ELEXON

Blockchain based Energy Trading: Regulatory changes proposed and needed to facilitate Blockchain in the GB Energy Market

Date	**September 2021**	Classification	**Public**

Introduction

Blockchain is one the most exciting new technologies to be developed in recent years, and in the energy sector it could revolutionise the way we produce, and buy electricity and gas.

This paper focuses on the electricity side of the equation but the key elements of this discussion could also apply to gas trading.

Now imagine a scenario where residents in a block of flats can trade electricity generated by solar panels between themselves, with the trades being tracked by Blockchain. It is the sort of development that could play a big part in the transformation and decarbonisation of the sector.

Elexon manages the Balancing and Settlement Code (BSC), which ensures that payments for imbalances in wholesale electricity supply and demand are settled accurately. We therefore play a key role in the energy market. Elexon is supporting the development of nationwide electricity 'flexibility platforms' to enable a more flexible trading market where existing grid capacity or demand side response offers could be turned up or down on demand to ensure that the grid is always balanced. This would ensure a more locally balanced system reducing the need for National Grid Electricity System Operator (SO) to take more balancing actions at a more central level (as is currently the case).

A flexibility platform using Blockchain technology could enable peer to peer trading enabling local balancing by providing an immutable record of smaller transactions at a fraction of the cost. However, it is important to remember that Blockchain is a technology alternative and not a governance one. Governance measures will still be needed to ensure that records generated in Blockchain transactions are created and used in an appropriate way. Also, it would be useful to keep in mind that Blockchain is a ledger technology that records data. The quality of data is therefore not influenced by it. As such, where the quality of data being recorded is poor, the outcomes are likely to also be poor. Clear procedures will be necessary to ensure that responsibility for negative outcomes can be accurately established. In a world where data is becoming a new currency, governance procedures will need to put in place to ensure that sensitive information being shared via Blockchain technology is protected.

The current regulatory framework is designed to service the needs of a unidirectional market– that is where electricity always flows from a generator to a consumer. However, the advent of subsidised embedded renewable generation has led to the creation of a new consumer type- one that is a producer as well as a consumer of electricity, a "prosumer" for short. We therefore now have a market where electricity flows bi-directionally. Added to that is the fact that most of the electricity generated by the prosumers is of an intermittent nature. The more unpredictable the supply the higher the volatility of the system price and the higher the cost of balancing actions leading to higher consumer bills.

Digital energy platforms based on distributed ledger technology including Blockchain could reduce transaction costs and consumer bills through optimisation of energy processes while simultaneously improving security of supply and promoting sustainability by facilitating renewable generation and low-carbon solutions; potentially helping to solve the energy trilemma.

However, radical changes in regulation will be necessary to ensure that technologies like Blockchain can be utilised to their fullest extent to solve the new problems energy market. One of the key ones being, changes to the 'supplier hub' model which will allow traditional suppliers to coexist with new models while allowing prosumers to take more control over their electricity supply needs without affecting the sanctity of energy trades. This needs to occur while maintaining or strengthening existing protections for vulnerable customers.

The energy sector is changing rapidly and regulation needs to anticipate future developments and actively support innovation. This paper takes a close look at current policy and regulation applicable to energy trading and more

specifically the changes necessary to support more flexible trading in GB. This paper also examines the characteristics of Blockchain based trading and how it could address the energy trilemma and help to deliver the net-zero agenda.

This paper examines Blockchain technology and how it could be implemented in energy trading, the current state of play in the market, the key regulatory challenges that will need to be met to enable full advantages of Blockchain technology to be applied in energy sector trading, Elexon's role and the upcoming changes in regulation that are likely to facilitate the advent of Blockchain based energy trading.

Background

During the 1990s, the UK's electricity and natural gas industry changed from a Government controlled monopoly to a competitive market. During this process a commodity market for wholesale electricity transactions and natural gas delivery was established. Just like other commodities wholesale gas and electricity prices are driven by traders' perceptions of the relationship between supply (how much is readily available and at what cost) and demand (how much is required now and in the future).

The energy sector in the UK is heavily regulated with two distinct regulatory regions, GB and NI. Any person engaging in the generation, transmission, distribution and/or supply of electricity or gas in GB must have a licence under the Electricity Act 1989 or the Gas Act 1986 as appropriate or must benefit from an exemption. The regulatory framework is complex and constantly evolving. Regulation in general has been perceived as barrier as there are a number of fixed costs and environmental programmes to meet. In 2018 Ofgem[1] launched a review of energy codes following criticisms from industry about the system and governance, pointing out that it is lacking coordination between the different code bodies and fragmented, with several code panels and bodies creating a complex institutional landscape. Overall, this leads to a lack of representation from smaller and/or newer parties and is a barrier to new entrants and innovation.

Further, GB's electricity and natural gas industry has broadly three main physical asset owner classes (there are also Meter Asset Owners). Generation Asset Owners, Transmission Asset Owners and Distribution Asset Owners. Gas and Electricity are differently treated and are subject to comparable but different requirements as electricity cannot be stored in the same way as gas. This is because, unlike electricity, gas is compressible and there is an inherent elasticity in gas transmission and distribution networks which will never exist in electricity networks.

The electricity transmission network transmits high-voltage (typically 400kV) electricity from where it is produced to where it is needed throughout the country. The network extends across Britain and nearby offshore waters. It is owned and maintained by three transmission companies, while the system as a whole is operated by a single SO.

The SO is responsible for ensuring the stable and secure operation of the whole transmission system.

Electricity generation in the UK comes from three main sources – gas, coal-fired power stations and nuclear.

A significant and growing proportion of electricity is supplied by renewables. Renewable energy sources broke records throughout the year for their contribution to UK's overall power mix, providing a 40% share in power generation for the time in Q1 2020 and remained above this level until the end of Q3 2020.

The current regulatory framework is designed to service the needs of a unidirectional market– that is where electricity always flows from a generator to a consumer. This is because bulk of the generation was typically undertaken by large generation plants which directly connected to the transmission networks. Electricity would be generated at a high voltages and would be carried through high voltage transmission lines across the country so as to avoid losses to consumers connected at lower voltages to various distribution networks. The direction of supply was therefore always unidirectional.

'Winds' of Change

All of this changed with the introduction of the Climate Change Act 2008 where the UK committed to legally binding greenhouse gas emissions reduction targets of 34% by 2020 and 80% by 2050 as compared to 1990 levels. Subsidy regimes like Feed in Tariff (FIT), Renewable Obligations Certificate (ROC) introduced subsequently encouraged the uptake of renewable generation. Most of these were smaller generation assets exporting at lower voltage levels than typical large transmission connected generators. More and more renewable generation started to be connected at the distribution level with exports using the distribution networks to reach the consumer.

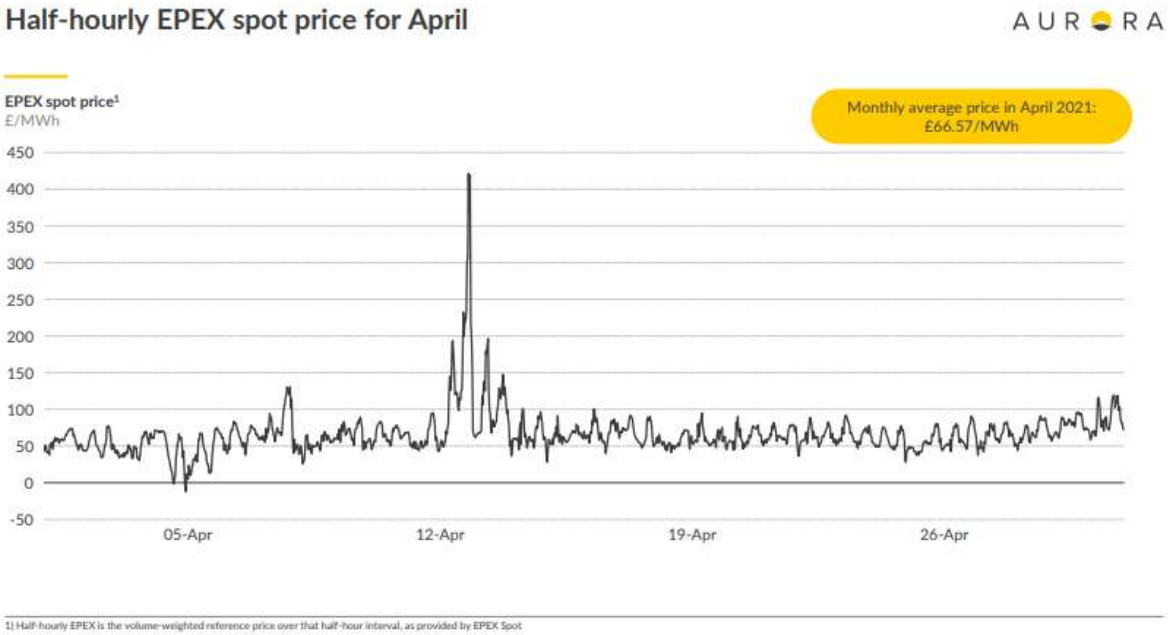
[1] (Ofgem, 2018, Ofgem and BEIS, 2019)

Added to that is the fact that most of the electricity generated by renewable resources is of an intermittent nature. This presented a challenge in and of itself as intermittent generation is far less predictable than electricity generated by baseline generators like coal and nuclear plants, which were also beginning to be decommissioned at the same time.

Also, electricity cannot be stored in the same way as gas (albeit large scale deployment of battery technology is enabling electricity storage, we are still a good way away from effectively storing electricity system wide in the same way as gas is stored). Electricity must therefore be balanced on a second to second basis to prevent blackouts or brownouts. It follows that the more unpredictable the supply the higher the volatility of the price of electricity in wholesale markets and also the higher the cost of balancing actions required to be taken by the SO, ultimately resulting in higher consumer bills.

Recent price trends in the wholesale electricity spot and day ahead markets are depicted below:

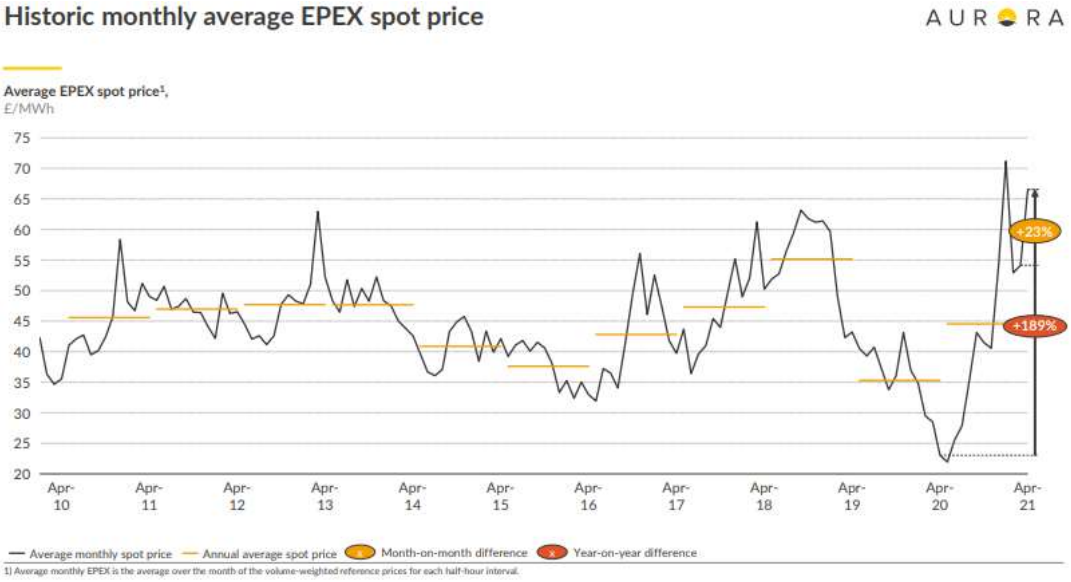
Figure: 1



Source: Aurora Energy Research Thomson Reuters

Figure: 2

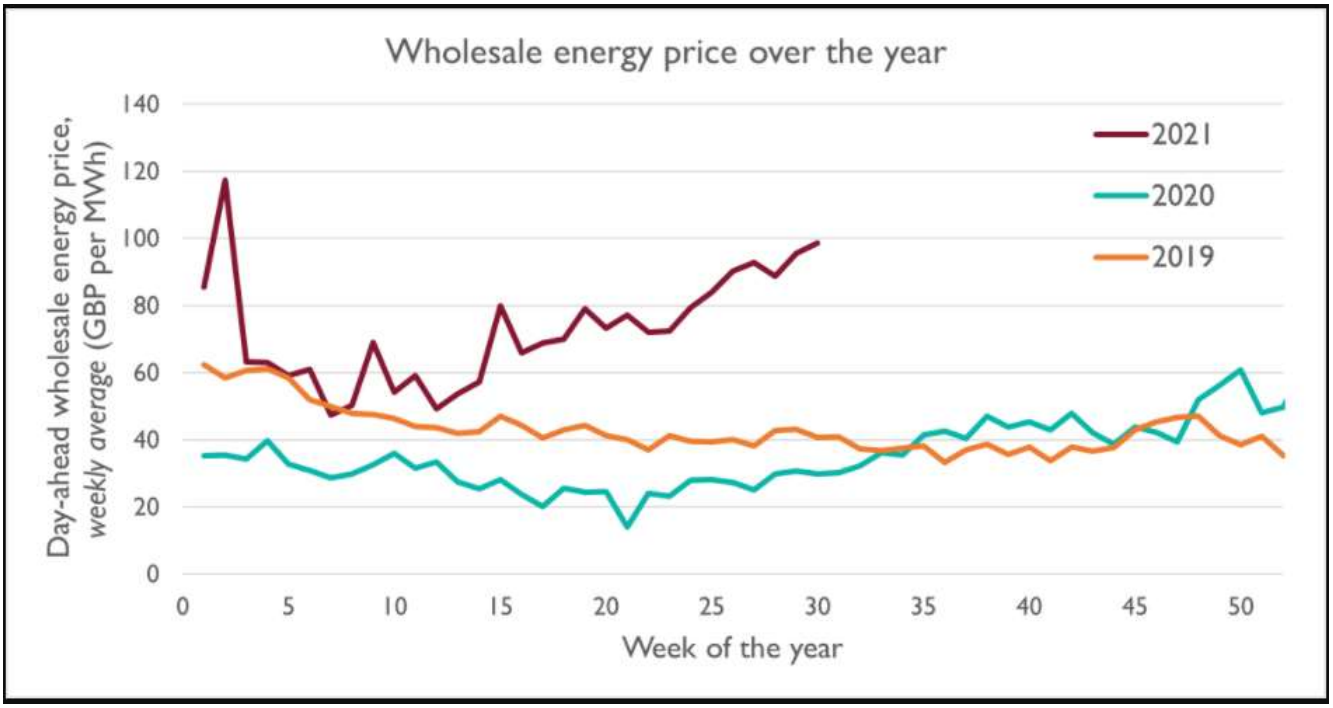
For comparison the historic monthly average spot price is as below. As can be seen the month-on-month change in power prices is +23.0% with year on year change of +188.9%.



Source: Aurora Energy Research Thomson Reuters

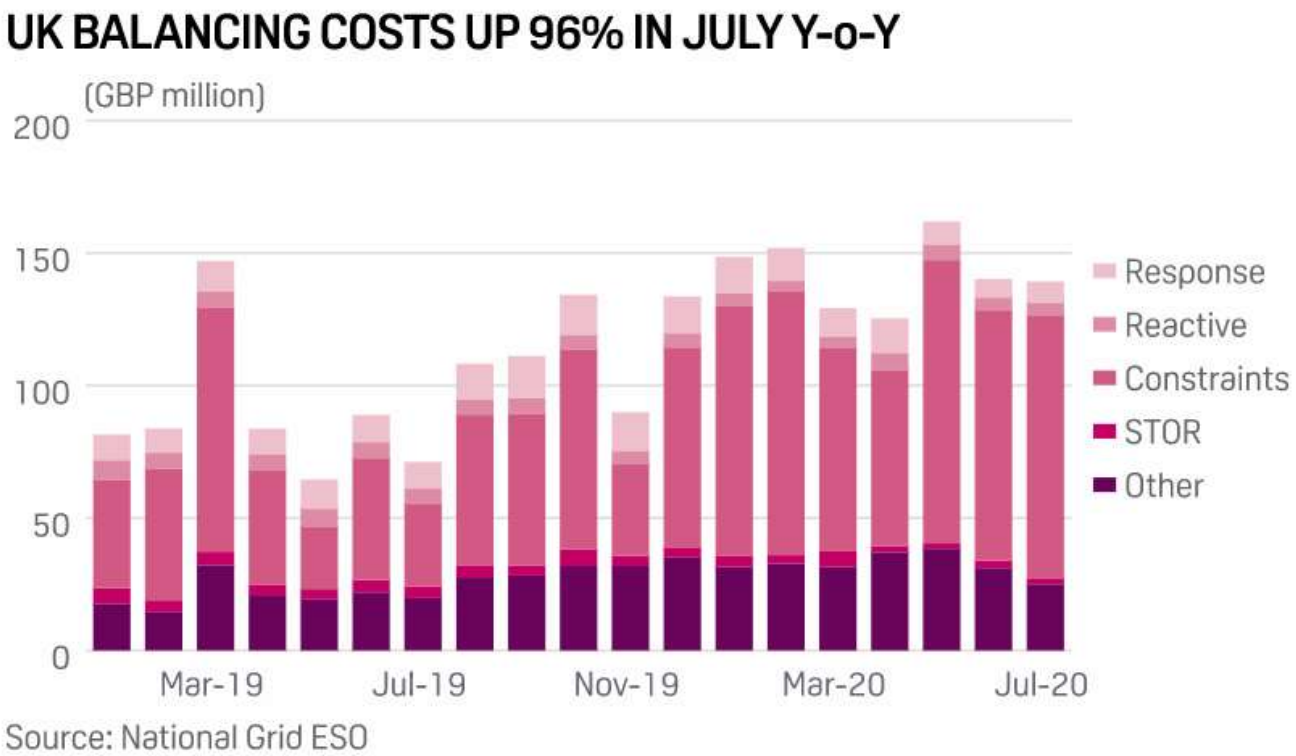
Figure: 3

Day ahead prices also continue to exhibit the upward trend:

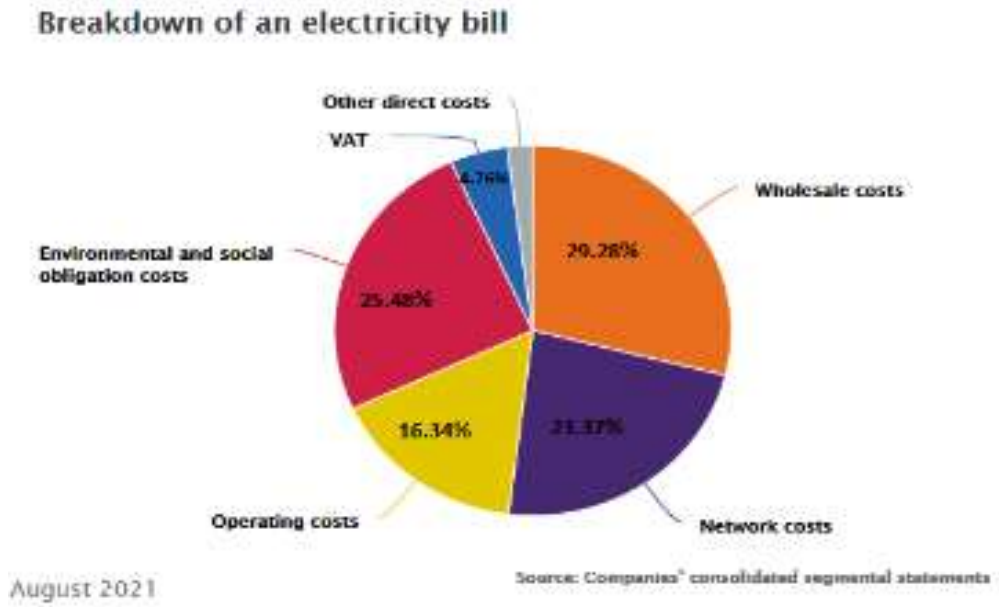


Source: http://everoze.com/app/uploads/2021/08/2021-08-05-Energy_price.png

Balancing Costs: Ofgem noted that between March and July 2020 balancing costs totalled £718m – '39% higher than expected costs for this period'.



Nearly 30% of the consumer bill is made up of wholesale costs with network costs which includes the balancing costs (Balancing System Use of System charge or "BSUoS") making up over 23% of the consumer bill.



Source: Ofgem

Changes to the current system are therefore necessary as it's socially, economically and politically unpalatable for electricity prices to remain high or get higher!

Current state of play

Digitalisation, Decarbonisation, Decentralisation and Democratisation

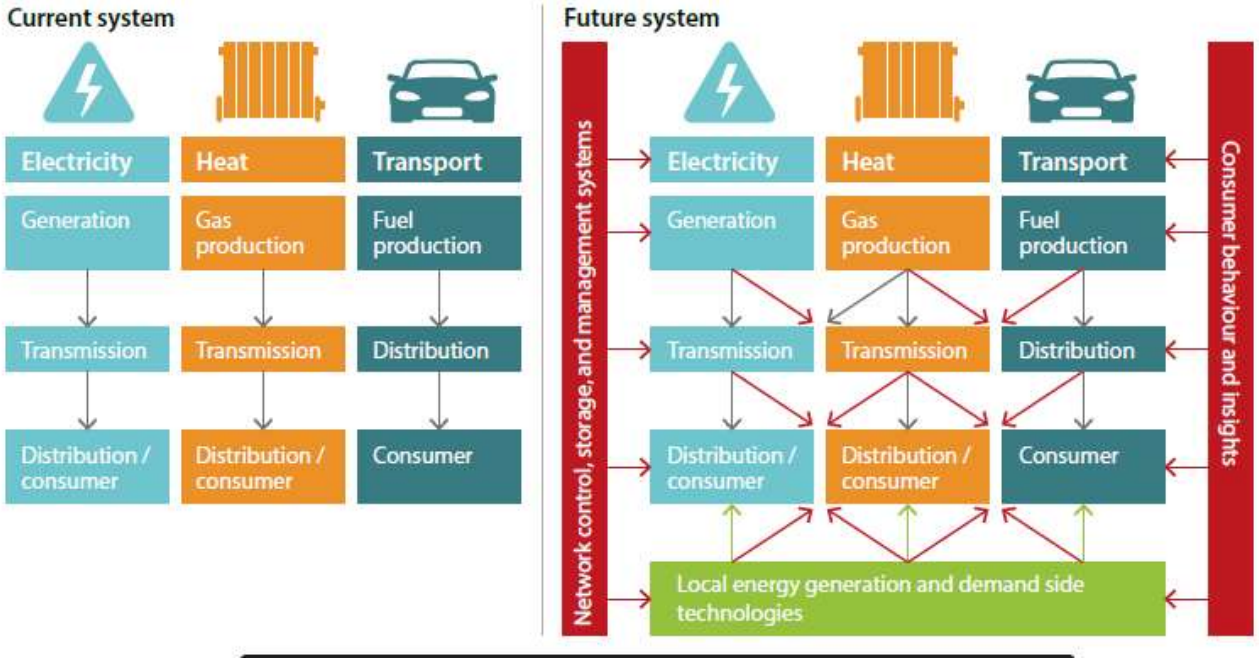
Increasing amounts of decarbonisation, decentralisation and democratisation are changing the energy landscape significantly and quickly. The challenges experienced by the current system have brought the need for digital energy management platforms into sharp focus. The "Working Paper 2: Digital energy platforms" published by EnergyRev in July 2020 specifically notes that "at the system level the use of data could enhance efficiencies through improved knowledge of asset availability and status, and through better coordination between transmission- and distribution-level operators, as well as suppliers (who have the most complete, yet not comprehensive, consumption records), contributing to better balancing of supply and demand."

Millions of embedded demand and supply assets currently 'invisible' to the SO, connecting these via a digital energy platform could bring improved system efficiencies which could then translate to cost savings for end users.

With an increased uptake of electric vehicles and charging technology anticipated to connect at the distribution level, digitalisation of the network will allow data, communications and analytics to be used to improve the efficiency, resilience and experience of the energy system. Customers are likely to take a more pro-active role as individually owned assets will be able to provide flexibility to the system, and new markets could allow trading between households or communities.

Digital energy platforms are already in use to some extent for active grid management, but other areas of the energy sector such as heating and transport have not been yet been tapped. Nonetheless, as digitalisation continues to progress in energy services, a more integrated energy system is likely to emerge, challenging existing boundaries between the electricity, heat and transport sectors through the use of a much more flexible system.

Additionally, as pointed out in EnergyRev's Working Paper 2, for the energy system to be truly consumer focussed "provisions must exist for consumers to switch between different commercial offers and technology choice."



Source: https://www.energyrev.org.uk/outputs/policy-and-regulatory-landscape-review-series-working-paper-2/

A flexible system is therefore key to overcoming the challenges faced by the energy system.

In 2015, the Committee on Climate Change (CCC) noted that improving the flexibility of the GB electricity system and making better use of low carbon generation could translate to system cost savings of £3–8 billion per year to by 2030 and £16 billion per year by 2050[2] .

Ofgem's decarbonisation action plan[3] published in February 2020 further sets out steps to make the electricity system more flexible and supports the creation of flexibility markets. It puts innovation and exploration of technologies at the heart of its decarbonisation plan noting that routes to more transparent flexibility markets need to develop. The plan sets out that this will be driven by greater data availability and transparency, interoperability of platforms and systems and reduced barriers to entry for new, innovative entrants.

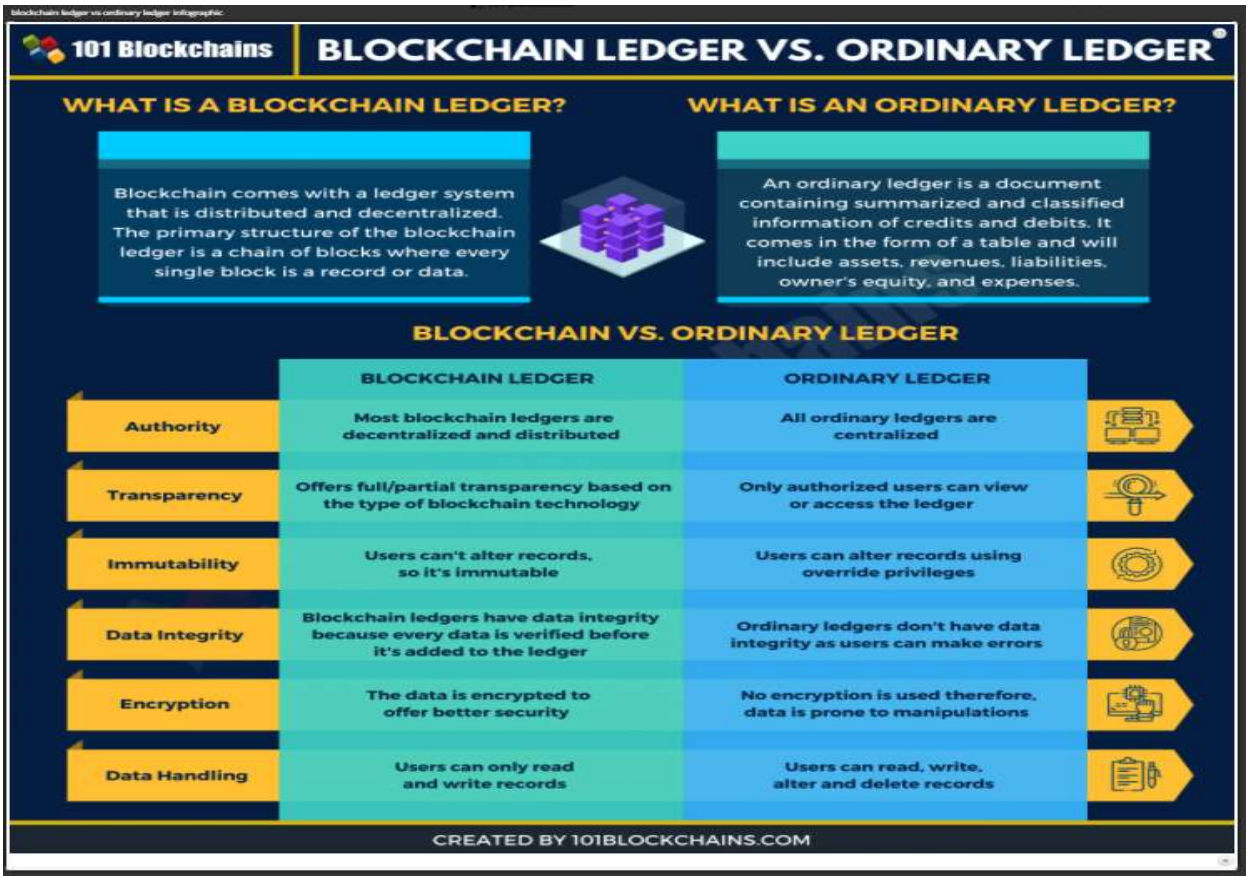
What is Blockchain?

Blockchain is a type of distributed ledger technology which typically underpins the functionalities provided by digital energy platforms. Distributed ledger technology (DLT) is a decentralised database managed by multiple participants. DLT imbibes technological infrastructure and protocols that allows simultaneous access, validation, and record updating in an immutable manner across a network that's spread across multiple entities or locations.

Each block in the chain contains a number of transactions, and every time a new transaction occurs on the Blockchain, a record of that transaction is added to every participant's ledger. Blockchains are constantly and continually growing as blocks are being added to the chain, which in turn significantly adds to the security of the ledger. Blockchains are therefore able to allow peers to make transactions without the need for an independent central authority or intermediary.

[2] file:///C:/Users/Aditi.Tulpule/Downloads/CCC_Externalities_report_Imperial_Final_21Oct20151.pdf
[3] file:///C:/Users/Aditi.Tulpule/Downloads/ofg1190_decarbonisation_action_plan_revised.pdf

How is Distributed Ledger different from Ordinary Ledger?



Stated Benefits of Distributed Ledger

Better Transparency & Data Security

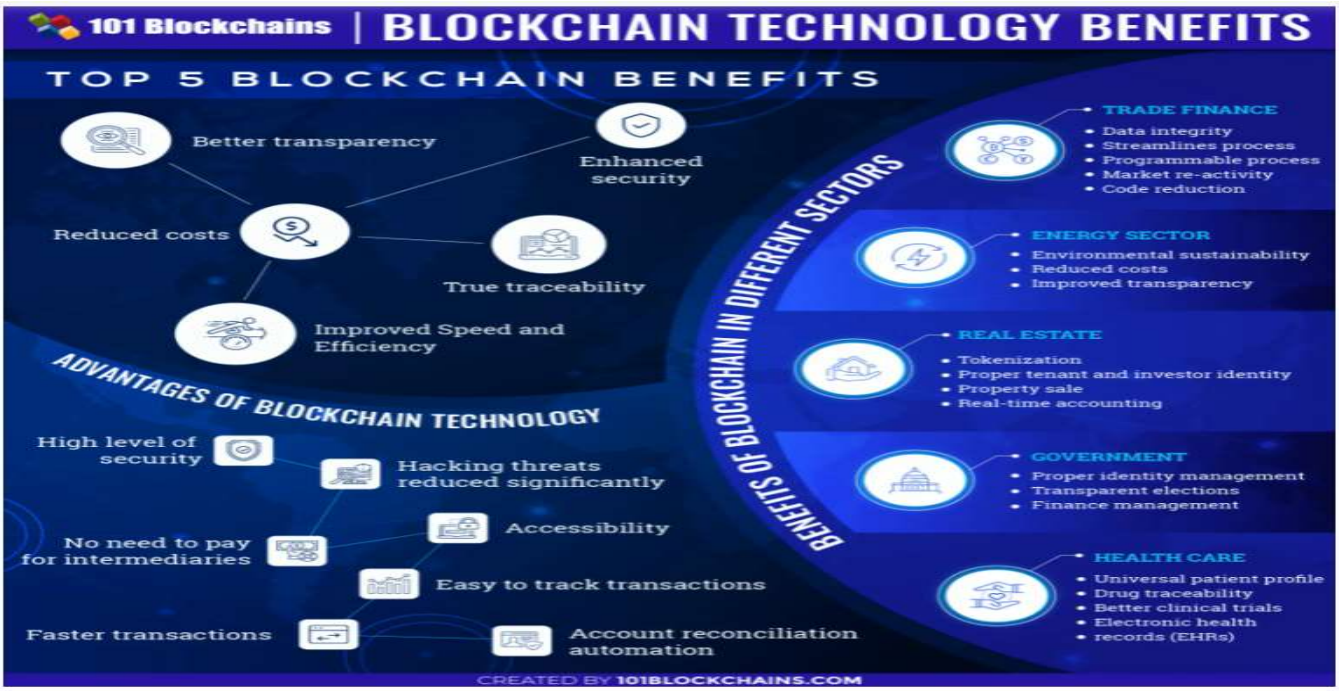
One of the prominent aspects of a Blockchain ledger is that it offers full transparency for all users. This means that anyone can see the ledger whenever they want but they cannot edit it. A Blockchain ledger is therefore a much more secured approach to the ledger system as its immutable, and no one can alter any documents or any data once recorded.

Distributed Ledgers

Based on the Blockchain type, the ledger is distributed among the nodes. This means if one block in one chain was changed, it would be immediately apparent it had been tampered with. If hackers wanted to corrupt a Blockchain system, they would have to change every block in the chain, across all of the distributed versions of the chain making it nearly impossible for cybercriminals to penetrate the system

True Traceability

As the records are verified before a node adds them into the ledger, it's easier to track or trace any data. This is a common use case of Blockchain that many industries are using; specifically, Blockchain for supply chain is widely popular and was recently used by the NHS to trace and track cold chain maintenance for Covid vaccines.



(Source: https://101Blockchains.com)

How Blockchain could be adopted in the energy sector

Facilitating Peer-to-peer (P2P) energy trading

DLT/Blockchain-enabled P2P energy trading could allow prosumers to sell their surplus electricity directly to local consumers without the need for a retailer, enabling mutually beneficial transactions. The prosumers can benefit from this arrangement by earning more than they would through feed-in-tariffs or Smart Export Guarantee tariffs, while consumers could pay less per kWh and express their preference for renewable energy without the need to own the technology.

Internet of Things applications

The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction (Techopedia).

The German Energy Agency notes that blockchain technologies have the potential to improve the efficiency of current energy practices and processes, can accelerate the development of IoT platforms enabling a more connected and efficient living environment.

Supporting the creation of decentralised marketplaces

The disadvantages of the centralized energy system, such as the heavy loss of energy in the long-distance transmission and distribution process, and the low fault-tolerant ability of the system, are becoming increasingly apparent. With a significant share of generation now connected to distribution networks, the creation of local energy markets or establishment of microgrids is becoming increasingly attractive where electricity generated locally could be consumed locally. DLT based energy management platforms including those based on Blockchain offer intrinsic functionalities that could be utilised to facilitate such trades effectively and cost efficiently.

Enabling local balancing and supporting DSOs

Energy distribution systems can also use blockchain to remotely control energy flow to a particular area by monitoring the usage statistics of that area. Further, blockchain-based frameworks can also help in the diagnosis and maintenance of smart grid equipment, procuring flexibility services and assessing grid reinforcement requirements.

Regulatory barriers

Supplier Hub Model

One of the key barriers to introducing innovative trading arrangements in current regulatory structure is the 'supplier hub' model as identified by Ofgem in 2018. The Supplier Hub model positions a single energy supplier as the primary interface between a given customer and the system. This has reinforced the dominance enjoyed by large suppliers and has stifled competition in the retail market, limiting opportunities for that customer to influence how energy is generated, transmitted or consumed. Domestic consumers cannot, for example, interact with network or system operators (and vice versa). Ofgem have recognised that the supplier hub model 'may not be fit for purpose for energy consumers over the longer term,' and that it can act as a barrier to consumers realising the full benefits of the increasing levels innovation, digitalisation and competition that are likely because of the energy transition (Ofgem, 2018). It has now committed to exploring fundamental reforms to this model, but has admitted that, because of the scale of change, this is likely to be a lengthy process (Ofgem, 2018).

Delayed smart meter roll-out

Smart metering in the UK, will greatly improve data quality and access and hence the potential for consumer benefit is significant. However, the roll-out of smart meters is behind schedule and may not be enough to fill the gaps in data that support innovative Blockchain based digital energy platforms.

Smart meter roll-out delays will also mean that the benefits offered by "Market Wide Half Hourly Settlement" (MHHS) may not be fully realised for all consumers.

MHHS is one of the biggest overhauls of electricity systems and processes since privatisation and the introduction of the competitive market in 1998. Moving to MHHS will make the Settlement process more accurate and quicker reducing current timescales to around 4 months. It will act as an enabler for new products and services, for example supporting use of electric vehicles or making use of smart appliances through 'time of use' tariffs (where consumers save money if they shift their energy usage away from times of peak demand). Also helping to encourage innovation to support a smarter and more flexible electricity system. A number of these benefits will allow Blockchain based platforms to bring to the fore the full extent of their functionality.

Ofgem estimates net benefits to consumers from MHHS of £1.6bn - £4.5bn.

Missing Data

Digital energy platforms require access to data of sufficient quality including data on time- and space-resolved energy generation and consumption, energy system state and weather. Currently, there are energy data issues caused by how data is collected, stored and processed.

Although the volume of energy system data is increasing, the quality is often poor, in some cases inaccurate, imprecise or party or wholly missing (CEER, 2019; Energy Systems Catapult, 2018). This 'missing' data can include that which exists only in a non-digital format, that which has been collected but not stored for additional purposes, and that which simply hasn't been collected, and is an issue across the entire energy value chain, from production to transmission to consumption (CEER, 2019; Energy Systems Catapult, 2019c).

However, no matter how good the technology is, quality of the output can only be as good as the quality of the input. And functionalities that could be offered DLT based energy management platforms including those based on Blockchain technology are likely to be fettered as a result of lack of access to good quality data.

Data Interoperability

Interoperability is widely recognised as a necessity for successful development of a smart, flexible energy system. The current lack of common standards means that approaches vary not only across the industry, but sometimes even within companies. This means that although a large amount of useful data about the energy system does exist, it is not interoperable (or sometimes accessible) between different actors in the system. For example, Whilst smart meter data

is, by default, shared with suppliers, Distribution Network Operators (DNOs) must have a detailed data privacy plan approved by Ofgem before being allowed access, which currently limits DNO visibility of their own network (Ofgem, 2016).

Insight into this data is becoming more important as for DNOs as networks adapt to household solar generation, electric vehicle charging, and battery storage. Consumption data could offer DNOs better visibility of usage patterns on their low voltage networks, helping them to plan reinforcement and to understand how load patterns would be affected by electric vehicles and other low carbon technologies.

This is caused by variations in the way data is collected, stored and processed and is already an issue for current market participants in terms of collaboration and system optimisation, and is cited as a significant barrier to entry for innovators. So, whilst the data exists, it isn't interoperable or sometimes accessible. Data interoperability is important as it can support other types of interoperability, including commercial and consumer interoperability (EnergyRev Working Paper 2)

Ensuring data interoperability can enable DLT based energy management platforms including those based on Blockchain technology to bring their full functionalities into effect.

P2P trading only possible through licensed suppliers

One of the intrinsic aspects of the Supplier Hub Model is also that only licensed suppliers can sell energy to customers. This means that currently any surplus generated by a prosumer cannot be supplied to their neighbour who may have a suitable demand. Therefore although the electricity may physically flow to the nearest point of demand, which may well be local, the current regulatory regime does not recognise such a "supply". Currently prosumers or other embedded generators may only export electricity to licensed suppliers who then may supply it to another customer even if such a demand customer is physically located next to the generator in question. This means that for example residential townships connected via public wire cannot undertake local balancing or create a local energy market.

Lack of a level playing field

The EU Guideline on Electricity Balancing (GL EB), adopted in late 2017, strives to create a level playing field for all potential participants in the balancing markets. However, even if new resources are formally accepted, their actual entry can still be hampered by too high transaction costs or stringent market rules. For example, distribution connected energy resources cannot currently provide black start services to National Grid.

Regulatory concerns

Blockchain is a technology option not a Governance one!

Lack of clear and widely adopted definitions

Blockchain, energy management platforms, digital energy platforms – all have multiple meanings in industry, offer different functionalities and therefore invite different concerns. The lack of clear and widely adopted definitions of the different types of platforms is an issue in this area as it actively prevents the development of common standards across industry, essential to provide regulatory and commercial certainty.

Impact on roles and responsibilities of existing actors

The roles of the SO and DNOs will change as the energy system progresses to net-zero transition. They operate and use digital platforms to procure balancing, ancillary and flexibility services and their demand for such services is set to increase. Their future system operation roles will be influenced by how smart local energy systems and digital energy platforms evolve. Greater emphasis on local energy systems could enhance the role of DNOs as distribution system operators (DSOs) including acting as neutral market facilitators for flexibility services. It is imperative that there is good communication and transparency between these system operators and digital energy platforms have an important role to play in this.[4]

[4] https://www.energyrev.org.uk/outputs/policy-and-regulatory-landscape-review-series-working-paper-2/

Trust: A precondition for transactions

Currently, trust between transacting parties is facilitated by suppliers and system operators. Any innovative trading mechanism will need to ensure that transacting parties can trust each other and the markets they trade in. Market participants must be able to trust protections provided to them and feel confident that the technology platforms are safeguarding their data, being transparent and that there are provisions for them to switch between both different commercial offerings and technology choices.

Data protection and confidentiality

In the current regime, consumers are protected by strong privacy protections through the Data Access and Privacy Framework. As well as obliging suppliers to obtain consumer consent to obtain half-hourly consumption data, this requires network operators (both gas and electricity) to have Ofgem approval of privacy plans which detail how they will aggregate or anonymise data 'as far as is reasonably practicable'.

Customers utilising DLT based energy management platforms including Blockchain will need to be provided with the same level of protections enabling secure exchanges of sensitive information between multiple energy suppliers and stakeholders.

Governance will need to ensure party responsibility for negative outcomes can be established for participants using DLT based energy management platforms including Blockchain.

Inclusion

Some consumers may be left behind in the digital energy transformation due to being excluded from participating in digital energy platforms. This could be because they cannot access them or perhaps their services are not valued by the platforms. Thus, they are harmed because they cannot access the benefits of digital energy platforms. In addition, some consumers who can engage with digital energy platforms could become vulnerable as a consequence. Without consideration of inclusion in their design that digital energy platforms could exacerbate existing fairness and distributional issues and may cause new vulnerabilities to emerge.[5]

Elexon: facilitating key market changes – proposed and upcoming

As manager of the BSC (one of the 11 codes that provide the commercial arrangements underpinning the energy system) Elexon plays a key role by acting as a 'critical friend' to help companies that are signed up to the BSC (known as BSC Parties) to develop changes to the code rules. Some of the more significant changes we are working support progress to net zero.

This is part of our 'end-to-end' service of proactive management of the code. Included in this is the running of the systems that support entry into (and exit of) the electricity market, our work to implement code changes, and the impartial, expert advice we offer to the government and Ofgem on policy development.

A number of major changes to code have been introduced which support greater competition in providing electricity balancing services, facilitation of demand-side response and more opportunities for smaller competitors to enter the market. Other changes are also due for implementation, or are still in development.

In March 2021 Ofgem approved P375 'Metering behind the Boundary Point' which will allow the activity of smaller asset owners to be recognised in Settlement through the use of individual 'asset meters'. Currently the activity of smaller assets behind the 'boundary point', where multi-use sites are connected to distribution networks, is not visible in Settlement. P375 will change this, as we will be able to make granular information on the capability of these assets available.

The reforms, which will be implemented in June 2022, are a further encouragement for small-scale renewables, storage and demand-side response units to participate in providing balancing services. The reforms are an evolution of the changes brought in through Modification P344 'Wider Access' in December 2019, which opened up the Balancing Mechanism to 'Wider Access' so that independent aggregators could trade in it in a newly created role known as a Virtual Lead Party. The approval of these changes was the result of significant work by Elexon and the industry to shape the proposals.

One of the most important components of a smarter system is increased access to energy data, as it helps companies to develop services and products. We took another key step towards better data provision in February 2021 when Ofgem approved P398 'Increasing access to BSC Data' which requires that all data held by Elexon is assumed to be openly

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available, unless the BSC Panel (an independent body of industry and consumer experts) decides otherwise. P398 was implemented in June 2021, and we look forward to making more BSC data available to more organisations in the coming years, with no additional charges.

Continuing support for innovation will be vital on the road to net zero. Elexon was the first energy code body to develop a 'sandbox' where innovators can trial concepts in a live market environment, without having to meet all the usual BSC rules. The sandbox service has been available since July 2020, and we were pleased to announce in May 2021 that Emergent Energy became the first company to have a request to use it approved by Ofgem. The trial is using proprietary technology to perform an 'on-site aggregation' calculation on private wire network. We will continue to support other innovators that want to apply to use this unique service.

The next big towards net zero is Market-wide Half Hourly Settlement (MHHS) for electricity. In April 2021, Ofgem confirmed that Elexon is to be the Senior Responsible Owner and Implementation Manager for MHHS, we are very pleased to be taking on these roles. We look forward to working with the industry to deliver this landmark change.

The current IT architecture which we use to manage settlement has remained largely unaltered as the retail market has developed. We are replacing it with our new flexible, scalable cloud platform, Elexon Kinnect, which will help us deliver value from MHHS, and respond more quickly to the changing needs of our customers.

In January we delivered the first major component of Elexon Kinnect. This is the customer solution, an intuitive online portal that allows BSC Parties to electronically undertake market entry. Parties that are active in the market can also 'manage their BSC account' online. The new platform has many other benefits. For example, architecting our services in the cloud allows us much greater flexibility when making changes to the BSC. Currently changes can take around a year to implement, with at least a third of that time spent on testing that our existing, ageing systems can manage the change

The next stages for Kinnect include developing an analysis and insights solution to replace our existing Balancing Mechanism Reporting Service (BMRS). BMRS is the go-to data source for statistics on the wholesale market, however, like the rest of our current systems it is based on an ageing platform.

Our new analysis and insights solution will draw its data from the Kinnect Platform, ultimately using market-wide half hourly data when this functionality is delivered. It will use best practice on data visualisation from the finance sector (particularly that provided by hedge funds) to completely re-imagine data provision for the wholesale and balancing markets, and Elexon's customers. The new solution will provide more up to date and detailed data. Users will also find it easier to perform their own analysis.

Separately, we are working to improve the accessibility of the BSC and its subsidiary documents. As mentioned earlier the BSC comprises around 10,000 pages and the documents can be difficult to navigate, especially for smaller companies and new entrants. We are developing a digital version of the entire code and supporting documents, which will be easier to use, and updating it will be less resource-intensive as code rules change in the future. This will make it much easier for people and companies to interact with the code and find the information they need.

Conclusion

In conclusion, DLT based energy management platforms including those using Blockchain may be able to help the development of the future energy system while addressing the energy trilemma as we march towards net zero. However, it is important to note that Blockchain is a technology alternative and not a governance option.

Governance will still be required to ensure consumers and market participants are appropriately protected and are able to trust the trading systems they operate in.

Regulation has traditionally lagged behind industry changes – going forward it must anticipate market developments so that rules don't inhibit the development of innovative solutions. However, it is important to note that significant and fundamental changes to the electricity markets are underway which are designed to provide wider access and lower barriers to entry. These changes could be said to be enabling changes in many ways that may well form the basis of further changes that will enable innovative technologies like Blockchain to engage to their full potential.

The industry therefore needs to work closely together with Ofgem and Government to ensure that regulation is able to appropriately support the use of innovative technologies in providing solutions to new challenges arising in an ever changing landscape!