Research on the Operational Impacts of High Penetrations of Wind and Solar Generation on the Western Interconnection

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Under DOE funding, the National Renewable Energy Laboratory (NREL) has undertaken extensive research into the operation of the power system under high penetrations of wind and solar generation in the Eastern and Western Interconnections. NREL worked closely with a diverse committee of regional experts to push the limits of existing modeling capabilities to perform rigorous and objective analyses at increasing levels of precision, fidelity, and resolution. The intent of this document is to provide relevant economic and reliability research to the Commission and EPA to assist in the understanding how wind and solar resources could be used to decrease power system emissions in the Western Interconnection.

In phase 1 of the Western Wind and Solar Integration Study (WWSIS), NREL teamed with GE to analyze the operational impacts (e.g. system production costs and emissions) of 30% wind and 5% solar for WestConnect, with significant levels of VG in the rest of the Western Interconnection. (WestConnect consists of the major transmission providers in the states of Arizona, Colorado, Nevada, New Mexico, Wyoming and parts of other states. It includes Arizona Public Service, El Paso Electric Co., NV Energy, Public Service of New Mexico, Salt River Project, Tri-State Generation and Transmission Cooperative, Tucson Electric Power, Western Area Power Administration, and Xcel Energy.)

Two years later, in phase 2, NREL studied the entire Western Interconnection with new emissions and cycling cost data sets in sub-hourly production cost models to understand how cycling of fossil-fueled generators impacted wear and tear costs, system emissions and system production costs under 33% combined wind and solar generation.

More recently, in phase 3 of WWSIS, NREL and GE conducted frequency response and transient stability analysis on select intervals from phase 2 to understand reliability impacts of up to a combined 53% instantaneous wind and solar penetration level. Taken as a whole, these studies document how, given the assumptions discussed in more detail in the attached Executive Summaries and linked Final reports, wind and solar generation can effectively be used to reduce system wide emissions while meeting several key metrics with respect to economics and reliability.

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