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Fully Decentralized, Cost-Effective Energy Demand Response Management System with a Smart Contracts-Based Optimal Power Flow Solution for Smart Grids

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Abstract

Recent advances in control, communication, and management systems, as well as the widespread use of renewable energy sources in homes, have led to the evolution of traditional power grids into smart grids, where passive consumers have become so-called prosumers that feed energy into the grid. On the other hand, the integration of blockchain into the smart grid has enabled the emergence of decentralized peer-to-peer (P2P) energy trading, where prosumers trade their energy as tokenized assets. Even though this new paradigm benefits both distribution grid operators and end users in many ways. Nevertheless, there is a conflict of interest between the two parties, as on the one hand, prosumers want to maximize their profit, while on the other hand, distribution system operators (DSOs) seek an optimal power flow (OPF) operating point. Due to the complexity of formulating and solving OPF problems

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