Blockchain experiences ENTSO-E perspective

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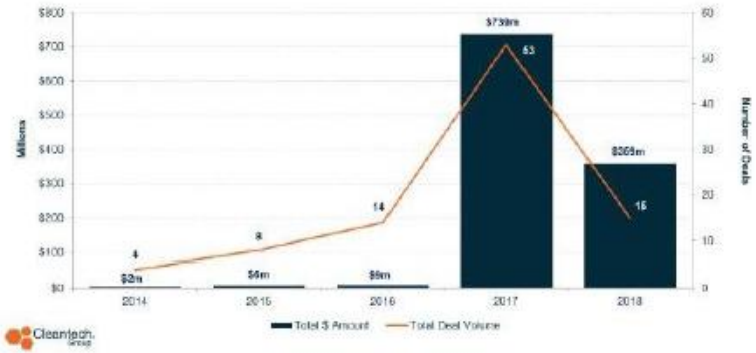
ENTSO-E

Workshop on open market places to spur innovative energy services
Brussels 22 October 2018

Blockchain in the energy

The first Blockchain in energy transaction took place in April 2016 in Brooklyn, New York. Today, more than two years later, there are **150+ organizations** involved in Blockchain technology and **40 deployed projects**.

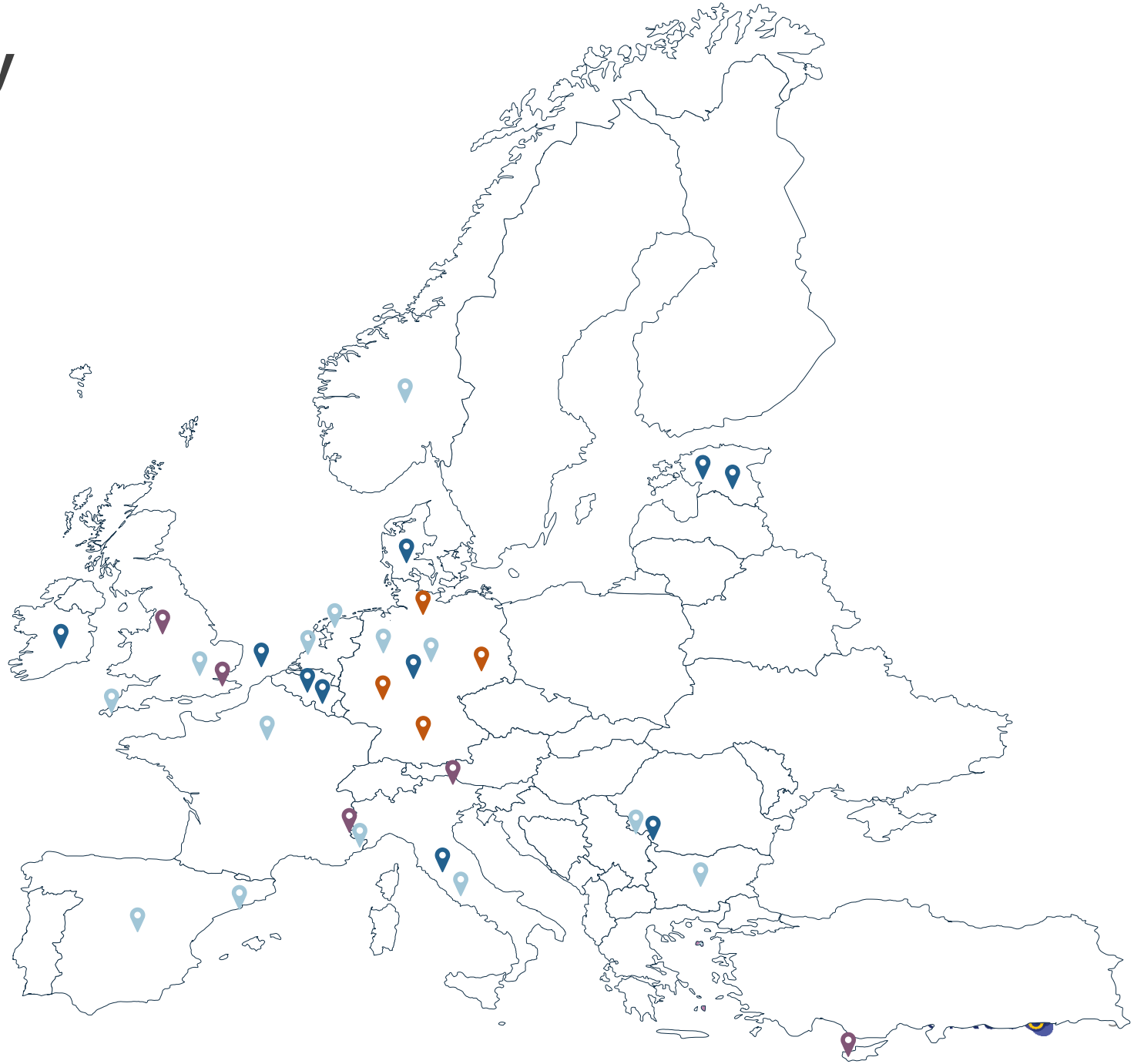
Between Q2 2017 and Q1 2018, over **$1 billion was invested** in the Blockchain in energy industry. More than 90% of money raised in 2017 and 2018 came from coin or token offerings



Europe is leading. EU companies have raised $723 million to date, compared to $140 million for North America.

https://www.cleantech.com/industries/#UtilitiesSource

Projects/pilots by category



Categories of the pilots:

- Flexibility Market Places
- Data Exchange
- Technical Solutions
- Aggregators (covering well all European countries)

Oportunities for the TSOs

Market facilitation

Flexibility : services (balancing /congestion management and ancillary) by engaging kW customers

System operation

Integrating new technologies while keeping the reliability of the system

Assets

Automated and connected assets

Distributed ledger Technology (DLT)

Characteristics:

- **Secure**
- **Public**
- **Distributed**
- **Truth**

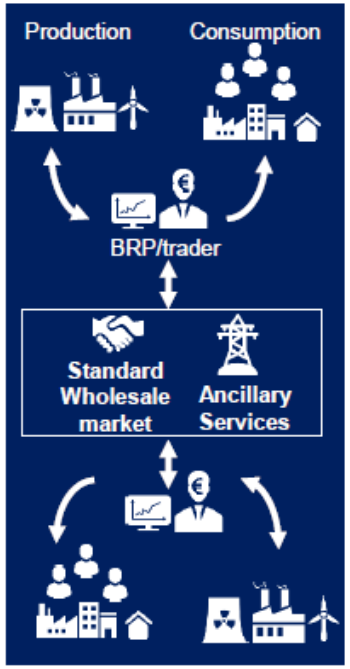
Benefits:

- **Efficiency**
- **Customer empowerment**
- **Reduce transaction costs**

Market of the future – engaging customers

Market Facilitation

Today



- Energy market for MW players
- Big flexibility assets own by few actors
- Dichotomy between retail and wholesale markets
- Standard products
- Fixed prices defined on forward market

2035

New digital infrastructure to enables the "kW prosumers".

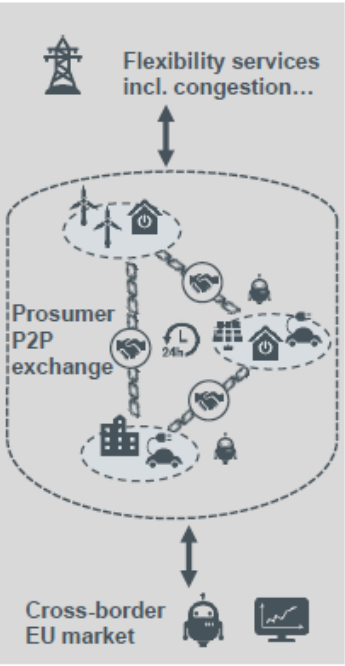
- Peer to peer trading is the norm based on blockchain
- Prosumers in the center of the market

Small flexibility assets own by a large number of actors

- Automatization of trading and decentralized markets
- Real time markets making R3 and R2 redundant
- Artificial intelligence will define a real-time price-based market

Development of short term markets and energy manage-ment tool

- Congestion management via market mechanisms
- Balancing equilibrium managed at more granular level



Source Elia

Blockchain power system apps

Energy Web Foundation and Alastria have identified more than 200 applications in the energy sector.

Some TSOs are undergoing R&D projects in identified domains

Utility billing: Utilities/third parties use cryptographic identities to manage customers.

Certificates of origin

Renewable generators create certificates; certificates are issued, traded, retired and tracked on a blockchain

Demand response/virtual power plants

DR, aggregators , utilities, third parties, use secure smart contract to conduct– automated settlements

Elia is developing a proof of concept to enable the **settlement of flexibility** (R3)

Electric vehicles

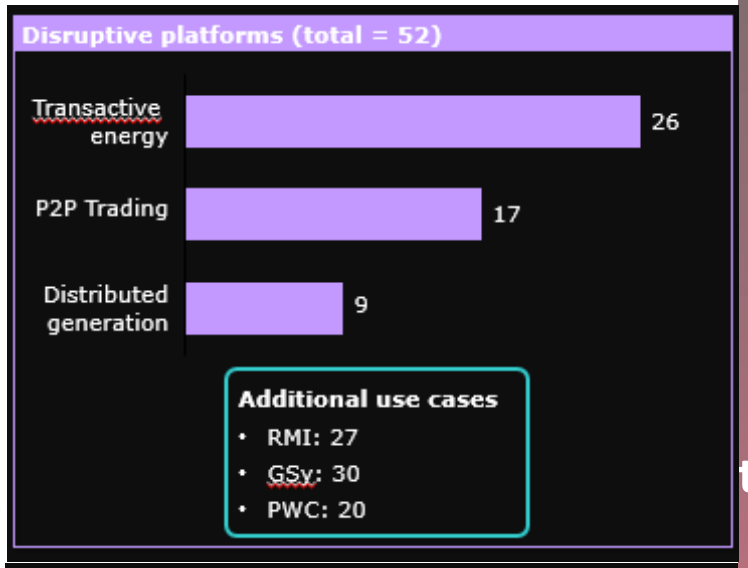
Utilities/third parties use cryptographic identities to manage customers, vehicles and charging infrastructure.

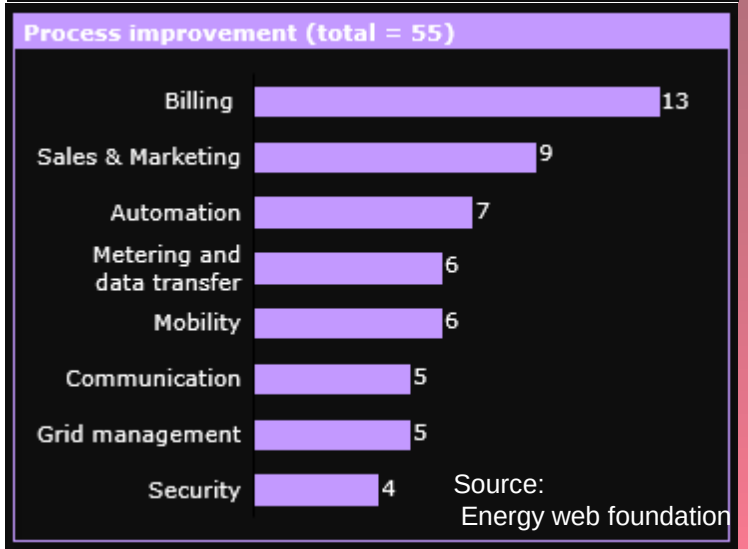
Tennet applies BC to provide **aFRR services** from electrical vehicle.

Transactive/Peer to Peer energy

Market design to balance and control the grid using temporal and locational price signals while maintaining grid reliability.

Peer to peer exchange: geographical (not only locally) , regulatory (outside BRP) and technological (BRP to become more agile) issues





Process automation and information exchange are the best use cases for the electricity sector

Blockchain is not yet suitable for..

Real time applications for system operation

Blockchain technology is not still in the stage of being used for real time power system operations due to a slow response time.

Maintenance and system development

Not yet applications for system planning or grid maintenance.

Blockchain Technology is not yet suitable for Real time Applications In the power System

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Impact on current roles

Roles: Blockchain enables peer to peer transactions, gathering data from thousands of assets:

could impact the role of aggregators and suppliers

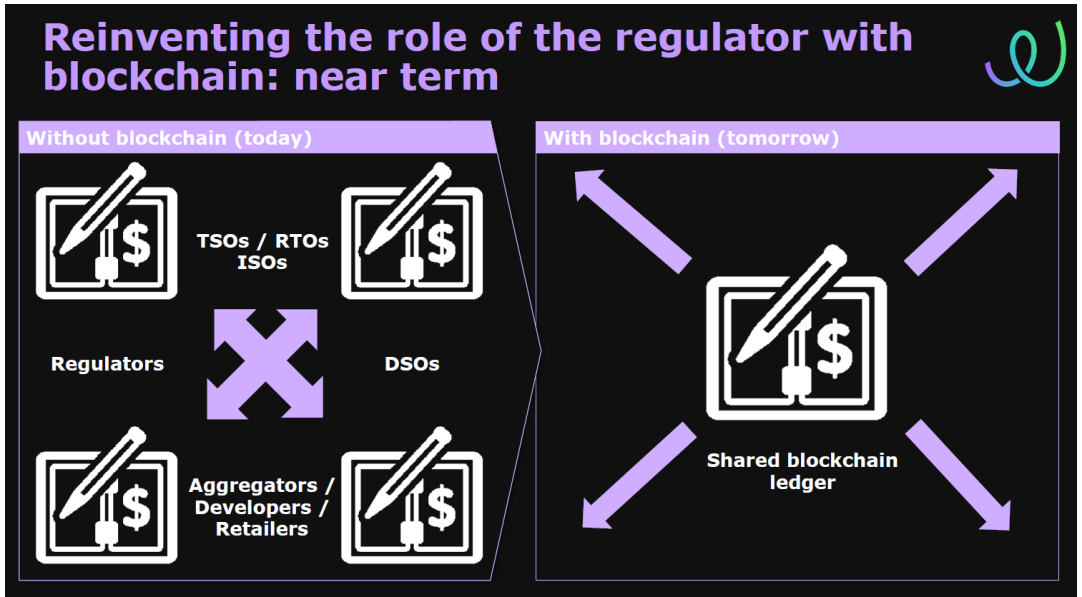
New business models

Enabling exchanges among multiplayers and reaching consensus

Reinventing the role of the regulators and regulated entities

Blockchain creates a secure environment to work in common information and data sets.

Transparency, availability of data and secure environment drive these changes.



New roles for aggregators and regulators enabled by Blockchain technology

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Topics to be assessed

Topics under research

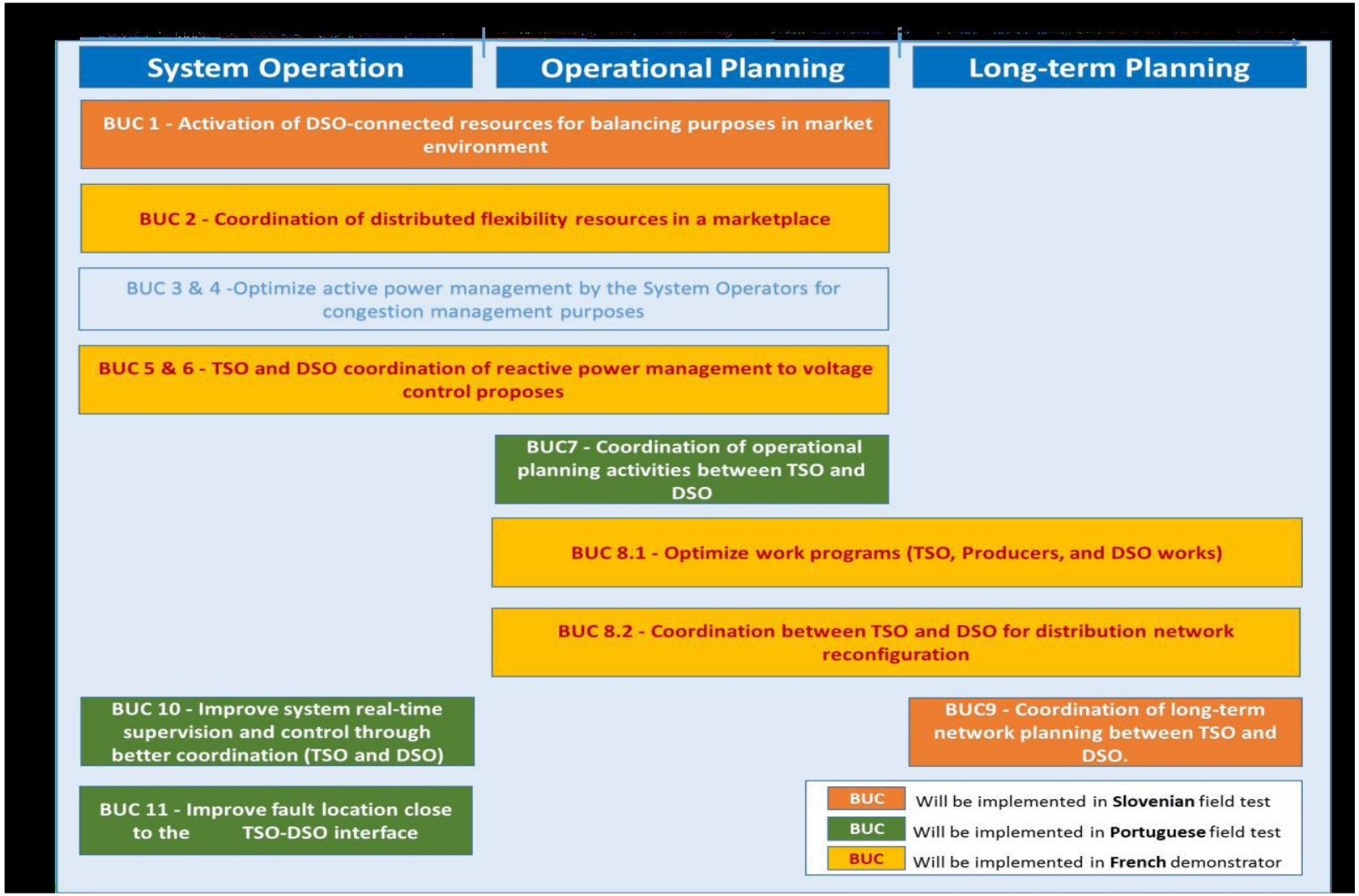
Privacy, security issues, speed in the settlement process, efficiency in the data exchange, assess the potential of the technology

Topics that need to be studied and assessed

- Blockchain increases the dependency with the communication infrastructure, which impacts in the field of the **critical infrastructure protection**.
- Business cases of the solutions implementing blockchain: **economic assessment, operation and maintenance costs.**
- **Cybersecurity**, since the distributed ledger increases the number of devices connected and gates to the information.
- Assessment on the **centralized and decentralized approach for data management**.

Topics that need to be assessed: Privacy, Security, Cybersecurity, Dependency, CIP

TDX Assist



"…for renewables integration in the European Market Places…"

Interrface project

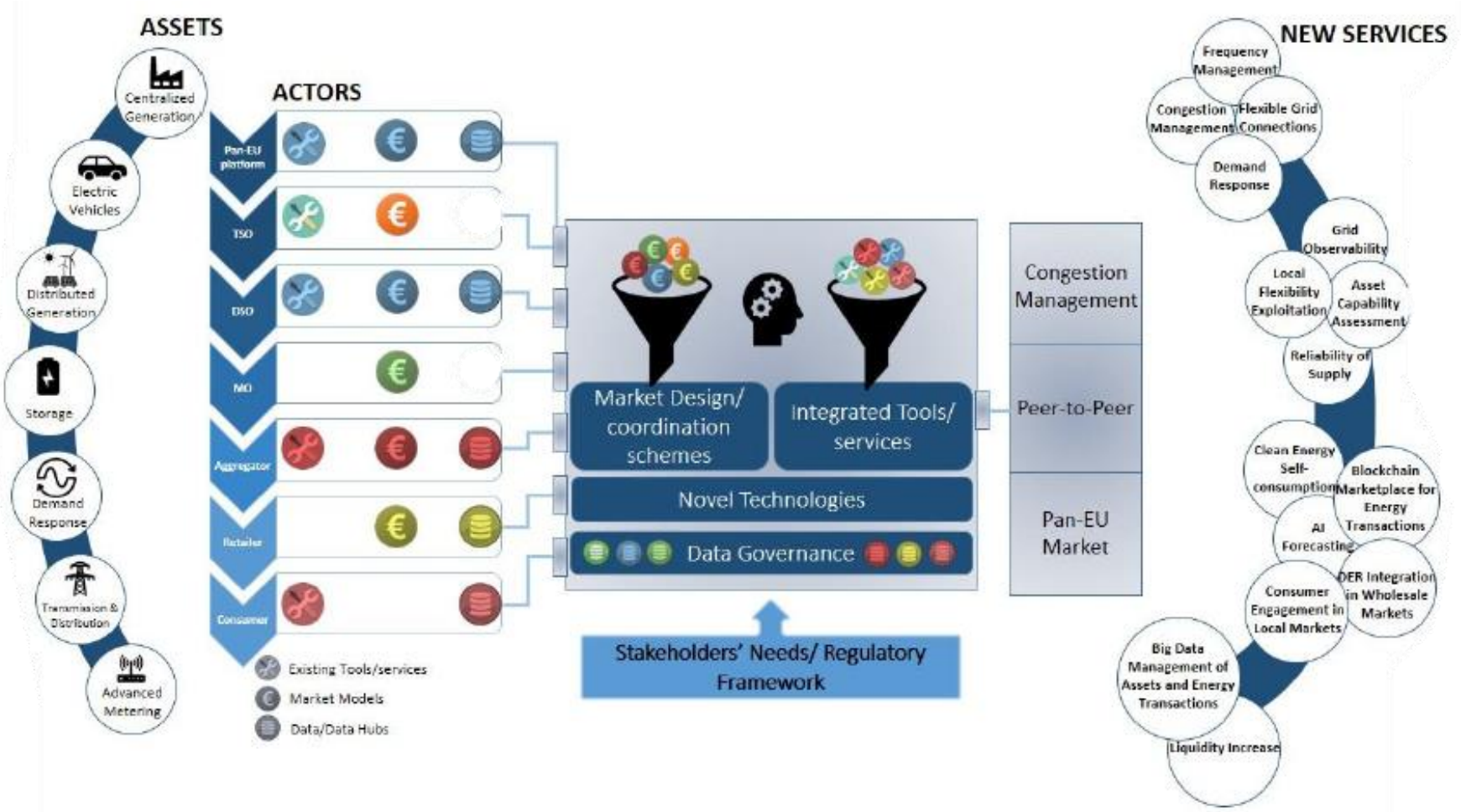


Figure 1 INTERRFACE Concept

Financed by Horizon 2020

Start January 2019

Conclusions

1. Blockchain technology is validated and up and running.
2. Current applications for blockchain in the power system are in the domain of process automation, such as settlement and information exchange.
3. Blockchain is not yet an option for the power system operation and real time applications due to the latency and response time. There are not applications in maintenance processes.
4. Blockchain is a technology that enables to unleash the potential of flexibility. This could create new roles for the current players such as regulators or aggregators.
5. Privacy, security, cybersecurity, IT dependency and critical infrastructure protection are aspects that need to be assessed and researched.

Thank you for your attention