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Sandia National Laboratories

Sandia's ESS Demonstration with Duke Energy

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Motivation:

As distributed solar penetration increases, PV output intermittency can cause significant power swings on the distribution circuit

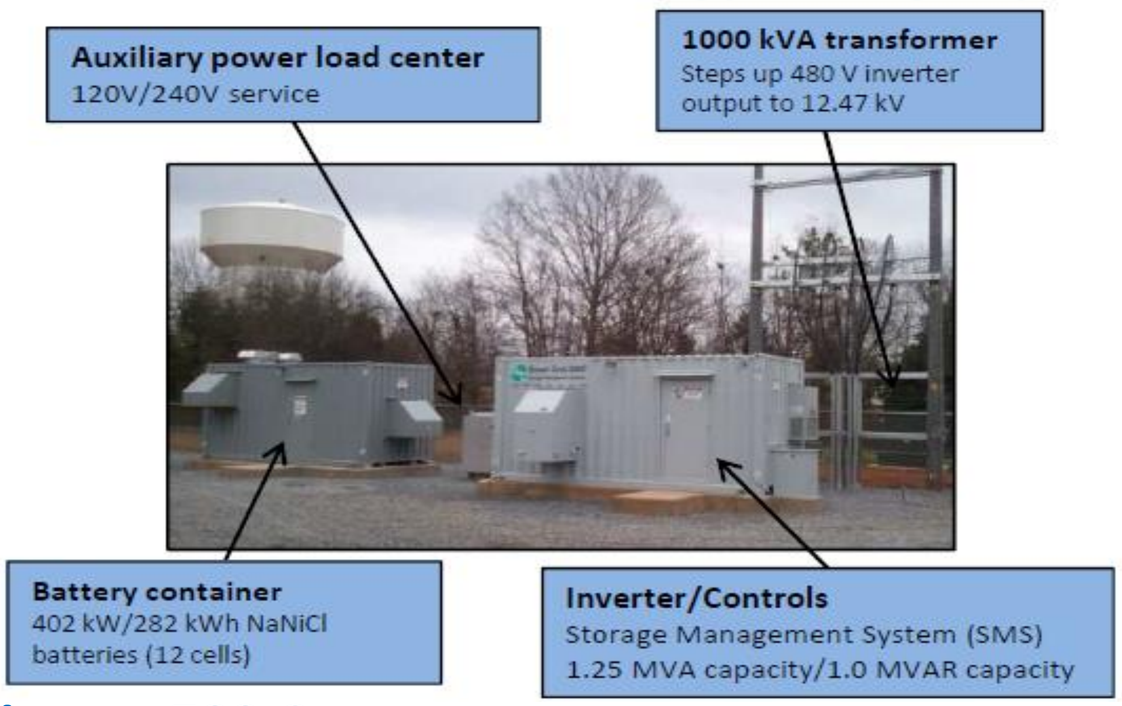
Unique Features:

- ESS has no direct connection to the PV: centralized location enables ESS to smooth power swings from multiple dispersed PV sites on a feeder circuit
- Substation-based ESS can reduce wear and maintenance needs on substation assets by compensating for PV-induced voltage swings

Tasks:

- Develop and validate models for substation, load tap changer (LTC), feeder, and voltage regulator (VR)
- Design and test control strategies for the ESS to mitigate the impact of PV on both the LTC and VR

Duke Substation-based Energy Storage System:



Primary ESS Components:

- FIAMM Sodium Nickel Chloride Battery
- 402 kW/ 282 kWh ESS Capacity
- 1.25 MVA S&C Electric Company Inverter/SMS

ESS Interconnection:

- ESS is electrically located on a 12.47 kV feeder
- ESS is physically located just outside substation
- Feeder contains a 1.2 MW PV site ~ 3 miles away

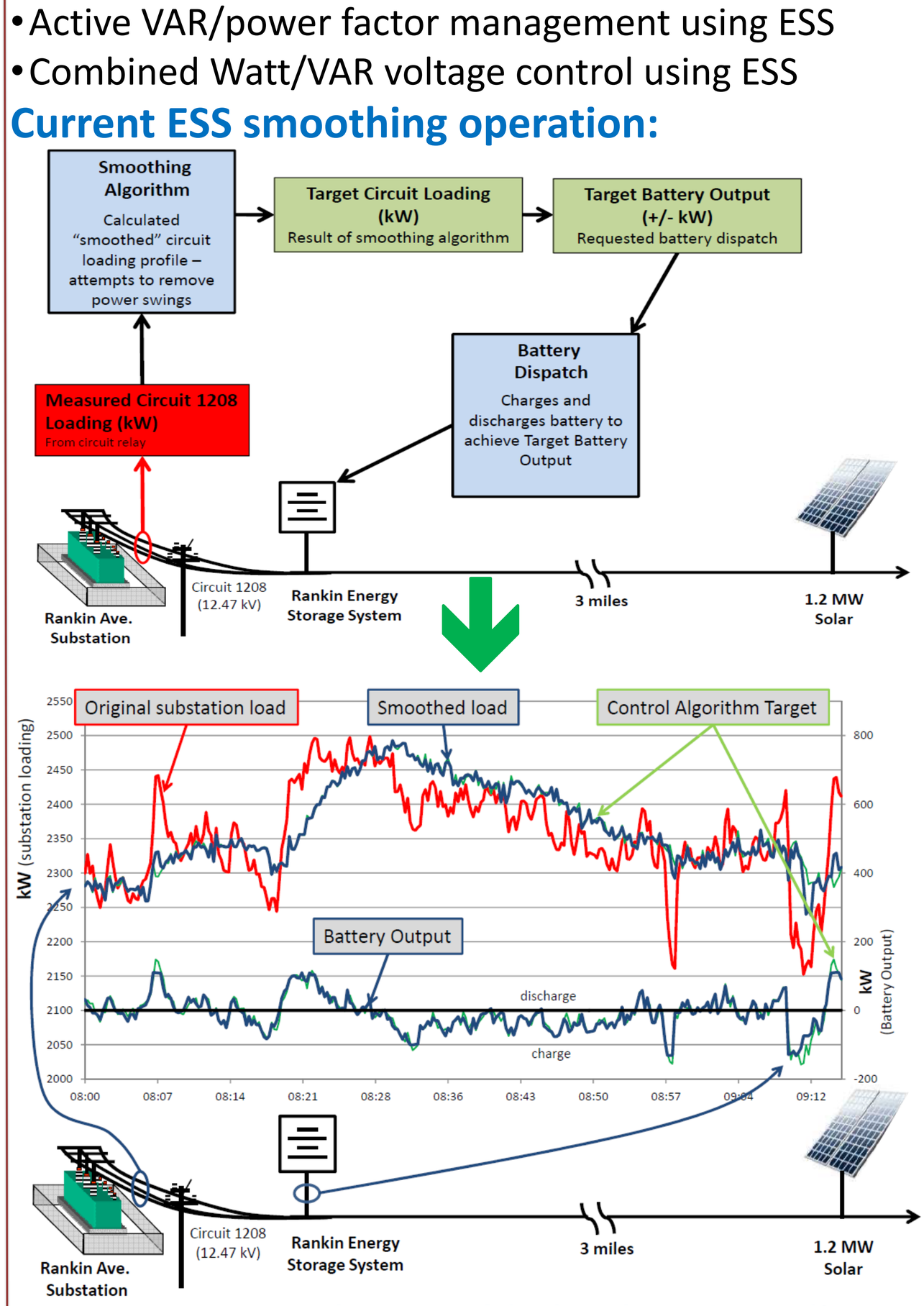
Current Outcomes:

- Metrics for PV smoothing have been developed to measure ESS effectiveness in mitigating power swings (published in SAND2014-2883)
- Qualitatively, ESS has been shown to provide a voltage stabilizing effect on substation assets

Future Work:

- Quantify protective effect of ESS on substation assets
- Active VAR/power factor management using ESS
- Combined Watt/VAR voltage control using ESS

Current ESS smoothing operation:



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