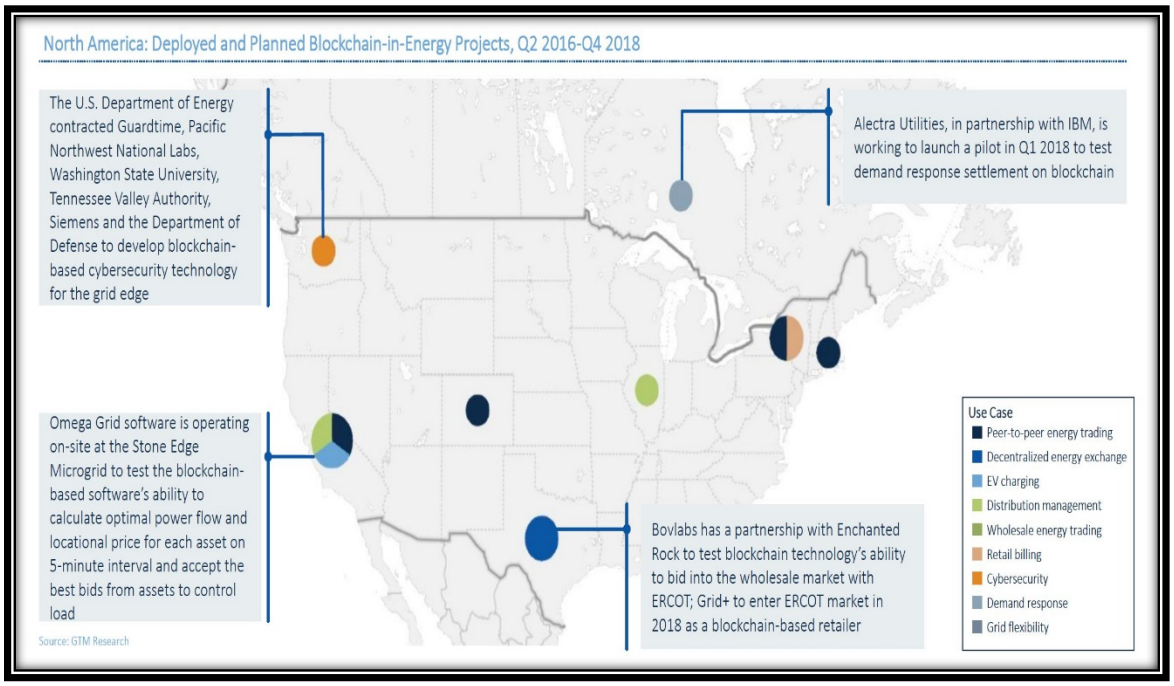
Blockchain Technology

A Gentle Introduction to its Use in the Energy Sector

Motivation

The first blockchain transaction to appear in the energy market occurred back in 2016 in New York. Only two years later there are now over 120 energy companies working in the blockchain space. In the last quarter of 2017, over $300 million was invested into energy businesses integrated with blockchain technology and since January this year, over fifty new blockchain businesses have launched within the energy market[1]. In this memo we explain what the *blockchain* is and its value proposition for the energy industry.



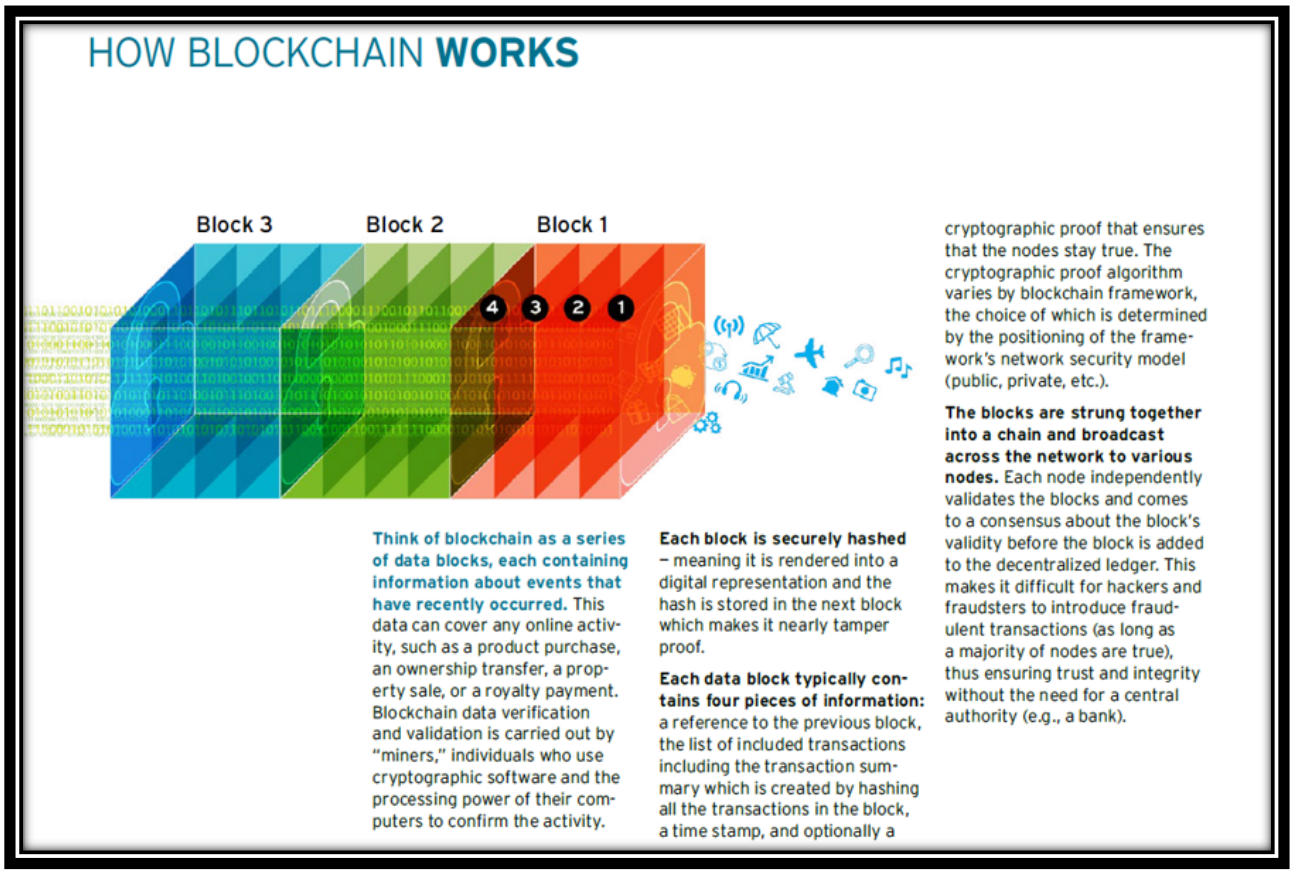
What is Blockchain?

Its name describes what blockchain software does: transactions are stored in virtual blocks, which are connected together in a chain, creating a complete history of all transactions that have ever occurred within a particular network[2]. Potential use cases for blockchain are being developed in many different industries, particularly where it is desirable to accelerate transaction times, remove centralized market control, reduce the cost of performing transactions, and ensure trust between different market

[1] *How will blockchain influence the future development of the energy industry?* | Catherine McLean | https://www.linkedin.com/pulse/how-blockchain-influence-future-development-energy-industry-mclean/

[2] Navigant Research | *Blockchain Enabled Distributed Energy Trading*

participants[3]. While many use cases have been proposed for the energy industry, the one gaining the most traction at present is peer-to-peer (P2P) power trading, where owners of small-scale generation can sell excess generation direct to other consumers. Today, centralized control of distributed energy resources (DER) restricts to whom and when DER owners can sell their energy back to the grid[4]. A blockchain-enabled P2P model allows much greater flexibility and could be a powerful enabler for truly customer-centric transactive energy.



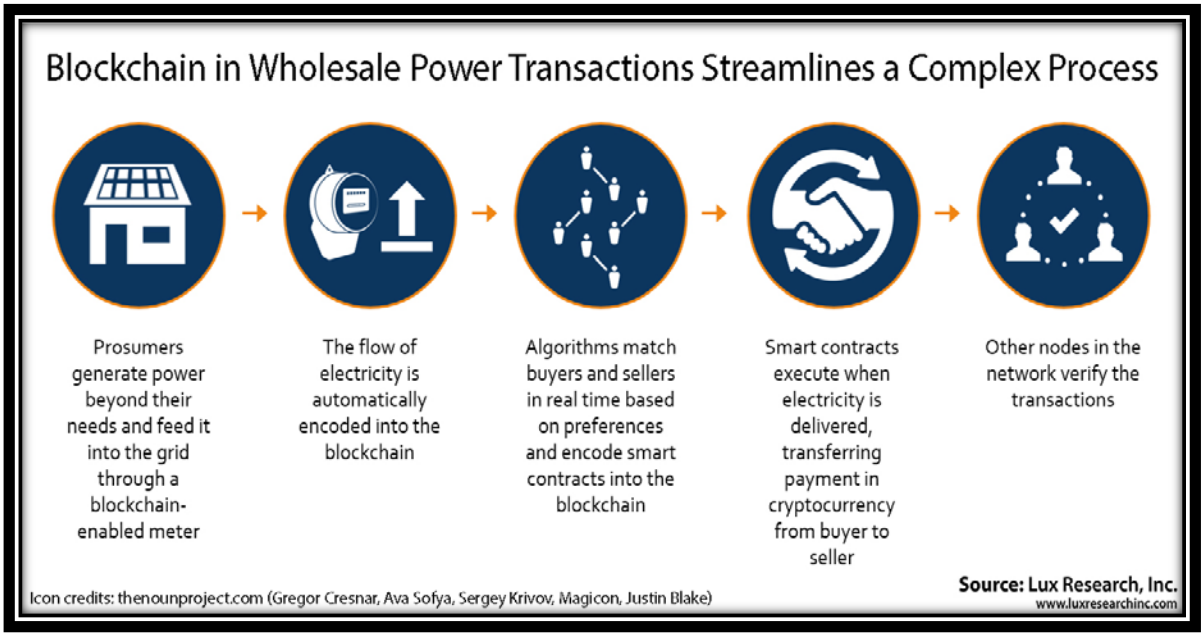
Blockchain Use Case – Trading Renewable Energy Certificates[5]

On an electricity grid, electrons generated from the sun, wind, or other renewable sources are indistinguishable from those generated by fossil fuels. To keep track of how much clean energy is produced, governments around the world have created systems based on tradable certificates. Problem is, the way we manage these certificates "sucks," and it's holding up investment in renewable power, says Jesse Morris, an energy expert at the Rocky Mountain Institute. A new system based on blockchain, could fix this.

[3] Ibid
[4] Ibid
[5] MIT Technology Review | *How Blockchain Could Give us a Smarter Power Grid*

When a renewable-power plant generates a unit of electricity today, a meter spits out data that gets logged in a spreadsheet. The spreadsheet is then sent to a registry provider, where the data gets entered into a new system and a certificate is created. A second set of intermediaries brokers deals between buyers and sellers of these certificates, and yet another party verifies the certificates after they are purchased. Such a byzantine system racks up transaction costs, while leaving plenty of room for accounting errors that can range from honest mistakes to outright fraud. The lack of transparency also scares many people off entirely. What if the meter wrote the data directly to a blockchain instead? Most of these problems would vanish at a stroke, says Morris.

The electricity sector is, for the most part, still based on massive, centralized power plants that generate power sent long distances over transmission and distribution lines. In recent years, though, a growing number of smaller “distributed” power generators and storage systems, like rooftop solar panels and electric-vehicle batteries, have been connecting to the grid. The owners of these systems struggle to maximize their value because the system is so inefficient, says Jemma Green, cofounder and chair of Power Ledger, an Australia-based startup developing a blockchain-based platform that allows producers to trade energy peer-to-peer with consumers. For instance, it generally takes 60 to 80 days for an electricity producer to get paid. With a blockchain-based system, Green says, producers can get paid immediately via preprogrammed “smart contracts” that trigger transactions automatically.



Appendix A

Blockchain Based Smart Metering and Electricity Trading Platform Proposal

Blockchain-based smart metering and electricity trading

Kenji Tanaka / The University of Tokyo

SIEBEL ENERGY INSTITUTE

PROJECT AREA – Energy Infrastructures

Motivation

The future electricity grid will be a two directional system with billions of consumers and prosumers interacting with each other. Microgrids including batteries, solar or wind generation modules will need to be interconnected
using distributed energy management software. Being able to conceive a secure and decentralized control and billing system adapted to these autonomous, peer-to-peer exchanges is one of the biggest challenges of this century.

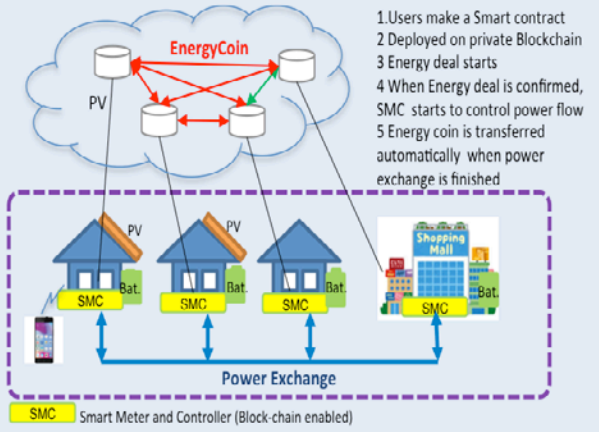
Proposal

We propose to use Blockchain as an underlying platform because it could perfectly fit these requirements: a decentralized digital currency that provides bidirectional and transparent rewards to prosumers and that is independent from Feed-In tariffs.

Overall objective:

In this research, we want to explore which are the most promising directions and develop a prototype to prove the feasibility of blockchain based energy trading and billing.
The trading system which is secured and cost conscious for energy trading of small transactions should be developed.
With this decentralized trading system consumers can purchase specified electricity based on their own preference or strategy with smart contract.

Fig.1 Blockchain-based smart metering and electricity trading



Approach

At first, we will make a simulation on computer: consumption, generation and storage of several interconnected microgrids shall be simulated similarly as proposed in. We overlay to this network a private ethereum-based blockchain which provides a virtual currency (EnergyCoin) to monetize exchanged energy as shown in Figure 1.
The second step will be to build a real smart meter and controller which is blockchain enabled. It will first be tested in laboratory conditions and if successful, we hope to deploy the system on a real environment such as the one in which already disposes of a fully decentralized energy exchange procedure.