VIEW POINT

BLOCKCHAIN – WHAT IT MEANS FOR UTILITIES

Abstract

With below average market volatility, the utility industry is averse to risks. This of course has been gradually changing, as the industry now finds itself at the forefront of disruption. Across the US and Europe, utilities are being challenged by a changing business landscape – aging infrastructure, renewable energy, distributed energy resources, new business models, changing regulations, digitalized customers, and more. Could the answer to some of the problems being faced by the utility industry lie in emerging technologies such as blockchain? The answer seems to be yes.

In this point of view, we identify a few prominent issues that the utility industry is grappling with and elaborate on how blockchain can address these.

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Improving operational efficiency, reducing expense ratios further and creating newer revenue streams with blockchain

Energy firms increasingly report higher electricity generation costs and declined revenues. At the same time, regulatory authorities are demanding increased transparency. As a result, utilities are reviewing several cost-saving and hedging methods of efficiency into their operations.

As transformation builds momentum, blockchain is poised to rewrite the rules of competition in the utility industry. This technology has the potential to streamline operations and enable data sharing with external stakeholders on a need-to-know basis. Initially, the focus can be to introduce efficiency in existing operations, process improvement, and cost savings.

Imagine replacing a complex and cost-intensive billing system with a distributed immutable ledger that is reliable, secure, and auditable. Once the technology is available to consumers, utilities can recover from their low consumer trust levels. With transactions published near real-time across several stakeholders on a need to know basis, blockchain can facilitate the seamless transfer of data/value, and automate manual tasks in wholesale trading, prescriptive and condition-based asset maintenance, and demand response management. The result will be a dramatic increase in efficiency, reduced costs, faster processing, improved customer satisfaction, and decrease in fraud.

Once the low-hanging fruit of efficiency is realized, the focus can shift to improving the expense ratio. Besides invoice reconciliation and settlement, a blockchain solution can streamline operations, and improve accuracy. Renewable energy certificate issuance & trading and optimizing spare parts inventory can ensure smooth operations along the value chain.

The impact of blockchain is not limited to driving efficiency alone, as it has a strong potential to disrupt the utilities market by creating new business models like a marketplace for P2P energy trading, EV charging, and battery swapping infrastructure.

Operational Efficiencies

Potential use cases for improving operational efficiencies are:

DER registration

The relationship of distributed energy resources (DER) with networks and system operators is becoming increasingly complex. The emergence of new business models is adding to the complexity. Today, a DERs must be registered at multiple places for different purposes. Depending on the registration portal, different information on the asset is collected to suit the data requirement of the registration system. There is no interoperability between these registration portals for effective utilization of the asset and this presents a risk to the utility's' system operation and planning. More so as the system operators and regulators have little oversight into the assets connected to their system. The problem gets accentuated with the increased installation of decentralized energy resources like EVs and solar PV.

A blockchain-based registration strategy can enable the asset owners to register multiple assets in one place and manage their information better. The distributed ledger-based register enables the system operators to know generation, storage, and changes in demand. This could give them increased visibility of DERs. With a complete view of the generation and storage capacity of grid-connected assets, system operators can develop flexible trading platforms and local markets.

Wholesale Electricity Trading

Wholesale electricity trading refers to the buying and selling of power between the generators and retailers or suppliers. Wholesale electricity markets have complex procedures, third-party intermediaries such as price reporters, exchanges, trading agents, logistic providers, brokers, regulators, and banks.

In wholesale trade execution, brokers procure the necessary energy from several buyers and sellers. Post-trade, buyers and sellers adopt traditional communication channels like email, fax, or phone to exchange information regarding the trade. This enables them to confirm and reconcile the trade. This process can generate mismatches resulting in recurrent reconciliation with counterparties leading to high operational costs.

Blockchain can integrate the entire trade lifecycle and reduce transactional and operational costs through disintermediation and automation of post-trade reconciliation. Producers, resellers, and third-party firms can collaborate to enable the interoperability of operational data and this can yield a potential savings of up to 30-60% [1].

Demand Response Program

Demand response (DR) programs are offered by utilities to energy consumers and prosumers. They can enroll in these programs and get incentivized for providing flexibility in their energy consumption at the utility's request, during peak periods of demand or during under-supply.

Centralized demand response management faces challenges such as data security and privacy of participants in the DR event, handling of a large number of energy transactions to effectively control the demand response in real-time, and the exchange of energy data between disparate consumers or prosumers. In this model, deviations by participants are addressed only at the end of the DR event. This results in inefficient DR management.

Blockchain-based demand response management connects the grid with prosumers or consumers who have signed up to participate in the DR event. Energy data from participants is stored locally in the blockchain using digital identities. This ensures data security and privacy. Real-time energy data from the participants' smart meter is stored in blocks as transactions and replicated across nodes. Smart contracts defined at the grid level ensure that the energy demand is balanced with energy production. Smart contracts defined for prosumers or consumers monitor energy adjustments to meet the baseline. In case of significant deviations, smart contracts trigger new DR events dynamically, which results in efficient DR management.

Asset Maintenance

Asset maintenance is a continuous process for improving the availability, safety, reliability, and longevity of physical assets.

An objective for most utilities with an aging infrastructure is to lower the risk of asset failure while reducing maintenance and capital costs. Unplanned downtime can cost a utility as much as $260 K per hour[2]. Utility infrastructure with an average asset of 30 years is a challenge resulting in unscheduled downtimes. According to market research, there is an additional spend of $2B, which is a 10% increase in maintenance spend on repairing and upgrading the existing infrastructure. The total cost of replacing aging assets is $4.8 trillion. If utilities continue to spend at their current pace, it can take just under 231 years to complete the upgradation[3].

Blockchain-based prescriptive (milestone-based) and condition-based (ambient & performance) asset maintenance will overcome unscheduled power outages with efficient monitoring of infrastructure, based on real-time data communicated by IoT devices. Smart contracts trigger the maintenance in case of any anomaly and automate the payment settlement leading to increased response time. Blockchain facilitates secure communication and data exchange between hardware suppliers, utility maintenance, and emergency response teams.

Reduce Expense Ratios

Potential use cases to further reducing expense ratio are:

Renewable Energy Certificate Issuance & Trading

Renewable Energy Certificates (RECs) are tradable energy commodities and represent proof that one megawatt-hour (MWh) of electricity is generated from eligible renewable energy resources. Renewable energy producers can sell energy and claim equivalent renewable energy certificates (1 per MWH). This can be traded in the open market as an energy commodity.

The current process of REC issuance and trading involves complex manual processes from generator verification, through certificate issuance, aggregation, trading to retirement. These processes involve high transaction costs due to the intermediaries which typically translate to 10% of a certificate's value[4].

Blockchain-based Renewable Energy Certification and Trading automates the process of certificate issuance, aggregation and sale, tracking, and retirement. The REC trading marketplace eliminates the need for aggregators or brokers and related process steps involved in the trading, optimizing operational costs. Smart contracts enable real-time settlement and tracking of renewable energy certificates from issuance to retirement.

Inventory Management

With deregulation, utilities face an urgent need to realize cost efficiencies. One major opportunity to do so is by optimizing their spare parts inventory.

Most utilities carry large volumes of expensive, relatively slow-moving spares because of a high degree of risk-aversion. Some utility companies maintain as much as 40% surplus inventory which can be up to the tune of $8 million[5] annually. These supply chains comprise multiple partners and each of these parties use their methods and systems for managing transactions and the movement of spare parts. Companies can face losses if they understock or overstock spares while anticipating risks.

Blockchain helps each party involved in the supply chain to connect with the others. It improves communication between parties and reduces errors. Blockchain helps in automating, recording, and monitoring activities involved in the spare parts management process; from ordering parts to stocking and distributing them. Relevant data is stored on the blockchain as transactions and shared across stakeholders on the network. The data on the distributed ledger can be accessed by all stakeholders of the network but it cannot be altered, making it transparent.

New Revenue Streams

Potential trends to watch out for:

Marketplace for Peer-to-Peer Trading

With the increased adoption of solar PV, more consumers are becoming prosumers. They produce electricity, sell it, or store it using battery technology.

Regulations around the wholesale electricity market and the lack of a peer-to-peer marketplace means that small-scale prosumers are unable to participate in the energy market. Utility companies purchase their surplus at low prices and sell it back to other consumers at standard tariff prices.

Blockchain-based peer-to-peer trading allows smaller energy prosumers to sell their surplus energy directly to other consumers without intermediaries. Consumers can buy electricity at lower prices, prosumers can derive greater benefits from their investment and the distribution grid can charge transaction/ maintenance fees for providing the infrastructure and facilitating the energy trade.

EV Charging Infrastructure

The main barrier to electric vehicle adoption is the range anxiety and a lack of public EV charging stations. Estimates suggest that $2.7 trillion[6] will need to be invested in charging stations to enable EVs to reach their forecasted potential of over half a billion vehicles by 2040.

A blockchain-based EV charging ecosystem will enable individuals to make their charging stations available for commercial use to maximize capacity utilization. A blockchain-based marketplace can catalyze faster adoption of EVs by coordinating the charging stations autonomously. EV owners can raise a request for charging and receive bids from listed charging stations thus creating a decentralized and transparent auction. EV owners can select the best bid matching their requirements and smart contracts can facilitate secure, peer-to-peer energy payments.

EV Battery Swapping Infrastructure

Battery swapping is effective for supplying power to EVs while mitigating waiting times at a battery charging station. Longer charging times also add to the problem - as it takes approximately 8 hours for AC charging type and up to 2 hours for DC.

A blockchain-based marketplace for battery swapping can address the challenges of range and long charging times. The blockchain-based solution will enable the EV owner and OEM to enter into a contract and agree on a time to get the battery swapped at the designated swapping stations by paying for just electricity and handling charges. EV owners will have the option to choose the best bid from the list of available swapping stations at any point of the journey based on the price and distance to get his battery replaced. A smart contract automates the contract management, billing, and settlement process.

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Conclusion

Blockchain has the potential to help utilities lower operational expenditure, increase efficiency, improve transparency, reduce capital requirements, and expensive upgrades. With blockchain, utilities can unlock new revenue streams by empowering consumers and prosumers to play a more active role in the energy market.

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