



# Hawai'i Natural Energy Institute Research Highlights

## International Support

### Thailand Regional Solar PV Forecasting

**OBJECTIVE AND SIGNIFICANCE:** Investment in solar generation has increased significantly in Thailand with decline in natural gas production and as reliance on imported fuel has increased. Thailand has high solar potential through the central portion of the country and the Thai government has supported the solar sector with feed-in-tariff subsidies. Thailand is projected to increase its solar capacity dramatically in the coming years, with significant penetration of new distributed solar systems. With funding from the U.S. Office of Naval Research (ONR) under the APRESA grant, HNEI's Grid System Technologies Advanced Research Team (Grid**START**) collaborated with Chulalongkorn University and leveraging critical stakeholder feedback provided by the Thai grid operator, the Electricity Generating Authority of Thailand (EGAT), to develop a regional solar PV forecasting system for Thailand.

**BACKGROUND:** This project is one of the collaborative activities under the Memorandum of Understanding (MOU) executed with Chulalongkorn University, Faculty of Engineering, Smart Grid Research Unit. The MOU establishes a framework for multi-year collaboration on a range of activities exploring approaches, methodologies, tools, techniques, systems, and policies that lead to enhanced resilience and reliability of energy while enabling Thailand's energy transition through grid modernization and the advancement of smart grid initiatives. As part of Thailand's plans to significantly increase the amount of solar energy on its power grid, EGAT recognizes the need to develop solar forecasting capabilities.

**PROJECT STATUS/RESULTS:** The HNEI solar forecasting system combines information derived from numerical weather prediction (NWP), satellite images, and ground based instruments to monitor current regional irradiance conditions in near real-time and predict upcoming irradiance conditions and resulting PV power production, from minutes to days ahead. HNEI Grid**START** set up a new test domain for the solar forecasting system to evaluate its application in Thailand. The test domain covers northern Thailand and surrounding areas.

Day-ahead NWP forecasts are provided by the Weather Research and Forecasting system (WRF). WRF is a next-generation mesoscale numerical

weather prediction system developed by the National Center for Atmospheric Research (NCAR). WRF is set up in a nested configuration, with an outer 6 km grid and inner 2 km grid focusing on Bangkok.

Hour-ahead satellite-based forecasts are derived from the Himawari-8 geostationary weather satellite operated by the Japan Meteorological Agency (JMA). Himawari-8 is considered a 4th generation geostationary weather satellite, nominally producing a new set of images every 10 minutes at 0.5 km resolution (a sample irradiance nowcast from Himawari-8 is shown in Figure 1). HNEI Grid**START** has access to both archived and real-time Himawari-8 images through Japan's National Institute of Information and Communications Technology.

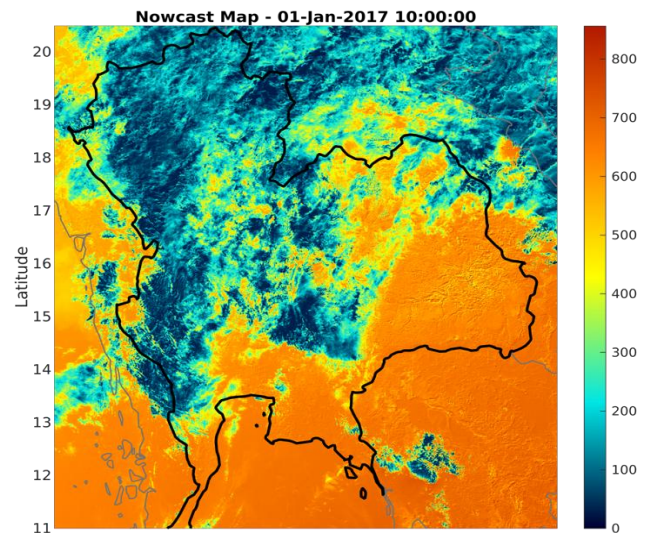


Figure 1. Sample irradiance nowcast map derived from Himawari-8 imagery.

Utilizing archived Himawari-8 images, HNEI Grid**START** generated a month of 6-hour ahead irradiance forecasts for over 30 test sites in Thailand. At each site, HNEI Grid**START** was provided observations of hourly insolation. To visualize the results, a regional aggregate dashboard was developed. These results are shown using web-based visualization tools, which can be found at: <http://128.171.156.27:5100/sitesforecast/>.

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