Toronto Metropolitan University

Centre for Urban Energy
Faculty of Engineering & Architectural Science

Research case study > transmission and distribution

Forecasting and Modeling of Distributed Energy Resources, and Models for Distributed System Operator Planning and Operation

Version 1 (October 2024)

Context: Large scale integration of distributed energy resources (DERs), such as renewables, storage and smart loads into electric power distribution systems, is a path that leads to greening of our energy systems and a zero carbon 2050 future. This is a future that our society desires and helps to mitigate climate change. This is also a challenging task. Electric utilities require aggregate methods for forecasting of DERs, aggregate steady-state and aggregate transient DER models - at feeder and substation levels - to best manage their electric power networks. Further, with the potential of peer-to-peer energy transactions between DERs and other customers, better economic techno-models are a pressing need such that DERs derive best value and utility customers gain the best advantage.

Problem: Within this framework, predicting and modelling numerous, small-scale, and intermittently operating DERs will pose a considerable challenge.

Solution: The development of aggregate models to represent DERs at the distribution feeder level in the steady state and during transients.

Impact: This will enhance the reliability and resiliency of the electric grid.

CUE's Role: CUE has developed a tool to forecast the integration of tens of thousands of DERs onto the Hydro One system.

Partners:
Hydro One, Peak Power, NSERC, Mitacs

Timeline:
January 2022 - July 2027

Research team:
Bala Venkatesh, Reza Arani, Walmir Freitas, Fernanda Trindade, Amr Mohamed, Ahmed Khwaja, Amin Ghasemi, Thiago Ramos Fernandes, Amir Nikzad, Pedro Vasconcelos, Pedro Pato, Felipe Bayma Barbosa Rolim, Leonardo Ramos Fernandes

Key stats

Algorithm
12 Tech reports