The Blockchain Buzz

Over the past several months, there has been an increase in the amount of reference to Blockchain technology and what it can do for the renewable energy sector. Much has been written about this technology (article 1, article 2). A number of global companies have even started to trial blockchain based energy trading schemes and are doing so with impressive market momentum.

Some may know blockchain as the technology which underpins Bitcoin trading. But what exactly is blockchain and how can it be used for energy trading? Although GSES is not an information technology (IT) specialist, as a renewable energy specialist we feel that it's important to relay how this technology might impact upon our readership, so we have put together this simple overview. Don't be daunted by the initial technical content, it gets simpler as the article proceeds, with a couple of comparative examples.

In simple terms blockchain is defined by a ledger of transactions. This ledger is very similar to the ledger kept by a bank or more pertinently, an energy retailer. The key difference however with blockchain is that this ledger is not kept by a single entity but is distributed across all participants (which are often called nodes) in the network. This means that all transactions can be seen by everyone in the network. But if all transactions are visible, then how are they secure? Blockchain is special in that it uses complex mathematical algorithms to pair a digital signature with each transaction, making each transaction unique and secure. The transaction also goes out with a public key to show where the transaction is going. This methodology gives security to the users of blockchain but it doesn't solve the problem of guaranteeing the validity of the transaction itself. To do this, an innovative method is employed; the method which gives this technology its name "blockchain". Blockchain uses cryptographic hash functions (ie. complex maths equations) in each block (ie. transactional ledger entry). When a block, representing a transaction or set or transactions goes out on the network, the entire network begins to try to decode this hash function. Any single node may take hours or more likely days to decode the function but in a large distributed network, where the sum of all nodes represents a huge amount of computing power, the function may be decoded by a random node in the order of minutes or even seconds. Once a function is solved, it allows the block to be placed in a chain which verifies the sequence of the transactions. This is important as it makes it highly unlikely that a single node will be able to generate false transactions, and solve the function of multiple blocks in a row. As more blocks are solved more assurance is gained about blocks further up the chain since blocks reference the block before them and the block after them. So, it makes sense then, that if it is highly improbable for a single node to solve several blocks in a row and create a chain, then it is also highly improbable for a single node to be able to create false transactions.

So in essence the whole system is based on complex mathematical functions and algorithms and a shared agreement on the validity and order of transactions. The distributed nature of the system means that no trust is necessary between participants, only the ability to interact with the blockchain network is required. The only trust required is that of the network itself, which usually comes with a deeper understanding of the security algorithms used.

While blockchain provides the functional means and the security to make transactions, given that the transactions are computer based, they can then be quite complex. For example, the transaction can have a lifetime associated with it such that if the transaction isn't completed by a certain time, the transaction is automatically cancelled. The transaction can set upper and lower limits, creating an acceptance window for a certain transaction. The transaction can even create a hierarchy of transactions, giving the transaction criteria for acceptance based on preferred outcomes.

The ride share platform 'Uber' makes a simplistic example of what could be. Imagine you are a "node" and want a ride somewhere, you open the app and say where you want to go. The app then connects you to a number of local drivers (also nodes) who can accept your request. An algorithm in the background then calculates what the fare will be including surge charges based on current market conditions. If the fare is too high or if the "node" which accepted your request is somehow unsatisfactory, you can cancel. Blockchain works in a similar way, but the transactions can be automated and are secured through the blockchain instead of through the central entity, in this case the company Uber. In fact, a new competitor of Uber is using blockchain technology in exactly this way. La'Zooz (http://lazooz.org/) is growing a community of drivers and riders which will all be connected via the blockchain.

Another simple and perhaps more relevant example; a homeowner with solar PV generation and an energy storage system may decide to participate in a blockchain based trading system. The homeowner may set up trade criteria such that other nodes may purchase energy or ancillary services (e.g. grid support functionality) from the homeowner under certain conditions. In nearly real time, the system would decide if it is more lucrative for the homeowner to use or store the PV generated energy or to sell it to another node, whether that be energy at a defined rate to a homeowner without a PV system or to a Distribution Network Service Provider looking to purchase grid stabilisation ancillary services. The transaction decisions are made based on the most equitable outcomes and the transactions are verified soon after through the blockchain framework.

Using blockchain technology, one can imagine a whole new energy network with the following features:

- All participants can be unique. No longer All participants can be unique. No longer does the network have to view "demand side" or "supply side". Even the poles and wires themselves can be viewed as a participant through which electricity trade is conducted.
- Consumers no longer need to search for the best energy deal because the system is continually looking to purchase energy at the best rate all the time in the background.
- Producers can sell or store their energy/power based on a set of rules and based on real time market conditions.
- Energy transactions are transparent and secure by using the blockchain. *Though blockchain

technology can be appropriated by electricity market incumbents, it does present a significant risk to the business plan of most centralised market participants (I.e. big power generators and retailers). Existing market participants are going to have to change their business strategy quickly in order to stay relevant in the long term. If energy companies are willing to change however, the future may a bright one for all involved. *The main hurdle for blockchain is public acceptance of the technology and its operational methodology. Most trading, whether it be real estate, company stock, energy or otherwise has grown to involve centralised "trusted" entities. For example, real estate sales typically involve agents, solicitors, conveyancers and banks; Stock trade involves government regulators, brokers, and market operators; Energy involves government, large power generators, retailers and network operators. For a truly distributed energy system to operate with a distributed trading platform requires a shift in public perception of how a market should actually work.

To help bring this technology into the mainstream, Standards Australia has taken the very progressive step of assuming the secretariat role of an international technical committee for the development of an International Organisation for Standards (ISO) blockchain standard. This standard will help to provide oversight to the development of blockchain technologies but more importantly, help to bring blockchain into the foreground of potential market mechanisms.

Blockchain is a truly disruptive technology, not just for energy or for banking but for all types of transactions. It exemplifies the global transition to a hopefully more equitable world but also a world with a high reliance on technology and distributed frameworks.

GSES is constantly investigating ground breaking and cutting edge technologies so that we can pass this information on to our students and our customers in a tangible way. Be sure to keep an eye on GSES courses as this exciting technology evolves over the coming years.

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