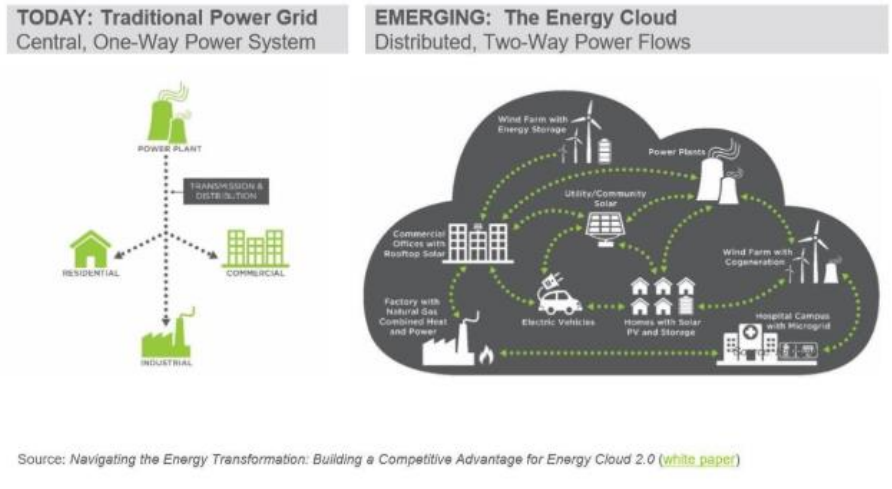
Blockchain Research Duke Energy & Blockchain Engineering Council

Elizabeth Escobar-Fernandes, Emerging Digital IT Manager and contributor to the IEEE Blockchain & Cybersecurity Task Force 1 for P2418.5

Dr. Claudio Lima, chair of the IEEE Blockchain in Energy Standards WG – P2418.5 and BEC CEO

4/22/21

Energy Trends



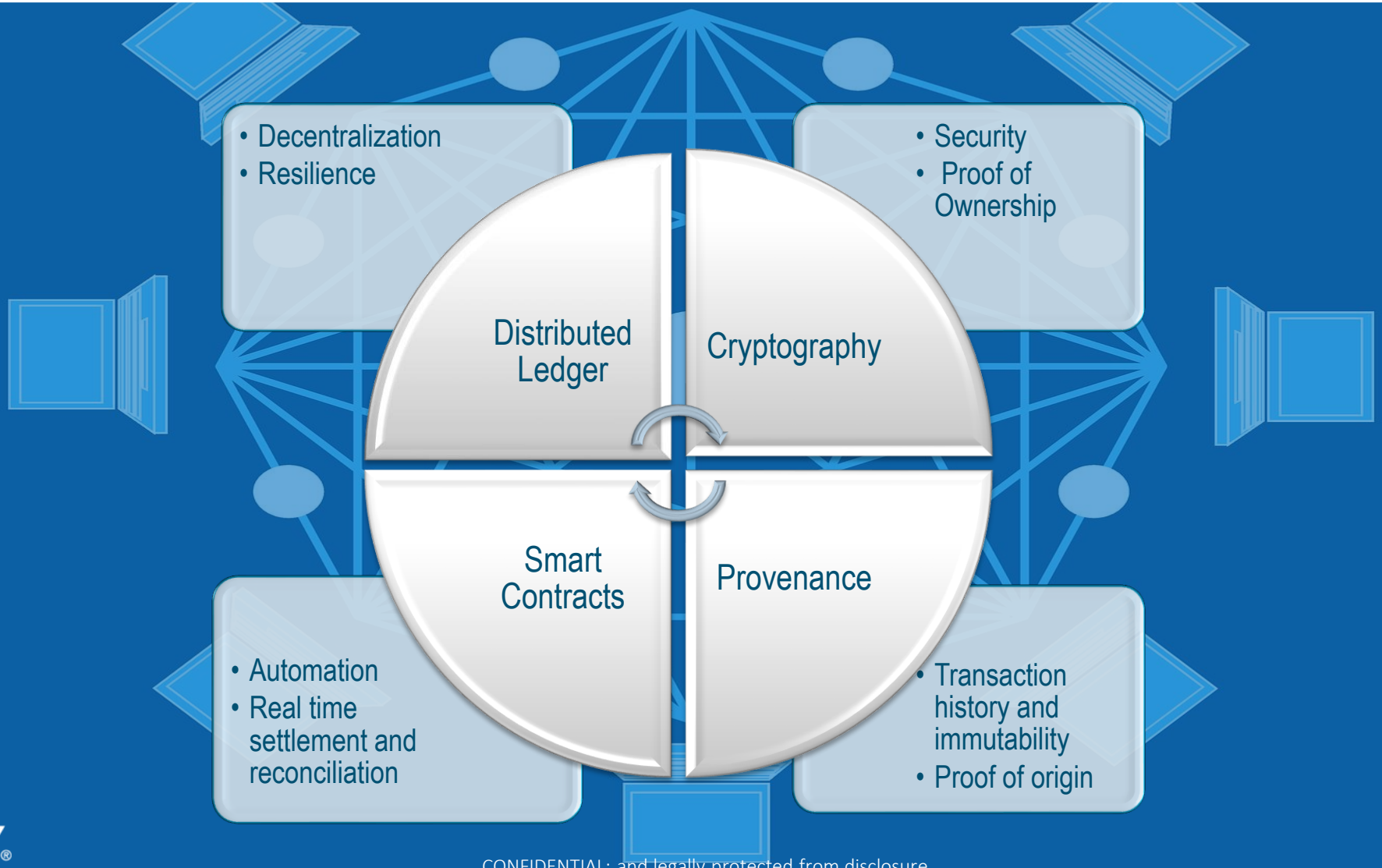
Source: *Navigating the Energy Transformation: Building a Competitive Advantage for Energy Cloud 2.0* (white paper)

Decarbonization: 215 Fortune 500 companies are investing in sustainability, reduction of carbon emissions and renewable energy initiatives. Wind and solar power projected to reach as much as 48 percent of total global electricity generation by 2050 from about 8 percent currently.

Decentralization: Increased penetration of DER's. DERs are growing three times faster than central generation from 2015 to 2019 in the U.S. (168 W vs. 57 GW).

Electrification: In transportation, a projected 55 percent of global new car sales and 33 percent of the global fleet may be electric by 2050, accounting for about 9 percent of electricity demand.

Distributed Ledger Technology Benefits



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Blockchain Use Cases in Energy

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Renewable Energy Certificate Use Case

"**The U.S. RECs market is valued at more than $3 billion**, and **transaction costs can tack on another 3% to 10%**. While there are effective digital options to trace RECs from when they are generated to when they are retired, costs add up when seeking to aggregate and trade them through brokers or bilateral contracts across state lines, Power Ledger Executive Chairman Jemma Green said in a telephone interview" [1]

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REC Tracking and Trading Platform

Duke Energy is working with BEC to design, prototype, and deploy the first utility-driven REC solution on Blockchain DLT in the North America energy market following the IEEE standards.

The platform will

- Show REC prices in real-time and present those options to customers
- Allow purchase of RECs
- Accept payment through the platform
- Avoid double counting
- Track ownership
- Provide API's for easy integration with Duke or other third-party apps

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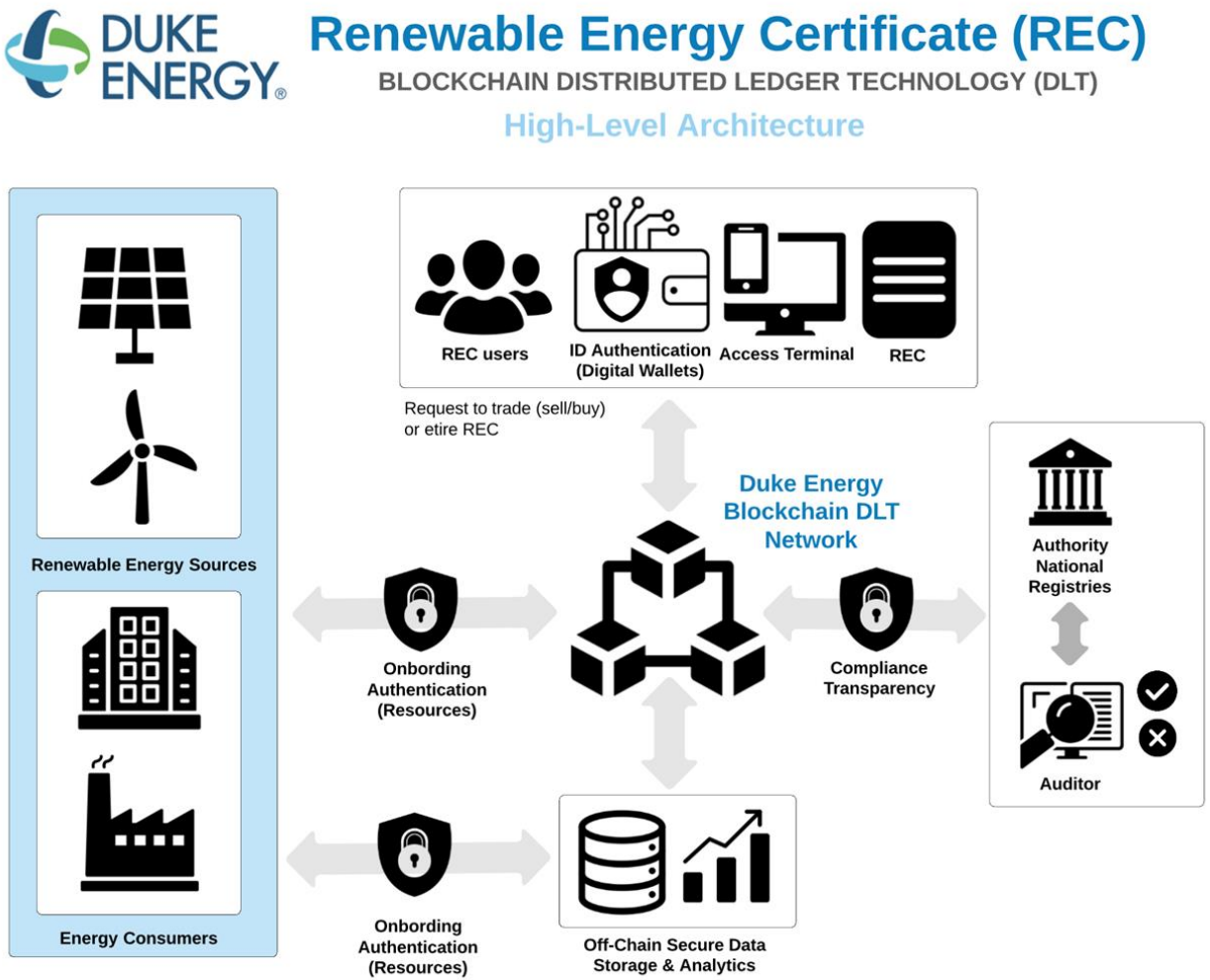
BEC BLOCKCHAIN ENGINEERING COUNCIL

Problem Statement

Duke Energy needs a Digital REC solution because we are offering an increasing number of solutions where RECs could play a central role, yet we still track them using non-digital means. A platform like this could fold into and enhance existing offerings, while paving paths to new opportunities for EBIT (i.e. a commission-based model, or a digital convivence fee model, in addition to base REC price).

System Level Architecture



IEEE Blockchain in Energy Standards P2418.5 Project Details

NREL NATIONAL RENEWABLE ENERGY LABORATORY

UNC CHARLOTTE

EPRI ELECTRIC POWER RESEARCH INSTITUTE

SENSES Global

GE

SIEMENS

ABB

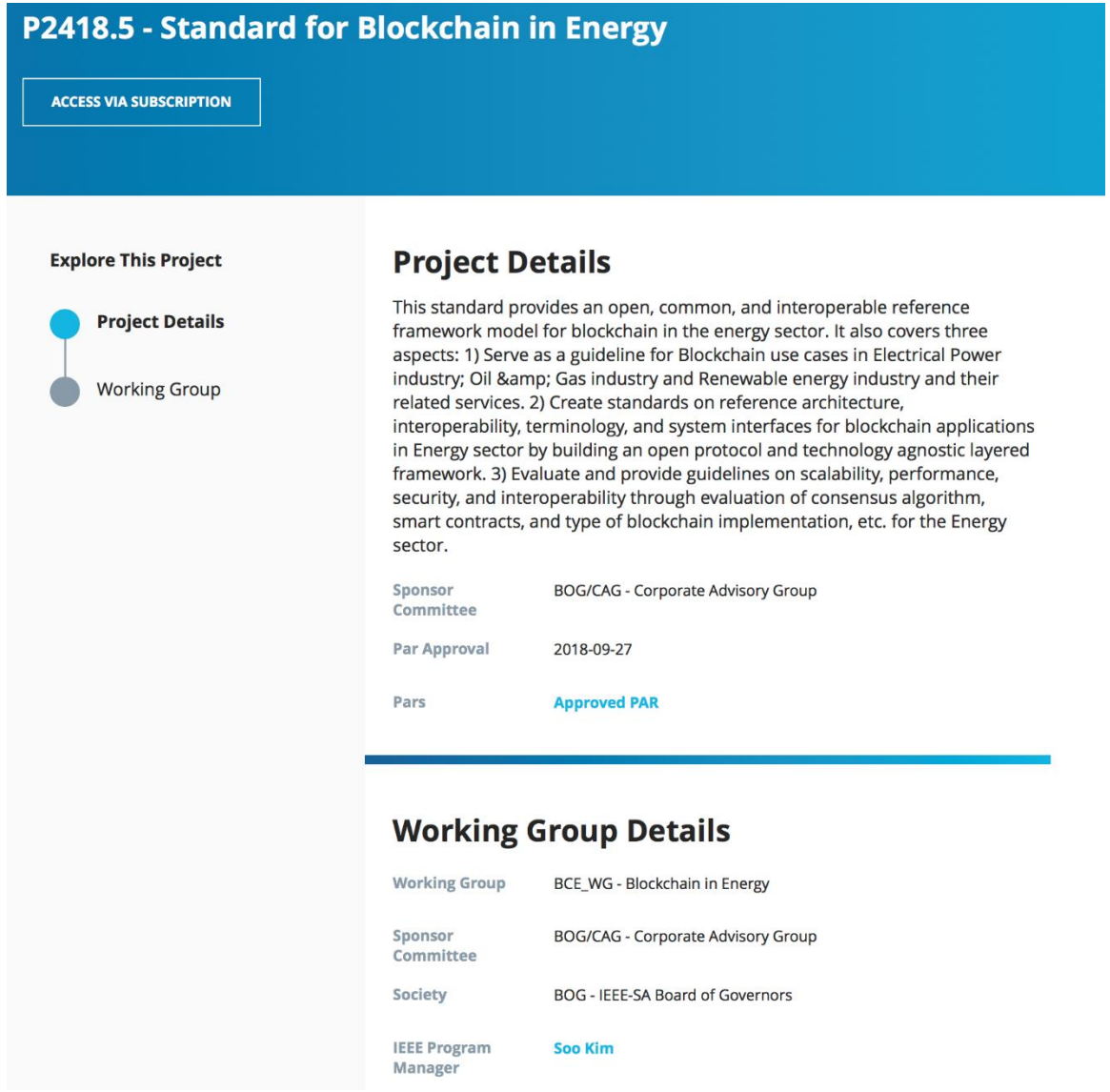
BEC BLOCKCHAIN ENGINEERING COUNCIL

Claudio Lima, Chair
Blockchain Engineering Council, BEC

Sherry Lee, Vice Chair
GE

Umit Cali, 2nd Vice Chair
UNC Charlotte

Johnny Lin, Secretary
0xSenses Corporation

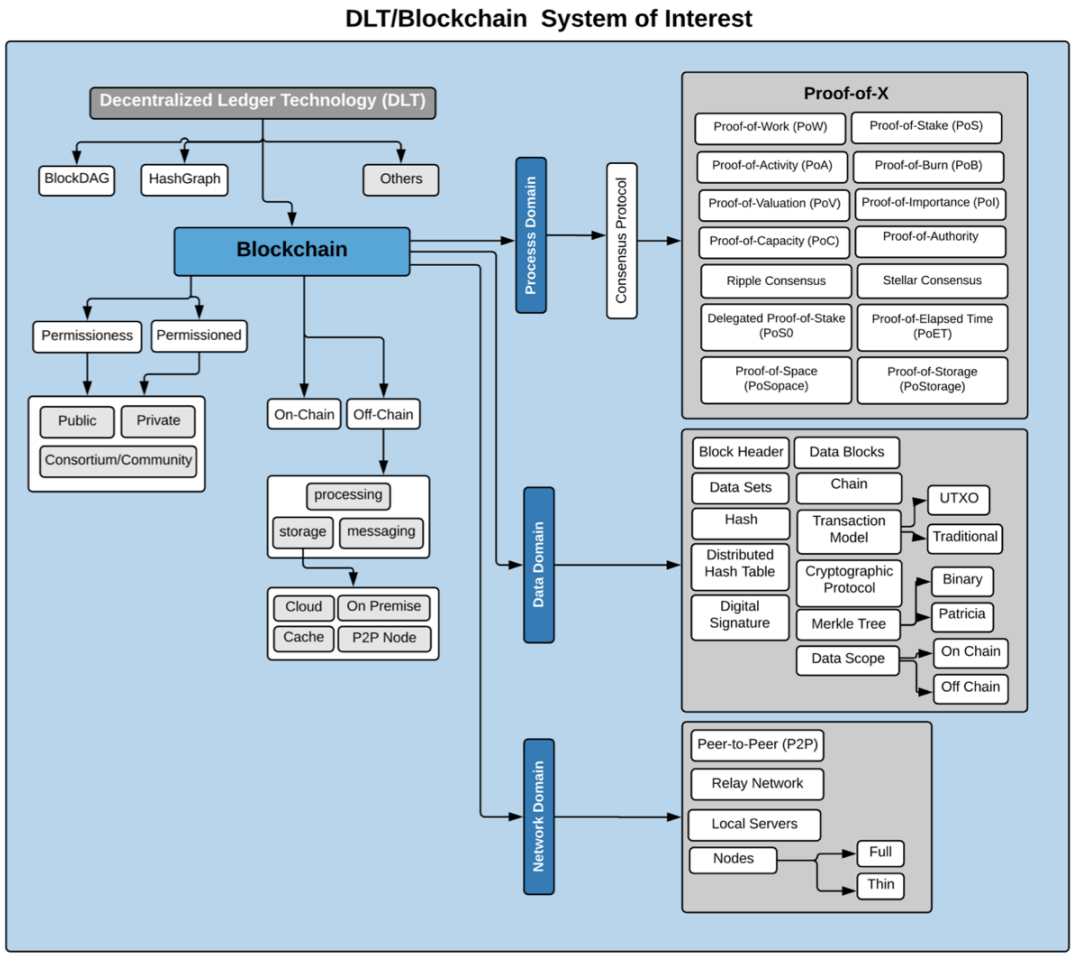


https://sagroups.ieee.org/2418-5/

https://standards.ieee.org/project/2418_5.html

BLOCKCHAIN DLT (IEEE 42010) MODEL

An All inclusive Framework

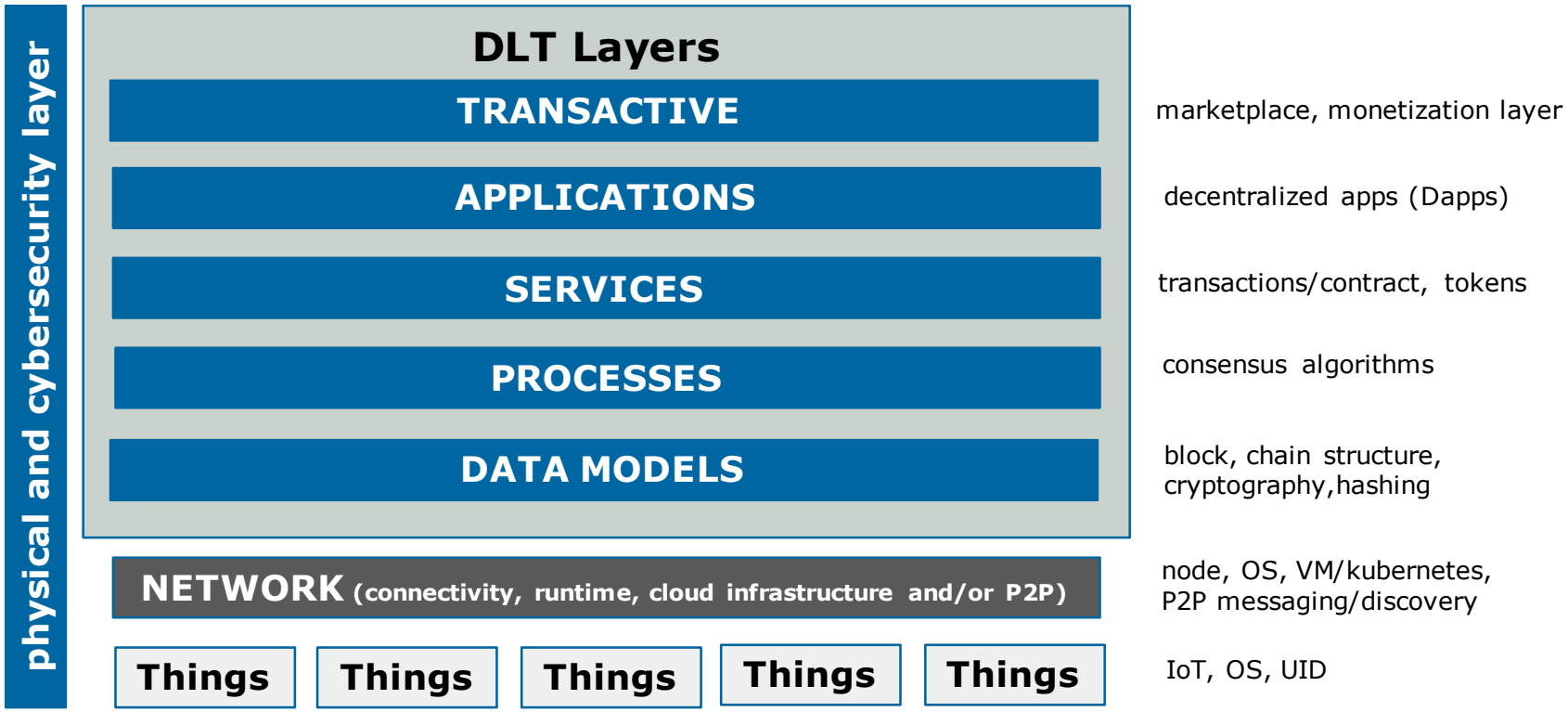


- ✓ Blockchain-IoT Reference Architecture, based on IEEE 42010 framework (undergoing)
- ✓ All alternatives included - considers more than Blockchain as technology enabler
- ✓ Addresses key domain/layer levels
- ✓ Includes (most) Blockchain/DLT technologies elements

source: submitted as contribution to IEEE P2418.1 Blockchain IoT Standards (2018)

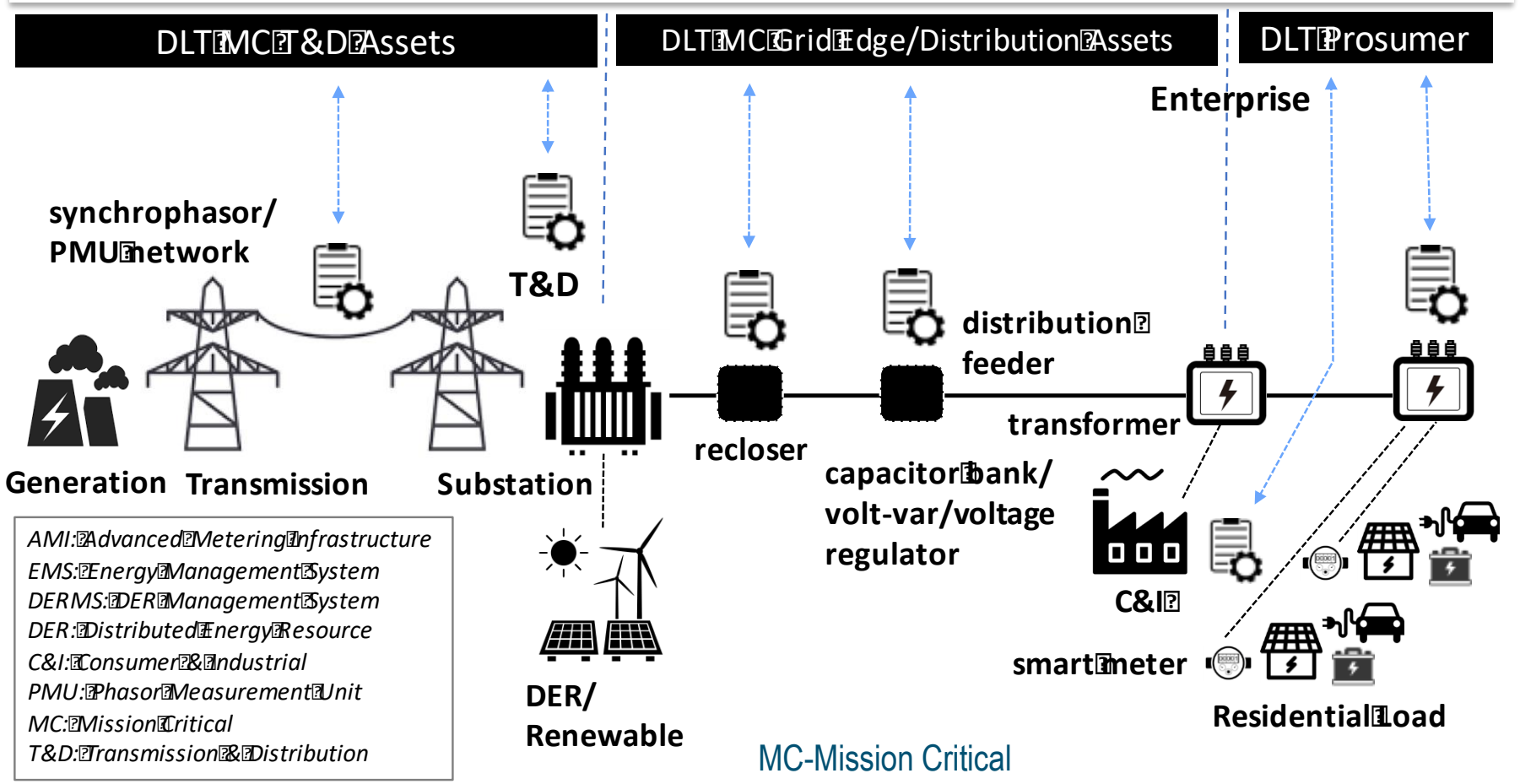
P2418.5 BLOCKCHAIN-DLT LAYERS

The building layers of Blockchain DLT systems need to be defined to categorize its key elements, independent of the DLT technology adopted



source: BEC, IEEE

P2418.5 GRID BLOCKCHAIN-DLT SEGMENTATION



Shall comply with P2P Design principles (Performance, Privacy, Security & Scalabiluty

source: BEC, IEEE

THANK YOU!

- **Questions?**