

# Research in Energy Systems Integration at the National Renewable Energy Laboratory

Speaker: Dr. James Cale  
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**Abstract:** There has been significant advancement in the past few decades in the development and industry adoption of energy efficiency technologies, renewable energy, and distributed energy resources. These efforts have started new industries and are changing the energy landscape towards a sustainable future. As the penetration of these technologies increases from small to very significant, several challenges and barriers have appeared, associated with the limits of the existing energy infrastructure, which was never designed for installation and operation of high penetrations of emerging clean energy technologies. In recognition of the limits of the existing infrastructure to host emerging technologies, strategies need to be developed to identify and overcome barriers for massive deployment. In particular, the future energy system will require highly integrated, intelligent, flexible, and efficient systems that enable utilization of diverse energy sources while maintaining reliability and affordable cost. This exciting new area of Energy Systems Integration (ESI) is a major research priority for the Department of Energy (DOE). Recently, DOE has made large investments in this research area at NREL with the construction of the Energy Systems Integration Facility (ESIF) and creation of new research programs focused on ESI. This presentation will give an overview of research in ESI at NREL including the vision and conceptual framework of ESI, current research programs and facilities, and government funding that support these initiatives. The presentation will also discuss expected job opportunities in this area.

**Speaker:** Dr. Cale is a manager and senior electrical engineer at the National Renewable Energy Laboratory in Golden, CO, where he leads a group that performs research in distributed energy systems integration. His background and research interests are in the areas of high-penetration PV impacts on the electric grid, power electronic controls, microgrids, and optimization. He has both industrial and national laboratory experience in modeling, simulation and testing of these systems and control of their dynamic behavior. He earned his doctorate from Purdue University, West Lafayette (2007).

**About NREL:** The National Renewable Energy Laboratory is the U.S. Department of Energy's primary national laboratory for renewable energy and energy efficiency research and development. NREL develops renewable energy and energy efficiency technologies and practices, advances related science and engineering, and transfers knowledge and innovations to address the nation's energy and environmental goals. Core areas of emphasis at NREL are Energy Analysis, Science and Technology, Technology Transfer, Technology Deployment, and Energy Systems Integration.