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Review of blockchain potential applications in the electricity sector and challenges for large scale adoption

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Abstract-

Blockchain technology applications in the electricity sector are getting considerable attention from both academia and industry. It is expected that blockchain will play an important role in the transition to the smart grid. The blockchain applications in the electricity sector can be classified to optimizing existing processes like metering and billing or grid management and using blockchain for emerging applications such as creating new platforms for value exchange like peer-to-peer (P2P) energy trading. This paper briefly introduces fundamentals of blockchain technology such as different types of blockchain networks and consensus mechanisms, in addition to introducing a few blockchain platforms that are widely used in current studies, projects, and startups or may have future potential in electricity sector applications. The contribution of this paper is to provide a review of potential applications of blockchain in many electricity sector use cases, and they are categorized into eight categories such as P2P energy trading, wholesale markets, retail markets, metering and billing, trading of renewable energy certificates (RECs) and carbon credits, electric mobility, enhancement of power system cyber security, investments in renewable energy sources (RESs), and power system operation and management. Moreover, examples of research studies, pilot projects, industrial projects, startups, or companies investigating the blockchain capabilities at each potential application are introduced. Furthermore, the studies presented at each use case are compared to clarify and highlight the blockchain functions and involved actors. Finally, the paper discusses the challenges that blockchain technology is facing that obstruct large-scale adoption in different sectors and in the electricity sector specifically and potential solutions to these challenges that are being developed.

Index Terms- blockchain applications, distributed ledger technologies, distributed ledger technologies applications, peer-to-peer energy trading, local electricity markets, electric vehicles, smart grid.

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