



Transmission Grids and Blockchain

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*Disclaimer: The opinions expressed in this presentation and on the following slides are solely those of the presenter and do not necessarily reflect the opinion of CRE.

What is blockchain?



*A distributed digital ledger of cryptographically signed transactions that are grouped into blocks. Each block is cryptographically linked to the previous one after validation and undergoing a consensus decision. As new blocks are added, older blocks become more difficult to modify. New blocks are replicated across all copies of the ledger within the network, and any conflicts are resolved automatically using established rules.*¹

*Blockchain is an open-source distributed database using state-of-the-art cryptography through a distributed ledger that enables trust among disparate individuals or third parties. Blockchain transforms the way transactions happen in the Internet age. A blockchain block is immutable, the information and details of the data contained on the blockchain are virtually impossible to change. The impact on every segment of industry and services verticals is hard to calculate.*²

*Blockchain technology is the best known distributed ledger technology. It avoids one centralised location and the need for intermediaries to perform transactions. Information stored on a blockchain is shared, verifiable, public and accessible.*³



Characteristics of blockchain:

- ✓ **Validation**
- ✓ **Information cannot be modified**
- ✓ **Information is secure and efficient**

In general, information is trackable, immutable and verifiable.

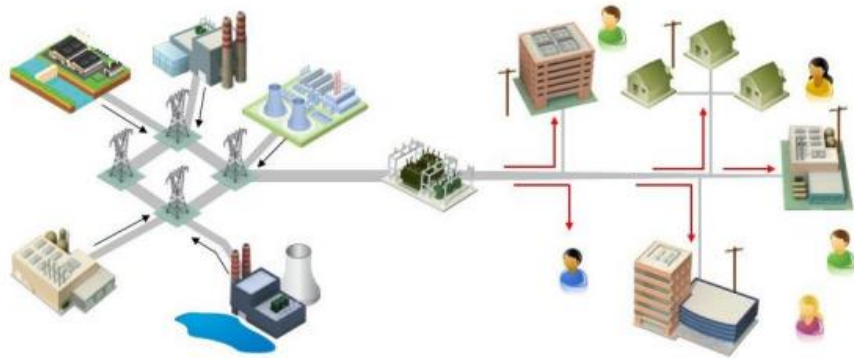
¹ Source: *Blockchain Technology Overview, Initiative by NIST*

² Source: <https://blockchain.ieee.org/about>

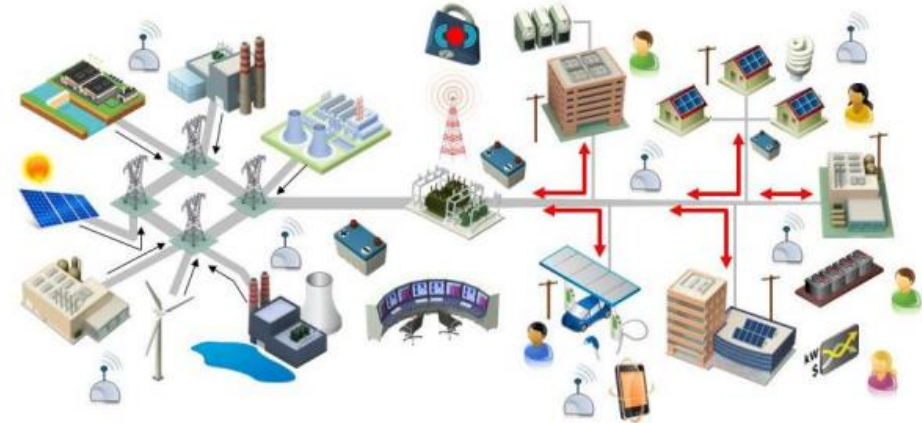
³ Source: <https://ec.europa.eu/digital-single-market/en/blockchain-technologies>

Blockchain in the Electricity Sector

Today's Power System










Tomorrow's Power System



Use of blockchain in the Electricity Sector

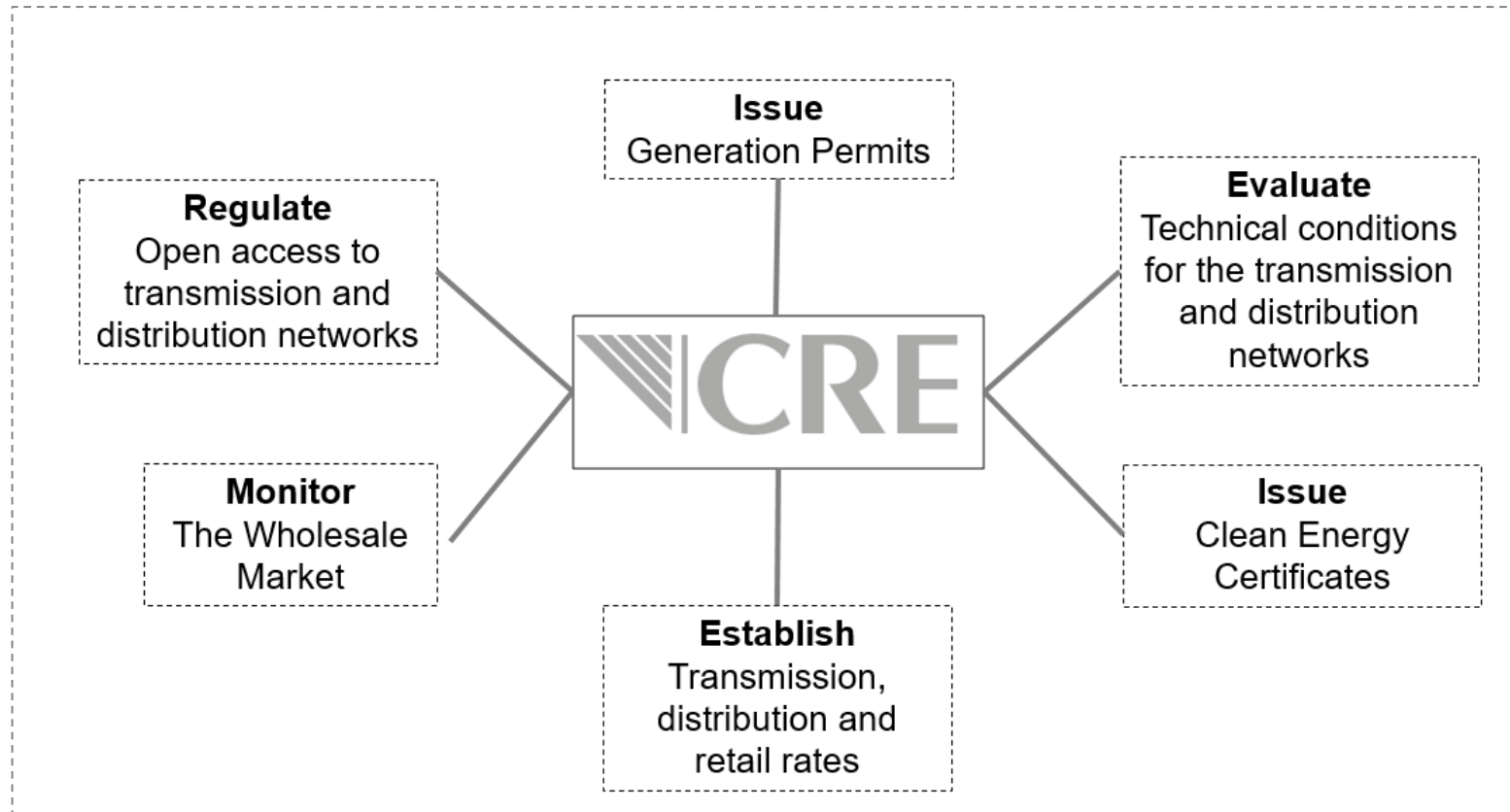
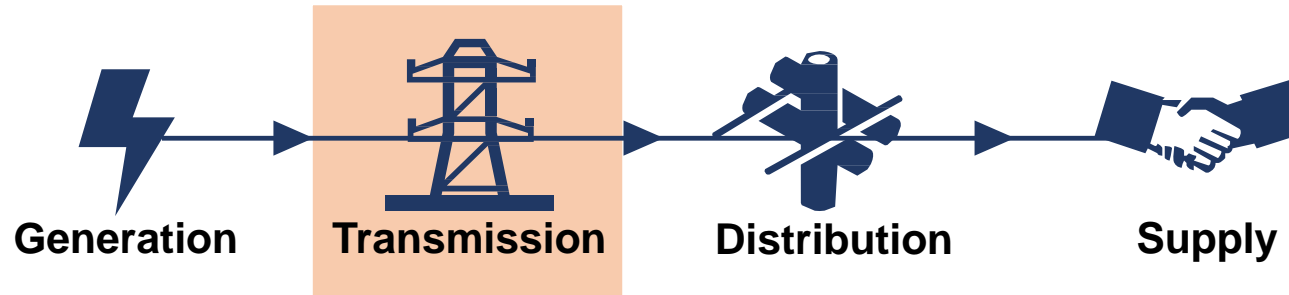


OPPORTUNITY / POTENTIAL BENEFIT

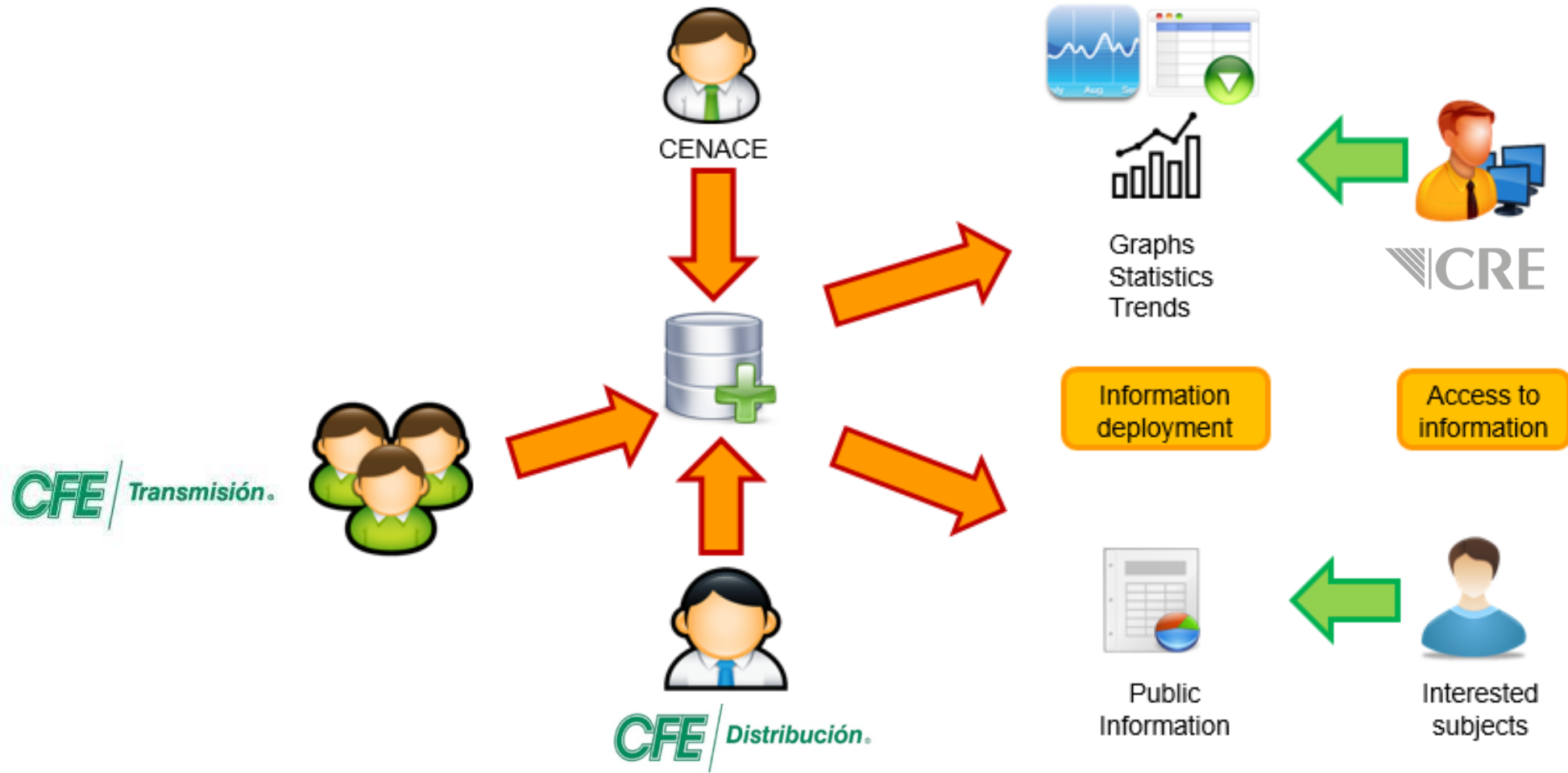
	Wholesale energy trading	<ul style="list-style-type: none">• Reduce transaction costs in wholesale energy trading
	Retail electricity markets	<ul style="list-style-type: none">• Reduce variable costs of retail payment processing and accounting• Greater transparency into billing• Fluid energy contract entry/exit• Greater customer choice of energy supply
	Peer-to-peer marketplaces	<ul style="list-style-type: none">• Relieve stress on transmission networks• Improve DER economics• Greater customer choice of energy supply
	Flexibility services	<ul style="list-style-type: none">• Improve TSO ability to balance supply and demand
	Electric vehicle charging and coordination	<ul style="list-style-type: none">• Improve DSO ability to coordinate electric vehicle load and discharge
	Network management and security	<ul style="list-style-type: none">• Improve DSO and TSO network management and security
	Environmental attribute markets	<ul style="list-style-type: none">• Improve efficiency and transparency of environmental attribute markets

Regulatory perspective

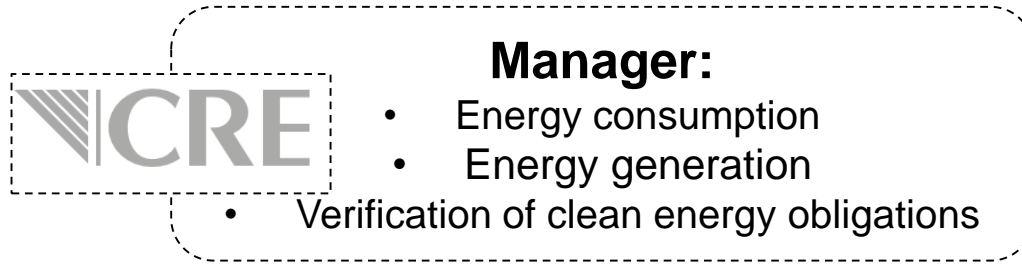
CRE's attributions in the Electricity Sector



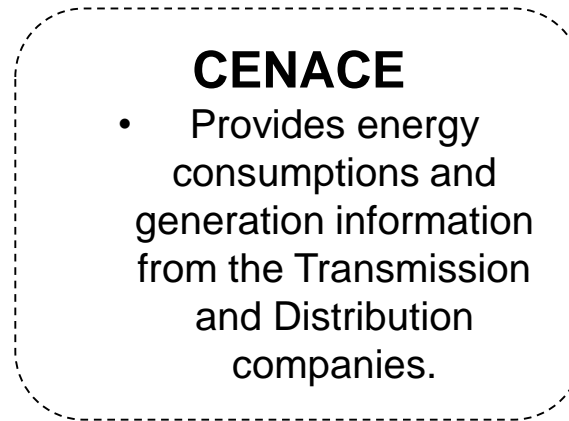
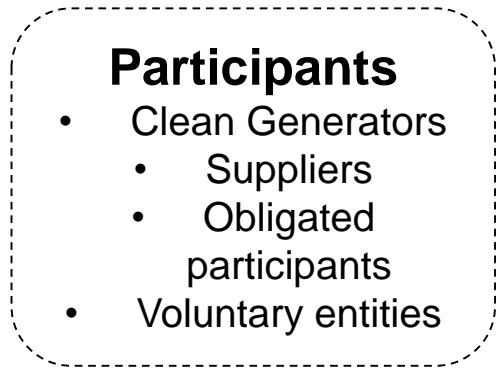
T&D performance evaluation



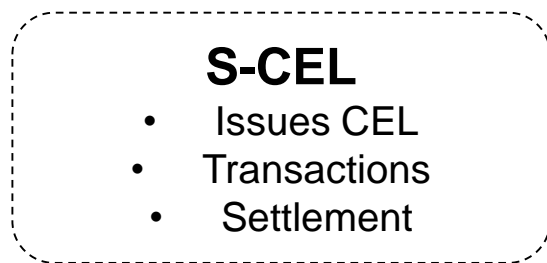
Clean Energy Certificates System (S-CEL)



Data base size
3 GB



CEL awarded by September 2018:
4,484,026



Blockchain applications:



CRE's internal functions

- **More reliable management of information**
- Statistics for energy generation
 - S-CEL
- **Monitoring of supply quality, including T&D performance**
- Improve reception of queries

Market applications:

- **Ancillary services**
- Registration of measurements
- Registration of transactions in the market (settlements for energy and CEL)
- Smart contracts for collective generation
- Market prices information



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