Toronto Metropolitan University

Centre for Urban Energy
Faculty of Engineering
& Architectural Science

Research case study > Transmission and Distribution

Resilient Distribution System Microgrids

Version 1 (July, 2026)

Context: Many rural Canadian communities rely on weak grid connections and diesel generation during outages, resulting in high emissions, poor reliability, and costly energy challenges that hinder efforts to achieve net-zero emissions by 2050. However, enhancing distribution infrastructure does not have business case considering load being served and cost of upgrades. In such cases, customer have to resort to backup generation.

Problem: Conventional infrastructure upgrades are often unviable in rural areas, and utility-grade microgrids are currently non-existent due to regulatory, design, and standardization challenges. Further, custom design of microgrids impedes in their general roll out.

Solution: Hardware Approach – As a first solution, a pure hardware-based design was created and utility-grade "microgrids-in-a-box" solution was implemented using standardized, commercially available equipment, enabling feeder-level sectionalisation and enabling reliable clean energy delivery. Software Approach – As a second solution, in this project, SCADA enabled software created a microgrid solution. In this case, breaker's control circuitry was connected to UPS (uninterrupted power supply) for continuous operation even when station loses supply. This allowed for a specialized software, operating via SCADA to continuously monitor station bus voltage, and island a section of the feeder and operate as a microgrid until station voltage is restored. Both approaches were implemented in the Schneider Electric Smart Grid Laboratory.

Impact: This project will enable scalable rural electrification, support transport and heating electrification, improve energy reliability, and contribute to Canada's community-level decarbonization goals.

CUE's Role: CUE is leading research, reference design, and prototyping of utility-grade microgrids, including simulation, standards development, and implementation planning.

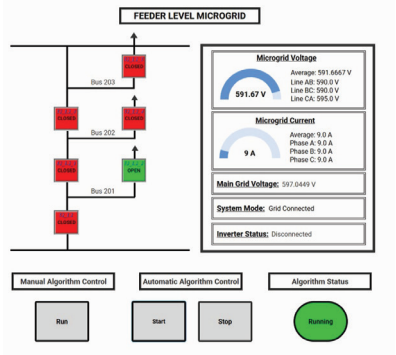

Figure 1 Control Screen Of The SCADA-Integrated Feeder-Level Microgrid Prototype Illustrating Grid-Connected Operation

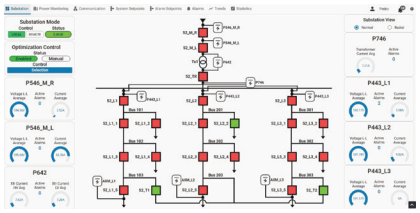

Figure 2 Overview Of The CUE-Developed Supervisory Control And Data Acquisition (SCADA) System With Advanced Distribution Management System (ADMS) Functionalities

Partners:
Canada First Research Excellence Fund (CFREF) through Concordia University's Volt-Age

Timeline: 2024 – 2029

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Key Stats:

5 Technical Reports
2 Presentations
3 Software