewable energy, efficiency and conservation.

Renewable energy is a vital and growing part of our energy supply.

*Results are estimated and reflect potential scenarios that achieve 80% reduction in carbon emissions by 2030; actual system depends on various factors, including regulatory approval of future plans.

Ramping Up Renewables: Steel for Fuel

Xcel Energy’s Steel for Fuel strategy resonates with all types of stakeholders because it expands the company’s renewable portfolio and delivers carbon-free energy without raising customer bills. Under the effort, we are adding renewable resources — the steel — at a net savings because the capital costs of the projects are more than offset by future avoided fuel costs.

Delivering on the nation’s largest multi-state wind investment

Several years ago, we announced the addition of 12 new wind farms across seven states, totaling 3,680 megawatts of new wind capacity, enough clean wind capacity to power about 1.7 million homes annually. All the projects have now moved from the approval to execution phase. When complete, we will own about 70% of the new capacity, more than quadrupling our company-owned wind portfolio.

Our Rush Creek wind project was the first to be completed in fall 2018, and we are now building three wind farms to be completed in 2019: Hale (478 megawatts) in Texas, Foxtail (150 megawatts) in North Dakota and Blazing Star I (200 megawatts) in Minnesota. Nearly all 12 projects will be online by year-end 2020 to take advantage of the full production tax credit. Only the Dakota Range wind project will be complete in 2021 and is still low cost despite qualifying for a partial tax credit.
All of these projects must be built from the ground up, except for one. For about 20 years we purchased power from the Lake Benton wind project in southern Minnesota. Now we plan to buy and operate the project as part of our wind fleet once it is rebuilt in 2019 with new, more efficient turbines. By repowering an existing wind farm such as this, we are able to take advantage of existing transmission and other infrastructure. It is one of the reasons Lake Benton could successfully compete in the bidding process against other wind projects.

**The Colorado Energy Plan**
Under the Colorado Energy Plan approved by regulators in 2018, we will add 1,100 megawatts of wind energy from three new wind farms and the repowering of a fourth, existing wind farm. The projects include the 500-megawatt Cheyenne Ridge wind farm that we will construct and own. We will also add a 72-megawatt solar farm and three solar and battery storage projects, which combined incorporate 560 megawatts of large-scale solar and 275 megawatts of battery storage.

The solar-battery projects are located in different parts of Colorado, with one project in Adams County near the Denver metropolitan area and the other two in southern Colorado. The two projects in Pueblo County are the largest, with capacities of 100 to 125 megawatts and four hours of battery storage. They will help provide reliable generation capacity to replace coal power from nearby Comanche units 1 and 2, slated for retirement by 2026.

**Economic benefits**
In addition to providing affordable, carbon-free electricity for customers, all of these projects support economic development. Our 12 new wind projects are expected to create 2,700 construction jobs, 150 full-time jobs and generate $800 million in landowner lease and property tax payments over the lives of the projects. The Colorado Energy Plan is anticipated to inject $2.5 billion into the state’s economy, including $1 billion from Xcel Energy.

**Repowering plans**
We continue to seek new, economic opportunities to expand our wind portfolio and have asked regulators for approval to buy two older wind farms in southern Minnesota, which are currently being repowered with the latest wind technology. We have purchased power from the Jeffers and Community Wind North projects over the past decade under long-term agreements. Adding the refurbished wind farms with a capacity of 44 and 26 megawatts, respectively to our own energy portfolio further supports our clean energy transition and will save customers money compared to long-term purchases. If approved, we would close on the completed projects by year-end 2019. We plan to pursue similar opportunities in the future.

**Renewable Choice Programs**
Just as customers want more control over their energy use, they also want more choice in how they engage with energy options. Our goal is to offer innovative solutions that enable our customers to meet their priorities around clean energy and the environment, while balancing these choices with the cost that all customers pay to support them.

We were an early adopter of voluntary green power back in 1998 with the introduction of our flagship program, Windsource. Since then, our program offerings have expanded to include options for community solar gardens, on-site solar and Renewable*Connect — our newest offering.

Through Renewable*Connect, customers can choose to make their energy up to 100% renewable through different contract options, such as month-to-month, five-year and 10-year terms. There is no equipment to install and customers can remain on the program if they move to a different home or business location within our service area.

Renewable*Connect exemplifies innovation. We have combined our program and regulatory experience and customer input to design the program so customers retain the renewable energy credits and rights to renewable energy claims. Renewable*Connect also keeps bills low for participating customers, while not increasing costs for nonparticipants. It is self-supporting through subscription fees, so nonparticipants don’t pay more.
In Colorado, the program’s energy is delivered from the new 50-megawatt Titan Solar facility, near Deer Trail, Colorado. The energy sources for the Minnesota and Wisconsin programs include the Odell Wind Farm and North Star Solar.

Participation in our other renewable choice programs continues to grow as well. In Minnesota, there were approximately 7,700 subscribers participating in our Solar*Rewards Community® program at the end of 2018. With more than 500 megawatts of capacity from 170 participating solar gardens, the program is easily the largest community solar garden program in the country, although the purchase rate for this Minnesota solar energy is two to four times higher than what we would pay from more cost-efficient energy sources. Our Colorado community solar garden program was one of the first in the nation and also continues to grow, quadrupling in size between 2017 and 2019.

In Wisconsin, our Solar*Connect Community® program is fully subscribed and continues to expand. A second community solar garden located in La Crosse began generating power for subscribers in March 2019 and a third project is expected to be built later during the year in Ashland. Once that project is complete, local gardens will be available to customers throughout our Wisconsin service territory. Similar to Renewable*Connect, the incremental program costs are covered through subscription fees so that non-participating customers do not pay extra to make the program available.

Customers also continue to install more on-site solar, with our Colorado customers increasingly choosing to install solar panels without incentives through Solar*Rewards®. Across all states, more than 7,600 solar systems were installed during 2018, adding 66 megawatts of additional on-site distributed solar. To reduce the impact of energy bills for customers struggling to make ends meet, we recently launched incentive options to test solar installations for income-qualified households in Colorado and Minnesota.

We offer the following renewable choice programs that reflect our company’s commitment to meeting the clean energy interests of customers.

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
<th>REC Attribution</th>
<th>MN</th>
<th>WI</th>
<th>ND</th>
<th>SD</th>
<th>CO</th>
<th>NM</th>
<th>TX</th>
<th>MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable*Connect</td>
<td>A flexible and affordable way to subscribe for up to 100% renewable energy</td>
<td>Participant</td>
<td></td>
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<tr>
<td>Windsource</td>
<td>An easy, low risk way to subscribe to clean wind energy</td>
<td>Participant</td>
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<tr>
<td>Solar*Connect Community</td>
<td>Subscribe to a solar garden and get full rights to the solar claims, plus a bill credit for choosing solar energy</td>
<td>Participant</td>
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<tr>
<td>Solar*Rewards Community</td>
<td>Subscribe to third-party solar gardens and receive electric bill credit payments for solar energy produced</td>
<td>All Customers</td>
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<tr>
<td>Solar*Rewards</td>
<td>Install your private on-site solar system and earn an incentive for transferring the RECs to Xcel Energy</td>
<td>All Customers</td>
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<tr>
<td>Net Metering</td>
<td>When you produce wind or solar energy through on-site equipment, you’re able to retain RECs and sell any excess energy back to the grid</td>
<td>Participant</td>
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</table>

*Solar*Connect Community has been filed but not yet approved in New Mexico.
**New Mexico Solar*Rewards availability varies from year to year and is not currently available.
In addition to renewable choices, we started offering customers in Wisconsin a Certified Renewable Percentage as a way to let them claim the full benefit of our increasingly clean energy mix. We now retire Renewable Energy Credits (RECs) to cover the entire renewable energy portion of the electricity we deliver to customers in Wisconsin, beyond what we retire to meet Wisconsin’s Renewable Portfolio Standard. Certified Renewable Percentage is not something customers enroll in or subscribe to but is a benefit they automatically receive. This enables customers to make renewable energy claims. For example, our commercial customers can claim the portion of renewable energy included in the Certified Renewable Percentage just by being an Xcel Energy customer.

We plan to propose the approach for regulatory approval in Colorado and Minnesota this year to begin offering customers the same benefit in these states.

**Integrating Wind and Solar Power**

The significant wind and solar resources on our systems have fundamentally changed the way we operate. With each increase in renewable capacity, we have improved system operations, enabling our ability to incrementally grow the use of wind and solar power and achieve new system records.

Some of our operational improvements for accommodating more wind and solar energy include:

- **Adding more flexible backup generation.** As we retire aging coal plants, we are replacing some of the energy with more carbon-friendly natural gas generation, which can more efficiently and cost-effectively ramp up or down to accommodate variable, renewable generation.

- **Cycling coal offline and reducing minimum generation levels.** Once considered infeasible, we are turning off coal units to accommodate more wind generation and are reducing the time that units need to be offline before than can be restarted. Cycling off coal units and then turning them back on is much more challenging than with a natural gas unit because of all the systems involved, but our Operations team has studied the issues and is working to cycle coal units more efficiently and cost effectively, helping to reduce fuel use and emissions.

- **Negotiating greater flexibility from our natural gas suppliers.** These agreements allow us to efficiently use our gas generation resources to balance variable renewable generation, helping to increase system reliability and lowering customer costs.

- **Investing in transmission.** We are improving and building new transmission facilities that can deliver more wind and solar energy to customers.

- **Using control equipment.** We use 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.** We previously carried one megawatt of reserve capacity for every megawatt of wind generation as backup in case winds suddenly dropped off. As our wind portfolio grew, we studied the maximum amount of wind energy typically lost within 30 minutes and were able to reduce this reserve, dramatically decreasing costs associated with carrying large wind reserves while maintaining system reliability.

- **Adjusting planned maintenance.** We now plan transmission and plant maintenance outages around times of the year when wind and solar production is lowest.

Generally, we find that wind and solar are very compatible resources for meeting customer needs. Our renewable generation works together fairly consistently to operate on average across all hours of the day.

While solar energy is relatively simple to forecast, wind generation has been notoriously difficult because of 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 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.
To improve on this, we began working in 2009 on a multi-year research and development project with the National Center for Atmospheric Research (NCAR) and its affiliate company Global Weather Corp. (GWC). Today the WindWX system helps utilities around the globe including Xcel Energy to make better commitment and dispatch decisions. It uses real-time, turbine-level operating data and applies sophisticated algorithms to forecast the amount of wind power that will be produced. 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.

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

Xcel Energy is on pace to surpass established renewable energy requirements in the states we serve through at least 2030. New Mexico recently adopted the Energy Transition Act to set one of the most ambitious renewable portfolio standards in the nation. We are currently evaluating our compliance strategy with the increased targets that will be set by the law once it takes effect in June of 2019.

**Renewable Energy Requirements in Xcel Energy States**

<table>
<thead>
<tr>
<th>State</th>
<th>2018</th>
<th>Next Increase</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado Renewable Energy Standard</td>
<td>20%</td>
<td>30% by 2020</td>
<td>30% of retail sales by 2020, with 3% from distributed generation (DG), including at least 1.5% from retail net-metered DG resources and up to 1.5% from wholesale DG resources (defined as resources ≤30 megawatts located in Colorado that are not customer sited)</td>
</tr>
<tr>
<td>Michigan Renewable Portfolio Standard</td>
<td>10%</td>
<td>12.5% by 2019; 15% by 2021</td>
<td>Goal of 35% by 2025</td>
</tr>
<tr>
<td>Minnesota Renewable Portfolio Standard</td>
<td>25%</td>
<td>31.5% by 2020</td>
<td>30% of retail sales by 2020, with at least 24% from wind, plus 1.5% of retail sales from solar by 2020, with at least 10% from on-site solar 40kW or less</td>
</tr>
</tbody>
</table>
| New Mexico Renewable Portfolio Standard        | 15%   | 20% by 2020         | The New Mexico Energy Transition Act increases future goals of the RPS; in addition to the immediate goals, it sets a standard of 40% by 2025, 50% by 2030, 80% by 2040 and then 100% carbon-free electricity by 2045
  Note: the Public Regulation Commission must consider the safe and reliable operations of the system and the prevention of unreasonable costs |
| North Dakota Renewable and Recycled Energy Objective | Voluntary | No RPS Requirement for North Dakota |
| South Dakota Renewable, Recycled and Conserved Energy Objective | 10% | Voluntary | No RPS Requirement for South Dakota |
| Texas Renewable Generation Requirement          | Statewide Goal | 10,000 MW statewide by 2025 (goal achieved) & (non-wind goal: 500MW) | Xcel Energy’s portion is approximately 3.3% of the statewide goal (the 3.3% is based on Xcel Energy Texas electric retail sales as a percentage of the total state electric retail sales) |
| Wisconsin Renewable Portfolio Standard          | 12.89% |          |                                                                                                                                                                                                                                                                                                                                 |

**Destination 2050**

Building the Future
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 provide a mechanism to commoditize renewable energy attributes and are tracked in national commission-approved REC tracking registries. RECs can be disaggregated or separated from the underlying renewable energy and sold separately. Typically, RECs are traded to companies looking to claim green energy or transferred to other utilities to reduce compliance costs.

Xcel Energy uses RECs to satisfy 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 and retire RECs can claim to use the renewable energy, according to the Federal Trade Commission’s Green Guides. However, renewable energy separated from or without the associated REC can retain its value and be used for compliance with environmental regulations.

In 2018, we continued 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 projected shelf life of RECs, we sold more than 3.7 million RECs in 2018, about 3 million less than in 2017. The renewable energy that generated these RECs came from Colorado, New Mexico, Texas and the Upper Midwest. Our customers benefit by sharing portions of these profits associated with the sales. REC sales make up a minor portion of our REC holdings.