

CLIMATE CHANGE INNOVATION AND TECHNOLOGY FRAMEWORK

Awardee Summary

CCITF PROGRAM	Clean Technology Development
PROJECT TITLE	Smart Gas Field Microgrids
SECTOR	Low Carbon Electricity Energy Efficiency
ORGANIZATION	University of Alberta, Department of Electrical and Computer Engineering
PROJECT LEAD	Yunwei (Ryan) Li
AI PROJECT ADVISOR	Bruce Duong
GRANT AMOUNT	\$1,580,000
START DATE	11/1/2018
END DATE	10/1/2021

PROJECT OBJECTIVE: Utilizing power electronics technologies to smartly integrate remote gas field microgrids in Alberta.

PROJECT PROFILE: The proposed 3-year project focuses on utilizing power electronics technologies to smartly integrate the remote gas field microgrids in Alberta. It will simultaneously address a few critical challenges facing today's electrical grid as well as the gas industry in Alberta, including:

- 1) Using gas to produce electricity at the gas field to increase owner's revenue when gas price is low, which also leads to lower emissions compared to coal and diesel based generation;
- 2) Using the power electronics transformers to decouple the gas field microgrid with the distributing system and therefore addressing the problem of limited allowed distributed power generation;
- 3) Using the smart power electronics to provide additional ancillary services such as voltage control;
- 4) Increasing Alberta's dispatchable electricity generation capability and facilitate Alberta's goal of moving from electricity energy market to capacity market;
- 5) Providing opportunities for new markets such as crypto-currency mining computation at the gas field with onsite power generation and therefore addressing the concerns on power consumption from those rapidly increasing virtual mining activities;
- 6) Controlling the gas field microgrid with dispatchable electricity generation and load demand control and therefore providing low-cost energy storage option for the grid; and
- 7) System level coordination of many such smart gas field microgrids for energy storage and load demand management to ensure large area stability and facilitate the goal of 30% renewable based power generation in Alberta.

In parallel with these research and development activities, a real-world gas field microgrid will be constructed in this project to demonstrate the idea and collect data for further research, development and deployment. The applicants at UAlberta has lined up with key partners for this projects, including: Horseshoe Power (previously jfEnergy), owner/operator of gas filed collection and sales to the bulk gas pipeline network, owner/operator of on-site distributed generation plants sited at the gas filed collection locations.

Fortis Alberta, Incumbent Electrical Distribution Utility (wires owner) to collaborate on grid compliance and ancillary function needs.

Non-Synchronous Energy Electronics, medium voltage MW power converter equipment and control solution provider, who also helps to connect with crypto-currency mining customers to utilize the gas field generation power.

The constructed pilot microgrid system will allow the team to perform tests and gather results in collaboration with Alberta utilities for planning large-scale distributed generation in ways that are presently prohibited with directly interconnected synchronous generators. At the same time, the team can verify the ancillary function capabilities, operating reserve potentials, as well energy storage and crypto-currency mining market through Alberta's gas field onsite electricity generation. The project has a total cost of \$6.063 million and will greatly contribute to the GHG emission reduction and contribute to Alberta's lower carbon diversified economy.

GHG EMISSION REDUCTION SUMMARY: