Application of Blockchain Distributed Ledger Technology in Energy Sector

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Outline

✓ Introduction

✓ Market Facilitation
  ❑ Wholesale energy market
  ❑ Retail electricity market
  ❑ Peer-to-peer energy trading

✓ Network operation
  ❑ Network control and management
  ❑ Demand response
  ❑ EV charging and operation

✓ Asset management
  ❑ Data management

✓ Other applications
Applications beyond energy sector

Source: McKinsey&Company
Energy is ahead of many other sectors

- Finance sector — between exploratory and growth stage
- No immediate physical exchange
- Energy sector — two thirds in exploratory stage
- Electricity markets are pooled, i.e. trades are cleared in aggregate on centralised trading platforms
## Blockchain in value chain of energy

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Wholesale energy market

- Energy trade between Generators and Suppliers
- Operator — TSO
- Current platform — Online exchange or brokers

Problems — inefficient communications
- Transaction costs (costly exchange and broker fees, pricing agencies)
- Operation costs (time-consuming reconciliation issues, costly back office processes)

Advantage of DLT
- Reduce the transaction costs for trading large volumes without an exchange or broker (No middleman)
- More efficient operational processes by connecting the trading desks of all parties (No clearinghouses/banks)
“Enerchain” is a pilot project, which aims to reduce the costs associated with wholesale energy trading by using Blockchain technology.

This project has developed a proof of concept Blockchain-based clearing platform for wholesale energy trade that does not rely upon a centralised exchange or brokers.

The platform allows wholesale energy traders to anonymously send orders to a decentralised “orderbooks” that can be accessed by other traders.
Retail electricity market

✓ Energy trade between Suppliers and Customers
✓ Current platform — manually meter to cash
✓ Problems — variable costs of the payment process
  ☑ Not transparent
  ☑ Expensive overheads
✓ Advantage of DLT
  ☑ Automating the “meter-to-cash” process
  ☑ By using cryptocurrency for bill settlement
  ☑ Removing Suppliers, and reduce costs
  ☑ Improving transparency of supply
Example application – Grid+

✓ Grid+, is developing an automated, Ethereum-based platform that will serve as a retailer in deregulated energy markets

✓ Grid+ aims to provide customers with nearly frictionless access to the wholesale market.

✓ Automated payment processing unit (token)

✓ Reading from smart meter and paying for electricity in real time (15-minutes to 1-hour intervals depending on market)
Peer-to-peer energy trading

- Market paradigms
- Multi-agent model / bidding platforms
- Control strategy for batteries/flexible resources
Peer-to-peer energy trading

- Local energy trade between prosumers and consumers
- Operator — Community manager/third party
- Problems — No regulation support, can only be achieved
  - in private networks, or
  - via virtual wire networks
- Advantage of DLT
  - By using cryptocurrency for bill settlement
  - Removing Suppliers, and reduce costs
  - Improving transparency of supply
Example application – Brooklyn

- Grid-connected Microgrid based on Blockchain technology to enable the customers to trade their renewable energy with their neighbours.
- The customers in the Microgrid achieve energy trading with each other automatically without a centralised intermedium.
- Being simple and saving their energy cost.
Network control and management

- Smart contracts communicate to the system when to initiate particular transactions depending on the predefined rules that are designed to ensure that all energy and storage flows are automatically controlled.

- Blockchain through smart contract can directly and automatically control the network flows as well as energy storage.

- Blockchain through smart contracts can be used to balance activities and virtual power plants.

- Blockchain through smart contracts offer control of a shared device.
Example – Control between 2 DSOs

- Two DSOs have different preferences for the control of a device that affect two networks, e.g. an MVDC link.
- Smart contracts offer the possibility of programming self-enforcing agreements, instructing the control of a shared device.
- Rule sets of the control algorithms were developed.

EV charging & operation

✓ Problems

- Highly fragmented charging market (various apps and different cards to access to charging points)
- Complex IT and payment processes
- Overloading and network reinforcement may be required for network operators

✓ Advantage of DLT

- Enable P2P EV energy trading, and local energy balance
- Facilitate payments at charging stations
- Real time pricing data are made available to EV drivers
Example – Share&charge

- A mobile APP
- EV and charging point owners both register in the APP
- The system uses an e-wallet and smart contracts on the public Ethereum Blockchain as P2P transaction layer, including Euro-based Mobility Token.
- P2P services allowing EV and charging point owners to rent their charging infrastructure to each other autonomously
Data collection & management

- DLT can securely and transparently support the integration of data from the edge of the grid to the cloud, so the data can be collected, stored, and examined later for reconciliation purposes.

Electron (founded in Nov. 2015) has built an ‘eco-system’ of Blockchain platforms, including systems for asset registration, flexible trading and smart meter data privacy. More recently, the company has been making waves with its work on customer utility switching.
Other applications

Source: World Energy Council
Conclusions

✓ Energy is ahead of many other industries in adopting DLT. Outside the finance sector, the energy sector is one of the industries where DLT could have the biggest transformative and disruptive impact.

✓ Market. DLT based meter-to-cash automation could remove the need for wholesale-to-retail intermediaries altogether, reducing the transaction and operational costs. DLT could enable the development of P2P energy trading, in which energy prosumers transact on a local scale.

✓ Operation. DLT is potentially able to help the grid management by integrating smart contracts. DLT allows the actual transactions to be automatically operated based on individual defined rules. DLT could improve EV charging coordination by facilitating energy payments at charging stations, and by enabling drivers to access real time pricing.

✓ Assets. DLT can securely and transparently support the integration of data from the edge of the grid to the cloud, so the data can be collected, stored, and examined later for reconciliation purposes.
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Thank you!!

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