



# Hawai'i Natural Energy Institute Research Highlights

## International Support

### EGAT Renewable Integration Study

**OBJECTIVE AND SIGNIFICANCE:** Under the APRESA Award from the Office of Naval Research (see “[Asia Pacific Regional Energy System Assessment](#)” project summary), HNEI’s GridSTART is collaborating with the Electricity Generating Authority of Thailand (EGAT), the utility responsible for generation and transmission of power throughout Thailand, to conduct a renewable energy (RE) integration study for the country and enhance the professional capacity of its engineers in advanced study methods and tools.

**BACKGROUND:** The collaboration is pursuant to a Memorandum of Understanding (MOU) executed by HNEI and EGAT (Figure 1) that is focused on a range of research, development, and capability enhancements of mutual interest and benefit.



Figure 1. HNEI-EGAT MOU signing ceremony held on February 28, 2018 at EGAT’s corporate headquarters in Bangkok, Thailand.

Activities include constructing a high-fidelity production cost model of the Thai power grid and assessing the operational and economic impact of high penetration solar photovoltaic (PV) scenarios over a five to ten year planning horizon. Applying the calibrated model, HNEI and EGAT are conducting joint analysis with reciprocal visits to Thailand and Hawai’i, empowering EGAT engineers to perform such analyses on its own going forward.

High levels of RE pose grid challenges due to its intermittency and variability and the limited flexibility of legacy power systems to respond to balance system net load. With high levels of RE, conventional generation may need to ramp more quickly over a wider-range to counter the variability and uncertainty of the RE resource production. The cost of dispatched generation may also increase due to less efficient operation and the need for increased operating reserves. Symptoms of increased frequency and voltage variability may appear when reliable grid

operation is at risk, with possible degradation in power quality. While Thailand’s moderate level of PV and wind resources today do not yet pose serious operating concerns, Thai energy policy is supporting rapid near-term market growth in RE additions. EGAT’s swift action to build the tools and capacity to evaluate high penetration RE scenarios is a necessity.

**PROJECT STATUS/RESULTS:** The HNEI GridSTART team and EGAT built and calibrated a high-fidelity production cost model of the Thai power grid in PLEXOS. In May 2019, HNEI held a multi-day workshop in Bangkok focused on model build, tuning and calibration, and presented model validation results.

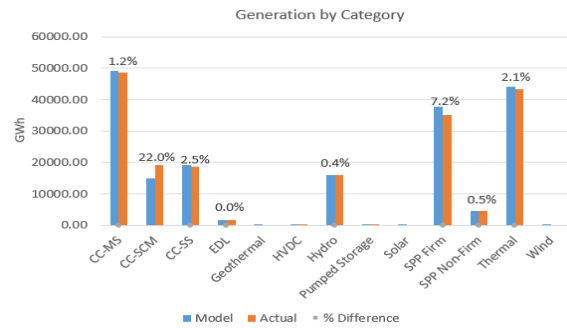


Figure 2. Model validation results.

Time series PV and wind data sets for all existing RE and future high penetration RE cases were developed. Analysis of base, low, medium, and high distributed PV scenarios are underway with conditions of operational concern identified, including excess energy production potential during low load periods. Modeling continues to assess flexibility countermeasures to grid impacts of high RE.

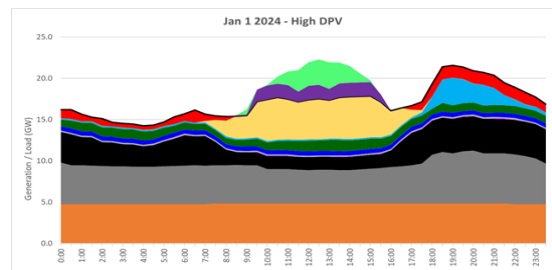


Figure 3. Thailand 2024 min system load day with high distributed PV. Distributed PV shown in yellow and excess PV production in green.

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