WHAT IS THE SMART GRID?

AND WHAT DOES IT MEAN FOR YOU?

A GUIDE FOR OUR CUSTOMERS

rpu®

we pledge, we deliver

RPU's
Cascade Creek
Substation

Smart Grid

WHAT IS IT?

The term "Smart Grid" was created after a major blackout occurred in the Northeastern United States in August 2003. Analysis revealed that if additional intelligence about grid conditions had been more widely known earlier, the extent of the blackout could have been reduced, if not avoided altogether.

Under the Energy Independence and Security Act of 2007, the U.S. Department of Energy is charged with the task of modernizing our energy system to a "Smart Grid". The concept has grown from transmission reliability to advanced technology that affects all aspects of our electric system from generation to consumer.

Several definitions of the Smart Grid exist with various elements, capabilities, and levels of participation. The general consensus envisions a Smart Grid with the following main components:

- Intelligent home area networks and appliances
- Advanced metering systems
- Two-way communication between the home area network and utility
- Faster, forward-thinking controllers processing real-time information about generation, distribution, and transmission
- Increased data and system controls allowing integration of customer load into system processes
- Increased data and information flow

The key to a successful Smart Grid is the re-education of the industry on how to make it work seamlessly and the education of the customer to take advantage of the increased energy usage information and choices.

To understand Smart Grid, one must understand our current grid. In simple terms, our energy is generated in power plants or by renewable resources (such as wind, solar, and hydropower), is transmitted to utility companies, and distributed to consumers. The goal of the Smart Grid is to allow all segments of the electric industry to get "smarter."

A Smart Grid will allow all segments of the electric industry to get "smarter."

- **Smart Generation**
  The Smart Grid could help manage the integration of new generation (such as renewable sources) and storage technologies (such as thermal energy and plug-in hybrid electric vehicle batteries) into our current system.

- **Smart Transmission**
  Increased investment in faster, forward-thinking, and more widespread data collection could improve current monitoring and controls to minimize outages and identify vulnerabilities.

- **Smart Distribution**
  The Smart Grid aims to make the distribution system more efficient, reduce losses by managing peak loads, and assist in serving increased loads from items such as plug-in hybrid electric vehicles (PHEV). Future distribution systems may be equipped with additional switching capacity to isolate damaged sections during outages.

- **Smart Customers**
  Customers could manage their personal energy consumption through smart appliances, home area networks, and advanced metering data.

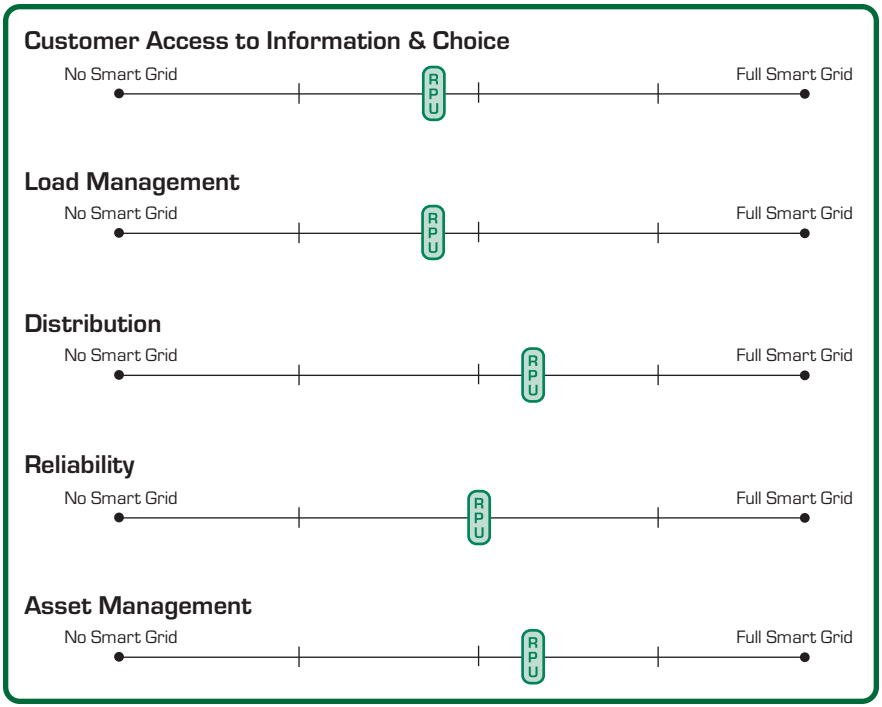
Smart Grid

WHAT IT MEANS FOR RPU

It will take time for both utilities and customers to transform to a new way of operating that is much more focused on data and customer participation.

In order to ensure Rochester Public Utilities (RPU) is prepared for Smart Grid transitions, Burns & McDonnell, an international engineering, architecture, and consulting firm, provided RPU with a complete business case analysis in 2010. The analysis examined RPU's current capabilities along with the integration of smart meters, data management, distribution automation, and advanced communications. The study also included a cost-benefit analysis to quantify the economic benefits of a Smart Grid system.

The business analysis quantified that RPU already has a relatively advanced system, and is already on the Smart Grid path...



...and RPU's current reliability is well above industry averages:

Measurement	RPU	Industry Average
Average # of Outages	**0.49/customer/year**	1.10/customer/year
Duration of Outage	**33.59 minutes**	90 minutes
Average Restoration Time	**69.01 minutes**	81.6 minutes

2009 Data

Many of RPU's Smart Grid objectives will be dependent on customers' demand for energy usage information, energy choice, customer service, and improved reliability. RPU intends to gain knowledge regarding customer preferences prior to setting specific objectives and goals regarding technology implementation within our system.

These technologies and advanced service offerings include potential changes in the following areas of the RPU system:

- Engaging and empowering customers to manage their energy bills
- Enhancing the metering of customer electricity usage
- Improving and automating the distribution system
- Expanding the data management systems to increase storage and sharing
- Implementing a communication system to facilitate real-time data flow
- Implementing appropriate system security to prevent internal or external intrusion or misuse

Successful implementation will require a joint effort between RPU and our customers to make the most of available technologies, fully manage load, and maximize efficiencies.

Smart Grid

WHAT IT MEANS FOR OUR CUSTOMERS

The Burns & McDonnell study anticipated benefits that may be realized from the use of increased digital data and control systems. The advanced systems offer a range of benefits for both the customer and RPU including real-time communication, monitoring and managing power delivery to homes and businesses, and providing energy usage for reducing energy costs.

The benefits can be categorized in the following areas:

RPU Customer Benefits:
- Improved reliability and reduced service outages
- Outage and power quality monitoring for each customer
- Increased detail of energy usage information
- Empowerment to reduce energy usage
- More energy choices
- Improved customer service

Rochester Community Benefits:
- Reduced regional green house gas emissions
- Improved local business climate
- Energy support for new businesses

RPU's Operations & Efficiency Benefits:
- Improved voltage management and conservation
- More efficient and effective dispatch of crews
- Reduced maintenance expenses

A significant portion of Smart Grid equipment and technologies is intended to enable customer choice and control over their energy usage. This includes the implementation of tools that enable customers to manage their energy consumption, along with providing incentives that encourage responsible energy management.

Smart appliances are being designed with computer intelligence and Internet connectivity.

Smart Grid Customers:

- Have access to and regularly evaluate their energy usage profiles
- Adjust their energy usage patterns to minimize their costs
- Invest in energy efficient appliances
- Participate in demand response programs and/or real-time rate structures
- Participate in direct load control programs such as central air conditioning compressor cycling
- Advocate energy conservation
- Use two-way communications to share information between themselves and their utility

Some of these Smart Grid advancements may be far in the future. Studies show that only 5 percent of utilities have a partial implementation in progress, while 79 percent will complete study-implementation within 5 years.

RPU is fortunate to have an engaged customer base that already participates in conservation and load management programs. Customers are informed about available programs and choices through the RPU web site, customer service inquiries, trade allies, advertising, and bill stuffers. However, RPU could expand the services and choices offered to customers by implementing some emerging Smart Grid technologies.

Smart Grid

IN PROGRESS

RPU's electric distribution system is modern and reliable because of investments already made to increase operational efficiencies, improve service to customers, and provide customers with valuable information regarding their energy usage. These investments mean RPU is already heading down the path to becoming a maximum information utility. Levels of Smart Grid functionality already within RPU's system include:

Automated Meter Reading (AMR)
The AMR system now encompasses all of our residential electric meters and 99 percent of our water meters. With AMR, meter readers drive through neighborhoods and gather information remotely via wireless connection. This replaces the old method of walking house-to-house to manually record meter data.

Geographic Information System (GIS)
The computerized software provides us with an overall picture of our facilities in the field and is utilized in our outage management system, location searches for repairs, and new electric service design.

System Protection
We have made a significant investment by installing microprocessor-based protective relays in our electrical substations. The new relays provide sophisticated protection for worker safety, customizable control, digital information about load, and significant outage information.

Home Energy Reports
25,000 RPU customers receive a free Home Energy Report as part of a pilot program in the City of Rochester. The report provides customers information on their energy use and offers easy, personalized energy saving tips.

Communicating with our Customers
We were among a small number of utilities on the cutting edge of electronic communication in 2004, when we launched our internet blog, "Behind the Meter" (http://blog.rpu.org/). Recently, we revamped its design to give customers more ways to react to our postings. At the same time, we set up a Facebook page and began instant messaging on Twitter.

Energy Efficiency Programs
Through our CONSERVE & SAVE® program, RPU continues to offer rebates to our customers who purchase and install new energy and water efficient appliances and equipment.

CONSERVE & $AVE®

RPU and Minnesota Energy Resources have teamed up with the Center for Energy and Environment to offer Rochester homeowners the Neighborhood Energy Challenge, a new full-service residential energy audit program.

NEIGHBORHOOD ENERGY CHALLENGE
rpu we pledge, we deliver
MINNESOTA ENERGY RESOURCES

Smart Grid

NEXT STEPS

Recognizing the potential of adopting more Smart Grid capabilities RPU developed the following Smart Grid vision statement:

"RPU will prudently adopt Smart Grid technologies which provide customer value in reliability and service."

The improvement of efficiency and performance in all sectors (customer, distribution, and generation) and the environmental impacts are the main goal of this Smart Grid vision.

We have a strong start, but RPU, like other utilities, faces major challenges to meet the changing needs of our customers in a Smart Grid environment. RPU's next steps will be crucial in building a smooth transition. These steps include:

1) **EDUCATE CUSTOMERS**
   The utility industry is currently demonstrating the average consumer is not prepared nor can relate to some of the smart grid terms that are being used such as time varying rate structures, market or green pricing, smart devices, and advanced control systems. RPU is determined to provide more education and outreach programs (such as our Home Energy Reports) that inform customers about the costs to provide electrical service, how behaviors impact those costs, and what they can do to reduce electricity consumption.

2) **EXPAND EXISTING SERVICES**
   RPU has the potential to expand the services and choices already offered to customers, especially residential customers, by implementing technologies such as smart meters that provide them with more detailed information and rate structures that promote energy conservation.

Smart meters, sometimes referred to as AMI (Advanced Metering Infrastructure) meters, wirelessly send information about electricity use to the utility. These meters can be teamed up with in-home display systems that show current usage along with potential price signals from the utility, indicate potential problems with "smart appliances", talk to thermostats, and basically encourage customers to use less energy when it's most expensive.

The goal of AMI and the core of smart grid is the two-way communication between generation, transmission, distribution, and customers.

3) FURTHER IMPROVE RELIABILITY

RPU has high reliable service, but outages do happen. Automation and remote control on distribution lines and substation equipment throughout the system could further improve reliability. Monitoring system power through smart meters, adding remote control and automation capabilities to capacitor banks, and adding remote control and automated switching equipment could enhance reliability and quickening RPU's response time.

4) PREPARE FOR DATA MANAGEMENT

The implementation of technologies that heighten digital data and control systems and by engaging customer participation could impact major areas of RPU's system. Prior to field installation of smart devices, RPU needs to consider the impacts and how to manage, store, and secure greater amounts of data and information. RPU will evaluate processes and information capabilities such as meter data management systems, changes to the billing structures, and customer relationship management.

Smart Grid

LEARN THE LINGO

RPU will continue to communicate with our customers about our Smart Grid developments. As you learn about local and national developments, it will be helpful for you to have this glossary of common Smart Grid terminology:

AMI: Advanced Metering Infrastructure is a term denoting electricity meters that measure and record usage data in hourly intervals (at minimum), and provide usage data to both consumers and energy companies at least once daily.

DSM: Demand-Side Management represents the amount of consumer load reduction at the time of system peak due to utility programs that are designed to reduce consumer demand and/or electricity use.

DISTRIBUTION: The delivery of energy to retail customers.

ELECTRIC POWER GRID: A system of synchronized power providers and consumers connected by transmission and distribution lines and operated by one or more control centers. In the continental United States, the electric power grid consists of three systems: the Eastern Interconnect, the Western Interconnect, and the Texas Interconnect. In Alaska and Hawaii, several systems encompass areas smaller than the State (e.g., the interconnect serving Anchorage, Fairbanks, and the Kenai Peninsula; individual islands).

FEDERAL ENERGY REGULATORY COMMISSION (FERC): The federal agency with jurisdiction over interstate electricity sales, wholesale electric rates, hydroelectric licensing, natural gas pricing, oil pipeline rates, and gas pipeline certification. FERC is an independent regulatory agency within the Department of Energy and is the successor to the Federal Power Commission.

FUEL CELL: A device capable of generating an electrical current by converting the chemical energy of a fuel (e.g., hydrogen) directly into electrical energy. Fuel cells differ from conventional electrical cells in that the

active materials such as fuel and oxygen are not contained within the cell but are supplied from outside. It does not contain an intermediate heat cycle, as do most other electrical generation techniques.

GENERATION: The process of producing electric energy by transforming other forms of energy; also, the amount of electric energy produced, expressed in kilowatt-hours (kWh).

LOAD: The amount of electric power delivered or required at any specific point or points on a system. The requirement originates at the energy-consuming equipment of the consumers.

LOAD CONTROL PROGRAM: A program in which the utility company offers a lower rate in return for having permission to turn off the air conditioner or water heater for short periods of time by remote control. This control allows the utility to reduce peak demand.

OUTAGE: The period during which a generating unit, transmission line, or other facility is out of service.

PEAK DEMAND OR PEAK LOAD: The maximum load during a specified period of time.

RELIABILITY: A measure of the ability of the system to continue operation while some lines or generators are out of service. Reliability deals with the performance of the system under stress.

TIME-OF-DAY PRICING: A special electric rate feature under which the price per kilowatt-hour depends on the time of day.

TRANSMISSION: The movement or transfer of electric energy over an interconnected group of lines and associated equipment between points of supply and points at which it is transformed for delivery to consumers or is delivered to other electric systems.

Visit our web site to learn about
the programs and services RPU offers our customers
to help manage, protect, and conserve energy and water!

www.rpu.org

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4000 East River Road NE • Rochester, Minnesota 55906-2813
(507) 280-1500 • (800) 778-3421

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