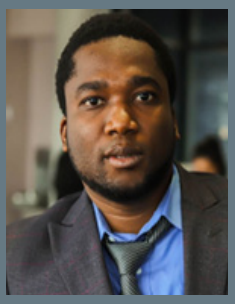
# Renewable Energy Courseware

**OP1142**



"This courseware helps to fully understand the real-time operation principles and control procedures of a microgrid and its major components such as battery energy storage, wind turbine and photovoltaic generations. Notions of maximum power point tracking, load shedding, demand response, and power flow are closely addressed."

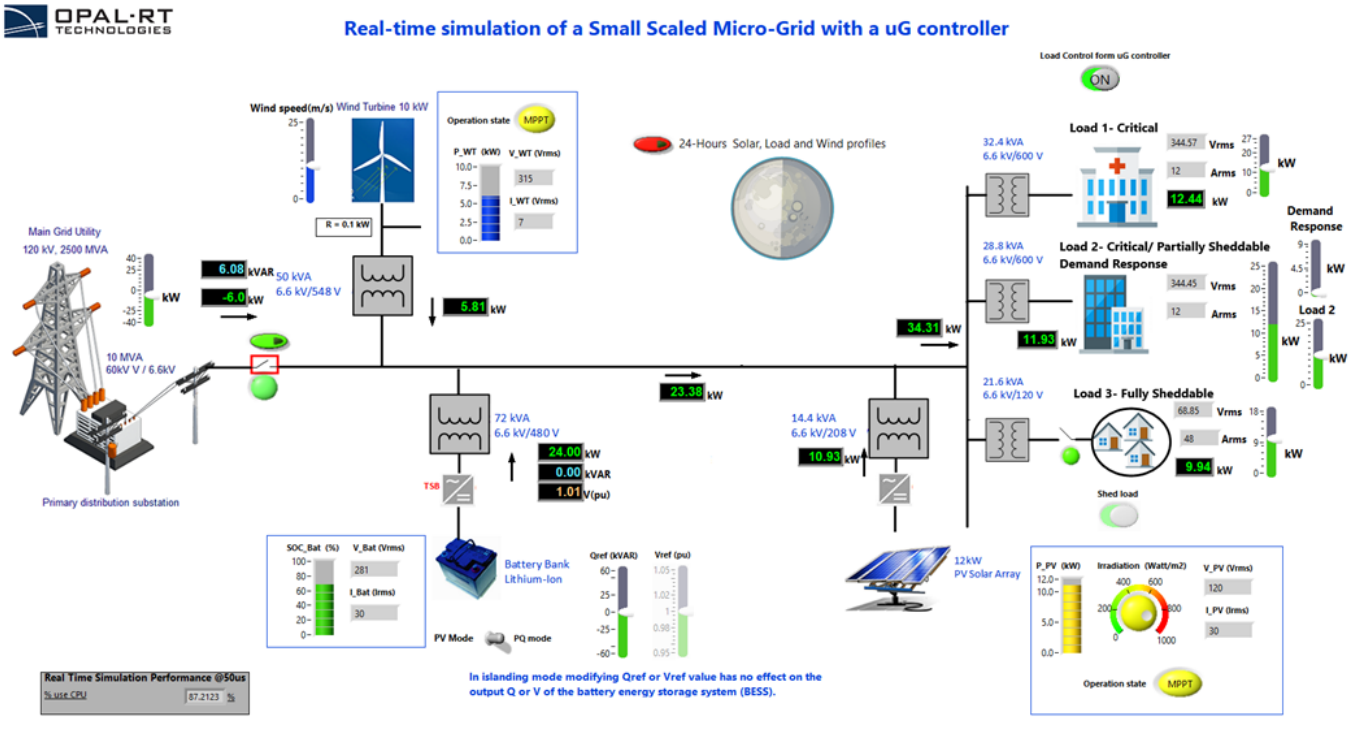
Wolf Peter Jean Philippe, Ph.D.
Electric Courseware Technical Product Owner

The courseware is intended to teach the real-time simulation of a microgrid and its major components to universities' undergraduates and colleges' students. Students can experiment and learn about the real-time operation principles of renewable energy resources, such as battery energy storage systems (BESS), photovoltaic generation system (PVGS), and wind turbine generation system (WTGS), including different control and mitigation strategies used by power systems operators and utilities.

## MAIN BENEFITS

- An interactive user interface brings students into the loop and allows them to emulate the operation and control of renewable energy resources as closely done in real-life applications.
- Provides the flexibility to perform simulation studies for safer protection, better control, and mitigation strategies for actual microgrids.
- Provides a good platform to pursue graduate research on the same setup.

## INTERACTIVE PANEL



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## RENEWABLE ENERGY COURSEWARE LEARNING OUTCOMES

**BESSS:** Study the effects of varying power and voltage references for grid connected and islanded operation modes, understand steady-state operation limits, and generation-load balance.

**PVGS:** Analyze the impacts of varying solar irradiance and temperature for both curtailment and MPPT operation modes, understand the system's steady-state operation limits, and power flow.

**WTGS:** Use the varying wind speed and reference currents to analyze the operation of a doubly fed induction generator (DFIG) with rotor and grid side controllers. Observe power flow and waveforms.

**Microgrid:** Investigate the controller's role in ensuring power flow balance under the constraints of variable power generations, different varying loads, and two distinct operation modes of the microgrid.