ALBERTA INNOVATES

CLEAN RESOURCES

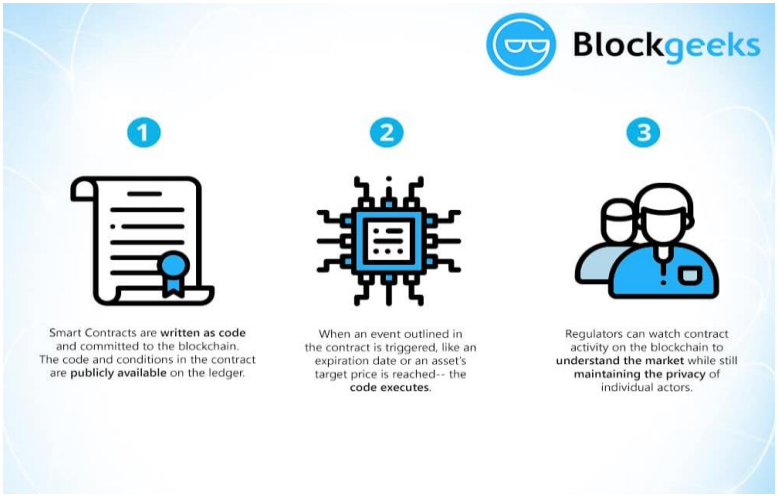
CLEAN TECHNOLOGY

RENEWABLE AND ALTERNATIVE ENERGY

Blockchain-Based Smart Contracts in the Future Smart Grid

Albertan homeowners who install solar panels on their roof can use the power that they generate to reduce the power they require from their utility. If the solar panels are large enough to provide more power than they need in their own home, they can send the excess power back to the electricity grid. The homeowner will receive a credit on their electricity bill and carbon credits to trade. There is a problem, however, if hundreds of thousands of homeowners start selling excess power to the electricity grid and to each other, the existing grid and billing systems may not be able to keep up.

This project is exploring how the use of blockchains and smart contracts can be used to enable homeowners to actively participant in energy markets. This will enable the development of new markets and create a more flexible power grid that can meet the challenges of small, distributed energy producers coming online.



FUNDING DETAILS

RECIPIENT:
Dr. Scott Dick
University of Alberta

PARTNERS:
Canadian Foundation for Innovation, Future Energy Systems Research Institute

TOTAL BUDGET:
$2,548,633

AI FUNDING:
$162,233

PROJECT DATES:
Nov 2020 – Apr 2022

PROJECT TRL:
Start: 3
End: 4

APPLICATION

This program is building on existing laboratory prototypes of microgrid power transactions to investigate how system-wide attributes (like voltage stability) can be enforced by an electric system operator when power flows between arbitrary customers. These blockchain-based smart contracts will be designed to ensure stability - by treating it as an emergent property designed into the grid. The ESO will then oversee the fulfillment and settlement of all such contracts.

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PROJECT GOALS

- Design smart contracts that consistently produce and enforce voltage stability on the electricity grid.
- Extend the contract design to ensure electrical equipment is protected when external events disturb grid stability.
- Extend the contract design to enable and support a distributed voltage and reactive power optimization algorithm to maximize power being delivered to the grid.
- Validate all three of the above contracts through simulations in the Future Smart Grid Technology Lab at the University of Alberta.

BENEFITS TO ALBERTA

- Reduced GHG emissions as solar power displaces daytime fossil-fuel power generation.
- Improved electrical power reliability in locations served only by distributed- and micro-generation.
- Increasing the amount and value of carbon credits awarded to consumers and homeowners.

8 Publications

5 Students Trained

Enabler of Future GHG Reductions

CURRENT STATUS

May 2021

The project is being kicked off with the initial work on developing the smart contracts underway. Preliminary simulations of network power flow throughs with real world data have been completed, and efforts are under way to study the scaling behaviour of smart contracts to manage power flow.