IBM Response to Ofgem Consultation on Delivering Faster and More Reliable Switching

IBM is pleased to respond to Ofgem's consultation on "Delivering Faster and More Reliable Switching: proposed new switching arrangements".

We have not responded to every question in the consultation. We have concentrated instead on those questions that are relevant to IBM, and where we are able to back up our opinions with significant real-world experience - from our successful business transformation and system implementation programmes around the world, to the application of innovation enabling industry leaders to embrace digitisation and exploit the benefits of artificial intelligence and cognitive computing.

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Contents

1. Introduction

IBM is pleased to respond to Ofgem's consultation on "Delivering Faster and More Reliable Switching: proposed new switching arrangements".

We set out a point of view based on advanced technologies now becoming available that could transform the way that central market transactions, processes and systems are being developed for the future (and the cost benefit analyses that sit behind these). Major industry disruption is being driven by, for example, the rapid adoption of renewable energy and decentralised electricity generation, community energy schemes, smart meters, the electrification of transport and heating, demand side management schemes, battery storage, and so on. As customer awareness and engagement increases and adoption accelerates, so market frameworks must evolve and correspondingly secure, scalable, cost effective data exchange mechanisms will be required – along with the need for data privacy, interoperability and non-discriminatory access.

We believe in the primacy of markets and the potential benefits that will accrue from engaged, aware, responsible consumers who are able to switch supplier at will. The full benefits of such a market will be delivered through a holistic, coordinated programme of change. Piecemeal change, process by process, is more likely to risk embedding and amplifying the problems inherent in a market that has evolved over a period of twenty years. Now is the right time to take stock, take a deep breath even, and invest in wholesale and integrated transformation that is focused on delivering a set of consistent, coordinated regulatory frameworks, markets and systems to support a smart, 21st century energy system. This is necessary for two fundamental reasons:

- First, there will be an exponential increase in Distributed Energy Resources (DERs). Their technical characteristics mean that a substantial market for flexibility and a range of other ancillary services will be created to support system stability and balancing. Aggregators will also need data services, requiring a platform to manage the data flows – and potentially some of the processes – to support that market segment. The industry is already undergoing significant change as the market moves towards the need for energy aggregation and optimisation at both national and regional levels, a transformation that is accelerated by the disruption wrought by technology across the industry.
- Second, the nature of transactional processes is changing. Blockchain in particular is starting to fundamentally change how multiparty processes are conducted, especially when viewed as an immutable exchange of smart contracts (as IBM prefers) as opposed to an unwieldy transfer of cryptocurrency. Our view is that many of the processes necessary in a smarter energy future value chain would be highly amenable to Blockchain based solutions. There are an increasing number of examples, both inside and outside the energy sector, that illustrate how this is happening. At present, these are very much piecemeal, with several niche providers cherry-picking services.

There is therefore a place for a primary role to deliver the essential services underpinning flexibility services, as well as for next day switching. To achieve this it is essential that the need for a central, secure data hub is properly considered, along with a full assessment of the capability and capacity of existing industry data management agents such as ElectraLink, Elexon and Xoserve, supported by a whole-system approach to the development of a Central Switching Service. We believe that these are a set of near-future changes that are so fundamental to the industry that we must reinvent things now, to make sure that they are fit for purpose, or risk running into much more serious trouble in the future with two-speed arrangements. We believe that the industry is on the cusp of wholesale digital reinvention.

Based on this assessment, IBM does not agree with the Ofgem conclusion that RP2a is the best value option, and we believe that there is no business case to justify the DCC's procurement of the communication network to interface with CSS. We believe that there are better options, or combination of options. For example ElectraLink's Data Transfer Network is a competitively procured, proven, secure, low cost network connected to a majority of market participants that will connect to the CSS. Re-use of

this industry asset in combination with Blockchain developments focused on appropriate use cases would simplify the programme and provide the lowest cost solution for industry and consumers.

We have structured our response to:

- Answer those consultation questions for which we can offer a relevant point of view;
- Describe our point of view on the transformation that the energy sector is undergoing globally;
- Provide some background to IBM's activities in the energy sector; and
- Outline some IBM projects that are relevant to the Consultation.

2. Answers to Consultation Questions

Question 1: Do you agree with our assessment that RP2a provides the best value option to reform the switching arrangements for consumers and with the supporting analysis presented in this consultation and the accompanying IA?

Based on the evidence presented it is difficult to agree with the assessment that RPA2a is the best value option. We are concerned that the costs are understated and the benefits are overstated, and as a result it is hard to avoid the conclusion that the business case is justified.

We believe, in some ways, that at this stage in the transformation of the GB retail energy market that the "do nothing" option, RP1, is more appropriate, as the market would perhaps be better served by an unstinting focus on completion of the Smart Metering roll out and the implementation of half-hourly settlement. These two projects are absolutely essential to the successful implementation of a smarter energy market that puts customers first, enables innovation in products and services and will put in place the basis to facilitate the optimisation of energy flows at all levels in the distribution and transmission networks.

To be able to accurately predict the costs it is necessary to have a clear view of the eventual solution component architecture and a strong understanding of the costs and risks inherent in integrating the new CSS processes and systems with the existing and new systems. The costs will not be minimal; not only for the new central switching system, but also the costs incurred by each participant in terms of integrating to the CSS and to their back-office systems and in carrying out exhaustive testing to ensure success. Experience suggests that the time, cost and involvement necessary to perform end to end industry testing is always underestimated; and this does not take into account the disruption to each industry participant.

We believe that the business case could be substantially improved by removing the need for a centralised switching system and associated business processes for reconciliation and remediation.

We do, however, agree with the importance of markets and the potential benefits that will accrue from engaged, aware, responsible consumers who are able to switch supplier at will. The full benefits of such a market will be delivered as a result of a holistic, coordinated programme of change. Piecemeal change, process by process, is more likely to risk embedding and amplifying the problems inherent in a market that has evolved over a period of twenty years. Now is the right time to take stock and invest in wholesale and integrated transformation that is focused on delivering a set of consistent, coordinated regulatory frameworks, markets and systems to support a smart, 21st century energy system.

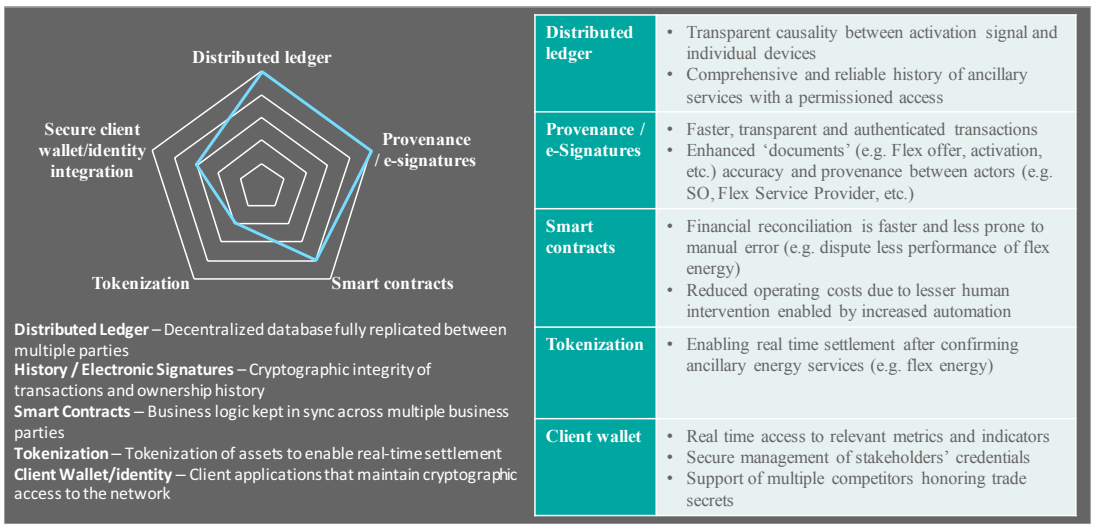
We know that there will be an exponential increase in Distributed Energy Resources (DERs), and that their technical characteristics mean that a substantial market for flexibility and a range of other ancillary

services will be created to support system stability and balancing. As a result, aggregators will also need data services, requiring a platform to manage the data flows – and potentially some of the processes – to support that market segment.

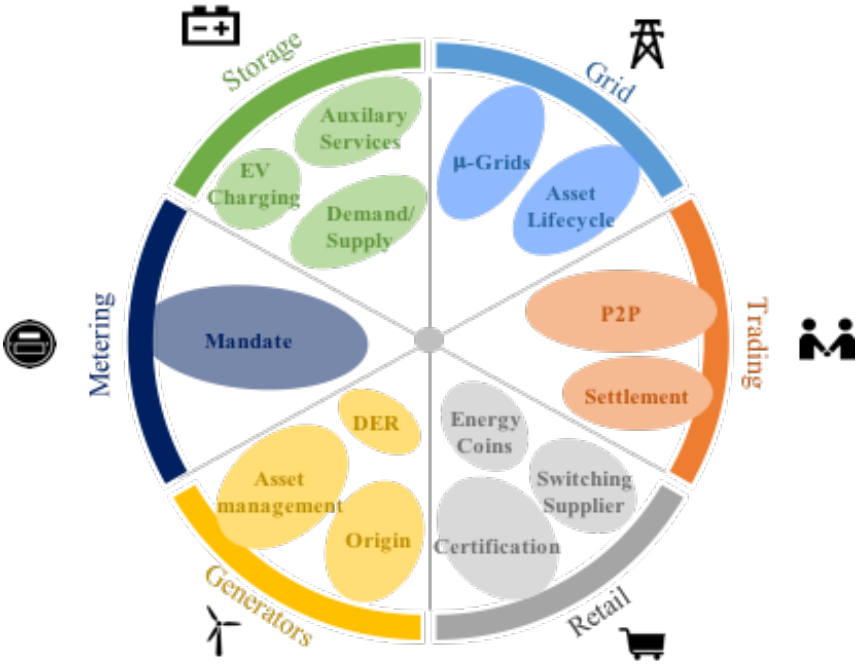
We also know that the nature of transactional processes is changing. Blockchain in particular is starting to fundamentally change how multiparty processes are conducted, especially when viewed as an immutable exchange of smart contracts as opposed to an unwieldy transfer of cryptocurrency. Our view is that many of the processes necessary in a smarter energy future value chain would be highly amenable to Blockchain based solutions. There are an increasing number of examples, both inside and outside the energy sector, that illustrate how this is happening. At present, these are very much piecemeal, with several niche providers cherry-picking services.

There is a place for a primary role to deliver the essential services underpinning flexibility services, as well as for next day switching. Developing and introducing a whole systems approach to Blockchain solutions within the UK energy market, which is in danger currently of being fragmented by a number of disparate Blockchain implementations, would be of huge benefit. It is essential that this whole-system approach is considered alongside the Central Switching Service to ensure successful delivery and value for money implementation.

IBM is leading in the application of Blockchain solutions in a range of industries through our membership of the Hyperledger Fabric. The figure below outlines key aspects of Distributed Ledger Technology that are relevant to the energy value chain:



Building on this, the diagram below shows some of the key use cases where IBM has developed applications of private Blockchain solutions using the Hyperledger Fabric that will deliver significant advantages over traditional solutions:



We believe that Blockchain based solutions will fundamentally transform the industry and enable effective implementation of new business models. To achieve this, it is important to ensure that open standards are applied to avoid proprietary technology lock in, and that regulatory change is delivered that enables markets to be rewired.

As an example, IBM is working with a DSO to apply Blockchain to allow multiple retailers and service providers to supply multiple services behind one household meter (for sub-metering and allocation). This allows energy service providers to offer services other than the household energy delivery. For example, to separately deliver electricity for an electric vehicle behind the meter so the EV bill can be sent elsewhere. This is currently in development with a client in Benelux, and the idea is to invite energy retailers or service providers to participate. Please see the following link for more details: https://www.acm.nl/en/publications/publication/17010/Multiple-power-suppliers-on-a-single-connection-to-be-reality-soon

In addition, moving towards the creation of a centrally controlled market data hub is in our view sensible, although at the same time we would question whether there is long term benefit to unlimited cleansing of existing data sources. It would be better to apply ongoing data cleansing progressively delivered as new devices and data sources are introduced across the energy system. The key will be then to make the right technology, architecture and communications decisions. The GB Energy Market Data Hub would then become a collection of cloud based services providing a platform for a wider range of flexible products to customers – both current and emerging.

Question 2: Do you agree that CSS should include an annulment feature which losing suppliers can use to prevent erroneous switches?

If a Blockchain solution is in place then an annulment feature is not required. The Blockchain would only trigger the change with consensus between the impacted parties.

Question 3: Do you agree that CSS should always invite the losing supplier to raise an objection, even where the Change of Occupancy (CoO) indicator had been set by the gaining supplier?

See answer to question 2 above – CoO would be set by the bill payer.

Question 4: Do you agree that use of the annulment and CoO features should be backed by a strong performance assurance regime?

We have no point of view on this question.

Question 5: Do you agree with our proposal to require DCC to competitively procure the communications network capability required to deliver the new switching arrangements?

We believe that it is sound commercial practice to appoint a professional body to manage the procurement of the Central Switching Service, but we do not believe that this role should be awarded uncompetitively to the DCC. Any award should be based on a critical assessment of the performance of the organisation in its current role in delivering the GB smart metering programme, and in any event should follow the appropriate competitive procurement regulations for the provision of both government and monopoly services.

The communication services underpinning this proposed new service will obviously be vital in delivering a system with the necessary security built in, adequate availability, coverage, bandwidth and latency, all at acceptable cost. Rather than procuring another costly standalone service, we believe that it makes sense to consider carefully the capabilities and track record of existing market participants, in particular regulated bodies that have extensive market, process and communications systems expertise such as ElectraLink, Elexon and Xoserve. Leveraging the experience, communications capability and sunk investment represented in, for example, the Data Transfer Network must be carefully considered.

If we consider ElectraLink as an example – it has nearly twenty years' experience providing data transfer to meet the industry's switching requirements (including facilitating the processing of objections, withdrawals and erroneous transfers) and in recent years has evolved the DTN into a scalable service that is easy to connect to, supporting multiple file and communication types (including XML) and which operates in near real time. The technology that supports the DTN is currently in the process of being re-procured to enable the DTN to better support evolving industry processes and models. The re-procured DTN will be designed to deliver multiple areas of industry change including the centralised switching service (CSS), the extension of half hourly settlement, the DNO to DSO transition and new technology such as Blockchain.

Question 6: Do you agree with our proposal to have a three-month transition window (aiming to protect reliability) during which time suppliers have to meet additional requirements if switching in less than five working days?

We would suggest that a transition period makes sense given the different speeds that market participants are likely to complete end to end testing and market acceptance. It is important however to adopt a whole system approach to ensure that this transition period is neither too long nor too short.

Question 7: Do you agree with our proposal to change the requirement on speed of switching to require switches to be completed within five working days of the contract being entered into (subject to appropriate exceptions)?

Yes, we agree with the proposals. With effective implementation of Blockchain technology we believe the requirement ultimately could be tightened to below 5 days.

Question 8: Do you agree with our proposal to create a dual fuel REC to govern the new switching processes and related energy retail arrangements?

Yes, we agree with the proposals.

Question 10: Do you agree with our proposal to modify the DCC's licence, in order to extend its obligation to include the management and support of the DBT and initial live operation of the CSS?

No, see response to question 5 above

Question 11: Do you agree that there should be regulatory underpinning for the transitional requirements and that this should be contained in the REC?

We have no point of view on this question.

3. IBM's activities in the energy sector

In addition to being the world's largest IT and consulting services company, IBM is a global business and technology leader, innovating in research and development to shape the future of society at large. IBM's prized research, development and technical talent around the world partner with governments, corporations, thinkers and doers on ground breaking real world problems to help make the world work better and build a smarter planet.

IBM recognises the importance of innovation; we invest around $6bn in Research annually. New technologies such as cognitive and advanced analytics are growing in importance within our portfolio. Our culture is to support our clients by driving innovation – both in terms of industry and IT specific innovation.

IBM works within a range of remits with clients across the Energy and Utilities Sector both in the UK and globally. Our involvement in the utility sector is both large and enduring. We currently work as business partners with many major utilities in the UK including National Grid, nPower, Thames Water, UKPN, ScottishPower, SSE, Centrica, EDF Energy, as well as many of the major European utilities including RWE, E.ON, Edf, DONG, Enel, Iberdrola, Red Electrica de Espana and many more globally. The figure below summarises our global reach.

Our work encompasses all segments of the sector, including generation, networks, retail and support functions in the case of electricity and gas. We provide the full range of services to our utilities clients, including strategy, design, analytics, cloud services, infrastructure, applications management, support and security. We have over 3,000 dedicated Energy and Utilities consultants globally, guided by a global Centre of Competence who, along with our Institute for Business value, provide industry insight and Points of View.

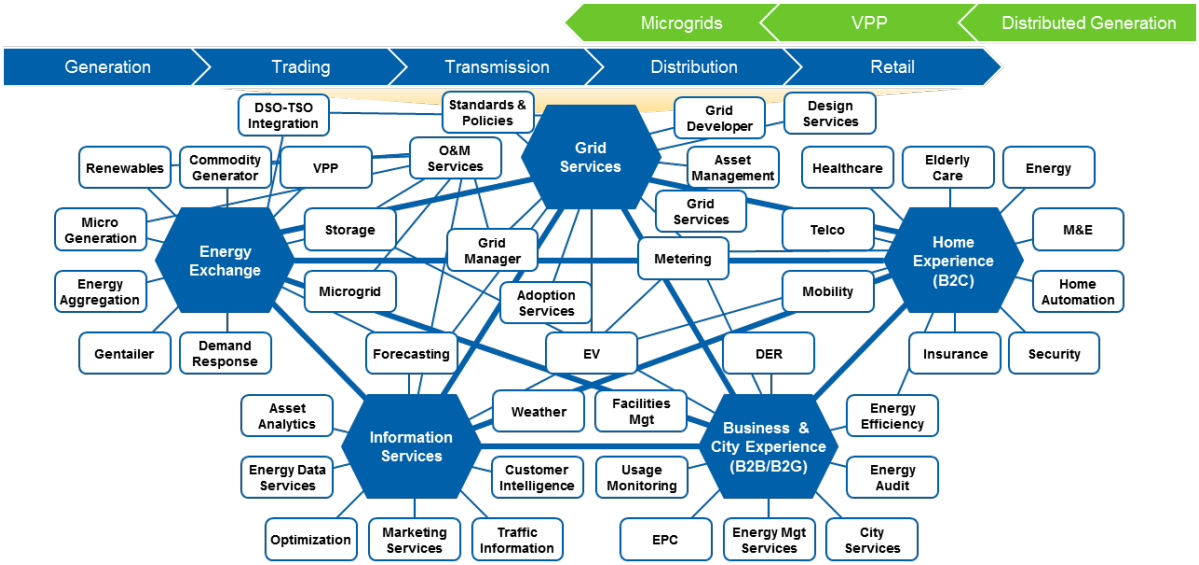
Please visit our public web page for more information: https://www-935.ibm.com/industries/uk-en/energy/index.html

4. IBM point of view on transformation of the energy sector: The Energy Integrator

IBM has published its own Point of View on the vision of the future energy market landscape which describes the new role of the Energy Integrator. Whilst this Energy Integrator Model is a global viewpoint, we feel it has relevance in the GB market where new marketplaces will become established as we move away from a traditional energy market where large, centralised generators sell to energy retailers/suppliers and on to consumers using a unidirectional transmission and distribution networks.

The Energy Integrator Model is described in a published white paper which we include with our submission. We invite stakeholders to read the paper and reach out to us for further discussion.

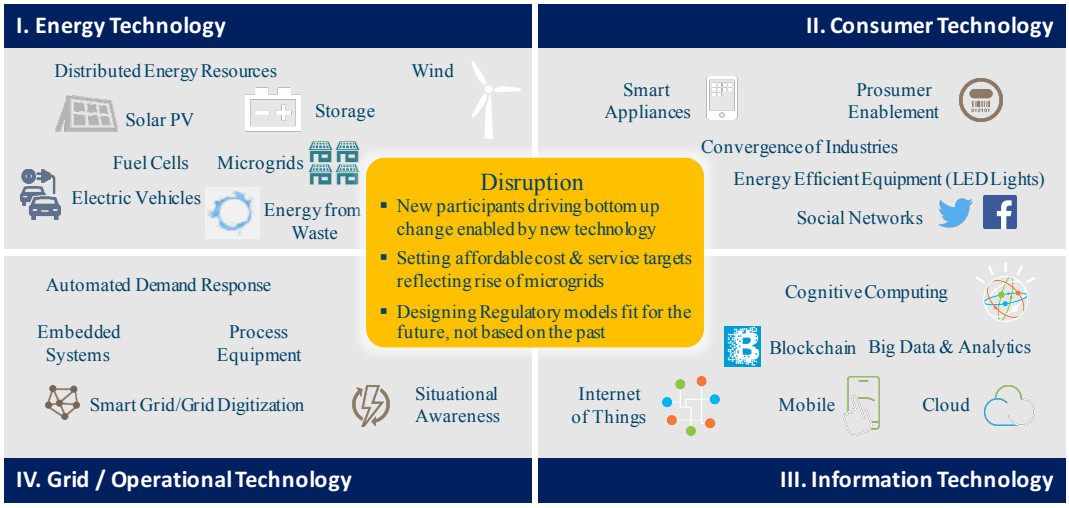
The figure below shows the context and potential roles of the Energy Integrator in an emerging Smart, Flexible Energy System.



Utilities are disrupted by four types of technology, as set out in the figure below, each playing an integral role in the transformation of the energy system and each influenced by the availability and secure exchange of near real time data. Given the aims of the Smarter Switching programme, we focus in this response on development of IT Technologies and their ability to drive transformation.

Technology Disruption

Utilities are disrupted by four types of technology – and this disruption has a huge impact on markets and regulators



IT innovation including Internet of Things (IoT), cognitive computing, Blockchain, big data, analytics and cloud computing are the underlying IT technologies behind a smarter more flexible energy system, and it is vital that these transformative technologies are considered by Ofgem throughout their innovation strategies and funding initiatives. The diagram above puts the four disruptive technologies into context, and we would focus on the following disruptive technologies in relation to this consultation:

- **The latest developments in Cloud and IOT services:** Adoption of secure, powerful and cost effective cloud computing services are the key enabler in the development of scalable platforms to serve the market represented in the IBM Energy Integrator model.

- **Blockchain** is a shared, distributed immutable ledger for recording the history of transactions. It fosters a new generation of transactional applications that establish trust, accountability and transparency. Blockchain became famous through its use in the Bitcoin cryptocurrency. When we discuss Distributed Ledger Technologies in this consultation response we exclude both crypto-currencies and Public Blockchains. To reduce cost, improve security we only consider permissioned, private Blockchains. In energy there are several use cases we foresee for this technology, including energy trading (especially peer to peer) and supply chain tracking (e.g. ensure that firmware on smart meters and other sensors are not tampered with as the devices make their way through the supply chain).
- **Internet of Things (IOT):** The convergence of connecting people, things, data and processes is transforming our life, business and everything in between. The technical definition of The Internet of Things (IoT) is the network of physical objects accessed through the internet. Energy systems were of the earliest distributed systems that were instrumented with sensors, though these are usually connected over bespoke and dedicated networks. The rapid development of the IoT has however lowered the cost of sensors (whether they are connected to the internet or a private network) and has led to the development of powerful IOT data handling platforms which is benefitting the Energy industry.
- **Cognitive computing** makes a new class of problems computable. Augmented Intelligence addresses complex situations that are characterised by ambiguity and uncertainty; in other words, it handles human kinds of problems. In these dynamic, information-rich, and shifting situations, data tends to change frequently, and it is often conflicting. The goals of users evolve as they learn more and redefine their objectives. To respond to the fluid nature of users' understanding of their problems, the cognitive computing system offers a synthesis not just of information sources but of influences, contexts, and insights. To do this, systems learn and often need to weigh conflicting evidence and suggest an answer that is "best" rather than "right" and provide their "reasoning".

  For more information see https://cognitivecomputingconsortium.com/definition-of- cognitive-computing/ and https://www.ibm.com/cognitive/

5. IBM References relevant to the Consultation

Continuous Linked Settlement (CLS)

The global foreign exchange (FX) market trades trillions of US dollars each day in multiple currencies, involving a worldwide interconnected network of central banks such as the US Federal Reserve, the European Central Bank, the Bank of England and almost all of the world's leading commercial banks. The most significant systemic risk to participants in the FX market is the loss of principal from settlement risk.

In the late 1990s, 60 of the world's leading financial institutions recognized the mitigation of settlement risk as a high priority for the FX market and created the CLS Group (CLS) - a new business incorporating a single-purpose FX bank, CLS Bank International (CLS Bank). CLS had the mission to radically rethink the way FX markets work and eliminate settlement risk.

CLS created a groundbreaking process for FX settlement and had contracted IBM to design, develop and manage the supporting global IT infrastructure CLS required in conjunction with established networking and application components from the Society for Worldwide Interbank Financial Telecommunication (SWIFT). The resulting Continuous Linked Settlement (CLS) system has been operating since 2002.

The success of the project and the ongoing operation of the system was dependant on close collaboration between IBM, CLS, the Central Banks, the member banks and SWIFT.

The service was originally designed to handle a maximum daily average of 45,000 "sides" or individual trade instructions. However, growth has significantly exceeded expectations, hitting a peak in September 2013 of 1.99 million trade instructions processed, the maximum value was USD10.4 trillion passing through the system in one day. The system currently handles an average daily volume of more than 1 million transactions, with a value of nearly USD 5 trillion, in 18 different currencies.

The successful go-live and continued growth of the service provides evidence of the success that IBM's design, project and service management has had and is continuing to have.

CLS is working with IBM to implement a blockchain based netting service for currencies that are not settled on CLS. Participants will be able to submit FX instructions for six products, including non-deliverable forwards (NDFs), and 24 currencies over existing SWIFT-based channels. They will also have the option of connecting directly to the platform via a highly secure, permissioned distributed ledger, administered by CLS.

CLS will build the Blockchain platform for CLS Netting using Hyperledger Fabric, an industry-accepted, open-source solution, and is collaborating with IBM to help ensure that the platform meets the requirements necessary for delivering a resilient, secure, and scalable service.

More information here: http://www-03.ibm.com/press/us/en/pressrelease/50615.wss and here: http://www.ibtimes.co.uk/what-difference-between-cls-blockchain-cls-blockchain-1612147

TenneT (Transmission System Operator in the Netherlands)

TenneT, sonnen, Vandebron and IBM have joined forces to develop Blockchain solutions to help in managing the electricity grid in the Netherlands and Germany. This innovative technology is the next step in enabling decentralised flexible energy sources to play a role in the management and optimisaiton of the power grid.

TenneT Energy Community: Because renewable electricity generation accounts for a growing share in the overall power supply, the electricity grid is becoming more volatile. In the coming years there will be times when conventional energy sources will not be able to fully meet the demand for electricity. To address this, TenneT is working to find new ways of maintaining the security of supply. As part of a broader Digital Transformation Program, TenneT with IBM is exploring the use of a permissioned Blockchain network that uses Hyperledger Fabric to integrate flexible capacity supplied by electric cars and household batteries into the electrical grid. TenneT CEO Mel Kroon commented: "These pilot projects are part of TenneT's broader strategy of preparing the electricity system to accommodate the growing volume of renewable energy." TenneT is developing this concept in two pilot projects, both using IBM technology:

Pilot project by Vandebron in the Netherlands

TenneT is responsible for maintaining the balance on the high-voltage grid. To guarantee a continuous supply of electricity, supply and demand must be balanced 24 hours a day, seven days a week. In the event of imbalance between supply and demand, TenneT makes sure additional electricity is supplied or deploys reserve capacity. In this pilot project, Vandebron will work with customers who own an electric vehicle to make the capacity of their car batteries available to help TenneT balance the grid. Vandebron will provide this service to its customers without compromising the availability of their car battery. The Blockchain enables each car to participate by recording their availability and their action in response to signals from TenneT. Note that only the charge rate on the EV is changed (up or down) depending on need – the EVs are not used as a V2G resource.

Pilot project by sonnen eServices in Germany

Re-dispatch measures prevent regional overloads on the grid. This system is necessary, for example in Germany, when wind energy produced in northern Germany cannot be transported to the industrial centers in the south of the country. In this pilot project with sonnen eServices (the energy group of the Sonnen group), a network of residential solar batteries will be made available to help reduce the imposition of limitations on wind energy at times of insufficient transport capacity. The Blockchain presents the operator from TenneT with a view of the available pool of flexibility, ready to activate at the push of the button, after which the Blockchain records batteries' contribution. This will enable sonnen and TenneT to support the integration of renewable energy sources into the German electricity supply system, preventing expensive curtailment of renewable energy sources.

Market parties will be informed about the pilot projects and relevant developments by means of newsletters and market consultation workshops in the Netherlands and Germany.

The project was successfully commissioned on 3rd November 2017:

https://www.tennet.eu/news/detail/europes-first-blockchain-project-to-stabilize-the-power-grid-launches-tennet-and-sonnen-expect-res/

http://www.trustnodes.com/2017/11/04/hollands-national-grid-germanys-sonnen-launch-europes-first-blockchain-pilot

Instantaneous Switching

Instantaneous switching of supplier utilising Blockchain and IoT is one of pour pilot energy use cases. In this case, the device/Blockchain knows who its supplier is and bills are netted. This use case may well be needed in the GB market in future; for example it would allow whitegoods manufacturers to provide goods with (green) energy bundled into the product.

IBM is working with a DSO in the Netherlands to apply Blockchain to enable multiple retailers and service providers to supply multiple services behind one household meter (for sub-metering and allocation).

This allows energy service providers to offer services other than typical household energy delivery, for example to separately deliver electricity for an electric vehicle behind the meter so the EV bill can be sent elsewhere. This is currently in development with a client in Benelux, and the idea is to invite energy retailers or service providers to participate. Please see the following link for more details: https://www.acm.nl/en/publications/publication/17010/Multiple-power-suppliers-on-a-single-connection-to-be-reality-soon

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