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Blockchain & Energy – The Current State of Supply & Demand

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WHAT WE WILL COVER

- Blockchain Basics
  - How is it different from Bitcoin?
  - What are “smart contracts”?

- How is blockchain technology interacting with the energy industry?
  - Streamlining renewable energy financing
  - Enabling microgrids and other trading mechanisms
  - Creating new load to support crypto/mining

WHAT'S A BLOCKCHAIN?

A FEW OPENING POINTS…

1. Blockchain is a software technology
   - There is no single “blockchain”
   - Applications can differ

2. Blockchain is not Bitcoin

3. Blockchain is not limited to monetary transactions. Almost anything can be “tokenized”

THE CORE COMPONENTS

1.PEER TO PEER (P2P) NETWORK

- The architecture of the network nodes

2.CONSENSUS MECHANISM

- How decisions and transactions are made and verified

3.SHARED LEDGER/DATABASE

- How information is stored

PUBLIC VS. PRIVATE NETWORKS

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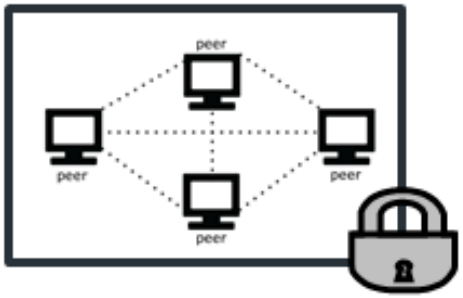
- **The p2p network can be created as either public or private, depending on the needs of the participants,** and identity of participants can be protected using **public-private key encryption.**

- **Public**: An electric vehicle charging app that allows owners to sell charging time to the public would likely create an open, permissionless network → anyone can access the network by downloading the app.

- **Private**: An energy trading exchange would likely use a closed network, where exchange membership grants network access.



CONSENSUS MECHANISM

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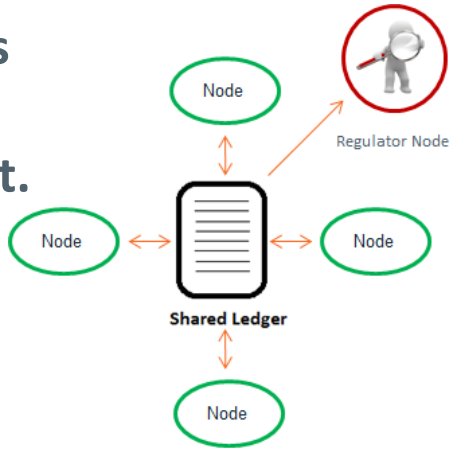
- Consensus = “Mining”
  - Specifies how nodes on the network agree on data written to blockchain ledger.
  - *In other words, how does the network determine what information should be considered valid?*

- Nodes can work as a group that can verify transactions even if some nodes fail.
- *Consensus* ensures that the shared ledgers are exact copies. Less risk of fraud because **tampering would have to occur across many places at exactly the same time**
- Most common consensus mechanism is “Proof of Work” - but see “Proof of Stake,” “Proof of Authority,” etc.

SHARED LEDGER

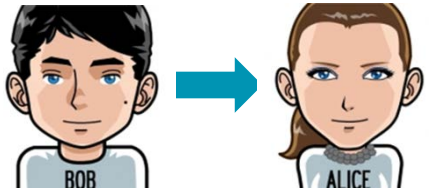
- Data verified → included in the digital ledger → immutability.
- Digital ledger exists on all blockchain nodes and keeps track of all transactions and their integrity (timestamping).
- Data accessibility on the blockchain ledger can be tailored to meet the specific needs.

- **Ex: Blockchain network designed to track LNG shipments**
  - **Merchants can add to/modify the ledger.**
  - **DOE has permission to view the ledger, but not alter it.**



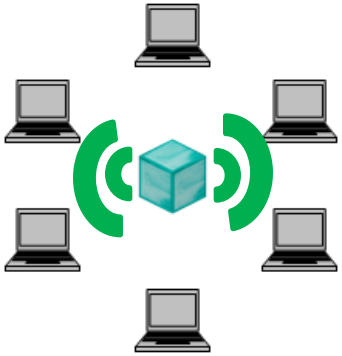
PUTTING IT ALL TOGETHER…

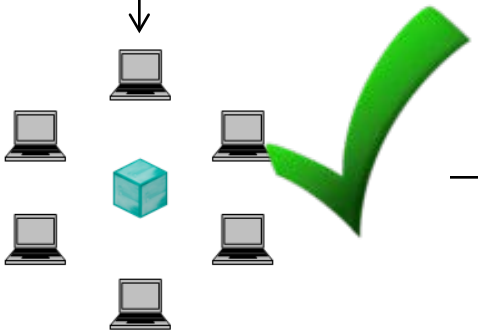
Bob wants to transfer ownership of a SREC to Alice

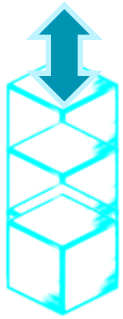


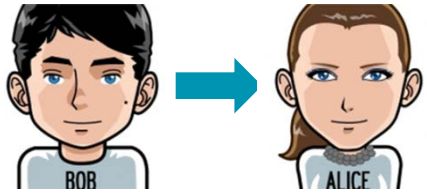
Transaction represented to the network as a block

The block is broadcast to all nodes on the network









Nodes on the network work to verify that the transaction is valid **(consensus mechanism)**

Once verified, the block is added to the chain of all blocks in the ledger to create an **immutable** record

Ownership transferred from Bob to Alice

WHY IS ALL OF THIS SIGNIFICANT?

1. Eliminates the need for a third party moderator
2. Creates one secure "**golden record**"
3. Can eliminate back office functions

Reduced transaction costs
Reduced transaction time
Better transparency

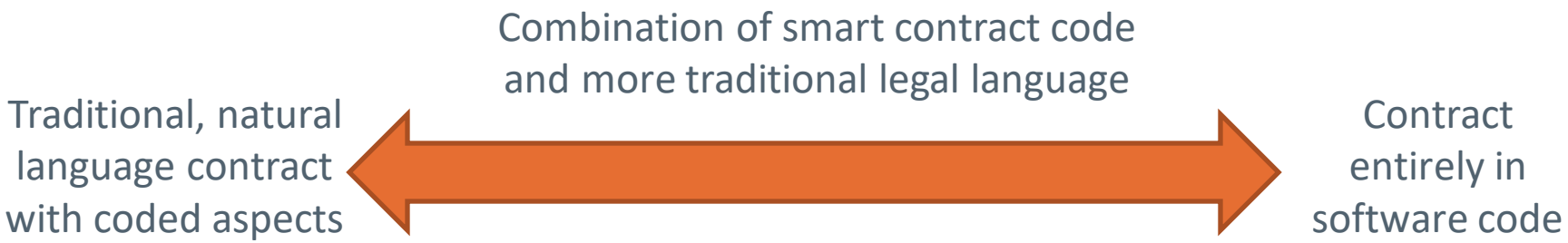
4. Can be paired with smart technology to enable coordinated record-keeping that would otherwise be logistically difficult

Source: https://www.linkedin.com/pulse/how-supply-chain-trade-finance-becomes-most-relevant-use-tabbakh

SMART CONTRACTS

What is a "Smart Contract"?

- "A set of promises, specified in digital form…"
- If-then statements (e.g., IF price is X, then take Y action)
  - Code sits within or on top of the blockchain application
  - Distributed ledger and consensus mechanism are used to confirm whether contractual conditions have been met
  - Automatic execution
  - Automatic enforceability
- Software Developer meaning v. Legal Meaning



SMART CONTRACT – Pros/Cons

- Pros
  - Self-executing and Self-Contained (it's all in the code)
  - Decentralized (no need for third party trust)
  - Immutable transactions
- Cons
  - Requires knowledge and understanding of code
  - Inflexible
  - Some legal uncertainty regarding enforceability

ENERGY INDUSTRY APPLICATIONS

HOW IS ENERGY INVOLVED WITH BLOCKCHAIN?

- **Financing Renewables.** Blockchain promises to streamline renewables development by lowering costs and unlocking capital.

- **Transactive Energy.** Blockchain entities are tracking and trading energy and environmental attributes.

- **Supplying Power to Blockchain Users.** Mining for bitcoin and other cryptocurrencies use a significant amount of energy that is straining current supply.

1- FINANCING RENEWABLE ENERGY

- Sell and trade project equity via blockchain
- Smart contracts = lower overhead
- Blockchain can help lower capital requirements associated with long-term financing.
  - Lower debt service requirements means more players—and more capital available for new projects.

FINANCING RENEWABLES: BANYAN INFRASTRUCTURE & DATAWATT ENERGY

- **Banyan** uses smart contracts to automate contractual compliance and decrease risk.
  - This reduces cost of capital and improves bankability of project.
  - Easier syndication
  - Cheaper loan servicing

- **Issues**: Scalability?

2- ENERGY and REC TRADING

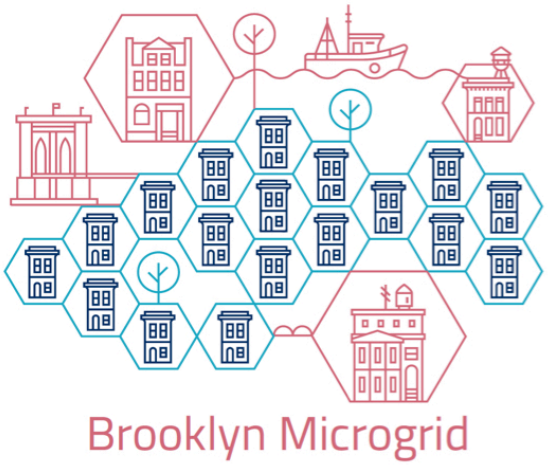
- Blockchain can automate energy tracking and trading
  - Assign a crypto identity and time stamp to every unit of energy generated helps track usage and production
  - Avoids double-counting for RECs or PPAs
  - Enables local microgrids to transact with trust and granularity
  - Examples: LO3 Energy; Electron; Power Ledger; Alectra; Share and Charge (EV applications)

ENERGY and ATTRIBUTE TRADING EXAMPLES

- **LO3** – Focus on DER integration for vertical utilities or retailers
  - Private, permissioned blockchain
  - Establish consumer markets

- **Power Ledger –** Trading energy (internationally)
  - REC tracking (domestically)

- **Energy Web Foundation**
  - Register, track devices
  - Settle trades
  - Origin/ PJM



BLOCKCHAIN'S BENEFITS FOR RECS, RINS, LCFS Credits

- Increased Transparency (clear record of title)
- Certification of Authenticity (cutting out fraud)
- Efficiency (reducing friction for recording trades)
- Greater Access and Anonymity

3- BLOCKCHAIN'S ENERGY DEMAND

- Many miners are drawn to Central Washington due to the low rates enabled by hydropower
  - This increased demand has put a strain on T&D and rates
  - New tariff structures, e.g. Grant County's "Evolving Industry" rate types

- Beyond Bitcoin - new blockchains help reduce energy consumption
  - Private, permissioned blockchains (Proof of Stake/Proof of Authority)
  - Examples: Energy Web Foundation; Ethereum(?)

E.g., ENERGY WEB FOUNDATION (EWF)

- EWF - proof-of-authority to decrease the amount of energy needed
  - Traditional proof-of-work systems allow anyone who can solve algorithms to validate transactions
  - Proof-of-authority moves validation to a set of “industry validators”
  - But is it a “blockchain”?
- E.g., Greensparc – cloud as a service?

energy web
FOUNDATION

LEGAL AND REGULATORY ISSUES

- Incompatible statutory/regulatory structures
- Jurisdictional questions
- Enforceability of smart contracts
- Dispute resolution

QUESTIONS?

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Email me to sign up for Blockchain Energizer list!