**Problem Statement**

Renewable energy is synonymous with variability. Creating integrated power systems which use multiple generation sources can aid in overcoming this intermittency. The proposed power system utilizes wind and solar with nuclear reactors and battery storage devices to ensure that renewables are optimized, and reliability is maintained. Battery storage devices are the costliest component and should be minimized to incentivize the adoption of these clean integrated power systems.

**Objectives/Scope**

- Model an integrated power system using NuScale Small Modular Reactors (SMR), solar, and wind farms, with a load following battery storage system.
- Perform an optimization to determine the sizes of generation sites which will result in the smallest battery capacity for a given data profile.

**Methodology**

- Load data [MW]: provided by regional utilities in 5-min intervals over three 1-week periods.
- Solar irradiance [W/m²]: collected via the Physical Solar Model (PSM v3) online tool.
- Wind speed [m/s]: collected via the Modern-Era Retrospective analysis for Research and Applications, Version 2 (MERRA-2) reanalysis dataset. Raw wind speed is associated with the specific power output via the chosen wind turbine’s (GE 2.5xl) power curve data.

**Data Collection**

**Optimization**

- Battery cost was estimated via Pacific Northwest National Laboratory (PNNL) [1].
- Price per MWh for solar and wind was found using the System Advisory Model (SAM).
- Price per MWh for nuclear was given in the NuScale SMR marketing publication [2].

**Results**

- Allowing the SMRs to bypass steam when demands were low, reduced the overall battery capacity needs.
- The minimum battery capacity resulted in the lowest overall system cost for all cases.
- Not all results passed the required surplus and ramping tests.

**Storage Requirements of Integrated Clean Power Generation Systems for Load Following**

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**References**


**Team & Acknowledgements**

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- Team Members: Faisal Alrumman (EE), Lindsey McGregor (ME), and Luke Pressley (EE), with special thanks to John Kiger (EE) for his contributions.

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