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Blockchain for Utilities

Energy Utility Basics: Electric Grid Security & Resilience

Deloitte & Touche LLP | Energy, Resources & Industrials
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Agenda

- What Is Blockchain?
- What Does Blockchain Do?
- Use Case Highlight – Renewable Energy Certificates
- Closing Remarks & Open Discussion

With you today:

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Deloitte & Touche LLP

What Is Blockchain?

What Is Blockchain?

Blockchain is to *value* as the *Internet* is to *information;* hence, the Internet of Value

No single ownership, Multiple contributors, No third party

{ Shared, Peer to Peer, Disintermediation }

A distributed ledger which allows digital assets to be transacted in real time, immutable manner

dig·i·tal ass·et: something represented in a digital form that has an intrinsic or acquired value e.g., land, house, currency, vote, goods, certificates, identity, rewards, etc.

Transparent, Secure, Irreversible

Low Friction

Near real time settlement of recorded transactions

Cryptography (Public & Private Keys)

Verifiable record of every transaction

Blockchain Myths and Challenges

Common misconceptions about blockchain remain an obstacle to widespread adoption

"Blockchain is Bitcoin"

- **Bitcoin is a type of cryptocurrency** that uses blockchain cryptography technology to securely record monetary transactions
- **Blockchain properties provide the underlying technology** that has enabled bitcoin and other cryptocurrencies to rise in popularity

"Blockchain is an enterprise database"

- **Vast amounts of information** that requires absolute privacy within a single organization is meant to be stored in an accessible location for viewing/querying (i.e., an enterprise database)
- **Blockchain is designed to record specific transactions** meant to be shared across a network of parties with a need for transparency and collaboration

"Blockchain security means inherent data privacy"

- **The identity of the submitter is captured through private-public digital keys** but blockchain's real secure characteristic is related to the fact the interrelation to all other blocks in the chain
- **This interrelated feature** means that tampering with a block's content requires altering each block onward

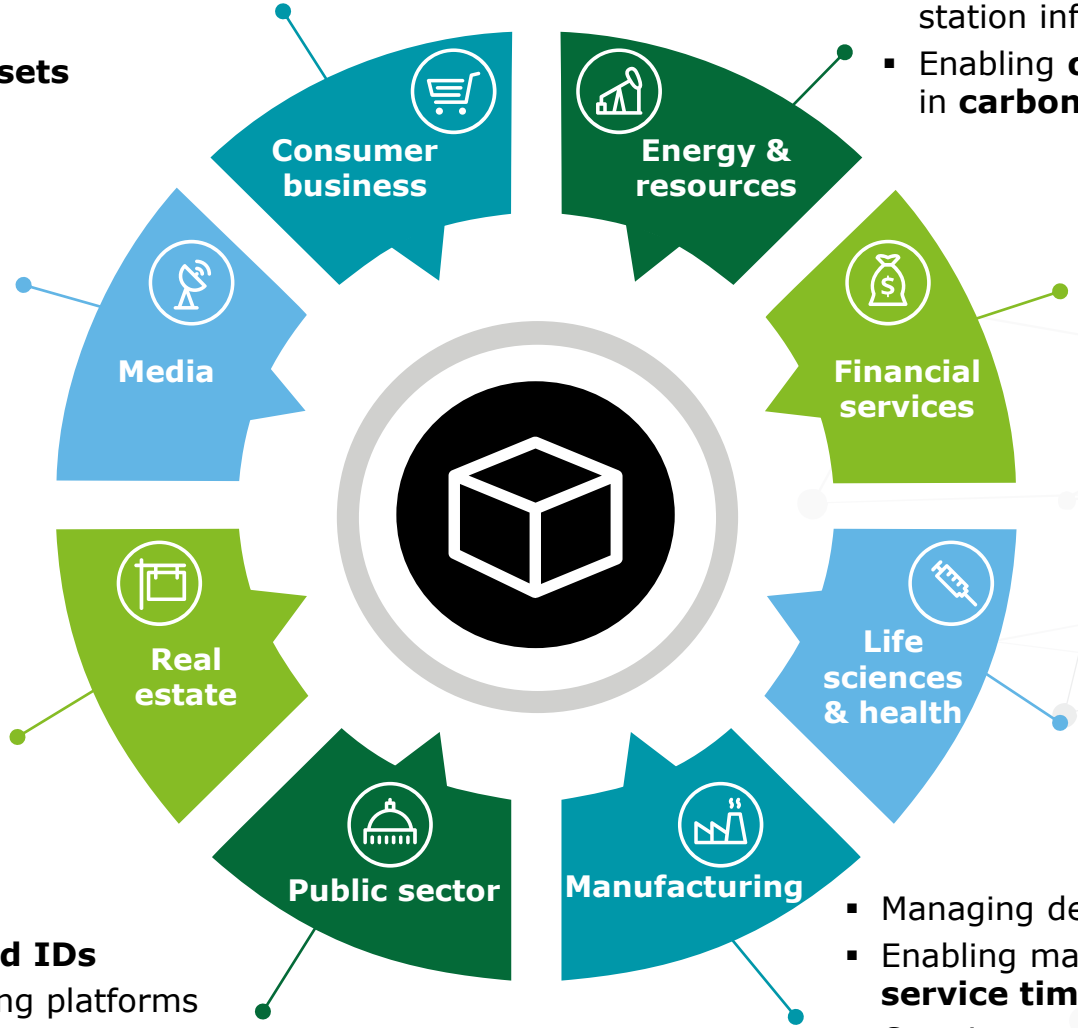
"Blockchain is always public"

- **A public blockchain** is available for anyone to participate in the consensus process - it is **permissionless**
- **A private blockchain** contains **permissions** stipulating the ability to view data, add to the chain, and participate in the consensus process

What Does Blockchain Do?

Blockchain Impacts All Industries

- **Digitizing warranties** for improved management
- Preventing trade of **stolen goods**
- Distributing and trading in **digital assets**



- **Integrating cryptocurrencies** into existing gas station infrastructure
- Enabling **oil commodities investment** trading in **carbon emissions**

- Supporting seamless **cross currency transactions**
- Facilitating direct **peer-to-peer payments**

- Preventing **medical data forgery**
- Tracing and **preventing counterfeit pharmaceuticals**
- Creating and recording a person's **genetic map**

- Managing devices such as **sensors**
- Enabling machinery to **autonomously manage service times** and supply schedules
- Creating transparency and **secure traceability of materials**

- Managing **registered IDs**
- Creating secure voting platforms
- **Time stamping** of certifications

- **Transferring existing land deeds**
- **Migrating the land registry** onto a transparent, immutable ledger

- Verifying **media authenticity**
- Creating a **decentralized, shared economy**
- Transforming phones to **portable blockchain wallets**

What Can Blockchain Do for You?

A blockchain solution can be initiated as a store or record of transactions, serve as a transaction platform, or automate business processes

Record Keeping

- A blockchain solution can offer automated, high-fidelity and low-cost mechanisms for record keeping
- Requires user-specific encryption keys – records are kept in the ledger but only accessible by authorized users

Transfer of Value

- A blockchain solution enables secure, near real-time, low-cost transfer of value without an intermediary
- Allows transfer of records and value between parties, removing the need for a trusted intermediary

Smart Contracts

- A blockchain solution transforms how contracts are executed
- Protocol is programmable to trigger transfer of value and information under certain conditions
- Smart contracts can be developed, exchanged, and automatically executed on decentralized systems

Any industry that is full of intermediaries that cause significant loss of value along the transaction path, and lacks transparency and trust, ***IS AN INDUSTRY*** *that is* ***RIPE*** *for* ***BLOCKCHAIN****-driven disruption.*

Aspects of Blockchain for Power & Utilities

Discussion topics that drive the blockchain conversation in the Power & Utilities sector and help identify beneficial use cases

Transparency and compliance

Blockchain technology delivers greater transparency and efficiency. The sharing of digital blockchain information, as required in joint operating agreements, could lessen the need for reconciliations between companies and for data hubs controlled by third parties

Seamless Regulatory Reporting

Cyber threats and security

Blockchain technology can reduce the risk of cyber threats and ensure that critical information remains safe. Recent innovations have led to the design of a protocol to encrypt data in tiny fragments, stored at multiple sites, while continuing to allow the data to be useful even when encrypted and broken into fragments

Dynamic Encryption and Hashing

High-volume trading/third-party impacts

Blockchain-enabled applications can address issues including removing or reducing brokers' fees; reducing fraud, error, or otherwise compromised transactions; and limiting credit risk and transacting capital requirements

Renewable Energy Credits

Smart contracts

The size and volume of contracts and transactions to execute capital projects in the energy industry has historically caused significant reconciliation and tracking issues among contractors, sub-contractors, and suppliers. Smart contracts could create a more seamless supply chain, improved capital project spend analytics, and simplified contractual obligations

Incorporating RPA, Analytics, AI, etc.

Key Power & Utilities Industry Challenges

Blockchain enables the Power & Utilities sector to address major challenges while reducing costs, increasing transparency, and increasing customer satisfaction

Key Industry Challenges	Blockchain Enablers	Future State
Centralized generators are located far away from population centers ▪ Energy loss ▪ Increased infrastructure costs ▪ Increased consumer costs ▪ Reduced customer satisfaction, due to limited insight and control	▪ Cryptographically secured **distributed peer-to-peer energy exchange platforms**, including sharing of electric vehicle charging stations, enables excessive energy produced by prosumers to trade energy	***Peer-to-peer (P2P) and Business-to-business (B2B) energy sharing economy*** ▪ Reduced energy loss ▪ Reduced infrastructure costs ▪ Reduced customer costs ▪ Increased customer satisfaction from increased engagement
Current metering and billing technologies are not interconnected ▪ Increased overhead ▪ Increased infrastructure costs ▪ Reduced transparency ▪ Reduced customer satisfaction	▪ **IoT enabled smart meters integrated with distributed digital wallets** provide prosumers with accurate information on energy production, consumption, and costs ▪ IoT smart meters provide real time data enabling utilities to offer extra incentives, which are automatically credited to the prosumer's digital wallet	***Real time metering and billing*** ▪ Reduced overhead ▪ Reduced infrastructure costs ▪ Increased transparency ▪ Increased customer satisfaction
Current energy trading is disparate and hard to track ▪ Reduced transparency ▪ Reduced engagement in the marketplace	▪ Blockchain platform creates **immutable record keeping** of energy trading transactions and ownership history of certificates	***Consolidated energy trading platform*** ▪ Increased transparency ▪ Increased engagement in the marketplace

Blockchain Use Case Overview

Multiple blockchain technology use cases are gaining prominence across the Power & Utilities sector

Enabling Sharing Economy

P2P energy trading

Blockchain can create secure and transparent trade of energy among prosumers and consumers within existing grids by creating cryptographically secured distributed peer-to-peer energy exchange platforms

Electric Vehicle (EV) charging and sharing

When a driver charges the EV by connecting to a charging station, blockchain records the amount of energy consumed. When the charging completes, the amount of energy used to charge the EV is paid using a smart contract

Real Time Metering and Incentives

Real time metering and bill payment

IoT enabled smart meters will accurately record and track the usage of the electricity securely through blockchain, and utilize smart contracts to control the flow based on the amount paid or prepaid by the consumers

Incentives and rewards

For every specific amount of solar energy prosumers generate and transmit to the utilities company, they get awarded with cryptocurrency

(e.g., every generation of 1 MWh is equal to 1 SolarCoin)

Energy Trading and Settlement

B2B Energy wholesale trading and settlement

Use of a blockchain platform to enable the execution of energy trades

(e.g., power trading, renewable energy certificate trading, emissions trading)

Records management

Use a blockchain platform as an immutable record of customer identities, energy trading transactions, and ownership history of certificates

Use Case Highlight – RECs

Renewable Energy Certificates Blockchain

REC Market Challenges

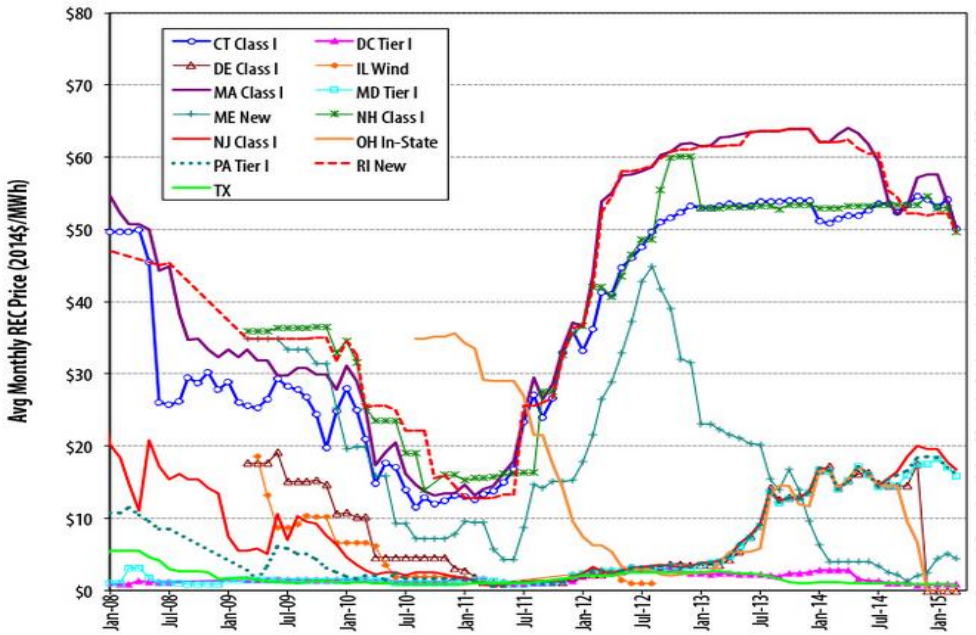
Multiple blockchain technology use cases are gaining prominence across the Power & Utilities sector

National Market Snapshot

Fragmented Marketplace	Inconsistent regional and local market practices and regulations
Large Units of Measurement	1 MWh units incongruent with mass market
Opaque Tracking	Costly certification and tracking measures
Protracted Timing	RECs transacted on a monthly cycle
Disparate Market Systems	Multiple IT platforms

Illiquid, Volatile and Convoluted Market

Current construct restricts market participants, increases transaction costs, and impacts working capital



Blockchain can alleviate market constraints and add value to commercial operations

The Consortia Model for Blockchain

The Business Case for the Consortia Model

Blockchain is both a network *and* transaction technology – it requires an ecosystem of participants with a high transaction volume to deliver real value

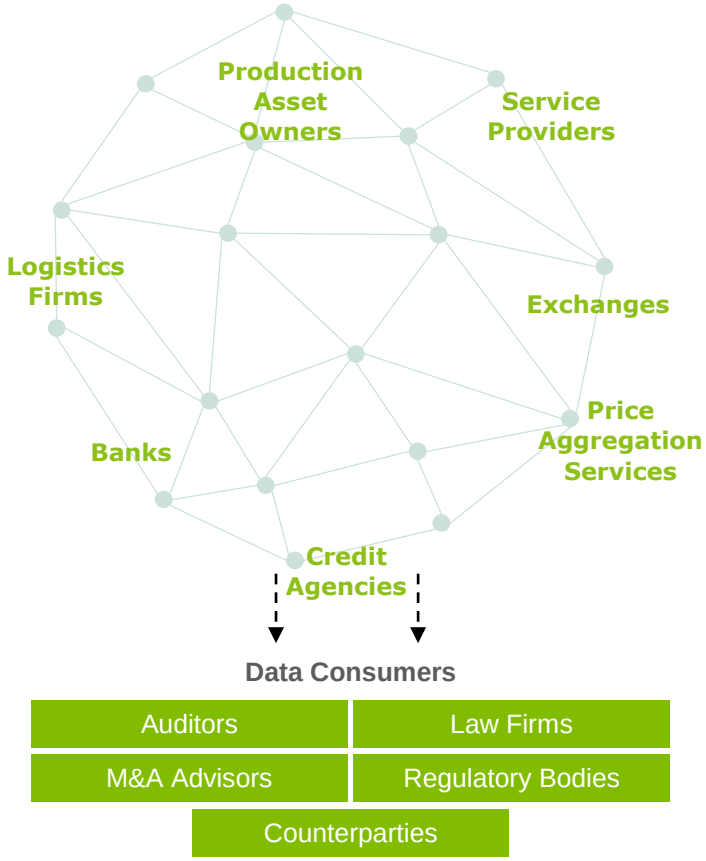
What is a Minimum Viable Ecosystem (MVE)?

- A small consortium with representation of each role necessary to complete the set of use cases that make the solution viable in the marketplace
- For example, a Commodities Trading Consortia would include multiple asset owners, credit agencies, banks, price aggregators, logistics firms, and other service providers

Why define and build a MVE?

- Defining a MVE focuses capability development to a select set of use cases and targets outreach/marketing efforts to specific entities
- Building a MVE enables the group of stakeholders to prove the value and concepts of the given use cases on a blockchain consortium platform. Distributing cost amongst the group, this provides a low-risk learning opportunities for the participants to explore and expand the technology

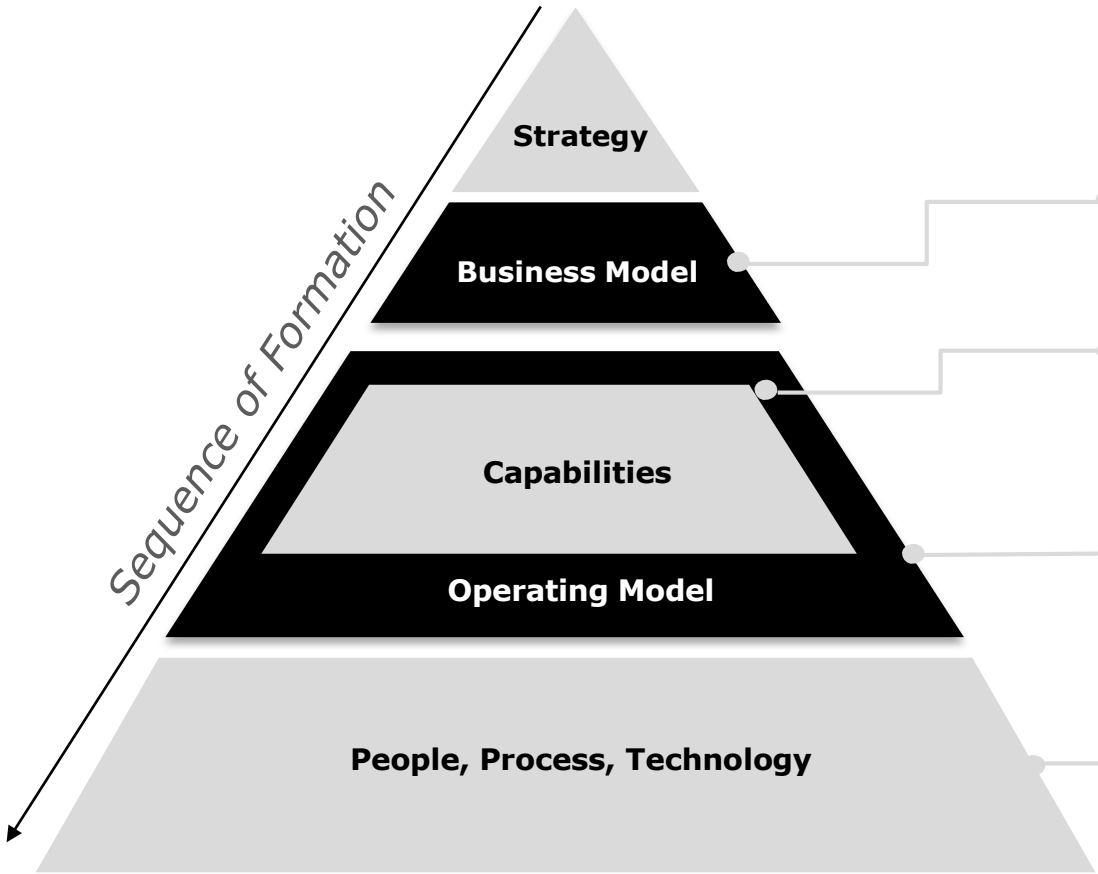
Commodities Trading Consortium Example



Foundational Elements of a Consortia

A robust Operating Model to address structure, key products, services, governance, roles & responsibilities is critical

Consortia Model



Strategy

The vision, mission, and objectives of the new entity. Examples:

- What value will the consortium try to create?
- Will the consortium be international?
- What are the strategic risks?

Business Model

The "who, what and how" of the business. Examples:

- Who are our partners in the Consortium?
- What use cases should we build and what is our go-to-market strategy?
- What should the role of each entity be in the context of the Consortium?

Capabilities

Combinations of people, process, and technology that define how the Consortium operates. :

- Identification of technical staff, control framework, hardware, and software needs
- Definition of architecture including node topography

Operating Model

Configuration of capabilities into business units, shared functions, and the ecosystem. Examples:

- Create infrastructure and capabilities required to support vision
- Identify strategies that make the operating model scalable so as to facilitate the achievement of critical mass via partnership growth

People, Process, Technology

People, process, technology enablers required to create or support the operating model. Examples:

- The organization structure should reflect functional division of roles
- Job profiles and roles in the new organization must be standardized to account for varying degree of expertise

Consortia Model in Power & Utilities

Results from Deloitte's engagement with a utility service organization

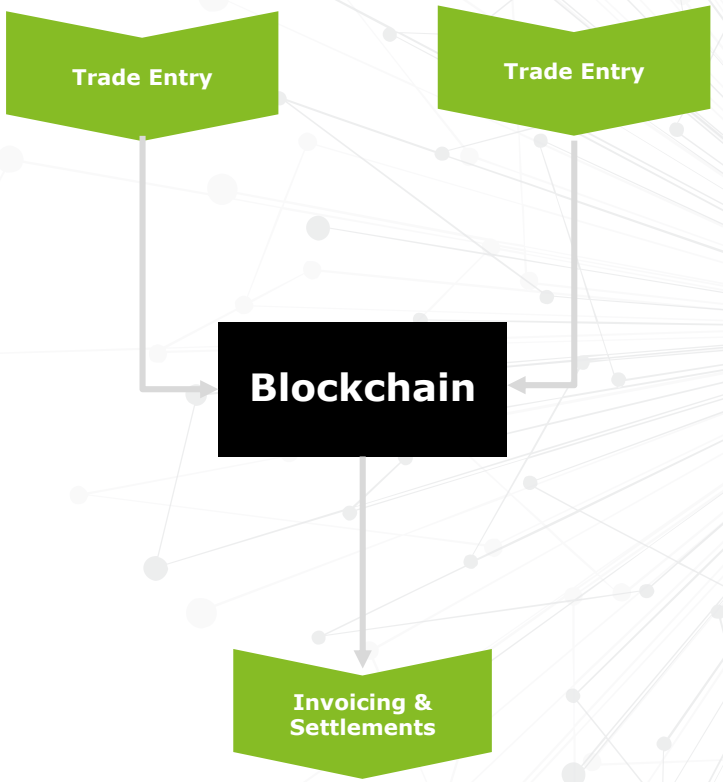
Without Blockchain

Personnel Required	Average Daily Hours	
• Trader • Scheduler • Trading Director	4 – 6	Trade Entry
• Director of Risk • Risk Analysts • Trader	4 – 6	Confirmation
• Risk Analysts • Settlements Analysts	5 – 6	Data Verification
• Trader • Trading Director	3 – 4	Checkout
• Settlements Analyst • A/P • A/R	8 – 10	Invoicing & Settlements

Daily Hours **24 – 32**

Annual Hours **5750 – 7750**

With Blockchain



Daily Hours **6 – 8**

Annual Hours **1500 – 2000**

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Thank you.