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PS 1 / THE EVOLUTION OF MARKET DESIGN AND REGULATION TO INTEGRATE DISTRIBUTED ENERGY RESOURCES

The Applications of Blockchain Technologies to Electricity Markets

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SUMMARY

Blockchain is a new technology which may have significant potential for application in energy markets. The objective of the working group was to assess the current use of blockchain in energy markets and the management of renewable energy certificates. The first part of the work was a review of the basic technology and the potential for its application to energy markets. Consequently, there are chapters on:

- The fundamental principles of blockchain technology
- The functional principles of blockchain
- Different Consensus mechanisms
- Blockchain domains (i.e. private/public and permissionless/permissioned)
- Consideration of some electricity market challenges and emerging technologies
- Some market shortcomings and challenges and how they can be mitigated using blockchain technology

The second part of the work was an assessment of actual operational projects which have implemented blockchain based systems in energy markets. The Working Group members created a set of criteria for selecting projects. With these criteria, they identified 37 projects. Each project was assessed against a standard set of criteria and the results are summarised in this paper.

The Working Group has made the following observations on this small sample. It should be noted that there is no claim being made this is a representative sample. The main observations are:

- The principal functional areas where blockchain is used are
    - trading and marketing,
    - automated control of decentralised power systems and
    - transparency to improve auditing
- The major blockchain frameworks used were Ethereum (42%) and Ecochain (24%)
- Projects commissioned earlier used Ethereum but most recent systems were using IBM Fabric.
- The most common consensus mechanism was Proof of Stake
- The number of customers using the systems were small with the most common size being 5-10 users

There appears to be a significant potential for the application of blockchain technologies to energy markets in the right areas. It is likely that a distributed technology like blockchain would be useful as the power system becomes more distributed with an exponential rise in the number of players in the market and the number of technologies employed. One significant technical issue is achieving the transactional speed and scalability which would be required for a widespread implementation of blockchain technology into energy markets.

This paper is a summary of the CIGRE Technical Brochure **824 The Role of Blockchain Technologies in Power Markets [17]**. The work of the contributors to the Technical Brochure is recognised. It is proposed to follow up this work in a new working group with a more in-depth look at the potential applications for blockchain in the area of energy trading.

KEYWORDS

Blockchain energy trading, distributed ledger, IoT, microgrid, demand response, renewable energy certificates

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