



# ENERGY INNOVATION

Rapidly evolving technology is changing customer preferences for more sophisticated products and services, which is driving change in how we serve our customers.

Within the next decade and beyond, we will have more change in our industry than we have experienced in the last half century, driven largely by technology. Through collaborations with researchers, technology developers, venture investors and others in our industry, we actively monitor and stay abreast of developments in emerging and advanced energy technology. We also have underway initiatives, pilots and demonstration projects that are building new customer experiences and testing the real-world application of cutting-edge technologies to serve customers today.

This work is foundational to fulfilling Xcel Energy's strategic priorities: leading the clean energy transition, enhancing the customer experience and keeping bills low. Because to eliminate the remaining 20% of carbon from our system and realize our carbon-free vision, we need advanced, zero-carbon 24/7 generation and long-duration energy storage technologies not yet commercially available. Technology is also a core component to creating a more customer-focused experience, one that is built around our customers' preferences and needs.

With new technology, we can also make our operations more efficient, safer and cost effective. As powerful tools emerge to transform our work, they can reduce our costs, improve productivity and enhance the service we provide, benefitting our customers through their overall experience and the costs they pay.



# HIGHLIGHTS

- A cross-functional team of Xcel Energy employees in 2019 evaluated emerging advanced technologies that our company will need to achieve its carbon-free aspiration by 2050. Based on the team's work, we are exploring more than 30 promising technologies in five categories: advanced, dispatchable renewable energy; zero-carbon fuels, such as hydrogen or ammonia; advanced nuclear, including advanced light water and non-light water fission, and fusion; carbon capture, utilization and sequestration; and demand efficiency, including long-duration storage and demand response.
- We are partnering with Idaho National Laboratory on a hydrogen demonstration project funded by the U.S. Department of Energy. One of Xcel Energy's generating plants will use carbon-free nuclear energy to produce hydrogen to help determine if hydrogen production can help balance the power grid with an increasing amount of wind and solar energy on the system.
- We continue to expand options for our customers who use Google Assistant. In addition to energy saving advice, customers can now access account information and pay their Xcel Energy bills on a variety of devices, including Google Nest Hub, Google Home, Google Home Mini, or even the Google Assistant app on iPhone or Android platforms. Before rolling out the new options, interested employees participated in a beta test to help resolve any issues and enhance product features. We expect to continue rolling out new functionality, including personalized insights about energy use and tips for saving money. For customers who use Amazon Alexa, we plan to release similar functionality.
- Our investment in Energy Impact Partners is providing valuable insights. The clean-tech investment platform has now invested \$548 million in 38 companies. We have engaged with several of these companies on strategic pilots or projects to accelerate innovation within our operations.
- As a complement to our participation in Energy Impact Partners, we joined EPRI's Incubatenergy program alongside some of our peer energy providers: Ameren, TVA, AEP, ConEdison, SoCal Edison, NYPA, Nebraska Public Power, SRP and PGE. Incubatenergy offers early stage start-up companies the opportunity to pitch their concepts, and if selected, to prove their innovations with the members over a 12-week period. This accelerated proof-of-concept process provides growth potential for the start-ups, and members have exposure to vanguard technologies that may improve operations of renewable generation, transmission, distribution, grid-edge, customer products or programs, and electric vehicles.



- To foster creativity and innovation, the company is launching an incubation space at its Minneapolis headquarters building to promote learning, collaboration and new thinking. The XCELlab is a place for Xcel Energy project teams and employees to come together to explore new concepts, test ideas and find ways to build the future of energy. That said, the XCELlab is not limited to our Minneapolis headquarters — the platform can be deployed across all locations within the company, as well with customers and third-party partners.
- We first began piloting the use of Robotic Process Automation — software programs that automate simple but time-consuming tasks like data entry — in our Finance department. Because the initial pilot was so successful, we expanded the technology’s use in 2019 to automate some of our customer service processes — again proving that Robotic Process Automation used in specific applications is highly effective and can increase employee and customer satisfaction while improving accuracy and efficiency. In 2020 and beyond, we plan to expand the use of the technology across Xcel Energy, with a focus on automating the most impactful processes in our Operations, Supply Chain and Corporate Services organizations.

### **ADVANCED GRID INTELLIGENCE AND SECURITY INITIATIVE**

Our Advanced Grid initiative is an extensive, multi-year project to modernize the power grid — an interconnected series of substations, transmission lines and distribution wires that deliver electricity from power plants to customers. Some parts of the original power grid are more than 100 years old.

Through Advanced Grid, we are updating this infrastructure and enabling a series of new capabilities that will improve outage restoration, provide customers real-time data to better manage their energy use and give employees new tools to more effectively work with customers and efficiently manage and protect the power grid. In Colorado, foundational work to modernize the power grid is underway, and early learnings from this initiative were used to develop a proposal that the Minnesota Public Utilities Commission is currently reviewing.

Colorado customers will begin to see benefits from Advanced Grid beginning in 2021 when the first smart meters are installed in a rollout that will wrap up in 2024. Our strategic partner, Itron, is developing the new meters, which are expected to leapfrog existing technology and pave the way for customers to better understand and control their energy usage and save money. Itron meters, for example, will have the ability to show customers exactly how much money they can save by running their dishwasher at night after peak demand has declined instead of right after supper when electricity prices are higher.

Customers will also appreciate the ability for Xcel Energy to better isolate outages when storms disrupt the power grid. Advanced Grid communications technology will greatly minimize the number of customers affected by an outage by using automatic restoration technology. The smaller number of customers who lose power should expect faster restoration times as the modern grid will better isolate the issue so our employees can quickly locate it and start repairs sooner.

Employees will have new tools to help them balance the system and more efficiently distribute power from the first customer adjacent to a substation to customers at the end of the line. This newer technology, called Voltage Optimization, is expected to save money for all customers. Private, two-way wireless communication is a key tenet of the modern grid and must be protected by a robust cybersecurity platform. The Advanced Grid system is designed to integrate several layers of cyber protection to ensure reliability and protect customer data.

## **ENERGY IMPACT PARTNERS (EIP)**

With the pace and scale of emerging technologies and changing customer interests, the energy industry is evolving in ways it never has before. Xcel Energy joined EIP's Fund 1 in 2015 as an opportunity to better understand technology's impact on our business and drive greater efficiency and innovation to meet evolving customer needs. In 2019, Xcel Energy committed to join EIP's Fund 2 at the same membership level.

EIP is a collaborative, strategic investment platform that provides capital primarily to clean-tech companies that seek to optimize energy consumption and improve sustainable energy generation. Investments have included multiple advancements from distributed energy resources to storage, electric vehicles, advanced data analytics, cybersecurity, microgrid applications, and other clean energy technologies. Our next \$50 million investment over five years will continue to support Xcel Energy's strategic priorities and carbon-free aspiration through investments in the clean-tech space.

Xcel Energy was a founding participant in the collaboration that originally included more than 15 utility and industrial participants. As EIP expands to include European investors, there are currently 25 participants. By joining with peer companies, we gain greater visibility into the business models and technologies of promising companies and can influence emerging business models so that energy companies and third parties can collaborate and grow together.

EIP brings together energy companies from around the world to share diverse, global perspectives and insights into policy and regulations, positioning our company to successfully manage new trends, rules and other requirements in the states we serve. We are gaining insights that inform our strategic decisions and how we conduct business across our organization from energy supply to distribution, customer solutions and cybersecurity.

## **ELECTRIC POWER RESEARCH INSTITUTE (EPRI)**

Through our long-time membership with EPRI, we gain insights into the challenges and opportunities associated with using advanced clean energy technologies and reducing carbon emissions. This includes EPRI's work on electric system resiliency, climate scenario analysis and greenhouse gas reduction goals, as well as renewable integration, electric vehicles, combined heat and power, customer demand response and energy efficiency.

EPRI also informs our regulators and customers on the technical and economic issues, as well as opportunities and challenges, related to new grid technologies, such as energy storage and distributed generation. In this collaborative research environment, we engage with other organizations that are testing and evaluating new technologies or products and that are developing tools and methodologies to optimize the use and analyze the effects of distributed energy resources on the power grid.

## **COLORADO INNOVATIVE CLEAN TECHNOLOGY PROJECTS: BATTERY DEMONSTRATION PROJECTS**

Our Colorado Innovative Clean Technology program was first approved in 2009 to test innovative technologies that appear promising in terms of achieving economic and environmental goals. It enables us to gain experience with technologies and evaluate their cost, reliability and environmental performance on a small, demonstration scale before determining whether to deploy them more widely for our customers.

In early 2020, we completed two battery-storage demonstration projects under the program.

- Customers are increasingly interested in installing solar panels on their homes or businesses, and because of this, we examined how battery storage can help integrate higher concentrations of customer-sited solar energy on our system. Through a project in Denver's Stapleton neighborhood, six homeowners received Sunverge residential battery systems to test with their rooftop solar installations. We gained real-world experience on how these residential batteries operate, while the batteries provided homeowners with backup energy during unplanned outages. We also installed six larger, grid-sized battery systems supplied by Northern Reliability, Inc., in rights of way or easements within the neighborhood. These utility-sited batteries helped our distribution feeders to accommodate more solar on a localized level, chiefly by charging with excess solar generation during times of low demand on the power grid.



- Through a public-private partnership, Xcel Energy, Panasonic and Denver International Airport collaborated to test a battery storage system that supports our power grid and serves as a microgrid to provide backup power to Panasonic's Denver headquarters. As part of the project, Xcel Energy owns a 1.3 MW-AC solar carport installation and a 1 MW/2MWh lithium-ion battery. Panasonic also owns a 0.20 MW-AC solar array located atop its building, which is tied into the microgrid system. The Panasonic battery has successfully islanded and provided microgrid support at the Panasonic headquarters during two unplanned outages at the feeder in the past year.

From 2018 to 2020, we studied various ways to operate the battery systems and evaluated and analyzed performance. These findings were reported on a semi-annual basis and filed with the Colorado Public Utilities Commission. Overall, we learned many things that will influence future battery system design and associated integration with our system. In August 2020, we will submit a final report to the utilities commission with our findings.

Additional details about the projects are available on [xcelenergy.com](http://xcelenergy.com) under battery testing.

### **COMMUNITY RESILIENCY INITIATIVE**

Communities are creating resiliency plans that better prepare them for extreme weather events, such as severe storms, wildfires or floods. One of the most critical components during these potential events is a stable, secure power supply. In Colorado, our Community Resiliency Initiative will support critical infrastructure during a disaster by using energy storage systems to deliver back-up power.

In 2019, we invited communities across the state to apply for the opportunity to partner in the development of battery-based microgrids to supply power for select facilities in the event of a wide-scale electrical outage. A microgrid is an electrical system containing multiple generation sources and loads that can either be connected to the power grid or intentionally separated from the power grid or "islanded".

Our community resiliency microgrids will provide backup power to a resiliency center by incorporating on-site traditional backup generators, renewable generation such as rooftop PV, and energy storage systems such as batteries. Customer owned, on-site generation at strategic community locations will be combined with Xcel Energy-owned energy storage systems. When not being used in emergency situations, the microgrid assets can be leveraged to supply benefits to the greater power grid.

We anticipate the Community Resiliency Initiative to provide multiple benefits for customers and the communities we serve. This includes improving outage restoration times, securing facilities' power supplies, advancing clean energy and clean energy jobs, and strengthening and improving grid resiliency. Moreover, the projects provide the opportunity to study the potential value in deployment of resiliency-focused energy storage systems on a broader scale.

At the end of 2019, we selected seven communities from across our Colorado service territory to participate in this program. Sites range from rural locations, to mountain communities, to the Denver metro area and include a variety of facility types from community centers, event centers and transportation hubs. We are currently seeking Public Utilities Commission approval, which we expect by mid-2020.

### **DRONES**

Xcel Energy is using unmanned aircraft systems or drones for many applications. From inspecting power lines to wind turbine blades and evaluating substations for equipment upgrades, drones are making these tasks easier, safer and helping to reduce costs.

In a company first, we used an unmanned aircraft to help build the 115-kilovolt Maple River to Red River transmission line. We contracted with North Dakota-based SkyScopes to complete the drone work to install conductor along the five-mile power line that runs from Reed Township to Fargo, North Dakota.

Xcel Energy also received a waiver to test and develop a new capability with drones to inspect wind turbine blades by controlling multiple unmanned aircrafts autonomously and simultaneously with one remote pilot. We can now inspect an entire windfarm within a fraction of the time and keep workers safe on the ground. In addition, we are using drones to monitor wildlife and perform avian mortality studies that will help us prove the pre-construction impact studies and understand how we can improve wind farm operations with minimal impact to wildlife and habitats.

In 2019, we used drones to inspect equipment and infrastructure safely and accurately at our nuclear generating plants. The missions resulted in a conservative cost savings of \$82,000 and reduced overall labor hours at both the Prairie Island and Monticello plants during refueling outages. Moreover, they helped to keep employees safe by eliminating 864 worker hours in higher-risk locations, those involving radiation exposure, confined spaces and heights.

Xcel Energy entered into the nation's first partnership for safety with the Federal Aviation Administration (FAA) in 2016 and was the first public utility to receive FAA permission to fly drones beyond the operator's visual line of sight and without a visual observer to inspect transmission lines on a routine basis for our eight-state service territory.

Traditionally, we have conducted these inspections with helicopters and foot patrols. Using drones to inspect 20,000 miles of electric transmission lines delivers value on many fronts, starting with ensuring reliability for our customers thanks to better data. It is also safer for employees, especially in remote mountainous areas, and less costly. As technology improves, the cost to operate drones continues to fall, which will save even more money for customers.

### **GRIDNXT AT SOLARTAC**

The Solar Technology Acceleration Center (SolarTAC) in Aurora, Colorado, is a world-class facility for demonstrating and validating advanced solar and distribution grid technologies in a real-world, grid-connected environment. Even before the project's grand opening in 2011, Xcel Energy recognized the potential benefit of the facility and signed on as an original founding member.

Our investment has paid off for customers. Not only have we tested important battery projects at the site, solar technologies fine-tuned at SolarTAC serve our customers in Colorado and New Mexico with more cost-effective, efficient solar energy. Through testing, solar developers were able to make adjustments for adverse weather conditions before installing the technology in our service areas.

To continue evolving with technology and developer needs, the 74-acre site has transitioned to become a test-bed for solar, storage and other distributed energy enabling products and components. GridNXT at SolarTAC now supports the demonstration of advanced technologies for integrating distributed generation and storage, including microgrid capabilities at the edge or end of the electric distribution system.