Architecture of the Future Low-Carbon, Resilient, Electrical Power System

Future Architecture of the Network (FAN) – Te Whatunga Hiko

Workstream 1 –Summer Project

Project title: MVDC Grid in Christchurch.

Relevant Workstream(s): WS 1 and WS 2

This project is offered to help in the ongoing research in the Future Architecture of Network (FAN) programme, where the benefit, design and analysis of DC electricity grids are explored. The FAN project is a 7-year, New Zealand wide research program led by the University of Canterbury. The project is broken into five workstream, where this summer student project is a part of Workstream 1, which is the development of fast and accurate numerical analysis tools to simulate large-scale hybrid AC/DC grids, such as for Power-Flow Analysis, Fault Analysis, Harmonic Analysis, Transient Stability, and Electromagnetic Transients. Also, WS1 proposes a future architecture of the hybrid AC/DC, which will be the focus of this project. Workstream 2 proposes the topological configuration of AC and DC circuits, which will impact and likely be impacted by the outcomes of this project.

Project Description:

This project expands the medium voltage network in Christchurch, specifically Orion's 33 to 66 kV network, with MVDC for future demand growth. A future scenario has to consider widespread adoption of Electric Vehicle infrastructure within parking lots in the Central Business District (CBD), commercial and industrial load conversion to DC, and distributed solar generation. The new MVDC has to be designed to carry the future power flows within voltage limits, while maintaining similar reliability standards. The successful applicant will improve their skills in DIgSILENT PowerFactory as the main analysis tool for the project, which is commonly used in the New Zealand electricity industry. Furthermore, knowledge of distribution network planning will be gained.

The main outcomes of the project will be a DIgSILENT PowerFactory file and design report.

Helpful Resources:

Electricity Authority, Electricity Market Information Website, https://www.emi.ea.govt.nz/, which includes historic demand data at the GXP level.

Orion's Asset Management Plan, https://www.oriongroup.co.nz/assets/Our-story/Publications/Orion-AMP-2024.pdf

Orion Future Energy Scenarios, https://www.haveyoursay.oriongroup.co.nz/future-energy

Commerce Commission Information, https://comcom.govt.nz/regulated-industries/electricity-lines/electricity-distributor-performance-and-data

Specific requirements:

- BE(Hons) - Electrical and Electronic Engineering (EEE) student- Third (second Pro) or Fourth (Third Pro) year.
- Good knowledge of power system grids and power electronics
- Experience with programming languages, e.g. MATLAB or Excel
- Some familiarity with power system simulation tools like PowerFactory DIgSILENT and PSCAD/EMTDC will very helpful.

- Excellent academic track record
- High proficiency in written and spoken English
- Enthusiastic applicants (any nationality) that want to make a positive impact in the world and can work in a collaborative environment

Potential Supervisor(s): Josh Schipper, Veerabrahmam Bathini, Neville Watson

Based in: University of Canterbury, EPECentre