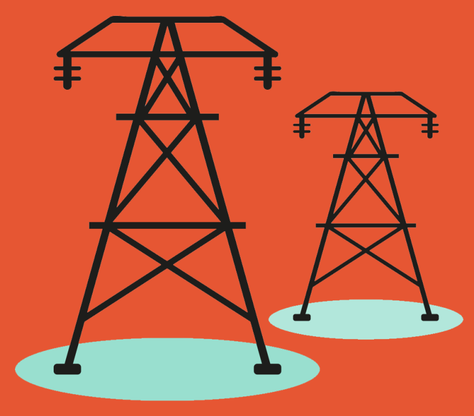
Peer-to-Peer Transactive Energy Model

New Zealand Electricity Consumers

Timothy Lopez | Nirmal Nair (Supervisor)



motivation

Advances in **Distributed Energy Resource** capabilities have exceeded the limitations of the current Electricity Network Structure.

Innovations in the data management sector and specifically the principles of **blockchain** enabling trust throughout a network sets the framework for network **disintermediation.**

The proposed **'Smart Grid'** structure gives way to the full reconsideration of market management in an effort to optimize distributed network assets not supported in the current grid.

research goal

The aim of this research was to explore the itegreation of blockchain technology with power systems economics. With research and various implementations emerging overseas we aimed to understand how the New Zealand Electricity Network could utilize this technology to not only create a P2P trading network but also aid its transformation into a 'Smart Grid'.

- Analyse the current Electricty Network
- Understand current system structure
- Consider parties and regulatory standards
- Explore fundemental principles of blockchain
- Methods of synchronization and consensus
- Consider parties and regulatory standards

HYPERLEDGER

Peers

Network User Applications

Privacy and Auditability

proposed solution

A **permissioned consortium** business network developed on the Hyperledger Frabric framework. A network in which all the network parties contribute too, and verifying network trust using **Practical Byzantine Fault Tolerance.**

Using Hyperledger Fabric v1 the developed blockchain solution was developed to be **modular, scalable and secure.**

Moving away from the usual blockchain architecture peers in this network were separated into three separate runtimes with three distinct roles: **Endorser**, **Committer** and **Consentor.**

In the network, identity is verified via a membership service. Transactions are then sent to peers only belonging to those parties involved.

Only after all peers have verified the result of this transaction then is it sent to a consensus network and committed to the ledger.

While all peers share the ledger, channels allow for **permissioned levels** of access between various peers. Peers only see what they are allowed to see while still retaining the ability to keep the ledger shared and verified by all.

results

- A business network deployed using the Hyperledger Fabric distributed ledger framework.
- Iteration of existing Electricity Authority APIs into a blockchain platform
- User Interface applications at various endpoints of the business network
- Practical Byzantine Fault Tolerance algorithm to reach network consensus
- Modular, scalable system design accounting for changes in system trends and requirements

New Zealand Peer to Peer Transactive Energy Platform

conclusions and future work

The framework proposed from this research encapsulated the very fundamentals of the New Zealand Electricity Network. We have proposed a peer-to-peer transactive energy platform inline with the various parties involved in the New Zealand supply grid and other regulatory bodies. There exists the need for significant development of this system in order to meet the requirements of a commercially available trading platform as well as to restructure the electricity supply chain to integrate blockchain technology. These include:

- Integrating various security protocols required by the various organisations in the business network.
- Further development of consensus algorithms.
- Scalability and efficiency testing on enterprise level hardware.

ELECTRICITY AUTHORITY TE MANA HIKO

HYPERLEDGER FABRIC

THE UNIVERSITY OF AUCKLAND Te Whare Wānanga o Tāmaki Makaurau NEW ZEALAND