ADB-ACEF – 2018

Blockchain – Smart Disruption for Clean Energy Deployment

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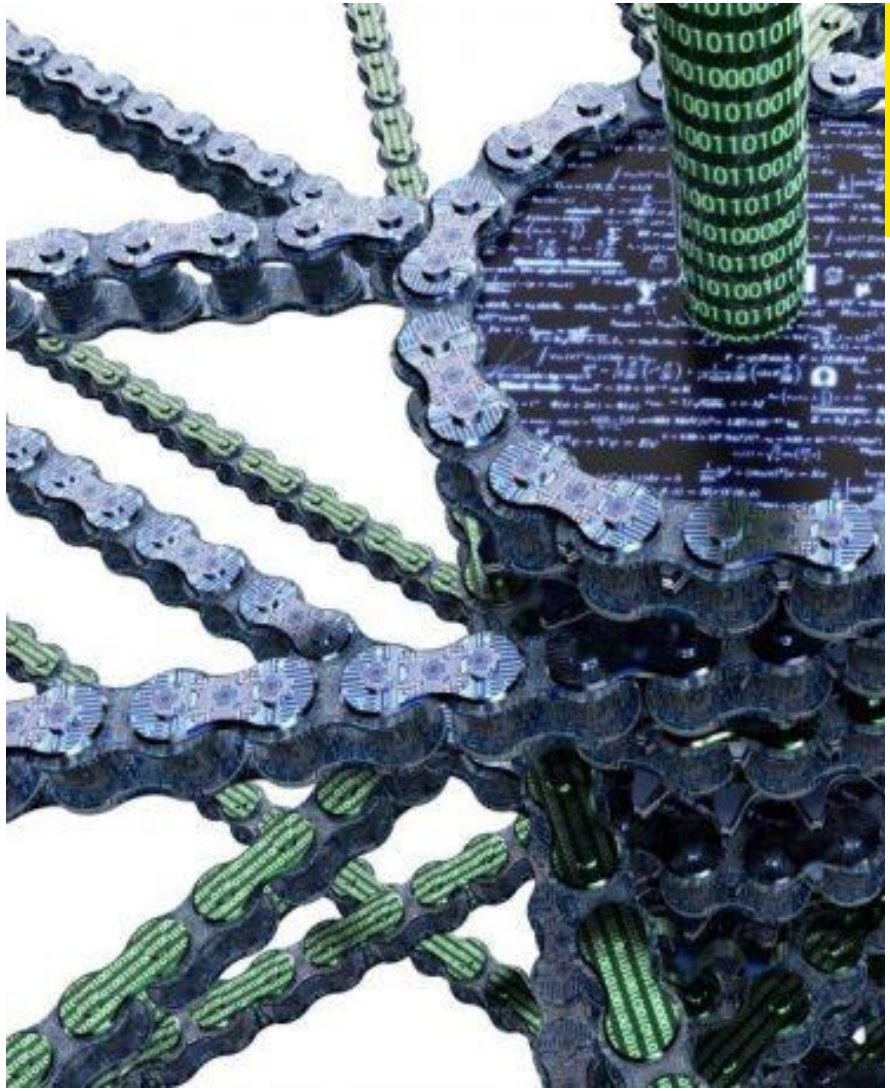
Building a better working world

What is Blockchain ?

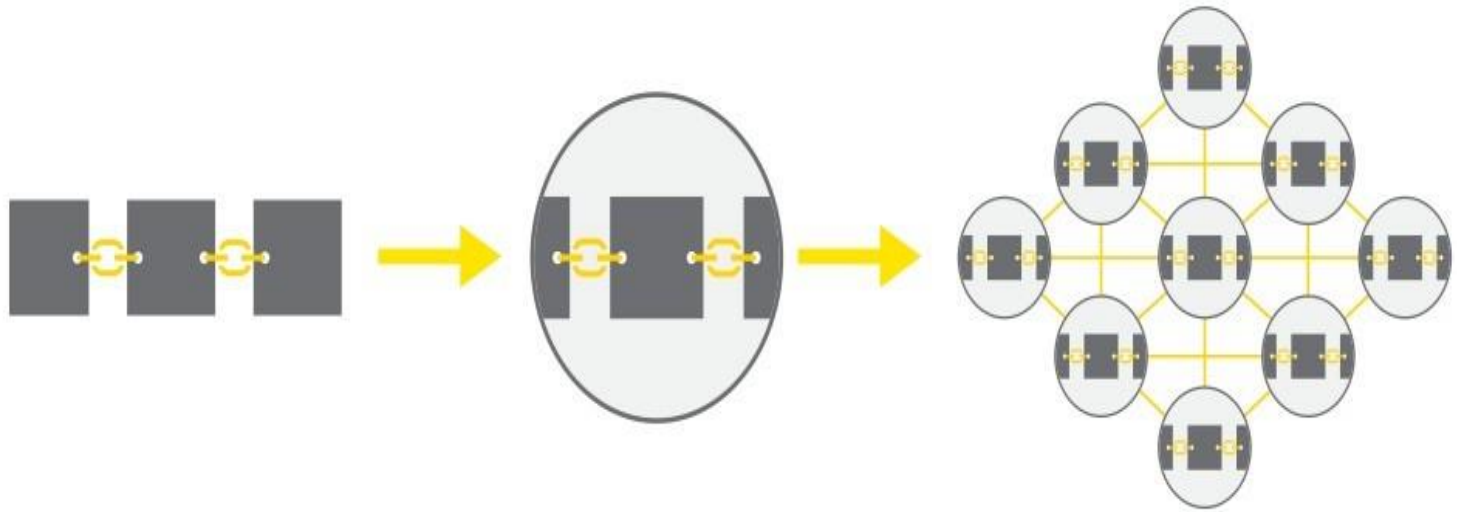


Blockchain technology is a way to structure data without the need for a central authority.

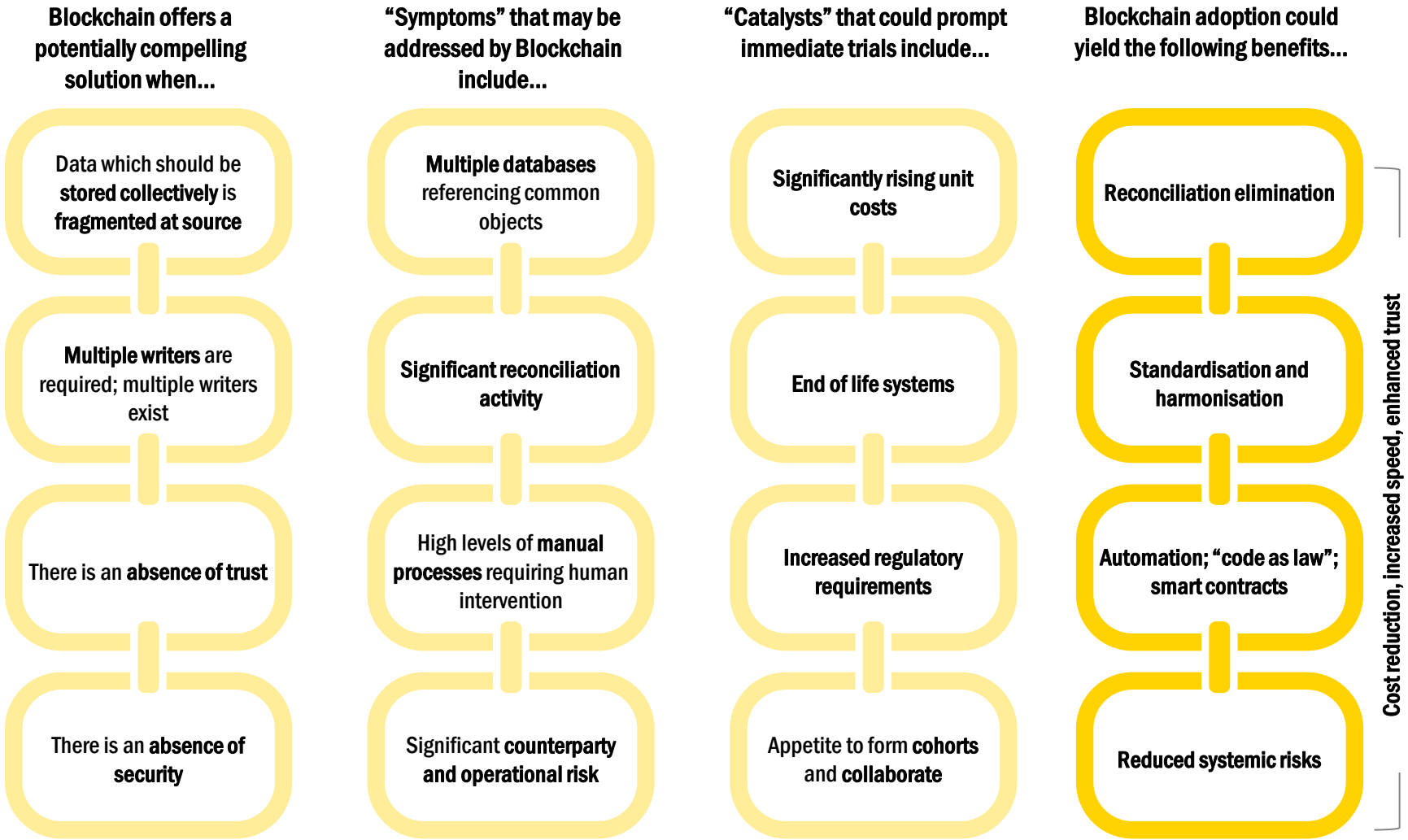
A blockchain is made up of a series of blocks containing validated transactions.

Each block is attached to the previous block, thereby making it extremely difficult to corrupt, helping to combat fraud and allow for accurate and complete information.

This chain of blocks is then stored and replicated across the network, enabling a distributed ledger.



Features of Blockchain technology



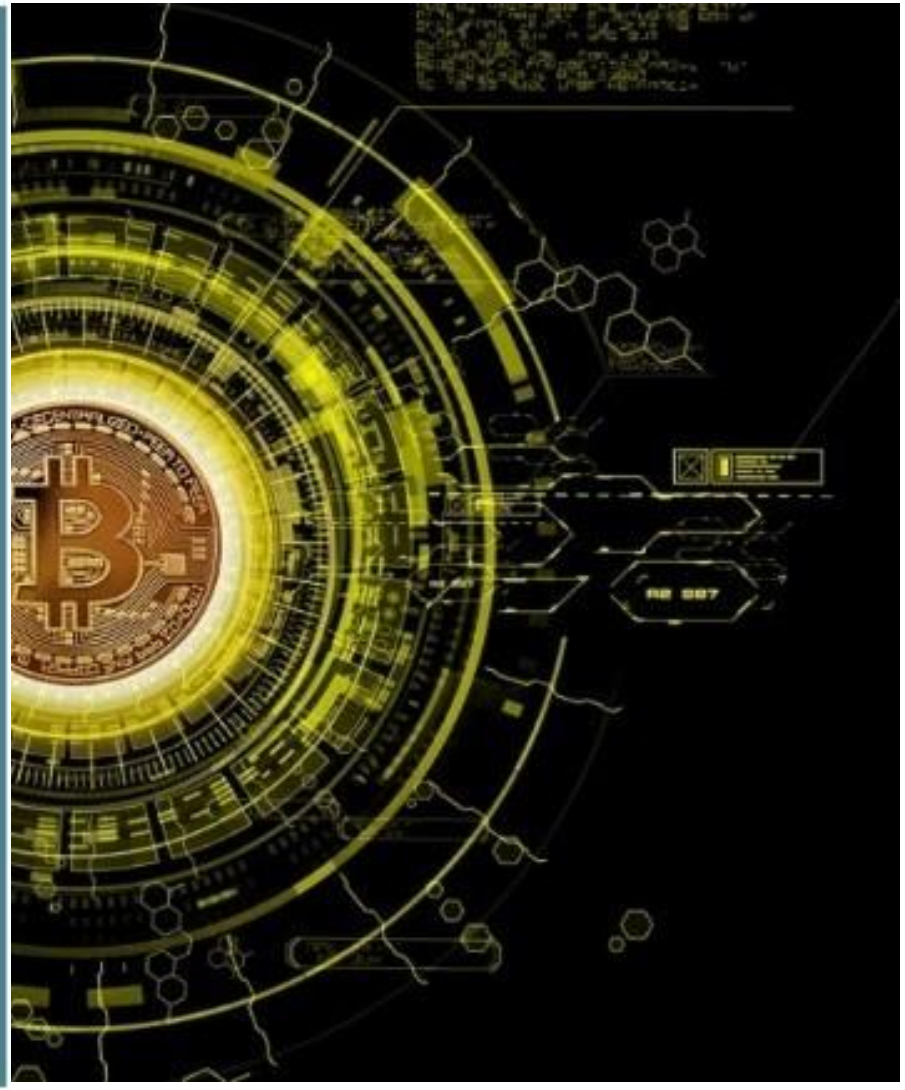
Why use Blockchain ?

Reduce the need for trust between stakeholders

Build a secure value transfer system

Streamline business processes across multiple entities (reconciliation)

Increase record transparency and ease of auditability



A different generation mix and technology will have implications for the future of Energy Sector & utilities

Regulatory encouragement of renewables and market reform	Transition to clean energy future	Digitalisation of the grid RE power grid integration	Energy usage and demand transformation	Changing consumer behaviour and expectations

To be successful, the industry will need to resolve some fundamental issues

Complex transactions

- As the number of participants increases so to does the level of transaction complexity
- Significant increase in the transactions volume

Standards and interoperability

- Seamless interaction between central and distributed resources will require open standards and interoperability

Autonomous response to market signals

- Real time monitoring of network performance, and continuous assessment of supply and demand based on price signals

Empowered Prosumer

- Flexible monitoring and control systems to accommodate different degrees of customer engagement according to individual preferences

Predictability & Reliability

- Renewables are less predictable than traditional grid power sources
- The grid is very sensitive to even small imbalances in supply & demand

Geographic Mismatches

- Ideal locations for solar and wind farms are often far from key demand centers
- Long distance power transmission has a high loss rate

Time Mismatches

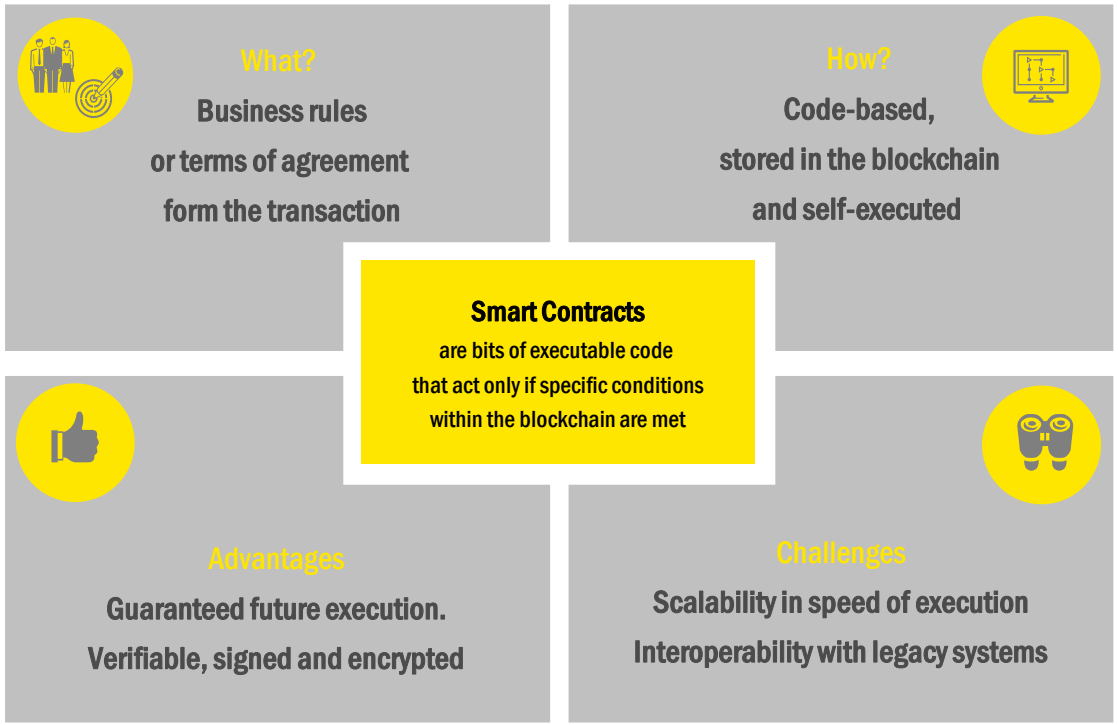
- Balancing the supply mix on a real time basis essential to maximise the energy output and cost effectiveness of the whole system

Trust/Security

- Significant increase in the number of new entrants makes security and trust a critical requirement in the system

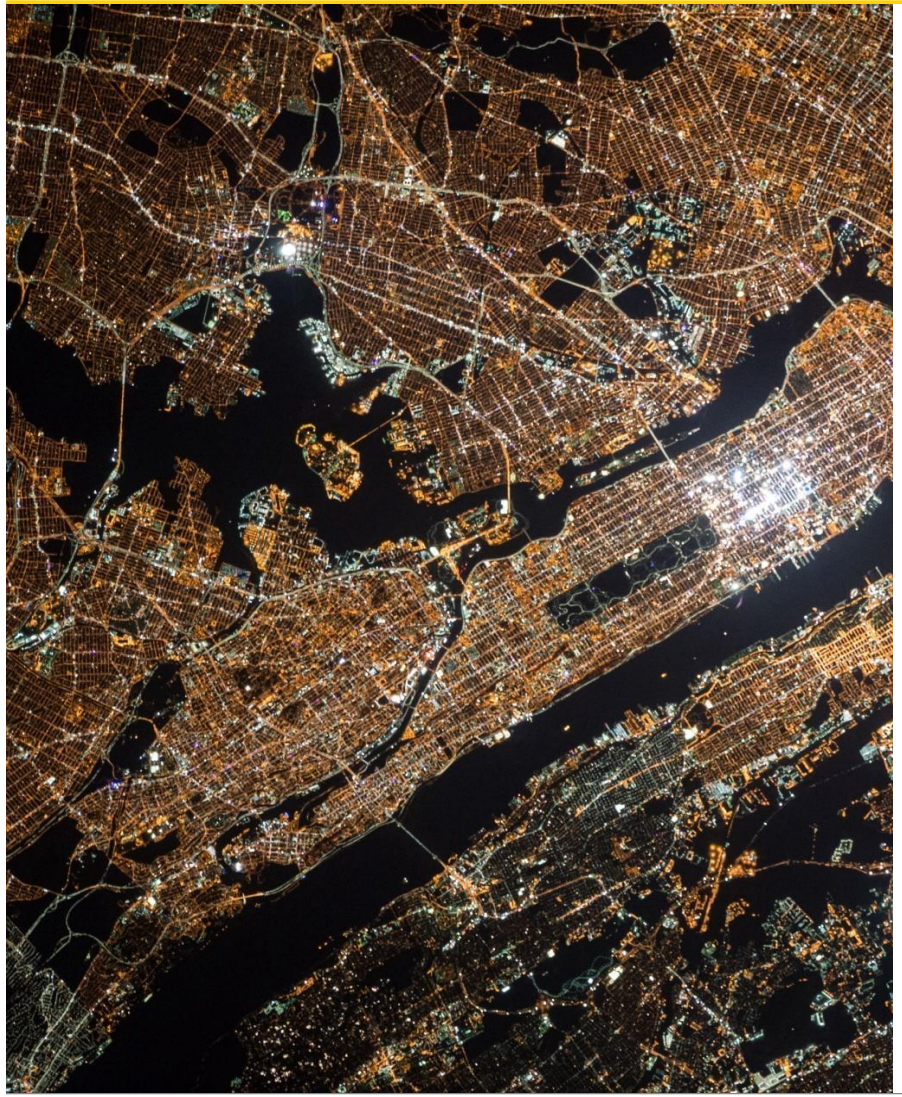
Smart contracts – why distributed transactions are enabled

The advantage of blockchain-based contracts is that they reduce the amount of human involvement required to create, execute and enforce a contract, thereby lowering its cost while raising the assurance of execution and enforcement processes. By automating a transaction in a fully verifiable framework (the blockchain) the transactions can have legal validity even at high frequency – a key enabler for network balancing



Traditional contracts	Smart contracts
1-3 Days	Minutes
Manual remittance	Automatic remittance
Escrow necessary	Escrow may not be necessary
Expensive	Fraction of the cost
Physical presence (wet signature)	Virtual presence (digital signature)
Lawyers necessary	Lawyers may not be necessary

Block Chain – Energy and Commodity Chain Transaction



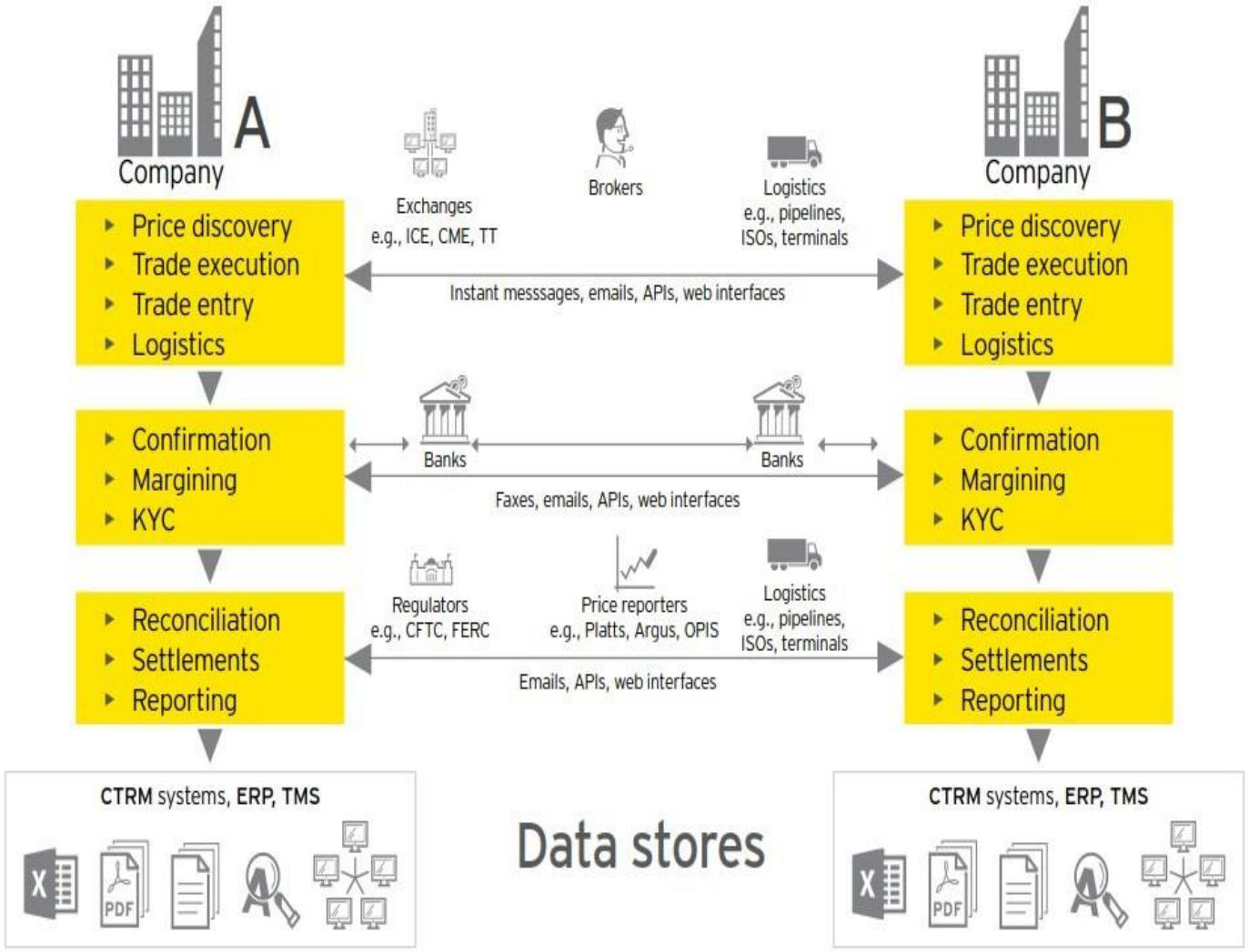
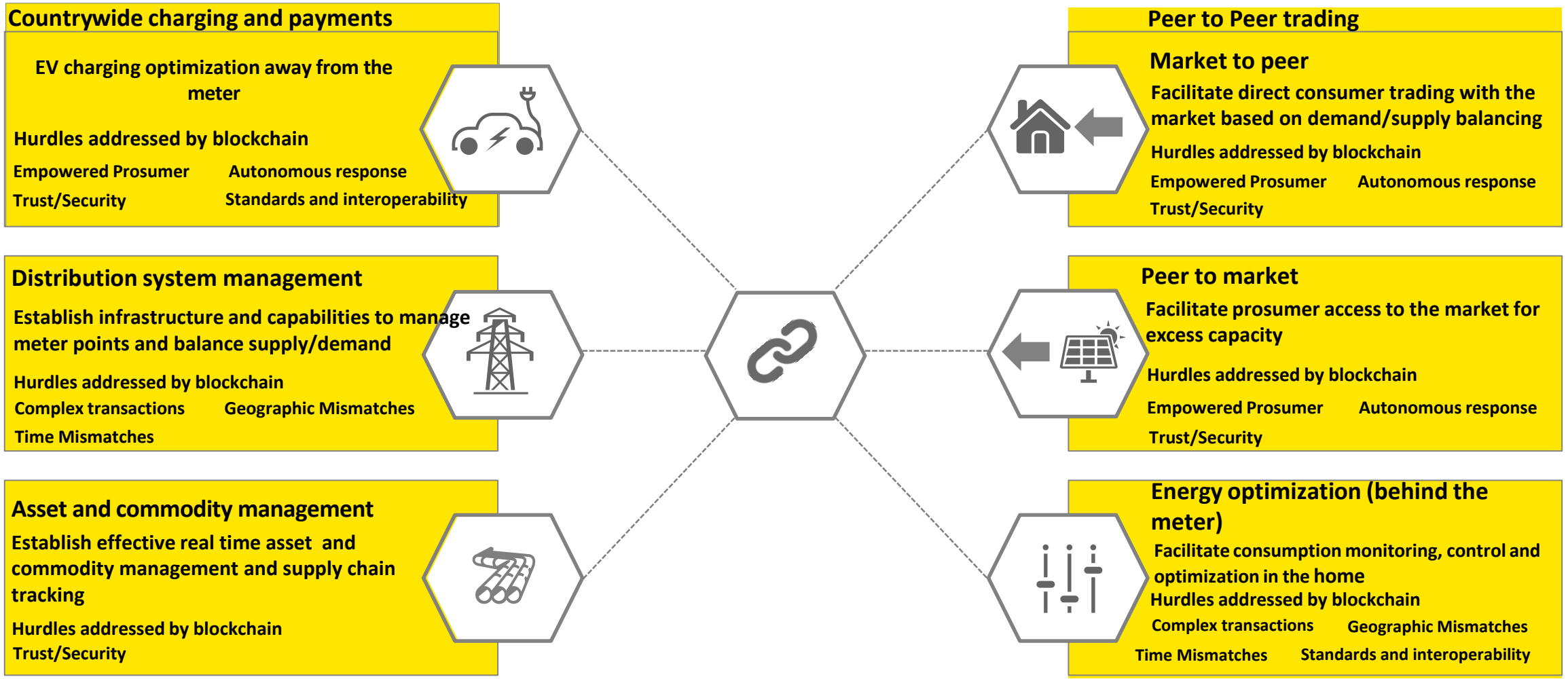
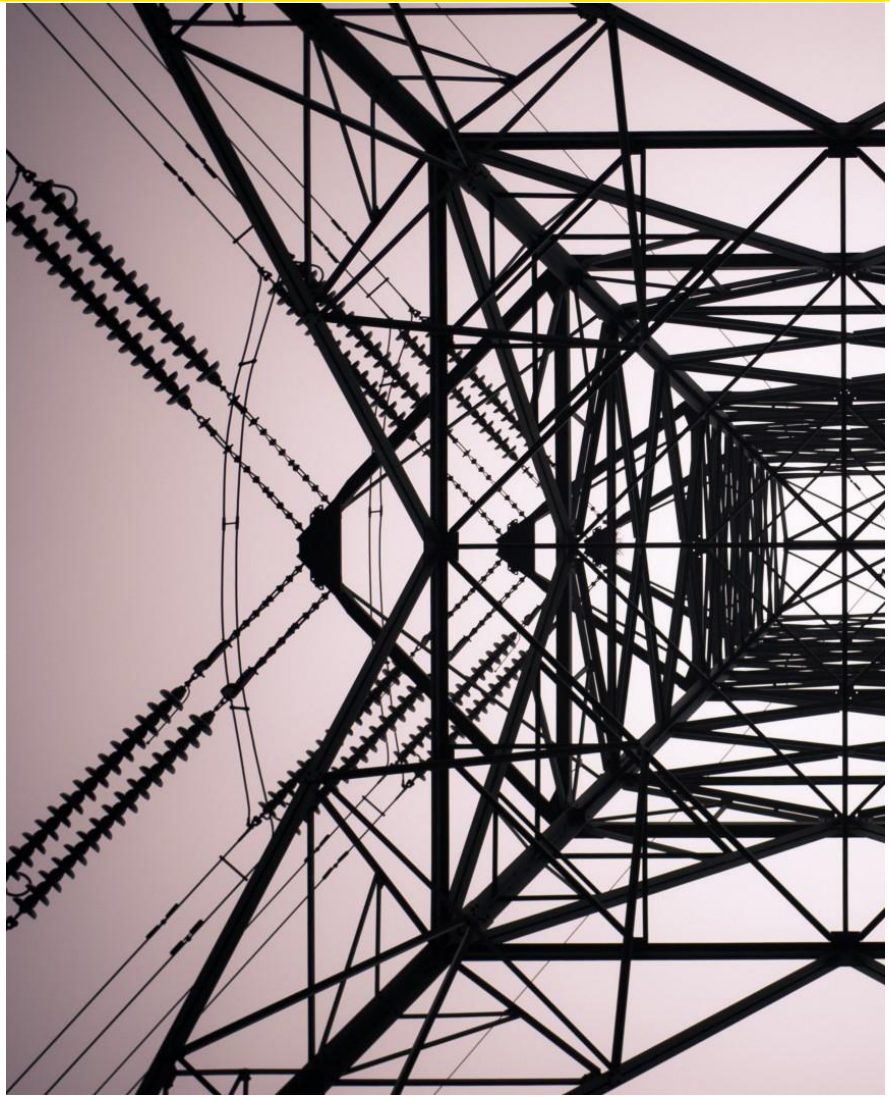


Photo Courtesy : https://media.consensys.net/the-state-of-energy-blockchain-37268e053bbd

Use Cases in Power and Utilities Sector incl. Clean Energy

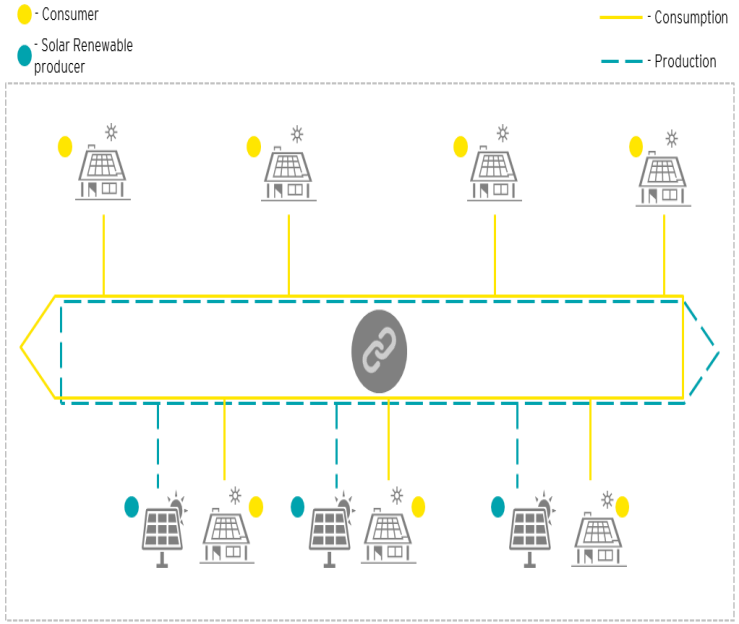


Blockchain and Microgrid – Use Case



Blockchain can empower microgrids with limitless potential to have seamless integration with grid thereby enabling peer-to-peer trading - a key to unlock finance !

- USE CASE: Microgrid - **Reference:** LO3ENERGY



Role of Blockchain?

- Blockchain facilitates secure transactions of power between individuals on a distributed network who do not have an existing relationship
- Grid is based on an open source, cryptographically secure decentralized application platform
- All micro tansactions are logged

How is Blockchain used?

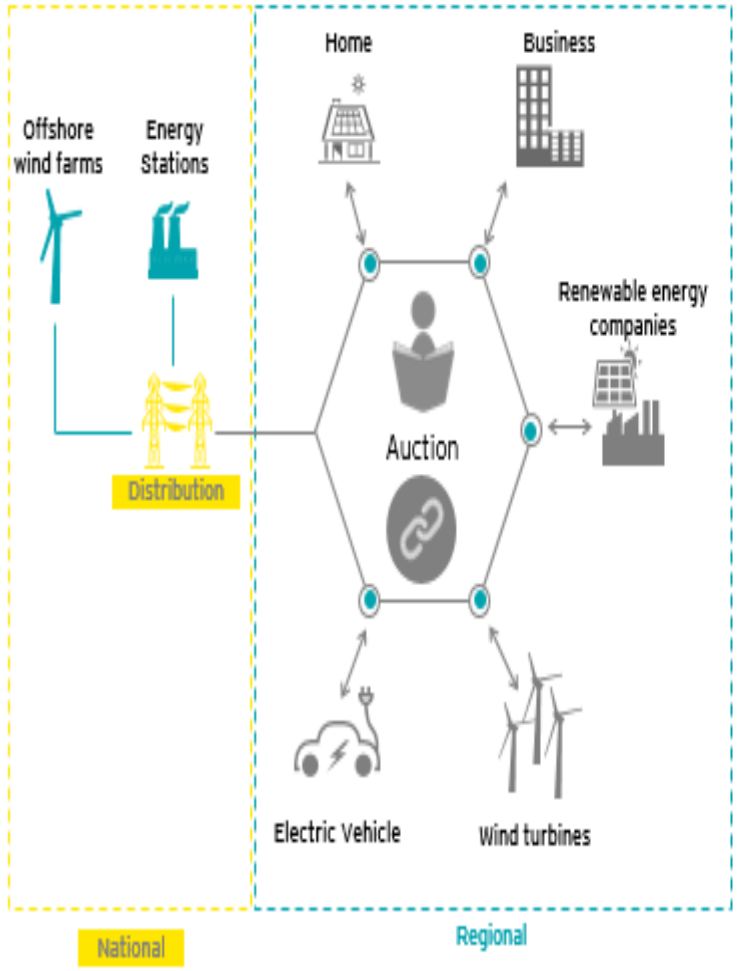
- Prosumers generate power beyond their needs and feed it into the grid using blockchain
- Real-time metering of local energy generation and usage as well as other related data
- Smart contracts automate agreed trading relationships eg order of preference in community

What is the benefit?

- Enables reporting and self management on a real-time basis
- Consumers able to control who uses space generation
- Commercial transactions are auditable improving trust

Distribution Management & Charging (EVs) – Use Case

- USE CASE: Green energy tracking - Reference: alliander



Role of Blockchain?

- Blockchain is used as a support regional energy distribution and mobile device use
- Demand response and mobility
- Facilitate interaction between supply and demand (on/off peak)

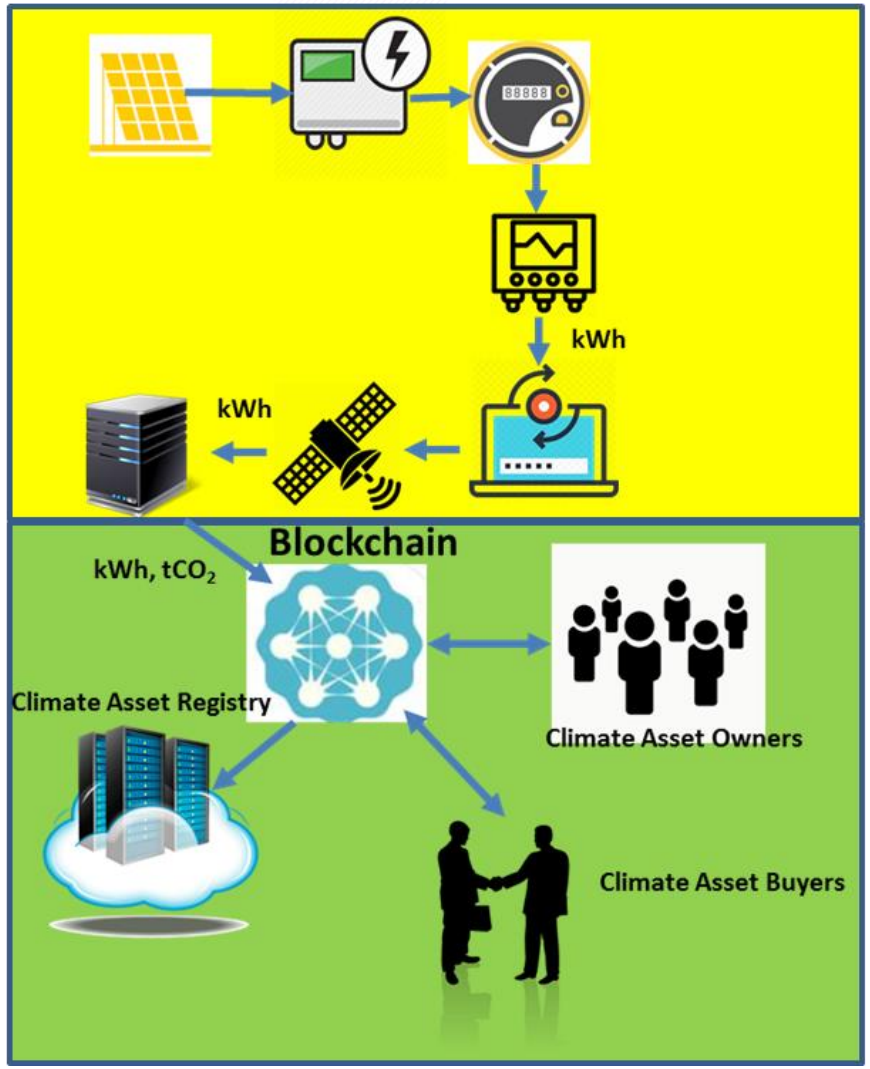
How is Blockchain used?

- Smart-wallets to log users in and charge the vehicle at times that do not contribute to a major peak, in effect shifting the load and reducing the cost per unit
- Ability for users to respond faster to system constraints at acceptable costs

What is the benefit?

- Improved energy flow
- Energy optimisation
- Security
- Real-time market response
- Broader customer base affordability

Indian Grid Rooftop Solar PV – Climate Assets and Blockchain

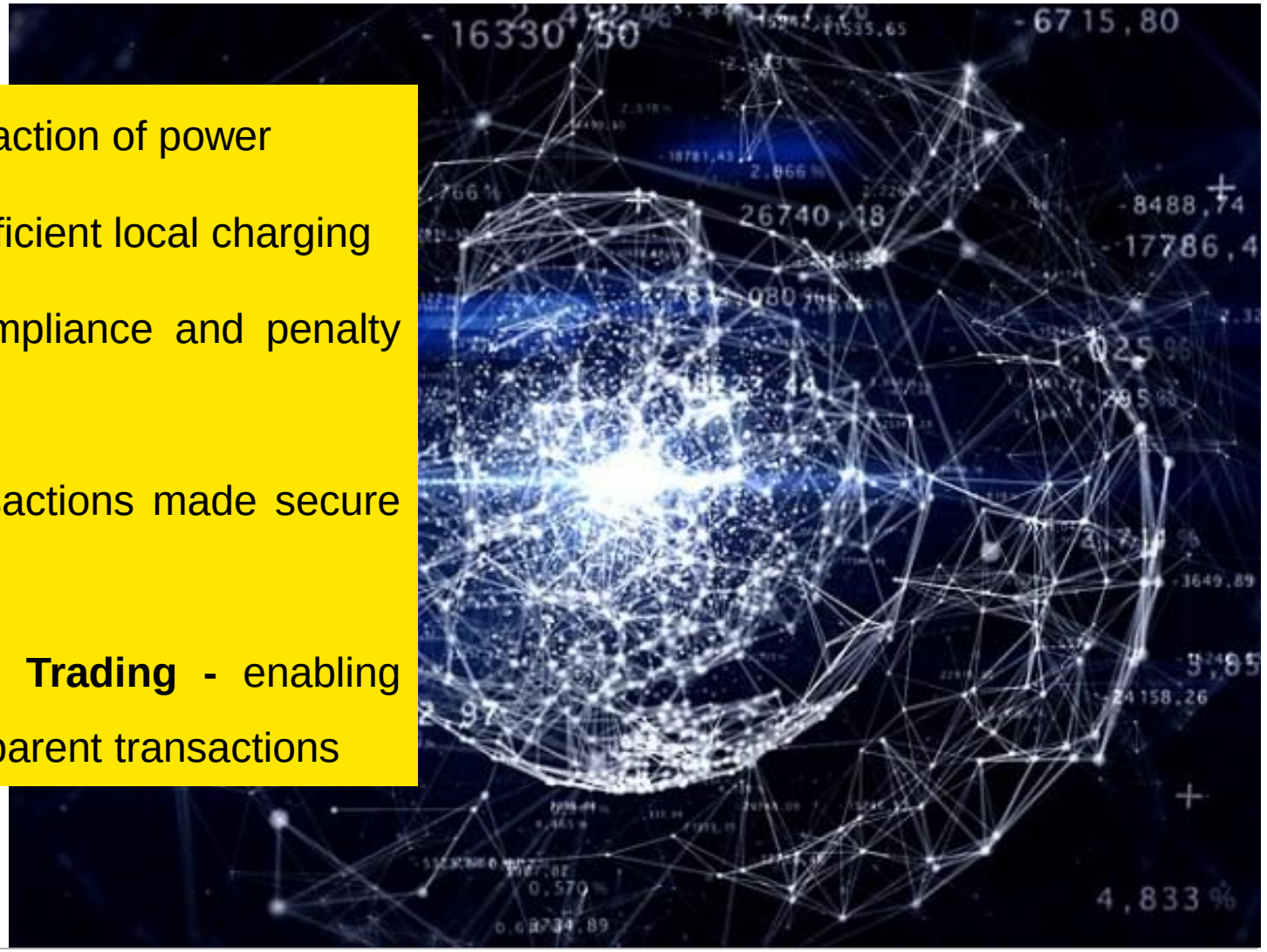


- **Large scale iGRPV projects** currently implemented by RESCOs
- **Measuring and monitoring** gross generation is picking up
- **Online monitoring** of gross generation mooted by DISCOMs
- **Gross generation** data will **assist** :
  (a) **DISCOMs for RPO** compliance and supply-demand assessment at Distribution Transformer level
  (b) **RESCOs and Investors** in system performance assessment
  (c) **MNRE** in reporting and analysing generation data
  (d) Carbon Market for monetising GHGERs (climate assets)

Blockchain will enable **validation** of **creation of iGRPV assets (Registry)**, **monitoring** and **tracking** of generation of **climate assets** including registry, **securing trust** and **transparency** on **transaction** and **monetisation** of climate assets.

Blockchain of the future in Clean Energy

- **Urban Micro Grids -** seamless transaction of power
- **EV charging infrastructure -** cost efficient local charging
- **Forecasting and Scheduling -** compliance and penalty validation
- **Climate Assets -** International transactions made secure and simple
- **Power and Clean Energy Assets Trading -** enabling large scale access, secure and transparent transactions



Thank You !

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