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# Grid Integration of Renewable Energy Resources

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## With Dr. Matthew Lave

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## Abstract:

The grid integration of photovoltaics (PV) and other distributed energy resources provide opportunities for enhanced reliability and resiliency of the electric grid. This integration also offers cost savings, reduced losses, and emissions reductions. However, distributed resources are typically variable in output (e.g., due to varying cloud cover) and customer-owned input, meaning the utility has no visibility or control over their generation. Grid integration concerns include matching load with generation and maintaining operations within safe voltage and current limits. This talk will present several areas of ongoing research in the Renewable and Distributed Systems Integration Department at Sandia National Laboratories. Specific topics will include a discussion of the magnitude of solar variability, how variability is "smoothed" when aggregated spatially, and variability's impact to electric grids with high PV penetrations. Also presented is an evaluation of PV and load forecasts, including their value to planning and operation, and a demonstration of hosting capacity analysis, which determines the maximum capacity of PV or other distributed resources that can be installed without causing problems to distribution grid operations. Additionally, methods to control distributed energy resources such that they can support rather than hinder grid operations will be discussed.


## Biography:

Dr. Matthew Lave is a Senior Member of the Technical Staff in the Renewable and Distributed Systems Integration Department at Sandia National Laboratories. He has worked at Sandia since 2013. Matthew is an expert at monitoring, analyzing, and modeling of PV power production, both for performance assessment and for grid integration studies. Matthew has been first author on many peer-reviewed journal articles on topics such as solar resource assessment, PV performance modeling, solar variability analysis, optimal tilt angles for PV modules, and the impact of solar variability to electric grid operations. He developed the wavelet variability model (WVM) which is now widely used by researchers, consultants, and utilities for modeling the aggregated solar variability of distributed or utility scale solar plants. Recent work includes developing new methods for analysis of bifacial PV module performance, parameter and topology estimation of distribution grid secondary circuits (i.e., transformer to customer resistance and reactance), evaluation of PV forecasts' performance and their value to grid operations, and leading the development of the Grid Modernization Testing Network to make it easier to understand and partner with National Laboratory testing facilities and capabilities.

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