IRENA INNOVATION WEEK
solutions for a renewable-powered future

IRENA
International Renewable Energy Agency

DIGITALISATION AND DECENTRALISATION TRACK

DIGITAL APPLICATIONS FOR THE ENERGY TRANSITION: BLOCKCHAIN

Session overview

Nearly everyone knows Bitcoin, but relatively few understand the distributed ledger technology behind it known as blockchain. Advocates of blockchain technology in the energy sector claim that the technology offers a myriad of possibilities and could pave the way for sophisticated, transparent networks that manage the entire energy value chain while fostering grid-edge flexibility. This includes: increased visibility of network assets; smooth billing, sales, and payments; innovative financing mechanisms; efficient contract management; decentralised energy trading; real-time green certificate attribution; and more.

In this session, participants strove to clarify how blockchain technology can tangibly contribute to the increased deployment of renewable power in electricity systems, the associated risks, and what policy makers and regulators can do to enable this. The session was moderated by **Colleen Metelitsa (Grid Edge Analyst, GTM Research)** and comprised three introductory presentations followed by a panel discussion.

Presentation 1:
Using blockchain technology to decarbonise, digitise and decentralise electric grids worldwide

Doug Miller (Energy Web Foundation) described how the Energy Web Foundation is leveraging blockchain to achieve a more transactive energy system. Device interaction based on price allows the system to efficiently manage itself and respond to price signals. Mr. Miller argued that the greater complexity of the energy system requires new tools.

New value propositions of blockchain technology for the energy sector include:

» enabling transactions between parties that do not necessarily trust each other in a low-cost way; this includes not only people but devices as well

» interoperability between private and public systems through open-source development

» maintaining privacy and security of data and transactions through immutability, secured by strong cryptography

» greater transparency and auditability

Presentation 2:
Unlocking grid flexibility – the use of blockchain at TenneT

Jan Vorrink (Manager National and Regional Control Centres, TenneT TSO BV) talked about two pilot projects in which TenneT is using blockchain solutions to facilitate flexible access to decentralised capacities. One project, in Germany, is providing TenneT with flexible capacities from interconnected home storage systems, in order to decongest the transmission lines between the country's north and south.

Another pilot project is being carried out in the Netherlands with the energy company Vandbebron. This Amsterdam start-up is providing TenneT with flexible capacities from an interconnected pool of electric vehicles (EVs) and charging stations. It enables voluntary contribution from EVs to the automatic frequency reserve response services. The real-time data communication between the EVs and TenneT is established using blockchain technology.

Presentation 3:
State of the market – a snapshot of blockchain investment and global project deployment

Colleen Metelitsa (Grid Edge Analyst, GTM Research) gave an overview of recent developments in blockchain investment and project development and presented some key numbers:

» USD 466 million invested in blockchain in power applications

» 189 companies working in blockchain in power

» 71 projects announced globally, with the majority being peer-to-peer energy trading, distribution management and EV charging

Panel discussion

In addition to the presenters, the panel included:

- » Arash Azami, Chairman, Universal Right
- » Mark van Stiphout, Deputy Head of Unit in DG Energy, European Commission
- » Morwesi Ramonyai, Managing Director, The Sun Exchange
- » Paul Massara, CEO, Electron
- » Tomas Baeza, Industrial Development Manager, Comité Solar

Highlights from the discussion:

- » **Blockchain is a tool that can be used to accelerate the energy transition and is not a goal in itself.** Its main advantages include decreased transaction costs, transparency, immutability and disintermediation, among others. Blockchain can potentially lower transaction costs, increase cyber security and increase visibility of network assets for system operators. One major hurdle is that the energy sector is highly regulated, and widespread adoption of blockchain will require a clear, stable regulatory framework. Panellists agreed that energy regulations are critical for the success of blockchain in the market, but there was disagreement on whether the regulations that currently exist are sufficient and how they could be adapted. New rules that enable increased interaction between network operators and distributed assets are needed.

- » **Blockchain has a strong business case in decentralised systems.** The majority of blockchain uses today revolve around verifying how much renewable energy has been produced, whether for carbon/renewable energy credits or for retail-based transactions around peer-to-peer (P2P) trading or billing. P2P applications depend on market-specific regulations, making it difficult for firms such as Power Ledger or LO3 to scale and launch their trading platforms in different regions. Even if today many start-ups and pilots are focused on P2P uses, the panel discussed other uses that may have a larger impact on the energy sector in the medium term. They argued that blockchain may have a much stronger business case for applications that facilitate the management of decentralised generation and that enable them to provide services to the main grid. Blockchain enables demand-side flexibility by aggregating, connecting and managing distributed resources, as trialled by TenneT.

- » **Blockchain has the potential to create new markets.** Blockchain has the potential to open up new connections in the energy marketplace that were not possible previously. For example, Electron is in the process of mapping all assets under 1 megawatt (MW) in the United Kingdom. The benefit of blockchain is that the assets will not only compete but also collaborate. It therefore is important to identify all types of power generating assets in grid systems and the technology being utilised. As another example, the Sun Exchange is creating new avenues to finance 1 kilowatt to 5 MW solar projects in South Africa which could be replicated in other developing countries depending on local regulations.

- » **Challenges remain in asset registration and integration, interoperability and scalability.** Some of the biggest challenges for blockchain relate to the interoperability of different platforms as well as being able to securely connect the digital world with the physical world. Network asset visibility is essential as automated smart contracts will become increasingly common. While data stored on blockchains is more secure than traditional platforms, ensuring the accuracy of that data from the start is crucial. The link between the physical and digital worlds remains a hurdle. At present, intermediaries are needed to verify that smart meters and other equipment are accurate, and that the data being written on the blockchain was correct to begin with. A ledger is only as good as the data it stores.