WHITE PAPER

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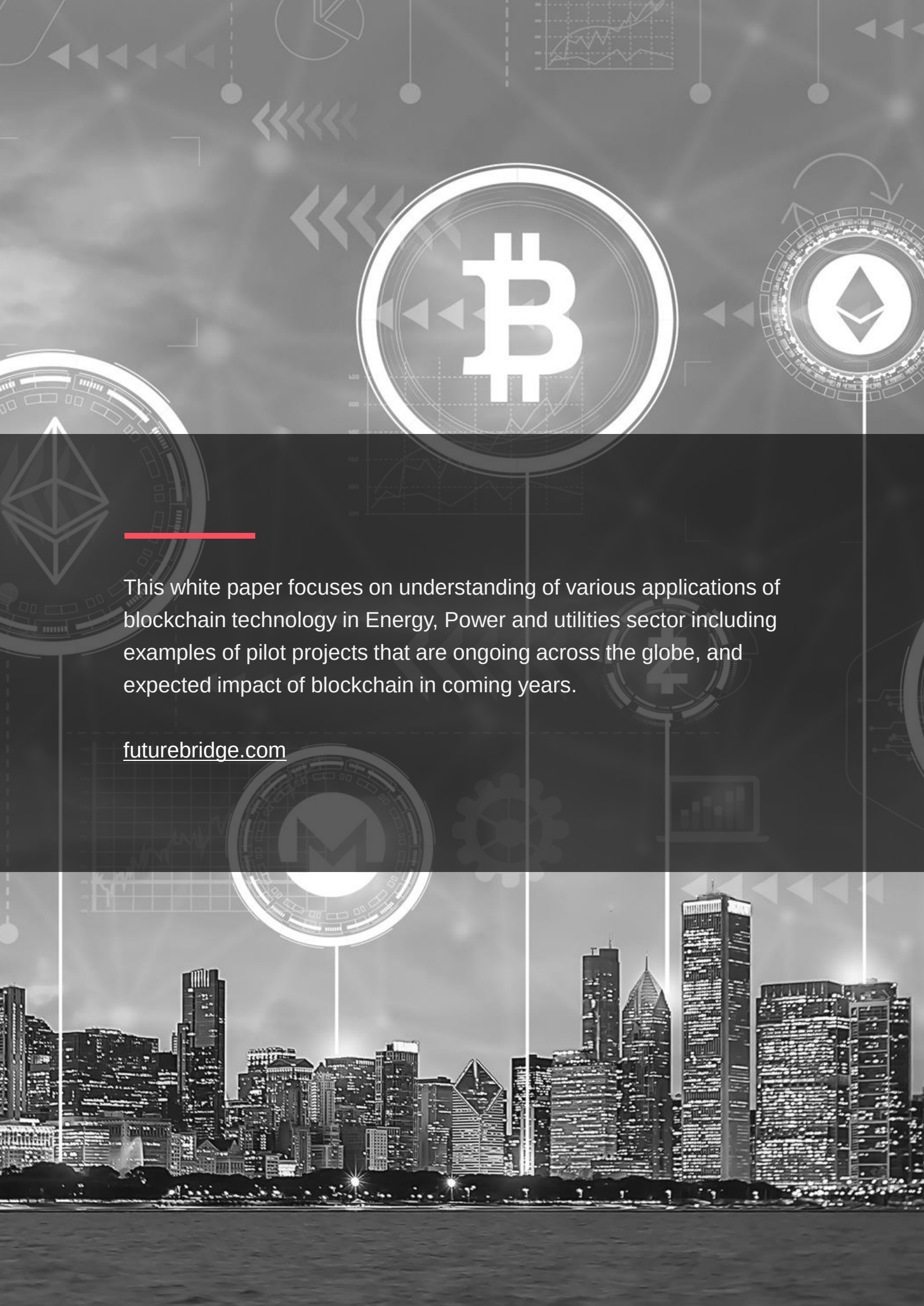
Blockchain in Power and Utilities

FutureBridge



This white paper focuses on understanding of various applications of blockchain technology in Energy, Power and utilities sector including examples of pilot projects that are ongoing across the globe, and expected impact of blockchain in coming years.

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Introduction

Blockchain technology is one of the most discussed topics in the world today, as one of its applications i.e. Bitcoin is making headlines by being highly volatile in valuations. Bitcoin achieved parity with US$ i.e. equal to US$ 1 in 2011 and then quickly zoomed to US$ 31 in the same year.

It reached its highest value in year 2017 at around more than US$ 17,000 and now bitcoin is trading at somewhere around US$ 8,000. Bitcoin crypto currency is primarily based on the blockchain technology and it will be interesting to understand the applications of blockchain technology in the energy sector.

What is Blockchain Technology?

Blockchain technology is a kind of digital bookkeeping technology or distributed digital ledger that keeps on updating and validating all the transactions happening in the network. The technology also keeps digital records of who owns how much and completely eliminates the need of centralized authorities, like banks, in case of financial transactions. This distributed digital ledger can be viewed by anyone in the network.

Whenever a transaction is carried out in a network, it is combined together with other recent transactions and a digitally protected block is created. This block is then verified by the members of network itself by decoding the puzzle attached to it. First member who decode and verifies the block get rewards. All transactions need to be verified by 51% of users in the network. Once the block is verified by required number of users in the network, it receives a time stamp and gets attached to the other block to create a blockchain.

Blockchain's cryptographic and decentralized nature allows users to transact peer-to-peer thereby making the need for central intermediary authorities obsolete.

Applications of Blockchain

Following are some of the major applications of blockchain technology:

Financial Institutions: International payments, capital markets, insurance, trade finance, peer-to-peer transactions, asset management are some of the applications

of blockchain in financial institutions. Bitcoin, the digital crypto currency has been major application of blockchain technology.

Government Institutions: In government institutions various functions like record management, voting, tax collection, contracts for work, and others can be performed with help of blockchain technology.

Other Industries: Some of the sectors which can make use and reap benefits by using blockchain technology are healthcare, real estate, energy, media, music industry, among others.

Blockchain for Power Utilities

Various startups and companies are in process of developing solutions based on blockchain technology for power sector. There are different areas in the power sector that can be benefited and simplified by using blockchain technology applications.

Bill Payment by Cryptocurrency: A number of startup companies have emerged with their platform to carry out bill payment of smart meters using cryptocurrency. Transactions using cryptocurrencies can be carried out and executed for payment contracts on blockchain. Eva Energy from Romania has become one of the first energy suppliers to accept electricity bill payments with cryptocurrencies.

Blockchain for EV Charging: There are few players that are working on EV charging, authentication, and billing for EVs based on Blockchain technology.

Peer-to-peer network of EV charging infrastructure can be built with the help of Blockchain. This network can be used by residential users, EV owners, and others to provide and share their electric chargers to EV consumers there by making use of home installed EV chargers to generate income.

The amount of energy used to charge EVs can be tracked by the technology platform and blockchain ledger transaction can be generated for the same via digital payments done from driver to EV charger owner. This ledger transaction can be verified by other users in the network and after verification can be sent to the entire network. This results in avoiding duplication of digital currency possessed by the EV owner.

Blockchain technology can also be useful in sharing of batteries and implementation of smart grid technology. In future, it could also lead to a network where EVs can be used to transfer electricity back to the grid when EVs are not in use or in kept ideal in parking.

Trading of RECs

The Traditional Method of Trading RECs

Independent auditors are assigned to assess, check, and validate energy produced by renewable-energy generators. These auditors certify electricity generated by generators as “green and clean” and these generators become eligible to sell their RECs (Renewable energy certificates) to customers who wish to buy these RECs. This approach is difficult for small scale renewable energy producer like home owners having solar panels at roof tops. Certification process of REC is cumbersome with physical audit.

Trading with Blockchain Technology

Companies like PowerLedger and LO3 Energy are working on blockchain technology to store renewable energy generation certificates that are created and saved by smart meters attached to solar panels. This blockchain technology helps in storing transaction records when RECs are traded amongst users, so that the same REC and same unit of generation cannot be resold.

This blockchain technology is expected to help in reducing transaction costs of trading, elimination of auditors, and price regulation, and will in a way make renewable-energy investment attractive for small players.

Decentralized Energy Transaction and Supply System

Various pilot projects are happening across the globe where blockchain technology has been used to carry out peer-to-peer energy transactions. Brooklyn Microgrid, which has been discussed further in the article, is one such example.

Blockchain eliminates the need of centralized authority required to validate the energy transfer and payments. It can be used to carry out energy transfer from one neighbor to another neighbor in a secure environment.

Pilot Projects Across the Globe

Decentralized storage system by Tennet and Sonnen

Blockchain technology and decentralized network of home energy storage systems will be used by Tennet and Sonnen to stabilize fluctuations happening in the grid. It's a first of its kind pilot project in Europe. In this project, decentralized storage systems will be integrated into Tennet's grid via blockchain technology.

IBM has developed the blockchain solution platform, while Sonnen has provided energy storage system solutions. Sonnen's virtual energy pool created by connecting its decentralized energy storage systems increases the general use of renewable energy and allows households to participate in energy markets to earn money. Households can offer their energy storage systems to grid services when it is required by grid, like for few minutes a day. It can help in providing additional earnings to consumers.

This project specially focuses on a grid service and helps in energy trading. It is claimed to be easily scaled and with attractive economics.

Brooklyn Microgrid Project

This pilot project was started in New York, attempting to create a peer-to-peer market place for energy trading based on blockchain technology and platform. LO3 Energy with Siemens has designed the Brooklyn Microgrid project. This Microgrid enables residents to sell energy to neighbors who are in need of electricity and also back to the local utility. It was in April 2016 when the first transaction took place between two neighbors wherein one of them didn't had a personal solar system and the other who produced excess solar energy.

Brooklyn Microgrid blockchain database is based on web book-keeping system that uses cryptographic technology to save and use energy data. LO3 Energy provided the blockchain platform solution. Siemens Digital Grid Division provided network control systems, converters, lithium-ion battery storage and smart electric meters.

Challenges for Blockchain Technology – Power Sector

Energy Consumption by the System

It takes huge amount of energy to carry out transaction processing in blockchain platform. In November 2017, Bitcoin mining took and consumed power equivalent of power consumption of entire Ireland. That is huge amount of electricity consumed for processing of transactions. This electricity is estimated around in the range of 40TWh in a year.

Scaling Problem

Today's blockchain technology, which is being developed for trading of RECs, is expected to carry out only few hundred transactions per second. These numbers of transactions are not enough if we have to scale the system. As democratic REC system, if scaled would generate thousands of transactions per second and current system would not be able to support the same.

Regulations

As blockchain technology in power sector is still in its infancy, there are concerns about the regulations in blockchain technology and acceptance of same by various countries. Highly regulated power sector is also the concern behind future of blockchain technology in power sector. Misuse of the technology is also not completely rejected.

Going Ahead

Bitcoin application of blockchain technology is being looked at very skeptically by a number of governments and central banking institutes across the globe. Many countries have banned trading of blockchain-based cryptocurrencies.

Cryptocurrencies are not the only application of blockchain technology. The technology can be used in various sectors advantageously to improve the flow of transactions and reduce the cost by eliminating the intermediaries. These advantages can help improve overall efficiencies in the energy sector.

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