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Blockchain, a Sustainable Solution for Cybersecurity Using Cryptocurrency for Financial Transactions in Smart Grids

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***Abstract* - Power systems are experiencing evolutionary changes. Future grids will be smarter and with a higher level of autonomy. In addition, the penetration of demand-side small-scale distributed generation is mounting. The proliferation of electric vehicles (EVs) conveys a promising and brilliant future for this technology, particularly for vehicles with V2G capability, that will result in a boom in the pervasiveness of EVs in the next decades. Digitalization and modernization of power systems, as well as ever-growing technological advances in information and communications technology (ICT) and the internet of things (IoT), will procure a smart platform that facilitates peer-to-peer (P2P) communication of power systems' elements. Thus, future power systems will be immensely complicated and interconnected in terms of data transfer and data processing. Hence, in addition to the employment of big data techniques, some structural changes are required to deal with such a massive body of data. Therefore, the security of data must be ensured specifically for financial transactions. Furthermore, in the future grids, millions of microsources will sell their generating power to the local loads in demand-side, and a load may be served by several microsources. Furthermore, flexible loads can use this platform to trade interchangeably with inelastic loads or the main grid. In this respect, myriad transactions must be recorded, which cannot be handled with the current banking system. This matter necessitates the deployment of blockchain-based cryptocurrencies for handling these microtransactions without needing to supervisory and authority. Hence, a proper platform is indispensable to connect the vendors and purchasers easily and executes the transaction after authentication, validation, and verification of both sides. This study delves into the necessity of employment of blockchain in power systems. Besides, the conceptual background of blockchain and cryptocurrency are explained.**

Keywords - Blockchain; Cryptocurrency; Restructured power systems; Microtransaction; Financial cybersecurity.

I. Introduction

The term "blockchain" was originally coined by Stuart Haber and W. Scott Stornetta in 1991. They tried to propound a model by using some certificates into an encrypted record, called block, in order to prevent tampering with digital documents and to produce a decentralized database. When specific data are recorded in a block, it is an extremely tough work to manipulate the data. Each individual block contains a timestamp, the transaction data, and the cryptographic hash of the previous block. The blockchain platform is so designed that prohibits and resists against modification and manipulation. The hash function generates a specific code (hash value or digest) for each specific input (message or text). The hash function receives a string of input data regardless of its length and generates a fixed-length digest. Any small change in the input data will drastically change the hash value. The hash function is not a stochastic process, which is why the same input results in the same digest permanently. It is also impossible to have the same hash value for two different inputs. The data in the blockchain is not centralized in a specific data storage unit, but they are replicated, synchronized, and shared with multiple devices (modes) which are spread across multiple places geographically. This kind of data management is known as a type of distributed ledger database. A peer-to-peer network with an inter-node communicational protocol is needed to manage and validate consensus data in the blockchain.

The term "blockchain" is fairly new in the power system literature and terminology. The authors in [1] have proposed a real-time model, in which it is tried to maximize the renewable energy exploitation incorporating the dynamics of electric vehicles. Some methods for user prioritization for charging of electric vehicles are investigated, and the trades of vehicles

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