

## **Microgrid Financing: Challenges and Solutions – sponsored by Duke Energy Renewables**

In this project, we conducted a national scan of microgrid projects to identify four projects to use in eliciting answers to the questions surrounding what makes a microgrid resilient, what are the greenhouse gas implications of microgrids, and what are other reasons aside resilience and carbon-reduction benefits to microgrid adoption. In this process, we identified specific examples of microgrid ownership arrangements including public, private or hybridized public-private ownership structures. Second, we developed an optimization procedure for optimal technology or unit commitment of the resources in a microgrid. The optimization regime is scaled for multiple objectives to minimize cost and minimize greenhouse gases. This process provides a series of sensitivity analysis on the trade-offs between the underlying objectives. The model is automated with a graphical user interface (GUI) for ease of use. Lastly, we identified specific legal or regulatory policy structures that have either facilitated or hindered the adoption and/or deployment of microgrids. The interaction between the regulatory frameworks and financing has led to the identification of financing barriers, designs and solution strategies. Some of these include sources of capital, beneficial tax or accounting structures, methods for cost recovery (e.g., tariffed rates, contract, revenues from markets external to the microgrid), and some identification of successful structures, with discussion of linkage to project characteristics – for example, non-recourse project finance relying on tax benefits might work best with a microgrid wholly owned by a single entity and serving only a few large customers; whereas an urban grid that serves a local area might need a tariffed structure and depend on a primary equity owner who backs the project off its balance sheet.