

WHITE PAPER / INNOVATIVE TRENDS FOR UTILITIES

# BLOCKCHAIN IN THE ELECTRIC & GAS UTILITY INDUSTRY AND HOW TO START NOW

BY Mike Beehler

Fast, efficient and secure transactions that can't be removed, altered or reversed – blockchain technology is projected to transform businesses. The power industry might have reluctance about this technological disruption, but careful evaluation and strategic testing could help utilities find benefits, opening a new era for the industry.



## WHAT IS BLOCKCHAIN?

Blockchain technology is a digital transaction ledger distributed throughout multiple computing resources.

With every transaction, nodes execute algorithms to evaluate and verify the exchange and come to a consensus about the validity of the entry, or block of data. If agreement occurs, the networks allow the block to be added to the chain of transaction data. The content within the data blocks and the links between blocks are protected by cryptography, so they can't be changed or destroyed.

Blockchain technology, also known as distributed ledger technology (DLT), records transparent, digitally signed, authentic and tamper-resistant information. The consensus model and digital ledgers not only create trust among participants but also integrity of the transaction, removing the need for a central authority to validate the deal.

Cryptocurrency, such as bitcoin, is a digital currency enabled using the blockchain protocol. Not created or controlled by countries or managed by banks, cryptocurrency is a peer-to-peer electronic currency system in which transactions are made and recorded using blockchain. While bitcoin is a public blockchain, private blockchain networks also exist, such as for co-ops, businesses, or other types of organizations or groups.

As noted in a Reuters article, blockchain technology “solves two key problems in the online world: transacting without the need of a trusted intermediary, and making sure those transactions can't later be altered, removed or reversed.” (“As Energy Markets Evolve, Blockchain Powers Up,” Reuters 2017)

Applications for blockchain technology are just beginning to unfold. Currently, blockchain is used as:

- Distributed ledgers that create traceability of all types of legal documents.
- Smart contracts, or cryptocontracts, that digitally verify or enforce the execution of predefined actions under established terms.
- An asset transfer mechanism for peer-to-peer transactions of any type without an intermediary.

Much goes into blockchain technology, and the concept can feel confusing or intimidating. Although the mathematics, algorithms and cryptology are advanced and somewhat difficult to grasp, projections are that blockchain, not unlike the internet, will transform how we live and work.



## APPLICATIONS FOR UTILITIES

Blockchain technology is broader than cryptocurrency and can be used wherever visible and traceable transactions are required. From supply chains to quality assurance, and peer-to-peer energy trading to fleet management, wherever fast, inexpensive and transparent tracking is needed, blockchain has the potential to deliver.

“What the internet did for communications, blockchain will do for trusted transactions, and the energy and utilities industry is no exception,” says Stephen Callahan, vice president of Energy, Environment & Utilities, and Global Strategies at IBM, in the Reuters article.

While blockchain is expected to improve operational efficiency, there are other ramifications for utilities. Blockchain technology and cryptocurrencies use a tremendous amount of energy mining for new coins and checking the blockchain integrity. According to Power Compare, bitcoin mining is currently estimated to use 29.05TWh of electricity each year, more electricity than 159 individual countries.

## BLOCKCHAIN FOR TRANSACTIVE ENERGY

Increased renewable energy generation, rooftop distributed and grid-connected solar power, customer-owned microgrids, and on-site energy storage — these trends not only altered the utility market but also created a new transactive energy model to receive compensation for electricity services in real time.

The concept of transactive energy is at the heart of all electricity markets — the existence of control systems that react and manage the exchange of energy as a function of consumer demand and market economics. With the growth of distributed energy systems, transactive energy can take on a whole new meaning, requiring smart device technologies that can meter distributed energy resources and potentially utilize blockchain digital ledger technology.

LO3 Energy is just one provider piloting the transactive energy model with its Brooklyn Microgrid (BMD) project and Exergy smart meter. The BMD enables residents and businesses to generate, store, buy and sell energy locally using a blockchain digital ledger albeit on a very small scale.

## BLOCKCHAIN IMPACTS ON CHELAN COUNTY PUD

Blockchain digital ledgers run algorithms that automate transactions and store digital records. Bitcoin and other cryptocurrency mining is a computational mathematical process that adds transaction records to a blockchain to create and add more bitcoins to the digital currency system.

Blockchain, whether used for bitcoin mining or another purpose or application, utilizes dedicated computers that need a lot of electricity to operate.

Chelan County Public Utility District (PUD) in central Washington state has seen an unprecedented demand for power as a direct result of bitcoin miners operating in the utility’s region.

As the value of bitcoin cryptocurrency surged, Chelan County PUD, and neighboring counties, had to determine policies, pricing, resources and staffing levels to deal with new high-density loads (HDL) for loads greater than 5 megawatts (MW). In addressing legitimate requests for additional power, Chelan County PUD is also dealing with unpermitted and rogue HDL that requires immediate attention to address and contain.

The impact of blockchain energy requirements for bitcoin mining has been significant. Where the average load is historically about 200 MW with a peak in winter of 491 MW, Chelan County PUD received four service requests for 100 MW or more and several inquiries for 10 MW to 50 MW for smaller, hobby connections.

Chelan County PUD has been challenged as it seeks to balance demand and strain on PUD resources against existing infrastructure, resource planning and serving the wider utility service area.





Blockchain optimizes and enables transactive energy by allowing fast and secure energy transactions on the grid that facilitate a balanced electricity flow. In addition, modernized transactive energy models could be leveraged by utilities to meet needs on the grid. These concepts are being tested in markets around the world to understand how this new policy can possibly improve the production and distribution of energy.

### **BLOCKCHAIN FOR SUPPLY CHAINS**

Bills of lading, letters of credit, compliance certificates, material disclosures, freight handling documents and purchase orders represent the predominantly paper-based world of supply chain management. Blockchain technology opens the possibility of modernizing supply chain administration and, in doing so, improving efficiency, productivity and security.

Blockchain technology is well-suited to facilitate smart contracts that are executed automatically when certain conditions are fulfilled, such as delivery of goods or services. The contracts and paper-driven supply chains in most industries are good candidates to utilize smart contracts for faster and more secure operations.

According to Miranda Marquit of *Supply Chain 24/7*, "With the use of smart contracts, you can make sure different suppliers are meeting their obligations.

You can see deliveries at multiple locations, and track shipments based on the fulfillment of smart contract terms."

Not only can blockchain technology better facilitate supply chain processes, but the nature of almost-instant transaction confirmations increases payment processes and shortens cash cycles for businesses. By using blockchain to replace documentation between supply chain parties, new data exchange methods can be developed to streamline processes and, in some cases, eliminate unnecessary third parties.

### **BLOCKCHAIN FOR VEHICLES**

From personal cars to company fleets, vehicles have not been left behind when it comes to incorporating smart technologies. Onboard navigation, GPS tracking, Bluetooth connections, emergency assistance and electric charging ports represent how vehicles have adopted new technologies that improve performance and convenience.

For company and trucking fleets, blockchain offers the chance to automate records of inspections, emissions and recall information, and even track operator safety to simplify asset management and utilization. Managing this data in a blockchain digital ledger consolidates and marries this information to provide insight into a vehicle throughout its entire life cycle.

According to Trucks.com, blockchain would allow trucking companies to “be able to maintain immutable records on each truck in their fleet, tied to every piece of maintenance given or damages incurred throughout the truck’s life — from the moment it rolls off the assembly line until it is sold again.”

For the electric vehicle (EV) market, a suitable charging station infrastructure network is developing at a slow pace. Indeed, consumers who have invested in EV vehicles are currently the primary owners of charging station assets, which remain idle most of the day at their homes.

Blockchain and peer-to-peer networks offer the potential to commercialize private, residential electric vehicle chargers, which otherwise wait for owners to return and be used to recharge vehicles overnight. This setup opens new income possibilities for residents and utilities by allowing individuals to charge from behind a customer’s meter, giving the customer credit for the consumption.

In California, a peer-to-peer charging network using blockchain technology is being piloted to allow EV owners to charge — and pay for — electricity using residential charging poles. In this network, electricity flows are recorded and the transaction made as the EV is charging at home, allowing the homeowner to earn credits from the utility. This model can also be used at hotels, shops, cinemas and other businesses looking to differentiate themselves, all enabled through a blockchain transaction.

## UTILITIES’ FIRST STEPS

For progressive gas and electric utilities looking to explore blockchain applications, the way forward may feel daunting. But utilities can move beyond taking a “wait and see” attitude and instead begin developing plans on how to pilot concepts at low cost and with low risk. Exploring ways in which other utilities and industries are applying blockchain offers insight into what low-commitment efforts are possible.

## TRANSACTIVE ENERGY PILOT

Explore and evaluate whether peer-to-peer microgrid energy applications are appropriate for your region. Are there communities that have actively adopted rooftop solar? Concentrated business districts of smart city pilots

that are receptive to shared energy models? Or public or municipal buildings that have implemented green energy solutions? All of these might be open to pilot a new energy model using blockchain technology as the facilitator.

Consider partnering with a new energy facilitator, like LO3 Energy, to identify pilot opportunities and logistics. The Energy Web Foundation, a partnership between Rocky Mountain Institute and Grid Singularity, also provides education and advice with a goal to accelerate blockchain applications in the energy sector.

## SUPPLY CHAIN OR WAREHOUSE PILOT

View blockchain as an efficiency enhancer for your utility and determine if there is a project or process that could be streamlined or improved. Can transmission or repair equipment in the warehouse be tagged and tracked? Is it useful to electronically log the quantity, transfer and use of assets like trailers, containers, pallets or supplies? Can improvements be made in supply chain purchase orders, change orders or receipts? All are open to efficiency enhancements using blockchain.

If your utility is exploring or already has implemented smart grid capabilities, blockchain technology could be tested to ease the metering process. Residents who have adopted smart metering may be a prime audience for a blockchain pilot to test more effective monitoring, tracking, billing and crediting renewable energy production and use.

Starting small and developing pilot programs with tangible assets or systems can help break down intimidation barriers while minimizing risk to the ongoing operations.

## COMPANY VEHICLE FLEET PILOT

Consumer EV charging offers a unique opportunity for utilities to develop new business models and test peer-to-peer networks. Evaluate other blockchain pilot programs for residential EV stations to see if these are feasible or to determine if there is demand that warrants testing this approach.

Consider establishing a utility vehicle fleet pilot to evaluate how to maximize fuel efficiency, track repairs or develop

a log of fleet history and maintenance. Using blockchain technology, utilities can not only get better insight into fleet maintenance and management, but the data also can provide an understanding of outage trends and repair call times and identify areas where efficiency improvements are needed.

Optimizing company vehicle fleets is a goal broader than the utility industry. The Blockchain in Trucking Alliance (BITA) is a forum aimed at developing blockchain standards and providing education to the freight industry. Consider getting involved with industry peers and events as blockchain pilots are developed.

### A BLOCKCHAIN FUTURE

Blockchain technology is a natural evolution of our ever-growing digital world. With the expansion of smart technologies sensing, tracking, communicating and storing data, it seems only natural that a digital ledger of transactions could be useful, if not necessary.

Representing another area where physical and digital worlds intersect, blockchains offer the potential for secure, traceable and virtual transactions within organizations and among suppliers and customers, and without a need for an intermediary.

While it might be tempting to put off considering how blockchain technology and bitcoin operations will affect your utility, be aware that applications are already out there. Many opportunities exist for the utility industry to not only benefit from but also lead.

### BIOGRAPHY

**MIKE BEEHLER, PE**, is a vice president at Burns & McDonnell. Mike has written and presented extensively on the subjects of security, reliability-centered maintenance, program management and the smart grid. More recently, Mike has written, presented and consulted on industry megatrends, the integrated grid and smart cities. He has a Bachelor of Science degree in civil engineering from the University of Arizona and a Master of Business Administration degree from the University of Phoenix. Mike is a registered professional engineer in eight states, a member of IEEE and CIGRE, and a Fellow in the American Society of Civil Engineers.

### IMPACTS ON UTILITIES

The three pilot application areas might affect one or more of the following:

- Safety
- Reliability
- Affordability
- Sustainability
- Compliance
- Customer service
- Employee satisfaction
- Shareholder value