CryptoHelvetia

Potential and applications of Blockchain technology in the energy sector

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The Blockchain beyond Bitcoin

Blockchain is radically changing the way **digital assets** are exchanged between individuals, thanks to its innovative method of managing and storing information based upon a decentralized network of users. This new technology promises to dramatically decrease the **cost and time of transactions**, hence facilitating a reliable way of **value transfer** without the need of **third parties**.

Historically, the financial world has been one of the firsts to recognize blockchain's potential (mainly due to the media resonance around **Bitcoin**); however, continuous development and increasing public attention led to an extension of this technology into **many other fields**. As a matter of fact, its potential applications span way beyond crypto-currencies, i.e. **smart contracts**, a tool that uses Blockchain to validate and monitor compliance with a contract.

Industry 4.0, **energy sector**, **digital identity**, **public administration**, **lending platforms** and **IoT** are only few of the possible applications of blockchain, which is becoming more and more popular as people and companies get used to it. Unlike the financial world, over the past few years many industries failed to recognize the value and potential of blockchain: one above all, the **energy industry**.

Despite the slow rate of adoption, however, an increasing number of experts in this field acknowledges the importance of this new technology and strongly believes that it can revolutionize an industry that's becoming more and more **decentralized** and **connected**.

A recent survey conducted by the **EMST** of Berlin, one of the most prominent business schools in Europe, highlighted how **39%** of executives of German energy companies plan to implement blockchain for their business in the near future; another **13%** stated that their company is already using or implementing this technology[1]. The confirmation comes from numbers: between 2017 and 2018 the estimated **investments for energy-related blockchain projects** was around **300M** dollars.[2]

[1] https://shop.dena.de/fileadmin/denashop/media/Downloads_Dateien/esd/9165_Blockchain_in_der_Energiewende_englisch.pdf, p. 18.

[2] https://www.ccn.com/energy-sector-invests-300-million-in-blockchain-in-past-year/

Digitalizing the energy industry

The **digitalization process**, intended as information and communications technologies (**ICT**) applied to different fields of economics, paved the way to a growing interaction and merging between the physical and digital worlds. The implications were a **growth in the amount of data**, thanks to the **reduction of costs for the storage**, a rapid progress for **advanced analytical techniques** (such as machine learning) and a **better human-device connectivity**, together with a more **efficient and cheap data transmission**.

Digital technologies helped **energy systems** improve and enhance for decades. Notably, the energy industry was one of the firsts to adopt IT systems and to deploy them on large scale. Back in the **70s**, electric companies have been true digital pioneers, deploying new IT technologies in order to ease production management and energy distribution. Today the energy market is monitored and run in real time over large geographical areas, serving a substantial number of users all around the globe.

This trend seems to grow consistently: in recent years, energy companies **strengthened their investments towards digital technologies**; as an example, global investments for infrastructures and software in this field have **grown by 20%** every year since 2014, reaching **47 billion dollars** in 2016[3].

Both startups and public companies start to look at blockchain as a way to solve current problems in the energy sector, such as the **growing number of devices** (IoT and Smart Grids) that need to be synced, the need to use and **extend renewable energies** and implementation of **new distributed systems** for energy production and consumption.

[3] http://www.iea.org/publications/freepublications/publication/DigitalizationandEnergy3.pdf, p.25.

Applying blockchain to the energy industry

Together with smart contracts, blockchain can be a great help for the **innovation of the energy world**, creating new way to produce and exchange energy. This could lead to several advantages:

More transparency and trust between manufacturers and consumers

Blockchain allows for complete data transparency and immutability, which can be a great plus for the energy sector, often touched by controversies and non-transparent practices towards consumers. A possible blockchain-based solution would allow people to **track the origin** of the energy supply, its **primary cost** and the eventual **increase** for the consumers. In this scenario, consumers will have a better knowledge for their purchases and companies would be encouraged to operate in a much more transparent way.

More accurate and informed use of electricity

Another possible strength of blockchain in this field could be its integration with the existing **Smart Meters**, electronic devices that record energy consumption and send this information to producers. By implementing blockchain with these devices, companies could verify the **energy consumption** with a 100% accuracy, avoiding manual detection and estimated consumptions procedures. This would result in a smarter way to allocate energy and a more accurate and transparent energy detection for consumers.

Incentives for renewable energies and more accessibility

It was observed that **35% of CO2 emissions** in the U.S. is caused by electric energy[4]. With a growing demand for energy, renewable energies are one of the main solutions to reduce CO2 emissions and other toxic substances. Moreover, renewable energies play a key role for **access to energy**, especially for developing countries and rural areas. According to the 2017 Energy Access Outlook: *From Poverty to Prosperity*[5], around **1,1 billion** people still have no access to electricity, making the **access and usage of renewable energies** a priority for industries and governments. Distributed technologies could positively impact the way electricity is produced and distributed, while at the same time encouraging renewable and sustainable energies.

[4] https://www.eia.gov/tools/faqs/faq.php?id=77&t=11

[5] https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport_EnergyAccessOutlook.pdf, p.11

Case study: Peer-to-Peer energy trading

The transition towards renewable energies will result in a much more climate-dependent production, therefore more irregular and volatile. As an example, sunny or windy days will produce a **surplus of energy**, higher than market demand, while during cloudy or calm days such production will be scarce.

This will then be one of the main challenge for the energy industry of the future: to ensure the **balance between production and consumption of electricity**. Over the past few years, there's been an increasing number of studies and projects around renewable energies, creating new ideas and tools to rethink about the energy industry.

In this scenario one of the emerging paradigms is the so called **Peer-to-Peer energy trading**, a shared and distributed platform for people to generate their own energy from renewable sources: the energy can be produced from houses, offices or factories and sold or bought locally (potentially globally) using a **peer-to-peer market**. Thanks to this solution, energy can be exchanged even between two single units, in an autonomous, efficient and sustainable way.

Many projects already started, like the New York based startup **LO3 Energy** that launched the Brooklyn Microgrid Project, a **distributed energy marketplace** for producers and buyers. In particular, solar panels were installed on top of five different buildings and the stored, unused energy was then sold to nearby buildings through an online platform. Thanks to the combination of both **smart meter** and **blockchain technologies**, transactions were handled and stored on the network, allowing electric energy sharing between neighbors. In this network, each individual (and his house) is a node and can choose when to buy or sell clean energy straight from his neighborhood.

Another example of blockchain applied to the energy sector comes from **SolarCoin**, a cryptocurrency started in 2014 with the aim to encourage production of renewable energy through photovoltaic systems. Thanks to **APIs connected to solar panels**, it is possible to record one's production of solar energy and send this data to blockchain: the owners of the panels are then rewarded with SolarCoin, proportionally to the amount of energy created.

Conclusion and challenges

In order to become a new standard for the **industry 4.0**, blockchain will have to overcome several **regulatory** and **technical challenges**. A lot of work needs to be done before implementing this technology in fields such as the energy industry, especially on a large scale. Problems like **scalability**, **network security**, correct integration with existing **smart grids** and **process interoperability** must be addressed before being able to successfully apply blockchain in the energy industry.

On the other hand, the energy market is **strictly regulated**: electricity grids and gas pipelines are considered **natural monopolies** by most countries and fall under **national or local laws**. These restrictions may hinder the transition from experimental projects to commercial platforms.

Moreover, blockchain will have to beat the **competition** of current solutions and to show its value to potential investors and users. In other words, only by showing clear **economical**, **social** and **environmental benefits** the blockchain will establish itself as the carrier of a **revolution in the energy industry.**