



Hawai'i Natural Energy Institute Research Highlights

International Support

EGAT Renewable Integration Study

OBJECTIVE AND SIGNIFICANCE: HNEI 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 grid simulation 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.

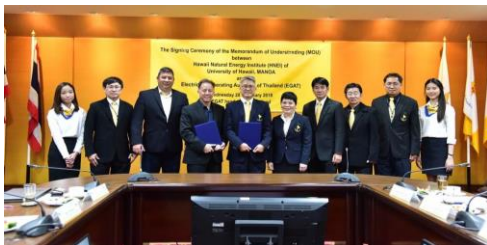


Figure 1. HNEI-EGAT MOU signing ceremony in 2018.

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. The project is intended to empower EGAT engineers to perform such analyses on their own going forward.

High levels of customer-sited distributed PV pose grid challenges due to its intermittency and variability and the limited flexibility of legacy power systems to respond to and balance resulting system net load. With high levels of RE, many conventional generation resources are shut down or dispatched to minimum operating levels to “make room” for the new RE generation, with remaining online units needing to ramp more quickly and frequently over a wider operating range to counter the variability and uncertainty of RE production. The cost of dispatched generation may also increase due to less efficient operation and the need for increased operating reserves. However, depending on the level of penetration, distributed PV may alleviate transmission congestion in some areas by collocating generation with load. 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: HNEI GridSTART and EGAT built and calibrated a high-fidelity production cost model of the Thai power grid in PLEXOS. The PLEXOS model includes seven nodes – each node representing a region of Thailand with inter-nodal transmission transfer limits modeled.

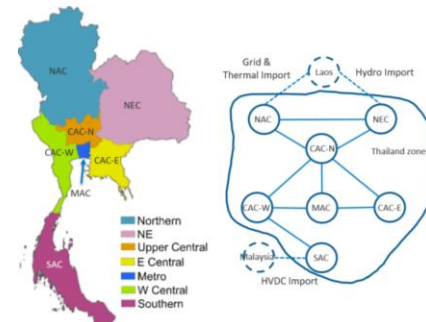


Figure 2. Thailand PLEXOS “bubble model” topology.

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 were completed with conditions of operational concern identified, including excess energy production potential during low load periods, transmission congestion, reserve shortages, high number of thermal unit starts, etc. COVID-19 travel restrictions slowed the project over the past year. HNEI GridSTART is working to update the focus of the analysis given Thailand’s current policy objectives, including carbon neutrality.

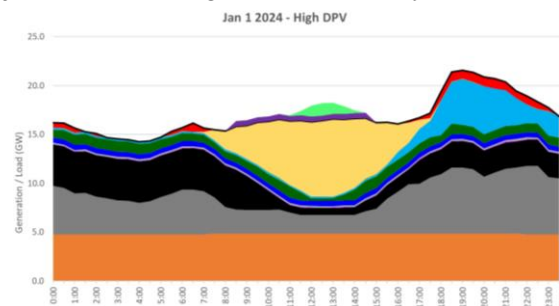


Figure 3. Thailand 2024 low system load day with high distributed PV (yellow) and excess PV energy (green).

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