RT25

Winds of change,
powering what's next.

Program at glance

17th Global User Conference

from 27th to 30th October 2025

Thompson Chicago, by Hyatt

opal-rt.com/RT25

OPAL-RT TECHNOLOGIES

RT25

Winds of change, powering what's next.

Global User Conference
from 27th to 30th October 2025
Thompson Chicago, by Hyatt

Andreas Bammes

Research Associate
Friedrich-Alexander-Universität Erlangen-Nürnberg

De-Risking Grid Forming Battery Energy Storage Projects - Grid Code Compliance Testing of a 50 MW BESS Using Hypersim for CHiL-Simulations

The grid code compliance of a 50 MW battery energy storage system (BESS) with a power plant controller (PPC) is validated through detailed analysis and testing. A real-time capable test setup is developed in Hypersim, integrating the PPC via Control-Hardware-in-the-Loop (CHiL) as the device under test (DuT). By connecting the controller to the simulated point of connection (POC), the test environment replicates field conditions. Various test cases evaluate PPC performance under critical grid code requirements, while additional tests, such as power oscillation damping (POD), address additional specifications from the national grid operator and the developer. To ensure reproducibility and user-friendliness, test execution is automated via a Python API-based graphical user interface (GUI). The successful validation of both grid-forming and grid-following operation demonstrates how CHiL testing mitigates field integration risks.

OPAL-RT TECHNOLOGIES

RT25

Winds of change, powering what's next.

Global User Conference
from 27th to 30th October 2025
Thompson Chicago, by Hyatt

Marcin Szlosek

R&D Manager
ABB

Real-Time Simulation of PV Inverter Systems with Grid Protection and Load Profiling Using OPAL-RT HiL Platform

This work presents the development and validation of a photovoltaic (PV) inverter system model using a Hardware-in-the-Loop (HiL) platform based on OPAL-RT. The project focused on enhancing model clarity, integrating grid protection mechanisms, and simulating realistic operating conditions. The original Simulink model was restructured for improved readability and modularity, enabling easier adaptation and debugging. The inverter subsystem was extended to include selected protection features in accordance with grid compliance standards. A custom power profile generator was developed using averaged solar irradiance data from a real-world location, enabling the simulation of PV generation under realistic conditions. Additionally, a dedicated application was created to compare simulation results across different measurement points and scenarios. Several simulation campaigns were conducted using real household load profiles recorded on various days, allowing for comprehensive testing of system behavior under dynamic conditions. The results demonstrate the effectiveness of the HiL approach in validating PV system performance and protection strategies in a controlled, real-time environment.

OPAL-RT TECHNOLOGIES

RT25

Winds of change, powering what's next.

Global User Conference
from 27th to 30th October 2025
Thompson Chicago, by Hyatt

Moazzam Nazir

Research Scientist
Clemson University

Integrated Transmission and Distribution Testbed for Seamless Renewable Energy Penetration

The shift toward a less carbon-intensive electric power grid is leading to increased dependence on inverter-integrated renewable energy sources. Consequently, grid operators must manage a more complex grid with various power generation sources that differ greatly in their operational characteristics. Adopting a more integrated approach to transmission and distribution infrastructure planning holds promise in addressing these concerns. This work will present a real-time electromagnetic T&D testbed developed in a real-time simulator to analyze the impacts of transmission or distribution level disturbances on each system. The project also involves the integration of actual utility-scale converters with the 15MW eGRID lab at Clemson University. The work emphasizes the need for new technologies for grid planning, operation, and protection of T&D systems under the changing grid dynamics.

OPAL-RT TECHNOLOGIES

RT25

Winds of change, powering what's next.

Global User Conference
from 27th to 30th October 2025
Thompson Chicago, by Hyatt

Ujjwol Tamrakar

Senior R&D Engineer
Sandia National Laboratories

High Fidelity Testing and Validation of Energy Storage Controls

Energy storage systems (ESSs) can provide a wide array of grid services spanning multiple timescales and is a critical infrastructure to facilitate a secure and reliable electric grid. However, novel, and pragmatic control algorithms are required to leverage this tremendous flexibility of ESSs. To reduce risks and accelerate deployment, Hardware-in-the-loop (HIL) simulation and testing of ESSs along becomes critical. In this presentation, HIL simulation and testing techniques for grid connected ESSs will be presented. Some control/dispatch applications developed and tested using HIL techniques for grid-connected energy storage will be illustrated as example case studies. The presentation will also cover discussions on ongoing efforts to leverage flexibility of grid simulations with actual ESS components (that includes power electronics converters, battery management systems (BMSs), etc.) to de-risk and accelerate deployment of grid connected ESSs.

OPAL-RT TECHNOLOGIES

RT25

Winds of change, powering what's next.

Global User Conference
from 27th to 30th October 2025
Thompson Chicago, by Hyatt

Jared Paull

PhD Candidate
University of British Columbia

Development of enabling power converter technologies to accelerate renewable integration.

This presentation focuses on new enabling power converter technologies to accelerate the implementation of renewables using novel converter topologies and advanced modeling and simulation techniques. First, novel multi-level converter topologies are introduced alongside validation studies using OPAL-RT MMC hardware. Next, numerically efficient SST modeling techniques are introduced. OPAL-RT digital simulators are used to perform proof-of-concept CHIL studies of large-scale SST systems. Finally, a new variable-step discretization algorithm is presented for real-time simulation. OPAL-RT's hardware flexibility allows for convenient validation of the proposed techniques.

OPAL-RT TECHNOLOGIES