GE Study Finds Minnesota Can Accommodate Significant Additional Renewable Generation

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- *Study by GE's Energy Consulting Business Finds That Minnesota's Electrical Transmission System can be Successfully Operated with Renewable Generation Supplying up to 40 Percent of State's Electric Retail Sales by 2030, Assuming There are Sufficient Upgrades to the Existing Transmission System*
- *This Level of Renewable Generation Penetration can be Successfully Achieved with Minimal Impact to Current Operating Procedures and Assets*
- *Dynamic Simulation Results with GE PSLF* Indicate No Fundamental System-Wide Dynamic Stability or Voltage Regulation Issues with 40 Percent Renewables Penetration*

SCHENECTADY, N.Y.—November 25, 2014—GE's Energy Consulting business (NYSE: GE) served as the lead technical consultant for the recent Minnesota Renewable Energy Integration and Transmission Study (MRITS), performed by the Minnesota utilities and transmission companies in coordination with the Midcontinent Independent System Operator (MISO), and directed by the Minnesota Department of Commerce. The study demonstrated that Minnesota's power system can accommodate renewable generation, representing up to 40 percent of retail sales in total with certain upgrades to existing transmission. The study also found that even with these higher levels of renewables, the overall system could continue to operate essentially as it does under normal conditions today.

The study also determined that this level of renewable generation in Minnesota could be reliably achieved with only about 2 percent curtailment of renewable energy, often cited as a challenge when considering whether to develop renewables projects. When moving towards 40 percent renewable penetration on the Minnesota system, there is modest change in energy from Minnesota's conventional generation.

"GE Energy Consulting's findings will help Minnesota develop and continue to achieve its renewable energy strategies and goals," said Minnesota Department of Commerce Commissioner Mike Rothman. "We appreciate Energy Consulting's technical analysis, showing renewable energy is a viable and reliable resource to meet Minnesota's energy

needs."

One of the concerns often raised with the introduction of high levels of renewable generation onto the grid is the impact on the grid's stability and its ability to adequately respond to system disturbances. This study, along with several others conducted by GE's Energy Consulting business, demonstrates that higher levels of renewable penetration do not negatively impact grid stability and further, can actually enhance resiliency when equipped with grid-friendly controls. The Minnesota study showed that wind and solar resources contribute significantly to voltage support and dynamic reactive reserves. Additionally, the fast response capabilities of wind and solar inverters can help with voltage recovery following a system fault.

This Minnesota study builds on several similar studies that GE's Energy Consulting business has conducted across the United States and Canada over the past several years using GE's PSLF* modeling software—including the recent study of the Eastern Interconnect (EI) of the U.S. for the National Renewable Energy Laboratory (NREL). That study considered the impact of 25 percent renewable penetration on frequency response on the EI system, finding that renewables at this penetration level could actually help with grid resiliency.

"While 25 percent renewable penetration on the Eastern Interconnection is an aggressive target overall, the fact that Minnesota's system could reasonably accommodate 40 percent renewables penetration demonstrates the importance of evaluating the role renewable energy can play in the generation mix at regional and local levels," said Doug Welsh, Technical Director, GE's Energy Consulting business and GE project manager for the Minnesota study. "Not all electric power systems are created equal, and taking into account the unique aspects of individual systems can create a better understanding of the role renewable generation can play across the U.S. and around the world."

Along with the Minnesota study, GE's Energy Consulting business also has completed comprehensive studies across North America, including in New York, California, Nova Scotia, PJM, Hawaii, Texas and the New England region.

You can find the entire Minnesota study at the following URL:http://mn.gov/commerce/energy/images/FINAL-MRITS-Report14.pdf

About GE's Energy Consulting Business

For nearly a century, GE's Energy Consulting experts have focused on solving the electric power industry's most pressing challenges—driving the evolution of electric power systems

with greater affordability, reliability and efficiency. Today, GE's Energy Consulting team continues this tradition by providing innovative solutions across the entire spectrum of power generation, delivery and utilization. With its cross-company resources, GE's Energy Consulting business is able to serve a diverse global client base with a strong local presence.

About GE

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