



**Electricity, Resources,
& Building Systems
Integration**

Utility Scale Renewables

Renewable and Efficiency Technology Integration

NREL Industry Forum

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NREL National Renewable Energy Laboratory
Innovation for Our Energy Future

NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

Integration Mission

- Enable maximum renewable energy and energy efficiency technology adoption
- Maintain and enhance grid reliability by advancing critical science and engineering in electrical systems and resource assessment.
- Transfer knowledge and innovations in these areas in a manner that accelerates commercial deployment and addresses the nation's energy, security, and environmental goals.

Electricity, Resources, and Building Systems Integration Center

Thermal Systems



Resource Information
and Forecasting



Transmission and
Grid Integration



Distributed Energy
Resources Integration



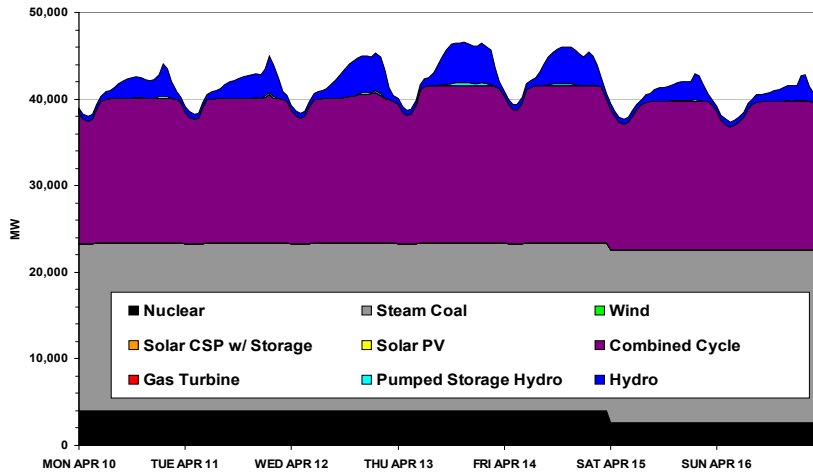
Commercial Building
R&D

Residential Building
R&D

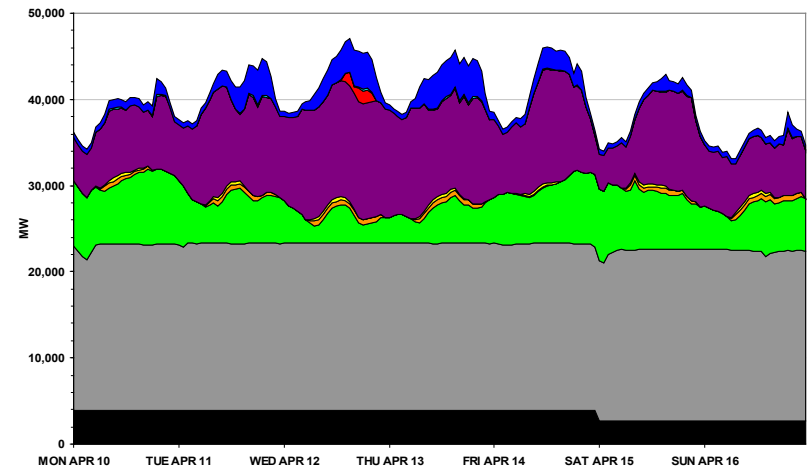


High Penetration Impacts on Dispatch

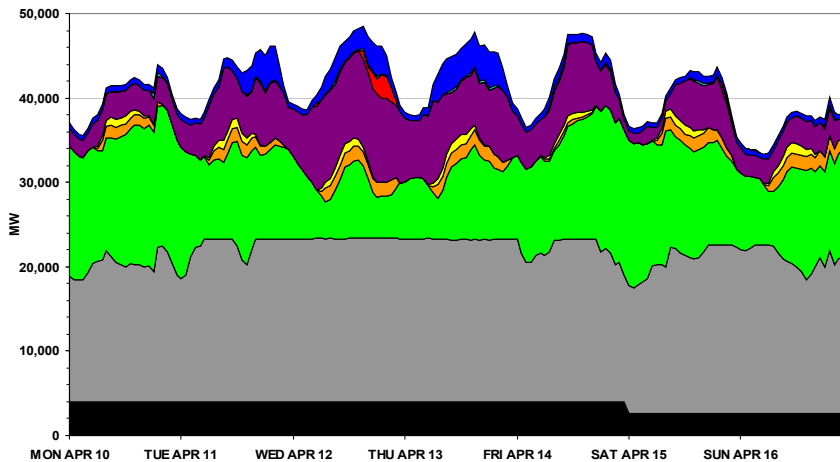
Study Area Dispatch - Week of April 10th - No Wind



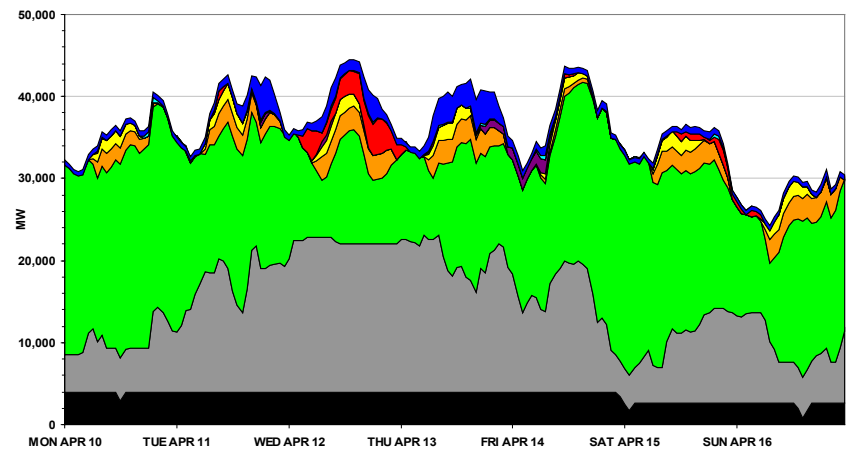
Study Area Dispatch - Week of April 10th - 10%R



Study Area Dispatch - Week of April 10th - 20%R



Study Area Dispatch - Week of April 10th - 30%R



Charts courtesy of General Electric Corporation

Western Wind and Solar Integration Study

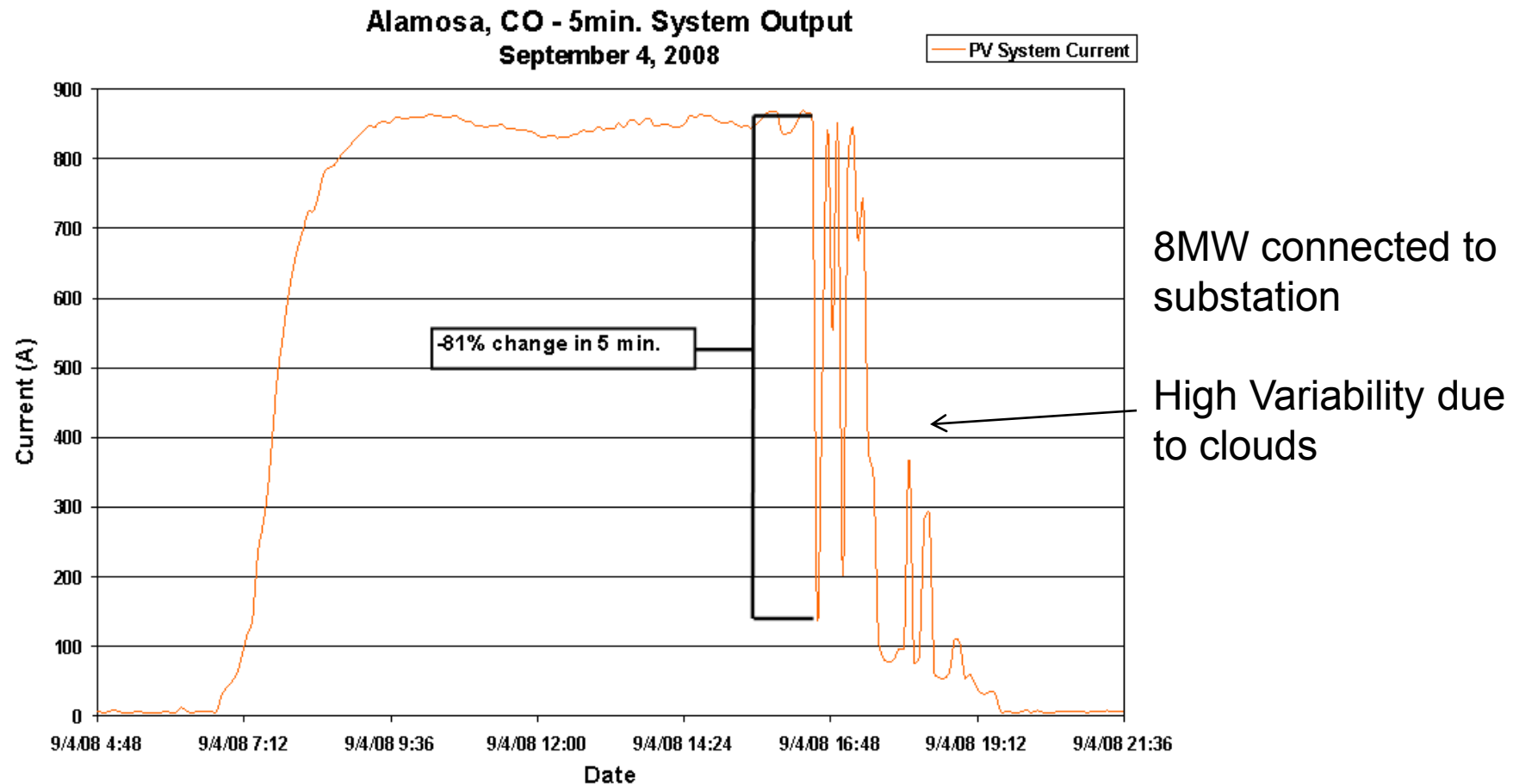
Xcel Energy - Alamosa, CO

Currently monitoring effects of 8MW PV system on distribution feeder in Alamosa, CO.

Working with Xcel Energy (utility) and SunEdison (system integrator).



Documenting Variability



Xcel Energy – Alamosa System