Operational Probabilistic Tools for Solar Uncertainty (OPTSUN)

DOE Solar Forecasting II Topic Area 3

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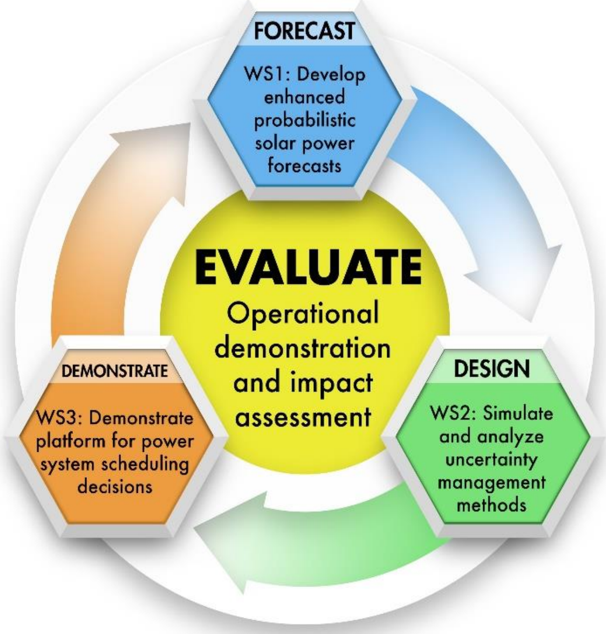
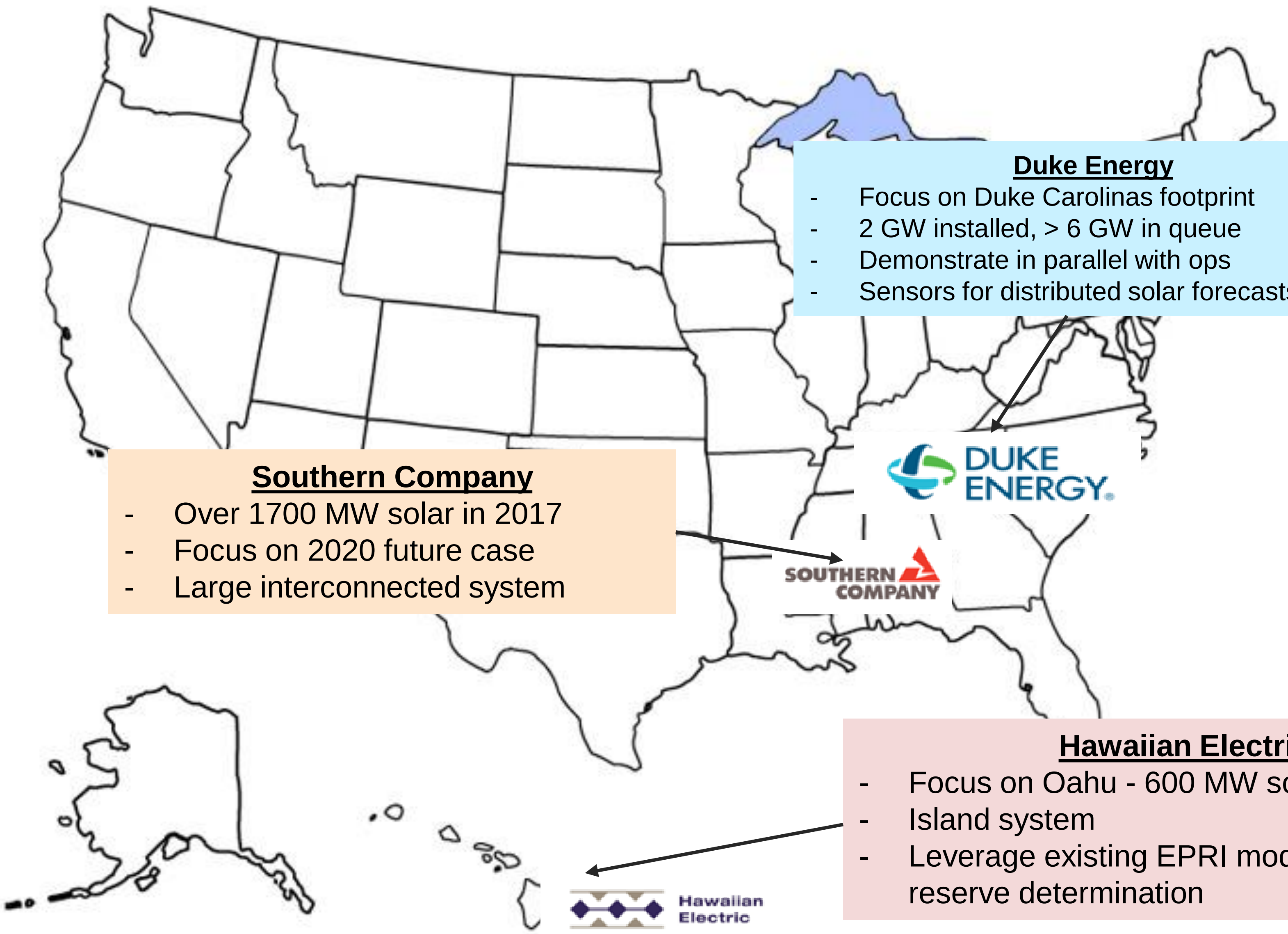
EPRI DOE Solar Forecasting Project– Three Workstreams

- 3 Year Project, anticipated $1,8M DOE funding, $760k EPRI/utility cost share ($110k from 173.05 over 3 years)
- A Forecasting Work Stream to develop and deliver probabilistic forecasts with targeted improvements for utility scale and behind-the-meter (BTM) solar
- A Design Work Stream to identify advanced methods for managing uncertainty based on results from advanced scheduling tools
- A Demonstration Work Stream to develop and demonstrate a scheduling management platform (SMP) to integrate probabilistic forecasts and scheduling decisions in a modular and customizable manner



AWS TRUEPOWER
DUKE ENERGY
VT
SOUTHERN COMPANY
POLARIS SYSTEMS OPTIMIZATION
Hawaiian Electric

Utility Demonstrations



Duke Energy

- Focus on Duke Carolinas footprint
- 2 GW installed, > 6 GW in queue
- Demonstrate in parallel with ops
- Sensors for distributed solar forecasts

Southern Company

- Over 1700 MW solar in 2017
- Focus on 2020 future case
- Large interconnected system

Hawaiian Electric

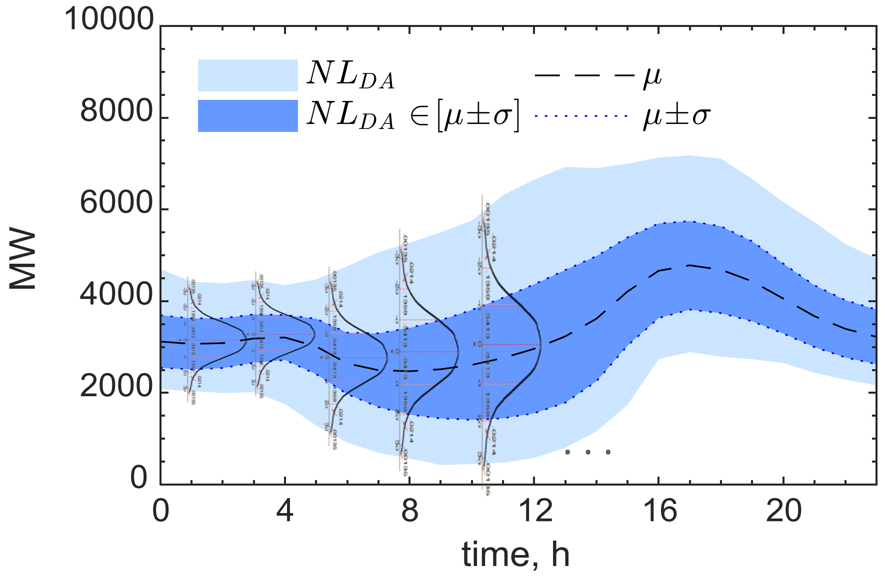
- Focus on Oahu - 600 MW solar installed
- Island system
- Leverage existing EPRI modeling on reserve determination

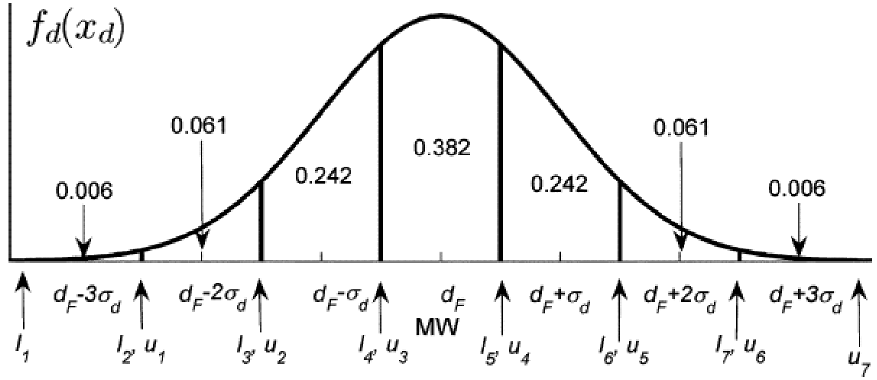
Probabilistic Forecasts in DynADOR Reserve Determination Tool

- Reserve determination using probabilistic forecasts added to existing deterministic reserve determination tool
- Calculation method proposed
  - For a given probabilistic forecast, determine the likelihood of net demand materialization
  - For each possible net demand combinations, determine dynamic reserves
  - The dynamic reserve requirements are given by the aggregation of the weighted individual reserve requirements

- Will be compared with existing dynamic reserve methods, which already show significant benefit

$$f(x) * g(x) \;=\; \int_{-\infty}^{\infty} f(\tau)\cdot g(x-\tau)\, d\tau$$

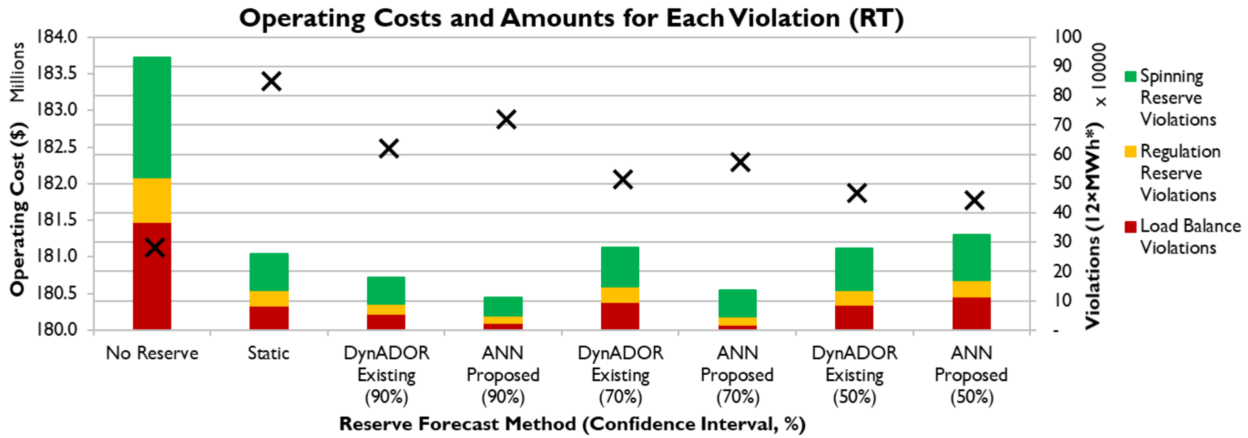




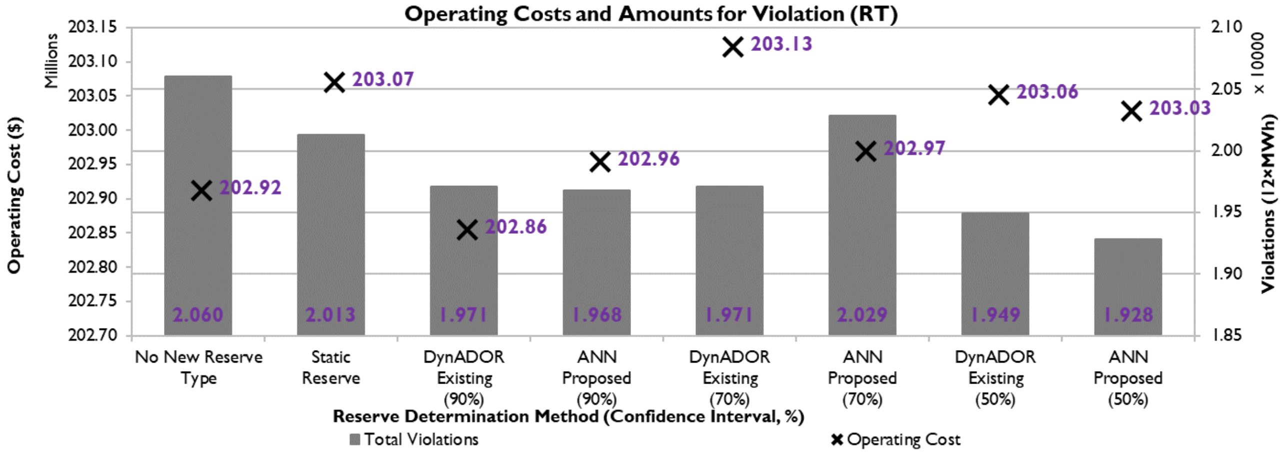
M. A. Ortega-Vazquez and D. S. Kirschen, "Estimating the Spinning Reserve Requirements in Systems with Significant Wind Power Generation Penetration,“ *IEEE Transactions on Power Systems*, Vol. 24, Issue 1, pp. 114-124, Feb. 2009.

Scheduling Process Model Development

- Important to understand how system responds to forecast error (whether reserves are cascaded and quick start allowed)
- RTS-96 test case has a significant amount of non-spinning reserve that can be synchronized in real-time → no significant differences were noticed between the different reserve determination methods for the second case
  - Significant reduction in violations and increase in costs in this case compared to online-only case
- Dynamic methods reduce costs and improve reliability
- Hard to notice difference between ANN and clustering methods, but expected results for confidence level
- These will be basis of comparison with probabilistic methods
  - Compared with method described earlier
  - Compared with spread of uncertainty (e.g. 5%-95%)



No quick start allowed



Quick start allowed, cascaded (offline) reserves

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