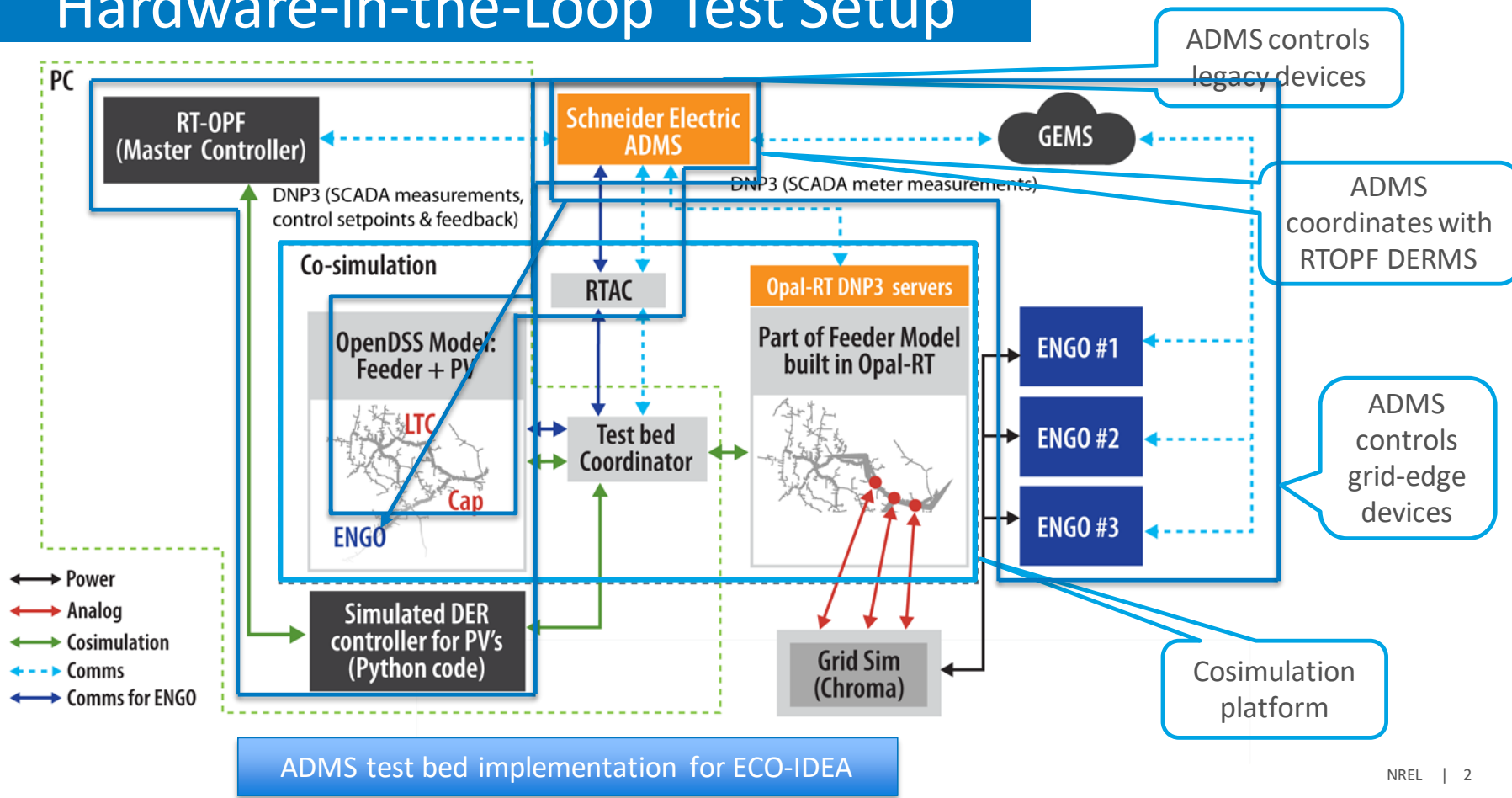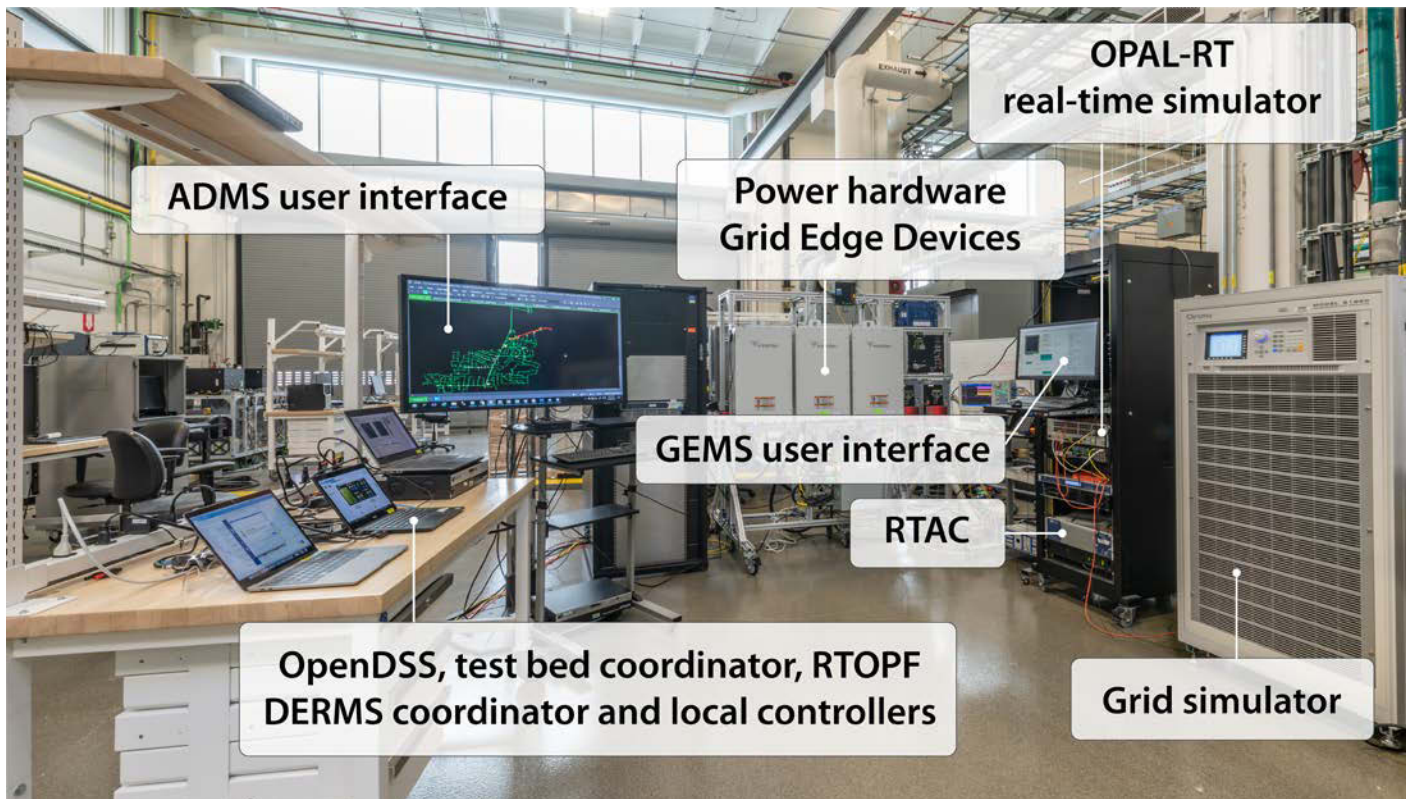# ECO-IDEA
Hardware-in-the-Loop Test

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Workshop on Enhanced controls and optimization of integrated distributed energy applications (ECO-IDEA)
ENERGISE project
November 14, 2019

# Data-Enhanced Hierarchical Control Hardware-in-the-Loop Test Setup

ADMS controls legacy devices

ADMS coordinates with RTOPF DERMS

ADMS controls grid-edge devices

Cosimulation platform

ADMS test bed implementation for ECO-IDEA

Lab Infrastructure

Hardware-in-the-Loop Test

Test scenario: evaluate data-enhanced hierarchical control (DEHC) functionality of coordinated controls to achieve desired voltage profile (0.95–1.05 p. u.).
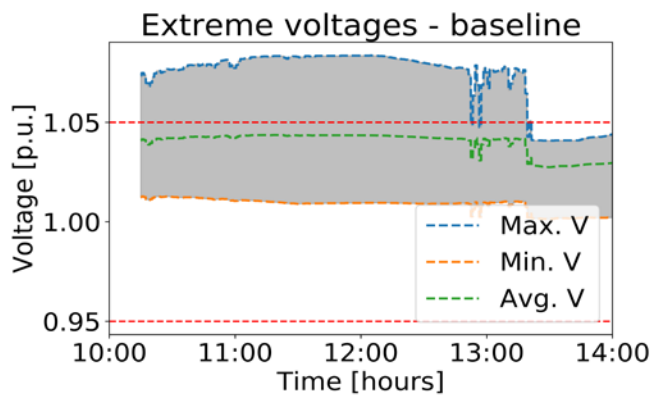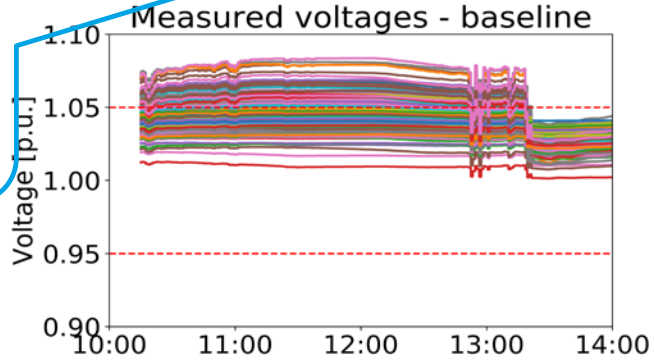
Test condition: moderate photovoltaic (PV) profile day, from 10:00–14:00.
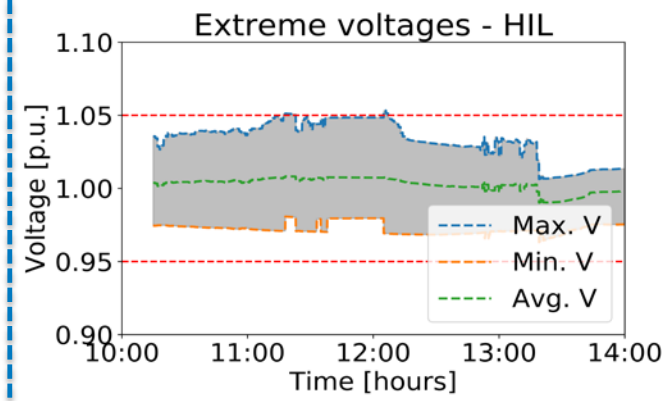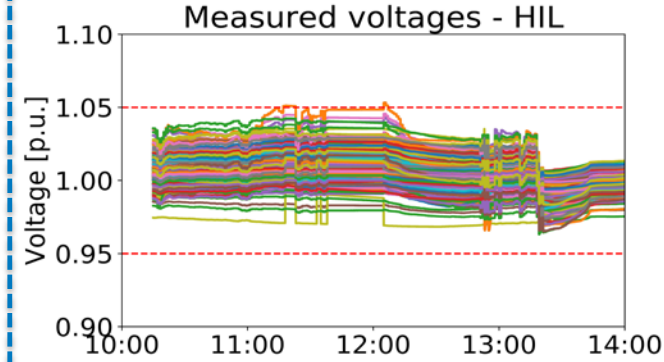
Hardware-in-the-Loop Test Results
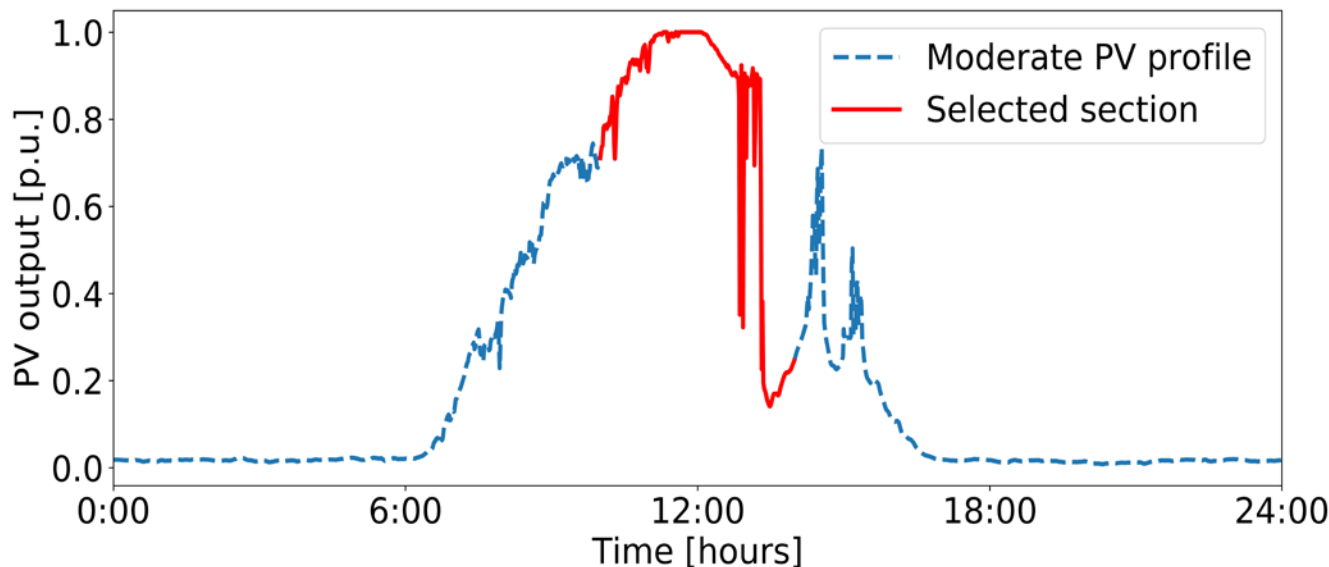
Baseline

ADMS-centered operation HIL test

No ADMS control: LTC and cap. bank local control, no ENGOs, PV local control
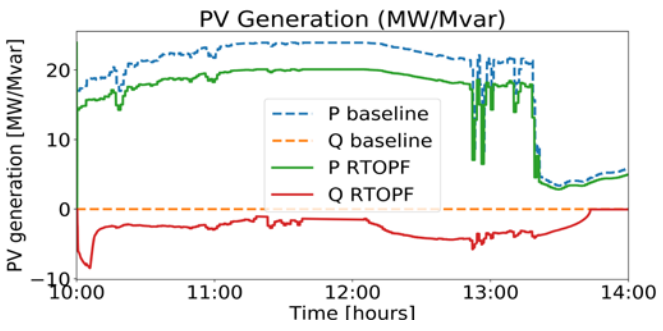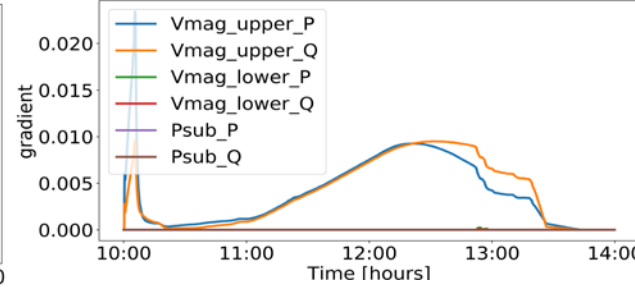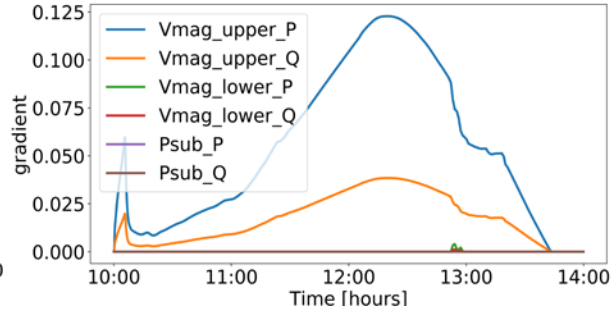
Hardware-in-the-Loop Test Results
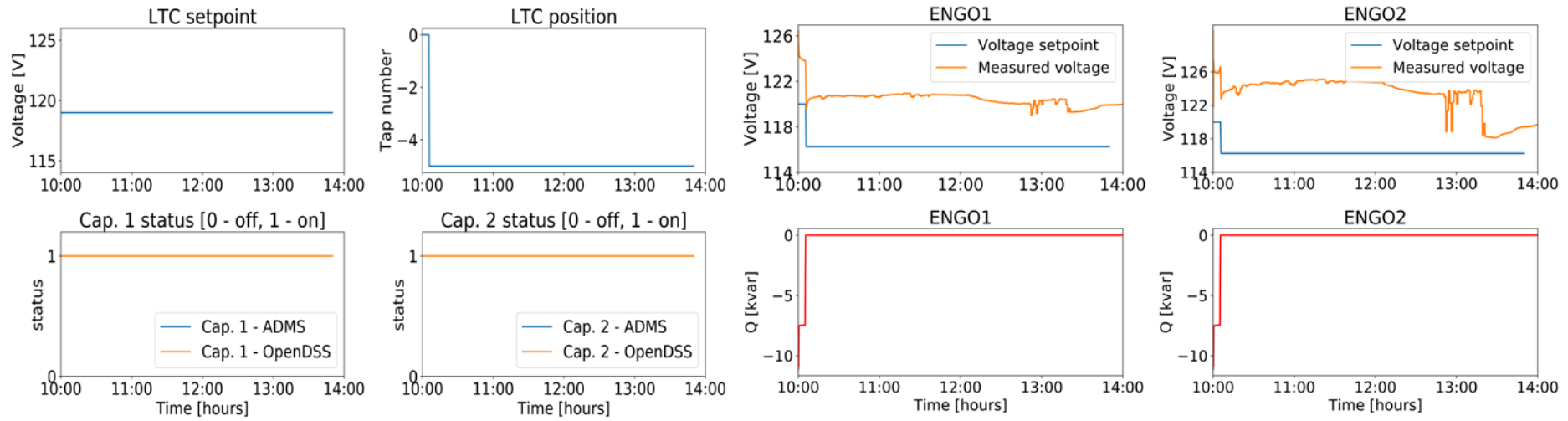
- The advanced distribution management system (ADMS) sets the tap position of load tap changer (LTC) very low (-5) to reduce the system voltage.
- ADMS gives priority to the LTC to regulate the system voltage before changing commands to capacitor banks.

Hardware-in-the-Loop Test Results
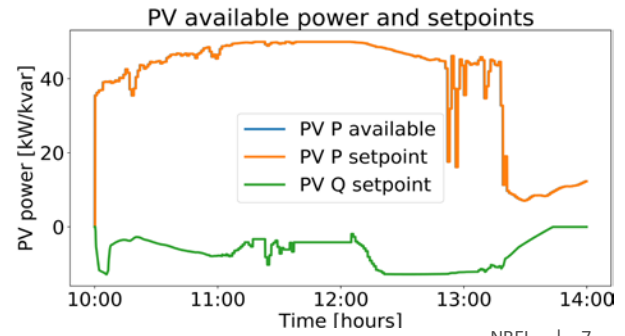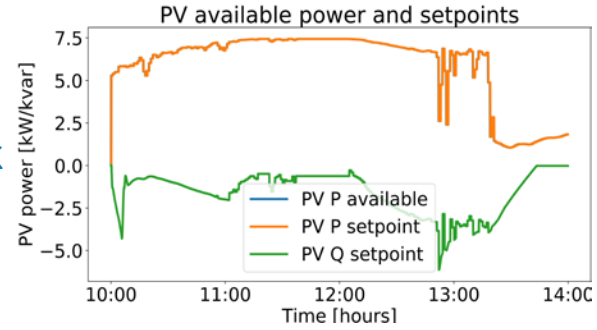
Total PV generation

RTOPF coordinator outputs

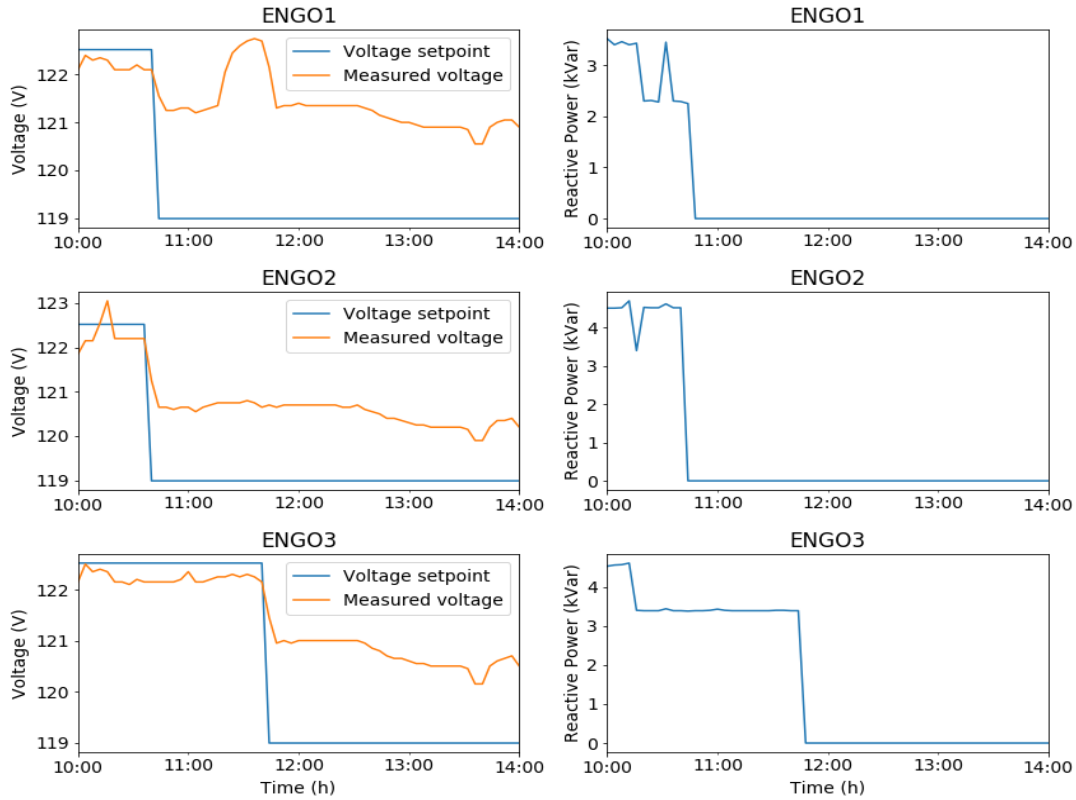
- The real-time optimal power flow (RTOPF) algorithms (coordinator and local controllers) converge and work as expected to regulate system voltages.

RTOPF PV local controller outputs

Hardware-in-the-Loop Test Results

Hardware ENGOs

- The edge-of-network grid optimizers (ENGOs) inject reactive power only when the voltage set point is higher than its measured voltage. This is as expected.

Summary
of Hardware-in-the-Loop Test

The test demonstrated the following features of the DEHC architecture:

a. Comprehensive situational awareness

b. ADMS-centered operation

c. Synergistic ADMS—grid-edge operation

d. Fast-regulation capabilities from PV systems.

Help utility partners understand the benefits of adopting hierarchical controls for ADMS-centered operation to collectively manage slow-response legacy devices and fast-response PV inverters and grid-edge devices to maintain grid voltages within safe operating limits with increasing PV penetration.

Thank you

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NREL/PR-5D00-75411

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