Deployment of blockchain technology to minimize investment risks in India's power sector

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The power sector in India has historically been plagued with several challenges that have stymyied investment, innovation and growth. One of the primary concerns voiced by a range of industry stakeholders pertains to weak enforcement of contracts, which creates financial and operational distress that often end up being litigated. The Government of India has also recognized power sector's concerns around contract enforceability and attempted to address these in the Draft Electricity (Amendment) Bill, 2020, wherein a statutory authority known as the 'Electricity Contract Enforcement Authority' is proposed to be set up with the sole responsibility of enforcing power contracts.

Blockchain-based smart contracts are increasingly being seen as a potential solution to help alleviate these concerns, especially in light of them being self-executable, immutable, and transparent. It is imperative to understand certain fundamentals of blockchain technology before we delve into its applicability to the power sector. Broadly speaking, blockchains are underpinned by Distributed Ledger Technology (**DLT**), which is a manner of record-keeping whereby information is recorded and stored across multiple & identical data stores (**ledgers**) and is possessed by each of the parties to a transaction. Two core aspects of DLT are as follows:

Peer-to-peer based record: Traditionally, record-keeping has been an activity undertaken by a centralized/nodal entity where the risk associated is limited to a single point of failure that could either emanate from genuine technical difficulties or malicious attacks/malpractices such as tampering. In contrast, DLT enables transactions and data to be recorded, shared, and synchronized in a digital form across a distributed network of various counterparties and participants, making it more resistant to failure.

Removing possibility of 'double spend': DLT ensures that the same asset/resource cannot be sent/promised to multiple parties at the same time. Different transactions on the same asset are proposed or initiated by different members **(nodes)** to ensure correct sequencing of transactions, which also prevents bad or improper transactions.

Blockchain is a type of DLT which employs cryptographic and algorithmic methods to create and verify continuously growing, append-only data structures (**blocks**) that take the form of a chain (**blockchain**). New additions to the blockchain can be initiated by nodes which creates a new block of data and information of this new block is time-stamped and shared across the entire network in an encrypted form. Thereafter, all network participants would collectively determine the validity of such block by a pre-determined algorithm-based validation method (**consensus mechanism**). Once validated, the block is added to the respective blockchain ledger of each participant[1]. In this way, each network member/stakeholder has the complete identical copy of the entire ledger on a real-time basis. Further, these 'blocks' cannot be retroactively changed, deleted or amended as a snapshot of each block is contained in its subsequent block[2]. Hence, the blockchain so created becomes immutable and resistant to malicious attacks or malpractices.

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[1] Distributed Ledger Technology (DLT) and Blockchain, FinTech Note No. 1, World Bank Group (December, 2017), http://documents.worldbank.org/curated/en/177911513714062215/pdf/122140-WP-PUBLIC-Distributed-Ledger-Technology-and-Blockchain-Fintech-Notes.pdf (Accessed on April 29, 2020)

[2] Blockchain: The India Strategy, NITI Aayog, (January, 2020), https://niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf (Accessed on May 3, 2020)

Smart contracts based on this technology will not rely on external authorities such as intermediaries to enforce their terms, and can be defined as self-executing contracts, wherein, the pre-negotiated terms of the agreement are directly written into the lines of the code. This codified agreement, once deployed, exists across a distributed, decentralized blockchain network making it immutable, thus eliminating any scope of human error/intervention.

Interestingly, pilot programs employing the use of blockchain technology are already being tested in India to develop peer-to-peer solar power trading platforms. One such instance is BSES Rajdhani Power and Power Ledger partnering with each other to enable residents of a gated community with rooftop solar plants to sell excess solar power to their neighbors, instead of letting it spill into the grid. Another example is Uttar Pradesh Power Corporation and Uttar Pradesh New & Renewable Energy Development Agency partnering with Power Ledger to enable certain government buildings and prosumers to carry out peer-to-peer transactions for the trading of surplus solar rooftop power. Notably, this appears to be India's first blockchain-based power venture to have received regulatory approval as it has been approved by the Uttar Pradesh Electricity Regulatory Commission[3].

While blockchain-based smart contracts are being experimented for automation of peer-to-peer transactions in select microgrids, its potential can also be explored for automating and enforcing traditional power procurement arrangements between procuring utilities and power generating companies. By way of an example, the first step towards deploying a blockchain-based smart contract in the power sector could be the pre-negotiated code which is proposed to govern the transaction and is approved by the regulator. Once the code is approved and deployed, the smart contract could potentially automate the entire power procurement process by undertaking activities such as scheduling, dispatch, sale and payment for electricity on a real-time basis, which could potentially reduce the volume of litigations on account of outstanding payments. While this is a very basic example, it is noteworthy that smart contracts based on private permissioned blockchains are extremely scalable and can be coded in such a way that it fits any foreseeable situation.

Blockchain technology is still at an initial phase of development all over the world and the challenges which may crop up, especially from a policy and regulatory perspective, are as yet unknown. However, such smart contracts could indeed be a small step towards reducing risk in India's power sector.

[3] UPERC Order dated December 2,2019 in Petition No. 1522/2019 (India).