



Research case study > renewables

# Microgrid design and operation

Version 1 (updated May 18, 2017)

**Context:** Research on microgrids plays a key role in advancing customer level renewable energy integration. Microgrids can work with the main utility grid or independently while incorporating many types of technologies such as renewables and energy storage.

**Problem:** Difficulty in implementing renewables into the grid and managing generation and demand mismatches is becoming increasingly difficult with aging infrastructure and the introduction of new technologies.

**Solution:** The Smart Grid Lab designed at Ryerson University allows for real world tests and verification of algorithms using the prototype microgrid.

**Impact:** This project provided researchers with real-world results that couldn't be achieved through computer simulations. Researcher conducted a greater depth of analysis of new technologies and microgrid management in a cost-effective manner.

**CUE's role:** Researchers developed a three-phase unbalanced AC-DC power flow algorithm for analysing microgrids and designed and implemented a lab scale microgrid at the Centre for Urban Energy at Ryerson University.

✓ Completed

## Sponsors:

Semiconductor Research Corporation

## Timeline:

September 2013–June 2015

## Research team:

Bala Venkatesh, Bhanu Opathella

## Key stats

4 AC & 2 DC  
2  
5kW

Microgrid buses  
15kVA transformers  
AC load