Hawai‘i Natural Energy Institute Research Highlights

International Support

Chulalongkorn University Smart Campus Project - ARGEMS

OBJECTIVE AND SIGNIFICANCE: In partnership with Chulalongkorn University in Bangkok, Thailand, HNEI's Grid***START*** team is field deploying multiple devices of its Advanced Real-time Grid Energy Monitor System (ARGEMS), a patented custom power meter and controller. The objective of this project is to build joint research and development capacity in the area of grid modernization and smart grid initiatives, ultimately helping to enhance energy resilience and reliability while enabling a clean energy transition.

Figure 1. Chulalongkorn University in Bangkok, Thailand.

BACKGROUND: This project is one of the collaborative activities under a 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 around smart grid technologies on Chulalongkorn University's Smart Campus Project.

PROJECT STATUS/RESULTS: To date, two ARGEMS devices have been shipped to Chulalongkorn University. The first device has been operating in a lab setting for over a year, and the second device is ready for installation on a campus building transformer. Other devices have been prepared for final configuration and shipment.

As preparation for the deployment at Chulalongkorn University, the ARGEMS documentation was improved, and software to enable remote firmware updates, configuration, and testing for supporting a new type of current transducer (Rogowski coil) was developed.

Numerous utility use cases are under discussion and/or active development. Beyond the core sensing and distribution grid visibility, benefits of using ARGEMS devices include:

1. In-situ distribution service transformer health assessment: By estimating the health and remaining life of distribution service transformers while in field operation, predictive maintenance and associated cost reduction benefits for asset owners may be delivered. Literature review and initial hardware and software prototyping were completed to measure and utilize transformer surface temperature and vibration in conjunction with power flow. Three related articles were accepted for publication. Further research and development of this application is pending resolution of challenges with obtaining long-term transformer degradation data or performing accelerated life testing.
2. Online, distributed PV hosting capacity analysis: By using local voltage and power measurements along with stochastic power flow analysis, it is possible to streamline the determination of how much PV generation can be connected on a circuit, or even enable proactive methods to increase hosting capacity. A power flow solver and associated analysis has been demonstrated on an ARGEMS device.
3. Fault location identification: By improving the process of locating distribution faults, utilities can more quickly address issues and thus reduce repair costs and improve resiliency. A novel technique which leverages the attenuation of fault-induced grid harmonics over line distance is being explored.

Figure 2. ARGEMS patented custom power meter and controller devices.

Funding Source: Office of Naval Research

Contact: Leon Roose, lroose@hawaii.edu

Last Updated: November 2021