Blockchain jolts the energy market

A POTENTIAL POWER MANAGER

It started with bitcoin, but the use of blockchain technology is quickly broadening beyond cryptocurrencies. Trade financing, pharmaceuticals and music licensing are among the industries already harnessing blockchain. As for the energy sector, one way in which the technology is currently viewed is as a potential platform for managing power markets. For it to play that role, blockchain will need to prove its flexibility and cost-effectiveness

Blockchain: a primer

Blockchain is a type of technology originally developed as a digitized public ledger for cryptocurrency transactions. It has become the generic description of a technology that is a distributed way of storing data. In other words, the blockchain database isn't housed in any single location. The records it keeps are public and easily verifiable. New data ("blocks") are added sequentially over time, and no deletion or modification of the data is possible. That makes it in theory an incorruptible digital database of economic transactions, which is why advocates see huge potential for its use in settling stock market trades or registering changes in the ownership of property, to give just two examples.

This public blockchain model has two main advantages over traditional centralised databases. First, no trust is required among the participating parties – hence the charge of many central bankers that cryptocurrencies are good only for criminals. Instead, trust is placed in the working of the system: in a process known as "consensus", the network of computers holding the blockchain has to agree on which block is added next. That being the case, there is no centralised store of information for a hacker to corrupt. Second, blockchain operates without government involvement or the need for a judicial system to enforce contracts. Seen in that light, it is the dictionary definition of anarchism.

But there are disadvantages too. First, performance may be slower than with a centralised system and the consensus process consumes vast computing power. The energy used to verify bitcoin transactions is disputed, but by some estimates it is equal to the annual electricity consumption of Morocco or Ireland. Second, computer security concerns have not gone away. There have been a number of well-publicised instances of cryptocurrency theft.

What's this got to do with the energy market?

A public blockchain, then, might be the right solution in a completely decentralised system with zero trust among parties. At first glance, energy markets do not seem to fit the bill. They involve the delivery of "real-world" power, not entries on a ledger, and so ultimately need some sort of physical verification and therefore trust - in meter providers, etc.

Yet the decentralised nature of blockchain is suited to the imperative to introduce greater flexibility into energy markets. This need arises because there are expected to be many more sources of local energy supply in future, particularly renewables – think solar panels on rooftops and discharging electric vehicle batteries. There will also be many uses for these assets – for example, providing (or drawing) power to ensure the local network capacity is not exceeded, or keeping the national electricity system in balance. Blockchain applications may make it easier to "stack", or display, multiple bids for such locally produced energy, thus increasing its value and deepening market liquidity for spare power. They may also allow third-party developers greater access to design innovative apps that link up with the database, perhaps connecting it to other data sources and developing new products.

Some experiments have already taken place. Blockchain was first used to trade power in 2016, when the owner of a solar panel on a micro-grid in Brooklyn, New York, sold his energy to a neighbour. Amsterdam boasted the first European trade later the same year. The UK joined in this April, when residents of an estate in Hackney, east London, traded 1kWh of solar power between buildings. From small acorns, mighty oak trees grow…

A brief aside on blockchain theology

Blockchain evangelists will object that these examples are not "pure" applications of the technology. They are certainly a different beast from bitcoin. For a start, we are often not talking about anonymous "public" blockchains but closed networks whose permissioned members are – for reasons of trust - identified. This means that blocks can be added to the chain by "proof of authority". Bitcoin, by contrast, works on a "proof of work" model, which requires much more energy to conduct the digital checks underpinning the cryptocurrency. The corollary of the new model is the need for a bespoke governance arrangement to ensure the legitimacy of the scheme. There is a third alternative, "proof of stake", which requires a user to lodge some form of collateral in order to validate a record on the blockchain. Proponents of this option argue that it will be able to arrive at a distributed consensus without the need for either energy-intensive calculations or an external authority. However, distributional concerns may arise, as it may only be those who can afford to put down a stake that stand to get ever richer.

Cost, flexibility and governance

Leaving to one side the debate as to what constitutes blockchain, we as economists are more preoccupied with the cost of various models; whether the systems are flexible enough to cope with conditions of uncertainty; and the market structures they are likely to spawn.

Distributed ledger technology is in its early days, and there is no real evidence yet whether or not it will prove to be cheaper than traditional systems. As new sources of local power come on stream, the need to balance fluctuations in supply and demand can only grow. Theoretically, blockchain could be able to do that more efficiently than a grid operator's centralised computer, allowing both local buyers and sellers of power to post short-term bids.

Another advantage of blockchain, its boosters argue, is that it is a system that can be built one block at a time, obviating the need for heavy sunk investment, and allowing future use cases to be "bolted on". Sceptics counter that distributed technology, almost by definition, begs the question whether it can be rolled out at scale effectively and cost-efficiently.

There is also the issue of the supervision of private blockchains. Regulators may still be struggling to get to grips with bitcoin's anarchic "proof of work" model, but distributed ledger technology also raises profound questions. Who – if anyone - should oversee new blockchain energy networks? Could deployment of a potentially powerful new technology be stifled by intrusive regulation? Conversely, if there is too light a touch, could de facto unregulated monopolies emerge that then have to be brought to heel?

Conclusion

Global energy markets are experiencing rapid change, from decarbonisation to the proliferation of smart grids and meters. The accent is on increasing flexibility, on both the demand and the supply side. These trends will continue with or without blockchain. The challenge is to apply distributed ledger technology to smooth the transition to a more efficient, responsive energy market - to the benefit of producers and consumers alike.

Sarah Deasley
+44 (0) 207 031 7112
sarah.deasley@frontier-economics.com

David Bothe
+49 (221) 337 131 06
david.bothe@frontier-economics.com