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April 1, 2014

VIA E-FILING
Dr. Burl W. Haar
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, MN 55101-2147

Re: 2014 Smart Grid Report
Docket No. E999/CI-08-948

Dear Dr. Haar:

Minnesota Power hereby submits, via electronic filing, its 2014 Report Concerning Past, Current and Planned Smart Grid Projects in compliance with the Minnesota Public Utilities Commission's Order dated June 5, 2009 in the above referenced docket. An Affidavit of Service is included.

Please contact me at the number provided above with any questions or concerns.

Yours truly,

Lori Hoyum

STATE OF MINNESOTA
BEFORE THE
MINNESOTA PUBLIC UTILITIES COMMISSION

Minnesota Power's 2014 Annual Report Concerning Past, Current and Planned Smart Grid Projects	Docket No. E999/CI-08-948 COMPLIANCE REPORT

Minnesota Power submits this Report to the Minnesota Public Utilities Commission ("Commission") in compliance with the Commission's Order dated June 5, 2009 (Docket No. E-999/CI-08-948). This report supplements last year's report as it is meant to serve as an update to Minnesota Power's Smart Grid activities. Minnesota Power welcomes questions and feedback pertaining to the information presented in this Report.

Review of Past Smart Grid Projects

Minnesota Power serves approximately 143,000 retail electric customers and 16 municipal systems across a 26,000-square-mile service area in central and northeastern Minnesota. Residential customers comprise less than 10 percent of the utility's total annual delivery. More than half of Minnesota Power's total energy supply is sold to industrial customers who operate with a particularly high load factor due to continuous operation. This ratio of industrial demand gives Minnesota Power a unique load profile with less variation than most utilities.

For more than 35 years, Minnesota Power has been making strategic investments into infrastructure and technologies to improve both the transmission and distribution systems that make up its grid. Minnesota Power has progressed from a company that was utilizing leased line substation communications prior to 1976 to a Company that is seen as a forward-looking distribution utility focused on the cost effective use of communication infrastructure. A brief history of Minnesota Power's investments to upgrade its system includes:

Year 1976 – Initial use of analog wireless substation communication towers

Allowed monitoring and automated control of Minnesota Power's Utility Substations. Communication paths with substations allowed for tremendous increase in operational efficiencies that resulted in less labor for managing remote facilities.

Year 1978 – First U.S. utility owned fiber optic used for operations

Paralleled with the deployment of wireless networks, Minnesota Power saw the value of bandwidth and movement of high volumes of data related to fiber-optic networks to manage its critical substation assets. These investments have continued to provide a reliable and secure path to manage its most critical assets.

Year 1992 – Use of public wireless networks for meter data retrieval

The advent of Solid state measurement devices in the late 1980's allowed for tremendous advancement in the way customer information was handled. Advanced Mobile Phone Systems ("AMPS") allowed utilities to replace labor intensive systems with analog wireless communication, allowing on-demand retrieval of usage data and reporting of service level issues.

Year 1994 – Substation communication converted to digital wireless

Conversion to digital wireless was a natural progression for the Company's analog systems, as that equipment became obsolete and required considerable amount of additional maintenance.

Year 2000 – Investment in power line carrier Automated Meter Reading ("AMR") System

Investment in AMR was a major step forward in efficiency. By deploying a one-way power line carrier network, Minnesota Power was able to get regular, reliable meter readings without the use of manual labor for meter reading. This allowed for a great deal more customer data to be stored for historical records and provided back to customers.

Year 2007 – Final conversion of AMPS wireless to digital

AMPS were determined to be an obsolete technology by the Federal Communications Commission, which forced replacement of all of the AMPS communication devices deployed across the country.

Year 2008 – Advance Metering Infrastructure ("AMI") smart meters deployed

As AMI systems became commercially available, Minnesota Power looked at all of the additional benefits that a higher speed, two-way AMI system could provide. The benefits of AMI are discussed in the Current and Planned Smart Grid Projects section of this report.

Year 2011 to present – Distribution Automation Self-Healing Network Online

In a partnership with the U.S. Department of Energy, Minnesota Power was able to deploy its first self-healing distribution network on its system. The system uses logic to limit the impact of outages to as few customers as possible. The Company installed all equipment in 2011 to create what is known in the utility industry as a "self-healing" or "self-correcting" feeder. The equipment and a high level of key enhancements it facilitates include:

- Six S&C IntelliRupter PulseCloser intelligent switches (can also function as reclosers).
- Eight intelligent dynamic devices (two existing reclosers and the six IntelliRupters) tied together and communicating with fiber optics.
- Switches are individually programmed to isolate a fault and automatically reconfigure the circuit to restore power to customers
- Automatic switching and isolation will result in lower customer outage minutes by dynamically responding to fault situations.
- The installation of six additional IntelliRupters is in progress to automate a 34.5kV subtransmission loop through the high load density area of Duluth. This loop will relieve some of the loading on downtown feeders and the automatic reconfiguration will provide improved reliability for the load.

Current and Planned Smart Grid Projects

In late 2007, Minnesota Power initiated evaluation of AMI technology. This evaluation resulted in the development of Minnesota Power's Smart Grid-AMI Pilot Project. The Company was selected to receive a Department of Energy ("DOE") American Recovery and Reinvestment Act ("ARRA") Smart Grid Investment Grant ("SGIG") for the Smart Grid-AMI Pilot Project totaling $1.5 million, or one-half of the estimated total project costs. See Table 2- Summary of the costs for currently planned Smart Grid projects, on Page 8, for further details of project budget information.

Advanced Metering Infrastructure:

Minnesota Power continues the process of implementing its AMI meter installation. At the end of 2013 the Company had installed approximately 24,000 AMI meters. The current AMI

population represents approximately 18 percent of the overall meter population. (See Table 1 on Page 4)

Table 1 illustrates the type and approximate percentage of meters currently in use

Equipment	Percent in Use	Description
Mechanical Meters	Less than 1%	Traditional electro-mechanical meter that records kWh usage.
AMR – Mechanical Hybrid	64%	Traditional Electro-mechanical meters that are retro-fitted with a one-way electronic automatic meter reading (AMR) module capable of reporting multiple quantities including kWh, kW, and outage count.
AMR – Solid State	17%	Modern Solid State electronic meters integrated with a one-way AMR module or retrofitted with an external AMR unit. Capable of reporting multiple quantities including kWh, kVARh, kW, and outage count.
AMI – Solid State	18%	Modern solid state devices integrated with a two-way AMI communication module. Capable of multiple measurement functions including Time of Use (TOU), kW, kWh, KVA, kVAh, kVAR, kVARh, instantaneous and average voltage, two channel load profile, and remote disconnect. Also capable of remote firmware, program, and display updates.

8,030 AMI meters were installed as part of the Smart Grid-AMI Pilot Project. The Smart Grid-AMI Pilot Project was originally designed to provide an incremental, but functional increase in the Company's ability to better serve customers. Overall, the AMI system allows efficient metering access between Minnesota Power and its customers. With the meters acting as smart nodes on each premise, a multitude of benefits can be derived including: efficient deployment of advanced time-based rates, outage notification, and notification of service issues (such as low/high voltage and tamper warnings), improved load control, and more frequent customer data. The expansion of Minnesota Power's AMI capabilities lays the groundwork for further Smart Grid initiatives.

Transmission Investments

Line Panel Project

The Company is continuing a project to replace certain 115kV line panels at key substation locations, and install system software that improves grid intelligence and enhances cyber security. This project involves installing a cyber-security solution to meet North American Electric Reliability Corporation ("NERC") Critical Infrastructure Protection ("CIP") requirements on Minnesota Power's Energy Management System ("EMS"). The project will deploy and test technology across a networked infrastructure to achieve the following: collection of non-operational data to a single intelligent source, NERC CIP conforming remote cyber secure access for equipment configuration and control, unified event file collection and archiving, and collection of data for smart condition based maintenance.

Minnesota Power's line panel project is aimed at implementing the necessary digital upgrades in the Company's transmission line infrastructure thereby improving outage detection and equipment maintenance. Key system software upgrades will help improve protection against cyber-related vulnerabilities. The upgrades also facilitate operating efficiency by reducing line panel maintenance, by insuring communication between system operators and new line panels, and by increasing overall system reliability. The modern technology utilized improves the reliability, security, and efficiency of Minnesota Power's electric grid.

Midwest Independent System Operator[1] ("MISO") Synchrophasor Project

Minnesota Power is a participant in the Midwest Independent Transmission System Operator ("MISO") Synchrophasor Project. MISO was awarded a SGIG to install Phasor Measurement Units ("PMUs") across its footprint. The PMUs will provide high speed synchrophasor data to system operators giving them a more comprehensive, wide area visualization of the power system network. Synchrophasor data can also be used to verify the computer simulation models that are used to plan and operate the system. As application

[1] The Midwest Independent System Operator is an independent, nonprofit organization that supports the reliable delivery of electricity in 13 U.S. states and the Canadian province of Manitoba.

software matures along with the rollout of these devices across the Eastern Interconnection[2], synchrophasor data will become an integral part of interconnected grid operations. To date, Minnesota Power has installed four PMU's and two Phasor Data Concentrators ("PDC"). The PDC compiles all the PMU data from Minnesota Power and sends it to MISO in one data stream. All equipment is currently operational and providing high speed measurement information to MISO and critical locations throughout the transmission system.

Distribution System Investments

Outage Management

Minnesota Power unveiled a website-based Outage Center in 2010 which facilitates the reporting and display of outage information. The Outage Center provides visitors with specific outage locations and also allows them to report outages or check the status of outages online. In 2011, Minnesota Power introduced applications to allow customers to view the Outage Center on their Android, Blackberry and iPhone devices. Customers are able to now report outages as well as check on the status of outages from anywhere at any time.

In addition to the customer-centric features described above, Minnesota Power has completed implementation on its planned integration of the Outage Management System ("OMS") and AMI system. The interface streams data directly from customer meters to the OMS. The architecture of the system provides outage or "last gasp" messages from all AMI meters. The meters utilize an internal temporary power source to provide notification of customer outages. Additionally, the meters stream "power on" messages when service is restored. The interface between the OMS and AMI system was completed in November of 2012 and is currently in use by approximately 18 percent of Minnesota Power's customers.

[2] All of the electric utilities in the Eastern Interconnection are electrically tied together during normal system conditions and operate at a synchronized frequency operating at an average of 60Hz. The Eastern Interconnection reaches from Central Canada Eastward to the Atlantic coast (excluding Québec), South to Florida, and back West to the foot of the Rockies (excluding most of Texas).

Voltage Monitoring

In 2006, Minnesota Power began a pilot program to install voltage/outage monitoring equipment on primary lines that were not monitored by its EMS to enhance outage response on these lines. These were normally lower voltage rural systems served by substations without any communications infrastructure. The pilot grew over the past several years to include other applications including customer sites and some lines that had limited EMS data points. These pilot installations have been improving outage response times due to the fact that dispatchers are able to send crews out to the right locations faster and restore outages at a more rapid pace. More precisely monitoring voltages also helps the Company determine the overall condition of the system, including voltage imbalances, during peak loading periods.

Time-of-Use Rates and Demand Response

Minnesota Power continues development of the Time-of-Day Rate with Critical Peak Pricing pilot project and Time-of-Day Rate filing which was submitted a Time-of-Day Rate filing to the Commission on March 20, 2012 which was approved on November, 30 2012.[3] The accompanying web portal that enables customers to view their usage information in monthly, daily and hourly increments was also introduced to Pilot Project participants in March of 2012. These efforts build upon Minnesota Power's existing conservation improvement programs and will offer insight into customer's appetites for more frequent and in depth information about their energy usage. Minnesota Power is currently preparing the final Rate offering for the Time-of-Day Rate to customers and this Rate should be available in the second quarter of 2014.

Project Cost and Cost Effectiveness

Minnesota Power has invested the entire $3.1 million Smart Grid-AMI Pilot Project budget. Approximately $1.55 million of the total project budget was provided through the SGIG. The majority of the grant expenditures were utilized for expanding the capability of the AMI system, the Dual Fuel system upgrade, and the Distribution Automation project.

[3] Docket No. E015/M-12-233

The total SGIG investment in the Dual Fuel system upgrade to date is approximately $420,000. This $420,000 investment has saved Minnesota Power customers approximately $300,000 in avoided capital costs compared to what would have been necessary if the older technology system was still being utilized. With this upgrade, Minnesota Power has realized a 70 percent reduction in overall costs for the Dual Fuel system. This reduction includes savings in operations and maintenance.

For the Distribution Automation portion of the project Minnesota Power invested approximately $550,000 ($250,000 in intelligent switches and $300,000 in fiber communication). The fiber communications addition provided further communication redundancy between two critical substations in the Duluth area, along with providing situational awareness at the distribution feeder level. Minnesota Power experienced a major event in the Distribution Automation area in the spring of 2013. During the event, approximately 2,800 customers would have experienced an extensive outage of multiple hours if upgrades to the system had not been made. As a result of the automation investments, approximately 70 percent of the effected customers were restored nearly instantaneously with only a momentary interruption of service. The upgraded system operated exactly as designed and provided the restoration benefits that Minnesota Power projected given the catastrophic nature of the Distribution Feeder event. Further analysis will be required to determine if the potential reliability improvement to can be justified at this level of investment for a relatively small group of customers. At this time the Company's engineering evaluation does not support system wide deployment of this technology. However, it may be justified in the future as the technology becomes more economical or customer expectations increase dramatically.

Project	Total Cost	Portion Recovered Through SGIG
AMI meter expansion	$5,400,00	$1,025,000
Distribution Automation	$550,000	$125,000
Dual Fuel Upgrade	$420,000	$210,000
Voltage Monitoring	$300,000	$0
MISO Synchrophasor Project	$150,000	$150,000

Table 2- Summary of the costs for currently planned Smart Grid projects.

Conclusion

Minnesota Power continues to be active and engaged in the developments surrounding a modernized electric grid. Minnesota Power will assess the performance and cost effectiveness of current projects and continue investment in those deemed beneficial to the Company and its customers. The Company will also pursue promising investments as additional advancements are achieved in Smart Grid technology. Minnesota Power has gained knowledge from being involved in the SGIG process and trusts that advancements on the grid will continue to produce positive results for customers and utilities alike.

STATE OF MINNESOTA	)	AFFIDAVIT OF SERVICE VIA
	) ss	ELECTRONIC FILING
COUNTY OF ST. LOUIS	)	

Kristie Lindstrom of the City of Duluth, County of St. Louis, State of Minnesota, says that on the 1st day of April, 2014, she served Minnesota Power's Annual Smart Grid Report in Docket No. E999/CI-08-948 to the Minnesota Public Utilities Commission and the Energy Resources Division of the Minnesota Department of Commerce via electronic filing. The remaining parties on the attached service list were served as so indicated on the list.

/s/ Kristie Lindstrom

Subscribed and sworn to before
me this 1st day of April, 2014.

/s/ Mary K Johnson

Notary Public - Minnesota
My Commission Expires January 31, 2016

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