BLOCKCHAIN APPLICATIONS IN THE ENERGY SECTOR – AN ASSESSMENT BEYOND THE HYPE

Christoph Burger, ESMT Berlin, +493021231-8040, christoph.burger@esmt.org
Jens Weinmann, ESMT Berlin, +493021231-8052, jens.weinmann@esmt.org

Overview

In the energy supply industry, commercially successful use cases of Blockchain and other Distributed Ledger Technologies (DLTs) have remained a niche phenomenon, despite the surge of decentralized energy installations that would potentially allow for disintermediation and direct peer-to-peer electricity trading. On the basis of a quantitative international survey and qualitative interviews, reasons for the slow adoption of Blockchain applications are explored. In comparison to sectors such as finance and logistics, in which viable Blockchain-based business models already exist, regulatory hurdles, particularly in the case of tokenization, as well as market acceptance and the level of maturity of blockchain technology are cited as delaying factors in the energy sector.

One of the predominant characteristics of Blockchain use cases is the technical implementation of an infrastructure that allows multiple agents to interact or exchange information. Our analysis extends the existing literature by providing a perspective based on platform economics: The results from qualitative interviews with practitioners suggest that early use cases can be classified as *transaction platforms,* either as a stand-alone business model, for example trading platforms, or as Blockchain-as-a-Service model. However, a second type of Blockchain plaforms has emerged in the energy sector, which could be called *innovation platforms*, following a taxonomy introduced by Cusumano, Gawer et al. (2019). This second type is characterized by a diverse composition of economic agents participating in the creation of an innovation ecosystem with multiple applications and complementary services.

Methods

The academic literature on blockchain-based business models in the energy sector has increased significantly in the past years, including e.g. papers by Andoni et al. (2019) and Khatoon et al. (2019). This contribution consists of two complementary analyses, which are both based on primary research undertaken by the authors:

- An international quantitative survey with around 70 respondents was conducted to assess the potential of business models and applications based on the blockchain in the energy sector. Respondents were asked to provide their estimates for commercial dissemination of blockchain, name the business fields or dimensions where they see the largest potential, identify hurdles, and whether their own company or organization had already implemented a solution based on the blockchain.
- A comparative analysis, based on semi-structured qualitative interviews with corporate decision-makers, explores how blockchain technologies are deployed in the energy sector and compares the results with blockchain applications in other sectors, especially fintech and IT.

The quantitative survey and the interviews with industry practitioners were conducted within the framework of the research project ETIBLOGG (Energy Trading vIa Blockchain-Technology in the LOcal Green Grid), financed by the German Federal Ministry of Economics and Energy.

Results

The majority of respondents of the quantitative survey see potential for optimizing internal processes, particularly in the areas of billing and proof of origin, as well as in market-oriented services such as peer-to-peer trading, microgrids and in wholesale markets. However, the majority of respondents is not expecting a larger spread of blockchain-based applications within the next few years. Interviews and an international survey reveal that there is widespread skepticism among corporate decision-makers regarding technological maturity and commercially viable

use cases, but also regulatory hurdles prevail. Furthermore, Blockchain-based platform models face similar challenges as other platforms, namely generating a critical amount of users and a sufficient number of transactions in order to assert themselves against existing trading platforms.

In our comparative qualitative study, we observe that Blockchain-based, one-sided or two-sided transaction platforms in the energy sector are exposed to market dynamics similar to non-DLT platforms, in particular to positive network externalities and multi-homing, thereby competing in an already saturated market of providers of trading places. The speed limitations of Blockchain applications lead to more successful use cases in new market segments with low-frequency transactions, such as Certificates of Origin for renewable energies, wholesale trading or electric vehicle roaming protocols.

From an institutional perspective, applications tend to move from permissionless to permissioned Blockchains, run by private industry consortia that work with Proof-of-Authority rather than Proof-of-Work to increase transaction speed and reduce energy consumption.

In comparison with the financial sector, Blockchain applications in energy do not only coordinate the exchange of information, but also physical parameters, like the flow of electrons, the balancing of the grid, or the amount of emissions. This results in a high degree of regulatory and technical complexity and increases barriers to entry.

As a response, industry stakeholders establish innovation platforms that serve as an open-source software ecosystem not only for specialized IT developers and entrepreneurs, but also for energy utilities, grid operators and startups to co-create the digital infrastructure for a smart electricity grid and machine-to-machine communication. Within these innovation platforms, two distinct strategies can be identified: a tokenized ecosystem strategy with a diverse composition of economic agents participating in the creation of an innovation ecosystem, and an enterprise solution strategy without tokenization and an established IT company offering complex service solutions in multiple industry verticals.

Our analysis suggests that innovation platforms tend to consolidate within the industry and compete with cross-industry IIoT platforms promoted and operated by multinational IT and tech companies. The high degree of industry expertise that is needed on specialized innovation platforms provides a competitive advantage in the “IIoT platform wars”, compared to more generic platforms or those with multiple industry verticals.

Conclusions

According to industry practitioners, regulation, technological maturity and market acceptance are perceived as the greatest hurdles for a fast dissemination of Blockchain technologies in the energy sector. Stand-alone transaction platforms based on Blockchain technologies are most likely to either survive in regulatory niches or to join existing, industry-specific innovation platforms and ecosystems, which act as agglomerative magnets with positive network externalities.

References

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