Blockchain for the advancement of decentralised RE systems

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In recent years, blockchain technology has made significant strides across various industries, from finance to supply chain management. It is capable of revolutionising the energy sector by enabling decentralised renewable energy (RE) trading through secure, transparent, and efficient transactions. By utilising blockchain, neighbouring households and industries can buy and even sell small amounts of RE locally generated from RTPV systems. Smart contracts or self-executing agreements between parties can be created using the technology to automate the process of buying and selling electricity. This approach provides an alternative to net metering and simplifies the process of connecting solar energy producers with customers who wish to power their houses or industries with green energy. The decentralised nature of blockchain increases the efficiency of energy trades, improves the reliability of power supply, and facilitates cost-competitive energy trades. In 2020, Uttar Pradesh launched a pilot project in Lucknow to trade energy generated by rooftop solar systems (RTPV) using blockchain. Powerledger, the blockchain technology partner in the state, has claimed that the pilot has resulted in a 43% decrease in the energy market purchase price compared to the retail rate. In addition, blockchain technology provides real-time verified data on RE purchases by users. The authorities can use this data to provide renewable energy certificates (RECs) to users.

A blockchain-based energy trading platform can also be used to manage energy storage devices, such as batteries. The platform can monitor the status of batteries and automatically execute transactions when the batteries are full and ready to sell excess energy. This would help optimise the use of energy storage devices and reduce energy wastage. Similarly, the platform can be used to monitor the energy production of a PV array and identify local consumption patterns. Trades can be executed automatically when energy is available for sale.

It is crucial to consider the impact that blockchain-based energy trading may have on the stability of the grid and energy distribution companies (DISCOMS). Ideally, energy exchanges through blockchain should occur as locally as possible. If energy supply and demand are matched over long distances, it becomes challenging to manage the distribution network. With energy customers opting to buy electricity directly from each other rather than from DISCOMs, the fees charged for using the distribution network would require revision.

One of the challenges faced by blockchain systems is slow processing speeds. Confirmation of trades can take an extended period, with blockchain-based cryptocurrency solutions such as Bitcoin and Ethereum taking 10 and 3 minutes, respectively. The systems should be capable of handling large volumes of transactions during peak times. Additionally, they are energy-intensive in nature. A single Bitcoin transaction requires 1449 kWh of power. This high energy demand has already caused disruptions to local power grids in Venezuela because of excessive Bitcoin mining activities.

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There is also a need for clear regulatory frameworks and protocols for blockchain-based energy trading. For example, if dynamic pricing is employed in such systems, the energy purchase price in the platform may become higher than the retail tariff. This could lead to financial losses for energy traders and consumers and affect the viability of systems.

As India shifts towards a more sustainable energy future, it is important to explore innovative solutions like blockchain for decentralised RE. While blockchain has the potential to bring significant benefits in energy trading, careful planning and pilot testing are essential to overcome the technical and regulatory challenges involved in implementing the technology at scale.