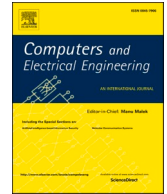




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Blockchain-enabled Peer-to-Peer energy trading

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ABSTRACT

The increasing amount of distributed power generation from rooftop solar panels allows new electricity markets to emerge in which prosumers and consumers can trade locally produced energy. The use of blockchain technology has increasingly emerged in energy markets and shows great potential to facilitate Peer-to-Peer energy trading. However, blockchain technology is still in its infancy meaning it is not yet being used to its' full potential. In this paper, blockchain technology for Peer-to-Peer energy trading and its implications are explored, especially in view of the 'trilemma': scalability, security, and decentralisation. Peer-to-Peer energy trading is the focus of this paper, which ultimately proposes a blockchain scalability solution. This solution is empirically modelled using data collected in a trial case study. The proposed solution increases scalability without compromising security and decentralisation when compared to base layer models.

1. Introduction

Peer-to-Peer (P2P) trading of energy has emerged as a next generation system in energy management that enables prosumers to trade their surplus electricity. This creates opportunities for power system markets and transforms the way consumers use their energy, allowing them to trade energy with their peers. P2P electricity markets may allow consumers to freely choose their source of electric energy by, for instance, investing in locally produced renewable energy.

Blockchain is considered by many as the next digital revolution and it is believed that it will be as impactful as the Internet [1, 2]. It has the potential to enable the spread of power across the system, giving every participant an equal opportunity without a central authority controlling the information (in some cases). The information is open, facilitating transparency. Blockchain has recently gained significant attention from both academics and the electricity industry and been applied in almost all fields, especially in energy trading. The adoption of blockchain technology for P2P electricity trading enables a transition from a highly centralised market controlled by a few key players, to a more democratic decentralised market dominated by microgrids. Although the concept of P2P energy trading is not new [3], it has recently drawn interest from academics and the electricity industry as it provides a solution to the phenomenon known as the 'utility death spiral' [4]. The latter is caused by the increased adoption of rooftop photovoltaic (PV) panels,

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