

SMART ENERGY SERVICES THROUGH DISTRIBUTED LEDGERS? A TECHNOLOGY PERCEPTION OVERVIEW

Michael SCHMIDTHALER¹, Ting JIN²

Abstract

Technological developments in data storage, processing and visualization as well as their efficient utilization in energy management have increasingly been debated in the relevant literature. This is particularly the case for distributed ledger technology, its most commonly known representative, Blockchain (BC) and their application in energy. Most literature sources point out BC's possibilities for peer-to-peer trading, proof-of-origin certificates and energy-related financial transactions. Such applications in combination with decentralized generation of electricity are regarded as key enabler for increased renewable generation in single and multi-client residential dwellings.

Yet, while exhibiting large potential in terms of added capacity, especially multi-client PV-installations face different challenges economically, legally and technically. These require new solutions for owners, investors and users, particularly in terms of energy management, exchange and data processing. The focus of this research contribution is therefore concerned with the prosumers' readiness of using an integrated energy service platform, which offers substantial simplifications with regards to information exchange, consumption and self-production visualization of decentralized power generation as well as the documentation of multi-client plant ownership. In particular, the readiness to use BC, a distributed ledger technology, as a solution for plant share ownership and consumption/production data storage and processing – is assessed empirically by means of an industry-specific survey approach among the technology's first users in Switzerland.

The empirical evidence finds that readiness for BC based services exists and will grow, though being limited to / hindered by several factors in terms of regulatory frameworks and technical issues. While energy management is regarded as prime application for BC technology, the use and trade of production and consumption remains to be seen largely undefined mainly due to the scarcity of associated services offerings. Filling this void offers novel business models to both traditional suppliers as well as new market entrants, especially when offering intuitive, secure and accepted energy service solutions.

Market Situation

In addition to individual benefits and positive energy system ramifications of decentralized electricity production, the aim of enabling tenants in multi-party houses to directly exchange electricity has become a policy goal and a novel factor in business plans of existing and new electricity providers. Three main reasons account for the anticipated increases of the needs for smart energy services (SES):

- Development of PV's economies of scale which led to grid parity for most European plant locations, provided that higher shares of own consumption [1],
- technical innovations rendered the direct exchange possible (peer-to-peer trade), and,
- the setting of regulatory frameworks for such bilateral energy exchange and management services in many countries enable the inclusion of renewable production capacities mainly in urban surroundings which are shown to have high potential [2].

This increases the energy production potential extensively, thereby posing new challenge for utilities, transmission, distribution and policy makers alike. Geographically distributed energy production renders the use of decentralized databases a necessity. Among other options, the use of BC-based technology can contribute to business operational processes and improve energy exchange's effectiveness and efficiency dramatically. While alternative data storage solutions exist, the assessment of BC' perception was conducted at first, given the ongoing discussions as well as the technology's benefits. While some best-practice examples of Prosumption-based energy services exist (aWaTTar), the majority of

¹ University of Applied Sciences Upper Austria, T: 05 0804 33516, Michael.Schmidthaler@FH-OOE.at

² Culmannstrasse 37, 8006 Zürich, T: 0041 7794 53048, ting.rigger@gmail.com

suppliers have launched trial offerings in addressing the existing customer segment of (semi)-urban, technology-affine plant owners, willing to acquire smart energy solutions for their energy management.

Empirical Research

Trust in the data storage and transaction backbone of future BC based service platforms enable for instance peer-to-peer trading as well as cost reducing legal transactions such as purchase and sale of production capacities (such as PV plant shares on multi-client dwellings). Understanding the level of trust and readiness is thus paramount in the development of these advanced energy service offerings. To this end, an empirical survey (N=79/480) was conducted for the case of Switzerland, given the country's leading status and high level of support for this technology. Descriptive analysis revealed that 79% of representatives have heard of Smart Contracts which also represent the building block for energy services. 48% of participants are familiar with BC technology's energy management applications. This is lower than the percentage of people familiar with bank or cryptocurrency applications of the technology (94%), yet suggests the strong suitability of BC enabling advances in energy services.³

In the further investigation of participants' attitudes towards BC, inferential statistics was utilized to assess the assumption that people's associated attitudes are influenced by their knowledge about the technology. The results support the hypothesis that people's attitudes towards BC development in the next five years are influenced by their Blockchain knowledge significantly ($r = 0.034 < 0.05$ in multinomial logistic regression and $r = 0.007 < 0.01$ in ordinal logistic regression). Thus, knowledge about Blockchain is crucial for successful implementations of associated energy service offerings. This is key in the phase of developing market offerings, which currently take place [3], going well beyond the traditional restraints of services such as data protection and privacy.

Summary / Outlook

Projections and policy goals uniformly envision higher shares of intermittent energy provision in the European electricity system. Developing smart energy services is needed to increase the production from such small-scale renewable energy sources. This contribution sheds light on the trust and application knowledge for Distributed Ledger Technologies as enabler for these SES. Such secure and inexpensive solutions used in the data management, storage and exchange for to be developed flexibility-creating solutions for e.g. higher PV self-consumption rates. As demonstrated by the empirical findings, there is strong believe in the applicability in the energy sector among the pool of blockchain-related companies and organizations in Switzerland. The main driving factors on BC adoption are business effectiveness and efficiency, as well as the believe in its potential future impact. The empirical analysis supports the hypothesis that people's attitude towards Blockchain development is heavily influenced by their associated knowledge level. Thus, our research strongly supports the scientific evidence that trust remains the main issue in the technology's applicability for advance energy services. Associated service provision will have to approach this issue first and foremost.

Referenzen

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³ Business models incorporating additional applications of Blockchain technology such as trade of carbon credits or white certificates as well as production proof of origin have yet to be developed.