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Charles River Associates’ SPP Wind Integration Study Identifies Challenges, Solutions to Adding More Wind Energy to the Regional Electric Grid

January 19, LITTLE ROCK, ARKANSAS – The recently released SPP WITF Wind Integration Study, conducted by Charles River Associates (CRA) on behalf of the Southwest Power Pool, Inc. (SPP) Wind Integration Task Force (WITF), found that enhanced electricity reserves and major transmission reinforcements are needed to integrate higher levels of wind generation into the SPP transmission system and energy markets. If the needed transmission upgrades were completed, there would be no significant technical barriers or reliability impacts to integrating wind energy levels up to 20%. Currently, approximately 4% of the region’s electricity is generated by wind.

According to SPP Vice President of Engineering Bruce Rew, “The study reinforced the criticality of coordinating transmission expansion plans with plans for building infrastructure to generate wind energy. Recommendations made in the study will allow SPP to prepare for continued growth in our region’s renewable wind resources.”

The study examined three wind penetration levels and compared each to current system conditions. Detailed analysis was completed on 10% and 20% wind levels by annual energy; limited analysis was completed on a 40% case. SPP wind generation resources are primarily located in the western part of the region, typically in sparsely-populated locations with little transmission and electricity demand.

The study found that an increase in the wind penetration level causes changes in power flow patterns – particularly increased flow from the western to the eastern part of the region – requiring upgrades and/or reconfigurations to the transmission system. To accommodate the increased west-to-east flows while meeting SPP’s electric reliability standards:

- For the 10% case, new transmission lines totaling 1,260 miles of 345 kV and 40 miles of 230 kV lines are needed.
- For the 20% case, an additional 485 miles of 765 kV, 766 miles of 345 kV, 205 miles of 230 kV, and 25 miles of 115 kV lines are needed.

These findings are consistent with CRA’s 2008 analysis of SPP’s Extra High Voltage Overlay plans.

Other significant study findings, assuming all needed transmission upgrades and an SPP Day-Ahead market are in place:

- Integrating the levels of wind studied in the 10% and 20% cases could be attained without adversely impacting SPP system reliability.
- Wind integration would be greatly facilitated by the creation of an SPP consolidated balancing authority, in which SPP would balance electricity supply and demand for the entire region. While a consolidated balancing authority should reduce overall needs for electric reserves and flexible resources, greater operational flexibility would be required to quickly respond to injections of wind to the grid. As wind generation increases or decreases, other sources of generation must quickly ramp up or back down to keep an uninterrupted power flow.
- Efficient wind integration requires a sophisticated process for determining what generating units are utilized throughout the region, explicitly addressing the uncertainty associated with wind forecast errors. The implementation of a centralized forecasting system would be advantageous.
The study further identified the impact of wind penetration on the scope and level of required reserve energy and generation patterns. Based on the engineering analysis and a review of international best practices of wind integration, the study includes specific policy and market design recommendations essential for the successful integration of higher levels of wind resources into the SPP footprint.

"In recent years, Charles River Associates has studied and analyzed the implications of a variety of energy options within SPP, and we are pleased to draw on our analytical insights and industry expertise in this latest report," said Paul Maleh, Charles River Associates’ President and Chief Executive Officer. "The study offers a comprehensive overview of the challenges for integrating wind energy resources into SPP, and suggests a framework for establishing a successful and efficient wind energy model."

The study was led by two CRA consultants – Mr. Bruce Tsuchida and Dr. Pablo Ruiz. CRA Vice President Dr. Aleksandr Rudkevich served as the Officer-in-Charge.

The WITF findings were accepted by the SPP Markets and Operations Policy Committee on January 12, 2010. SPP’s Regional State Committee and Board of Directors will hear a WITF report later this month. Study recommendations have been assigned to SPP working groups for further consideration and development; the groups will report back on their progress at the April 2010 Markets and Operations Policy Committee meeting.

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Southwest Power Pool, Inc. is a group of 56 members in Arkansas, Kansas, Louisiana, Mississippi, Missouri, Nebraska, New Mexico, Oklahoma, and Texas that serve more than five million customers. Membership is comprised of investor-owned utilities, municipal systems, generation and transmission cooperatives, state authorities, wholesale generators, power marketers, and independent transmission companies. SPP’s footprint includes 29 balancing authorities, 50,575 miles of transmission lines, and 370,000 square miles of service territory. SPP was a founding member of the North American Electric Reliability Corporation in 1968, and was designated by the Federal Energy Regulatory Commission as a Regional Transmission Organization (RTO) in 2004 and a Regional Entity (RE) in 2007. As an RTO, SPP ensures reliable supplies of power, adequate transmission infrastructure, and competitive wholesale prices of electricity. The SPP RE oversees compliance enforcement and reliability standards development. Read more fast facts or watch a video about SPP.

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