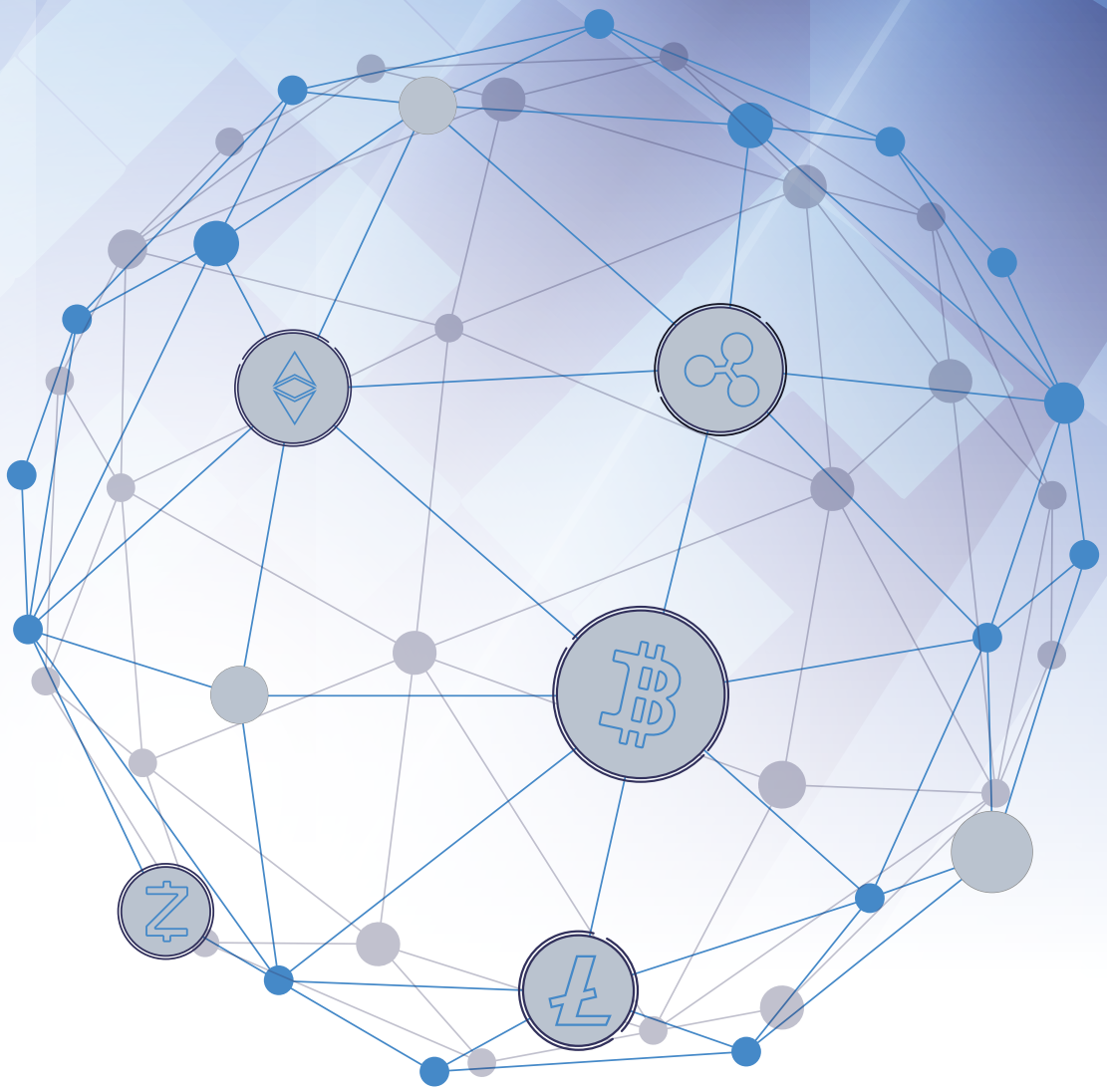
SUMMARY FACTSHEET



BLOCKCHAIN

EMERGING TECHNOLOGIES FOR THE RENEWABLE ENERGY SECTOR

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CONTENT

BLOCKCHAIN

SUMMERY

1. What is Blockchain?

Blockchains are immutable digital ledgers that can securely record all transactions on a network; once data is sealed within a block, it cannot be modified afterward. This encompasses nearly anything of value, not just financial transaction data.
By creating the infrastructure to allow peers to safely, cheaply, and swiftly interact with each other without a centralised intermediary, the technology is enabling a new world of decentralised communication and coordination.

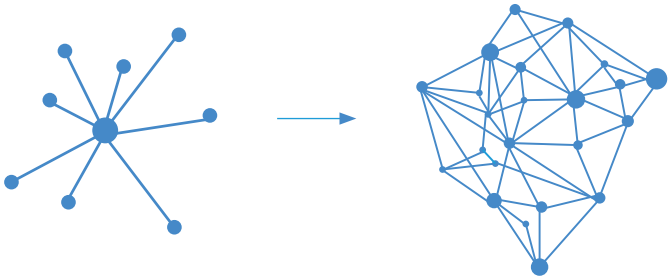

Figure 1: Moving from a centralized model with a trusted intermediary to a decentralized one.

2. The role of blockchain in the power sector

Smart contracts turn customers into active market players, allowing them to buy and sell electricity without the need for a trusted authority or intermediary. Smart meter systems can even upload renewable generation data to the blockchain as soon as generated, similar to carbon reduction incentives and green certificates, which can be calculated and earned automatically. When combined with smart meter technology, smart contracts offered by blockchain provide several efficient, effective, and affordable ways to help transform the power sector and may eventually enable completely transactive energy systems (EWF, 2018).

3. Applications

1. Peer-to-peer power trade

Trades can be made automatically using price signals and real-time renewable energy production data across the network using smart contracts. Processes that formerly needed manual labor and several parties will be automated via smart contracts.
Smaller electricity producers might sell excess renewable energy to other network participants, lowering prices in theory by boosting competition and improving grid efficiency.

2. Grid management and system operation

Blockchain technology could directly control network flows and flexibility options, avoiding curtailment of renewable energy resources; Smart contracts would inform the system when specific transactions should be carried out. This would be based on the platform's predefined rules, ensuring that all power and storage flows are automatically controlled to balance supply and demand.

3. Financing renewable energy through hybrid asset classes

Through its relatively low transaction costs, efficient processing and security features provided by smart contracts, and payment capabilities, blockchain technology presents an appealing platform for financing mechanisms and marketplaces to bring together energy demand and finance supply.

4. Management of renewable energy certificates

Distributed renewable energy producers can now receive renewable energy certificates (RECs) in real-time as their power is generated, thanks to blockchain technology. Real-time generation data can be recorded and propagated using sensors and smart contracts throughout the network. Because all data would be secure and available on the blockchain, a central verification body to check generation data may be unnecessary. Public entities administering RECs could save money by speeding data verification and automating REC granting using this new technology.

5. Electric mobility

EV owners would be able to stop at any charging station recorded on the blockchain, including residential sites, and exchange power for cash in real-time without needing a centralised intermediary. Smart contracts would also work towards making secure and automatic peer-to-peer payments. Blockchains could enable widespread adoption of e-mobility and the distributed renewable energy generation required to power it by providing the foundation for a more extensive and more efficient charging network.

6. Rural electrification and increased access to modern energy services

When paired with smart and innovative financing schemes, smartphone applications, and digital sensors, blockchains can improve the distribution of small amounts of energy in underserved areas by allowing local solar generators to sell power to their surrounding neighbors.

4. Challenges and Enabling factors

• Maturing technology: Improving performance and scalability

Blockchain networks must scale up to enable the widespread application of blockchain technology in the electricity sector and other sectors. This involves raising the number of transactions processed per second (TPS) in these networks, decreasing block time (the frequency with which computations on the blockchain are aggregated and verified), and increasing the block size limit (the number of transactions bundled in each block).

• Establishing clear and consistent regulations

Most blockchain platforms in the power sector are currently being examined only for behind-the-meter applications as part of regulatory sandboxes set up in some countries to test these technologies. This requires just minor changes to the energy regulatory framework and gives consumers more flexibility and independence. However, blockchain technology has the potential to revolutionize more extensive interconnected grids, which will require set policies and technical standards to operate. To do this, the regulatory frameworks in the power industry must be well-defined and stable. To foster this emerging decentralized internet, clear and uniform policies are required.

• Reducing power consumption

Bitcoin and Ethereum, for example, rely on mining to validate transactions and safeguard the network by solving complicated cryptographic puzzles.
A shift from proof of work to other means of transaction validation and network consensus achievement, such as proof of stake, is required for blockchain technology to transform the power sector, among many others, sustainably; this system requires the user to show ownership of a certain number of cryptocurrency units.

• Enhancing grid infrastructure

It is critical to shift toward a more interconnected, technology-enabled smart grid to maximize the usage of blockchain technology for renewable energy. Grid-interactive infrastructure is required to reap the benefits of distributed ledger technologies (DLTs) such as blockchain.

• Better understanding of the technology applications and developing user-friendly solutions.

There is a demand for innovative applications with user-friendly interfaces. Individual customers and small-scale renewable energy generators will need applications developed to provide a simple, consistent, and positive experience. A greater understanding of this technology and its application in all aspects of the electricity sector is required. Electricity trading platforms currently in use are designed for large-scale brokers and are not straightforward or accessible to the general public.

5. Projects and Services

• Peer-to-peer electricity trading

Conjoule

Conjoule is a German private sector company that offers a blockchain platform designed to support P2P energy trading among rooftop photovoltaic (PV) owners and interested public-sector or corporate buyers.

Axpo

The Switzerland utility Axpo launched a P2P platform that allows consumers to buy electricity directly from renewable producers.

• Grid management and system operation

Eneco

The Netherlands utility started piloting a blockchain application to create a decentralised heating network in Rotterdam.

Sunchain

A French private sector company specialized in distributed solar power storage for private prosumers.

• Management of renewable certificates

CarbonX

A Canadian private sector company offers peer to peer carbon credit trading platform.

• Financing renewable energy deployment

M-PayG

A private sector company based in Denmark offers pay-as-you-go solar energy services for households across the developing world.

• Electric Mobility

Chubu Electric Power Company

Chubu Electric Power Company is a utility company based in Japan, they started piloting a blockchain-based EV charging service.

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