

View from Abroad

The Future of European Grid Operation

Laurent SCHMITT
ENTSO-E

GridConnect, 6th December 2018
Washington

The European Power Grid



43 TSOs, **36** countries



500+ million
citizens served

3 673 TWh generated

3 631 TWh consumed

1 140 GW of generation capacity



+/- 435 TWh of electricity
exchanged

+/- 480 000 km
of interconnections



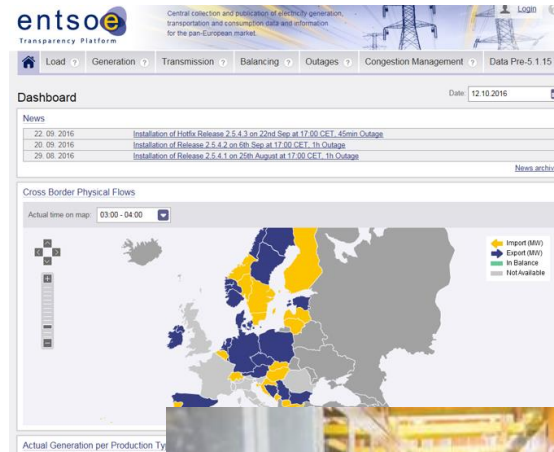
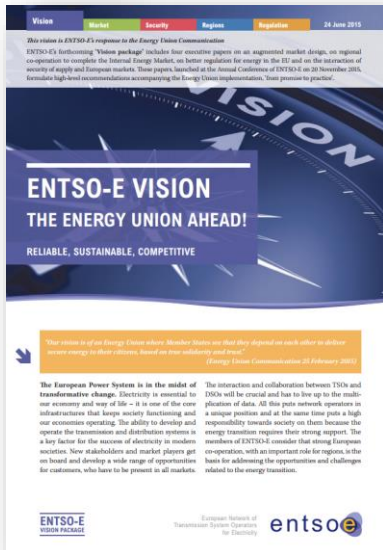
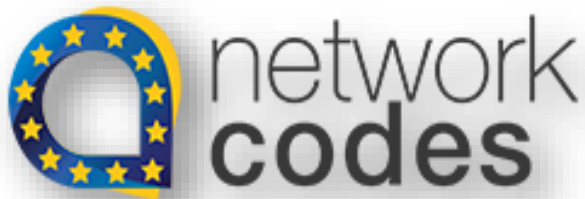


What does ENTSO-E do?

Contributes to the design and implementation of the Internal Energy Market

Develops the necessary IT tools to enable European System Integration

Provides regular reporting and recommendations for the development of the European Grid



Will they be able to manage 4 degrees more ?



Significant Transformation expected...

Paris agreement



Clean energy for all Europeans



Clean Energy Package



Energy Union and
Market integration



Electric vehicles



Distributed energy
sources

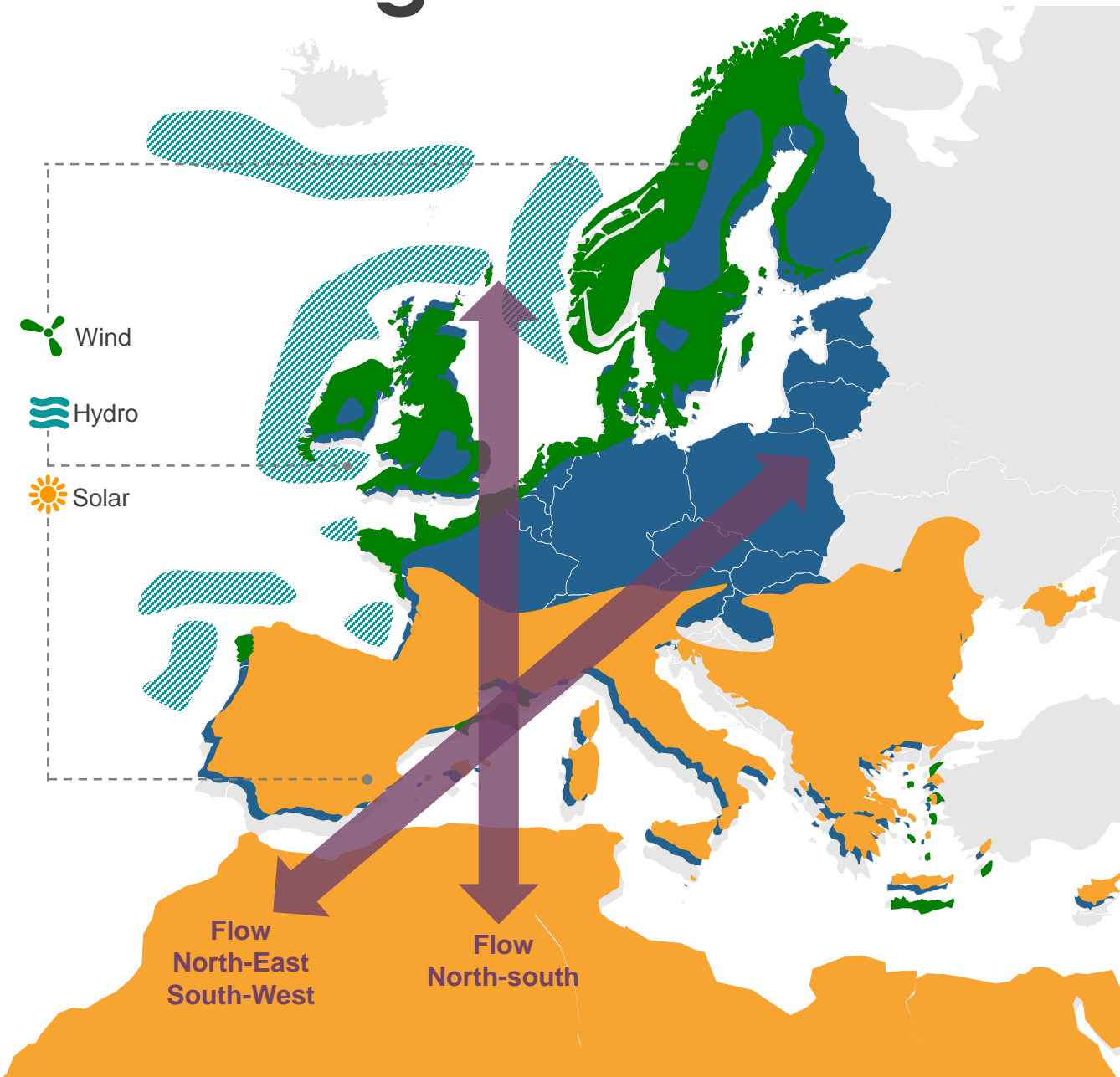
#DigitalGrid

The current transitional challenges

27% renewables by 2030 =
+/- 45% for the power system (and
60-70% by 2050)

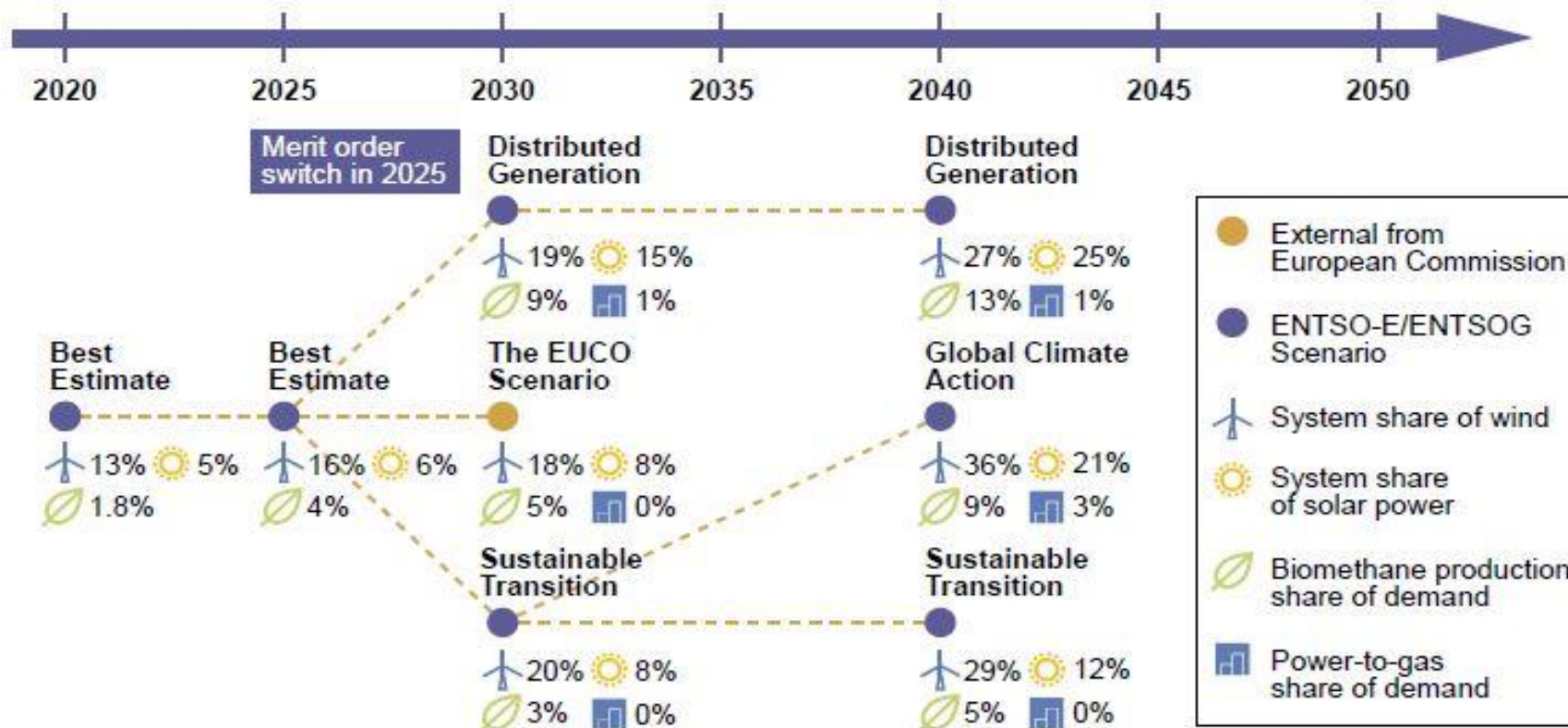
CHALLENGES

- System stability & inertia
- Growing interconnections
- Changing power flows & congestions
- Unlocking prosumer flexibility together with DSOs, new Power System of Systems
- New Digital Orchestration

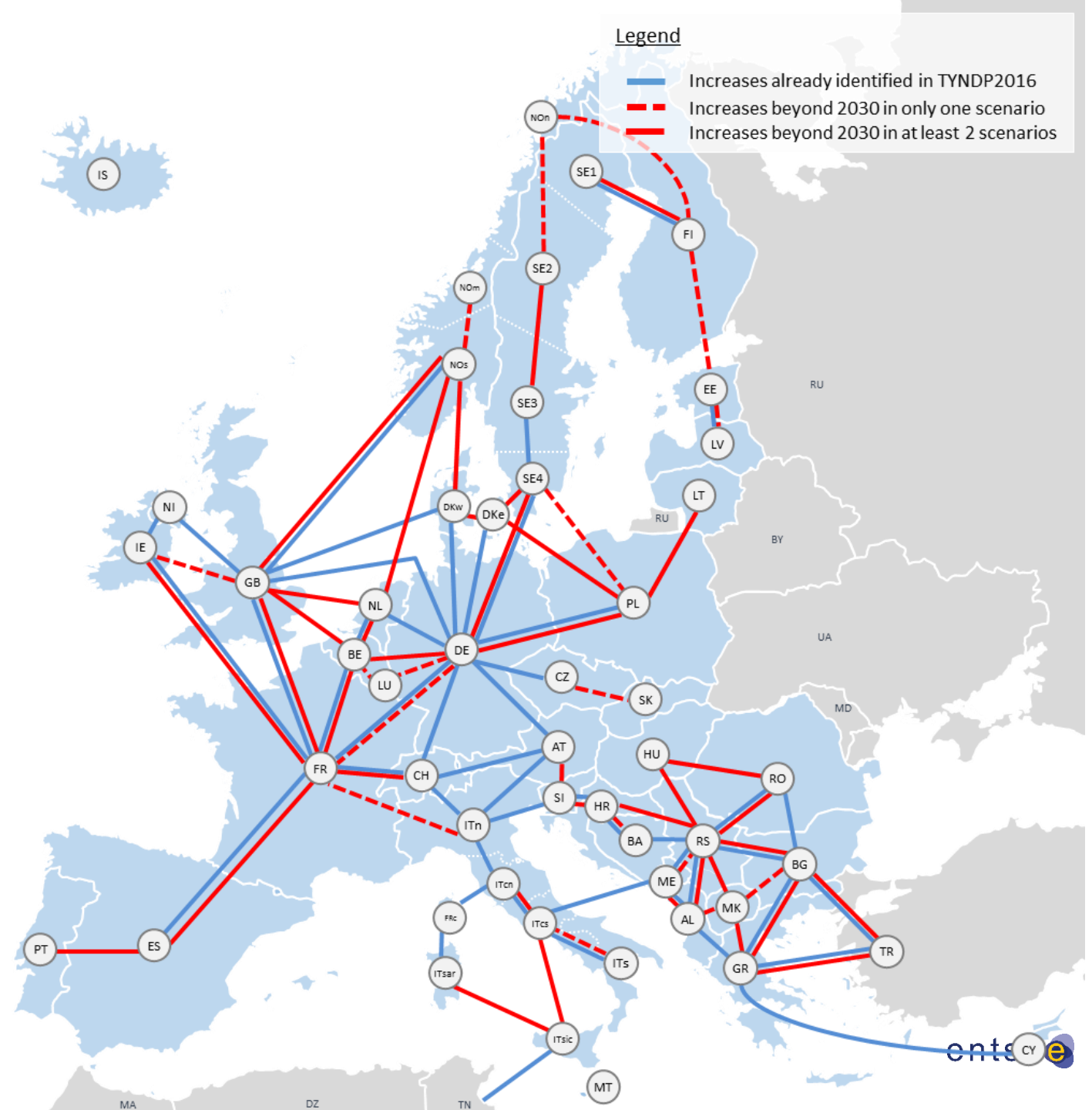


2040 Grid Development Pathways

Figure 1: The scenario building framework for TYNDP 2018. Renewable Energy Systems (RES) share of demand for electricity and gas

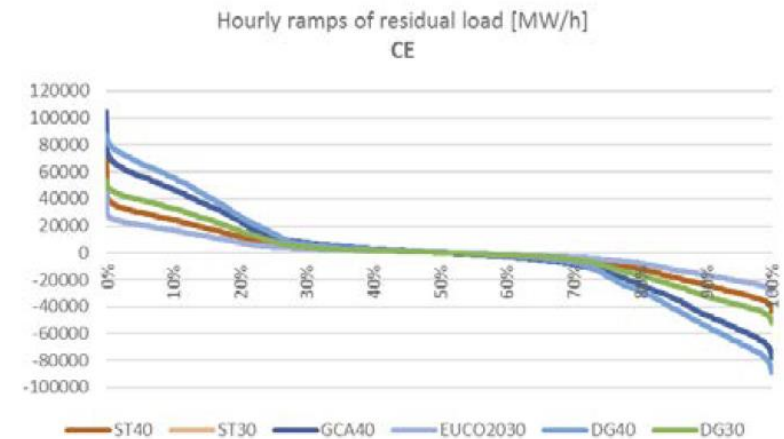
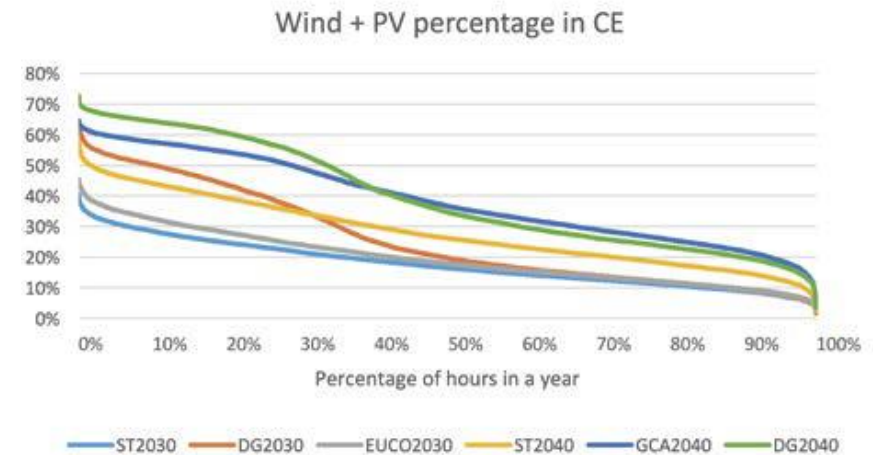


Significant Grid Development needs...



... as well as system flexibility needs

- Wind and Solar penetration reaching 60-80% of the electricity generation mix during Renewable Peaks
- Residual Load ramp rates reaching 40-100GW/h
- Low inertia limits reached in small synchronous areas
 - ❖ New Interconnector usage (VSC and AC)
 - ❖ Batteries
 - ❖ Fast Synchronous Condensers



Current European Grid integration challenges

New Network code to implement

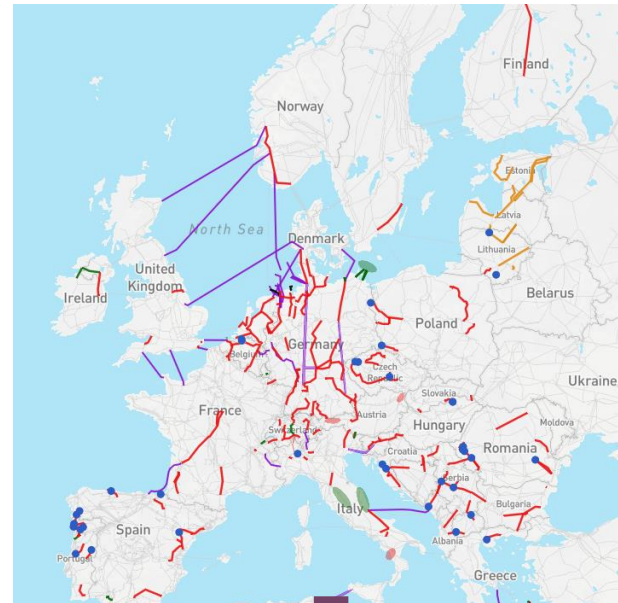


Enabling more
RES &
demand response
connections

flow based
bidding zones
review

Regional security
coordinators

Growing Scarcity in Grid Capacity



Including links inside
countries

New Regional Security Coordination



One System coordinated through regions

PLANNING

Regional planning used in the EU 10-year network development process (TYNDP)

TYNDP used as basis for the EU Projects of Common Interest



MARKETS

Internal Energy Market developed voluntary & regionally

EU guideline on capacity allocation & congestion management



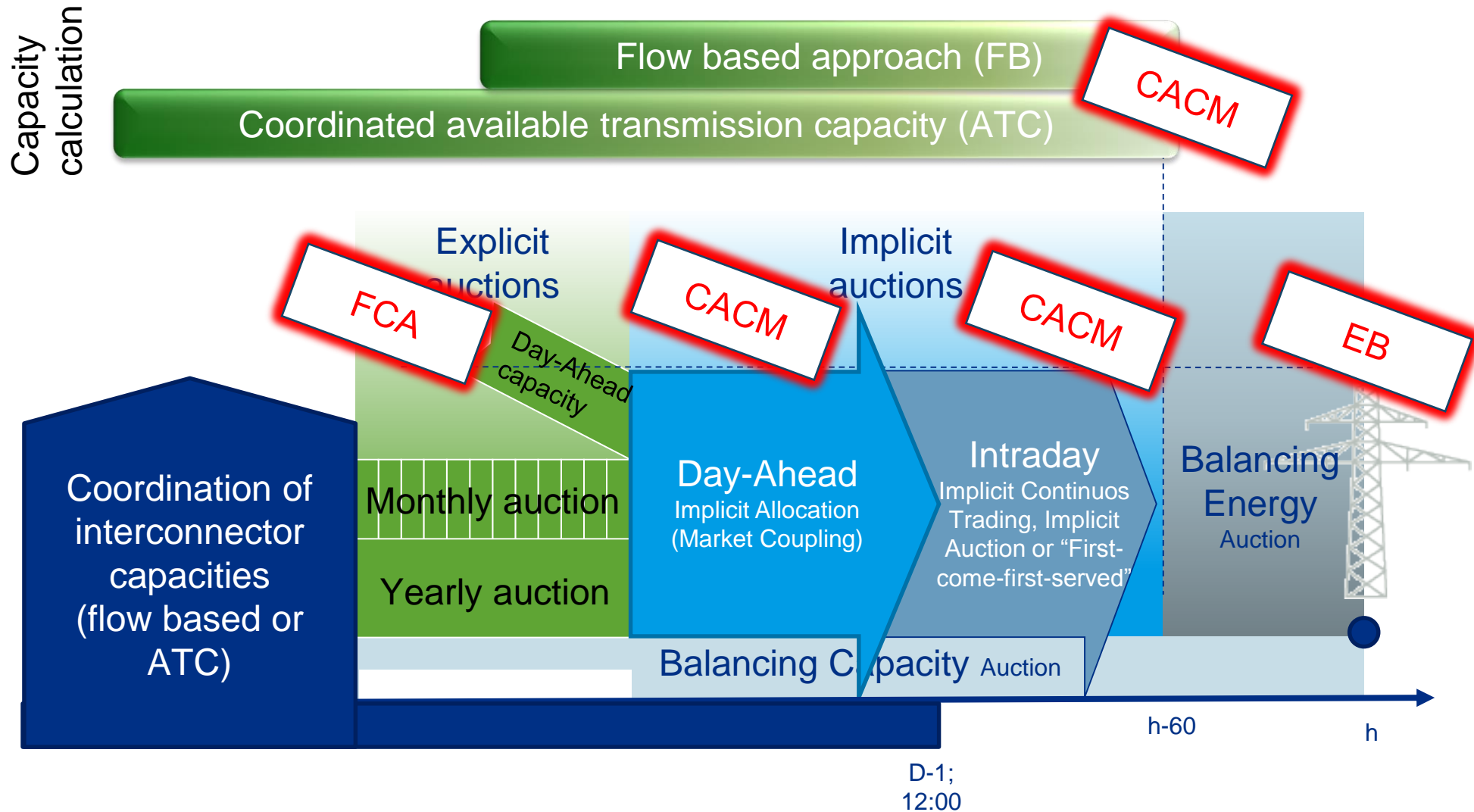
OPERATIONS

Regional security coordinators created on a voluntary basis

Registered in the EU system operation guideline

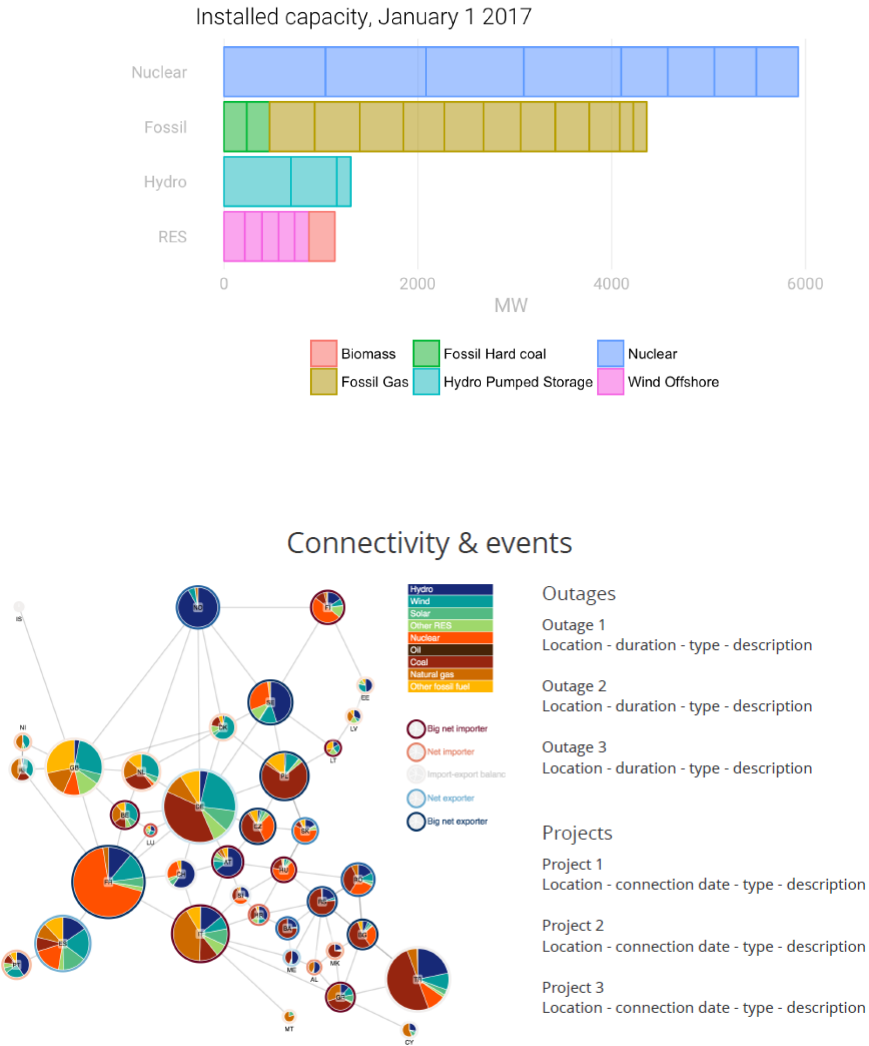
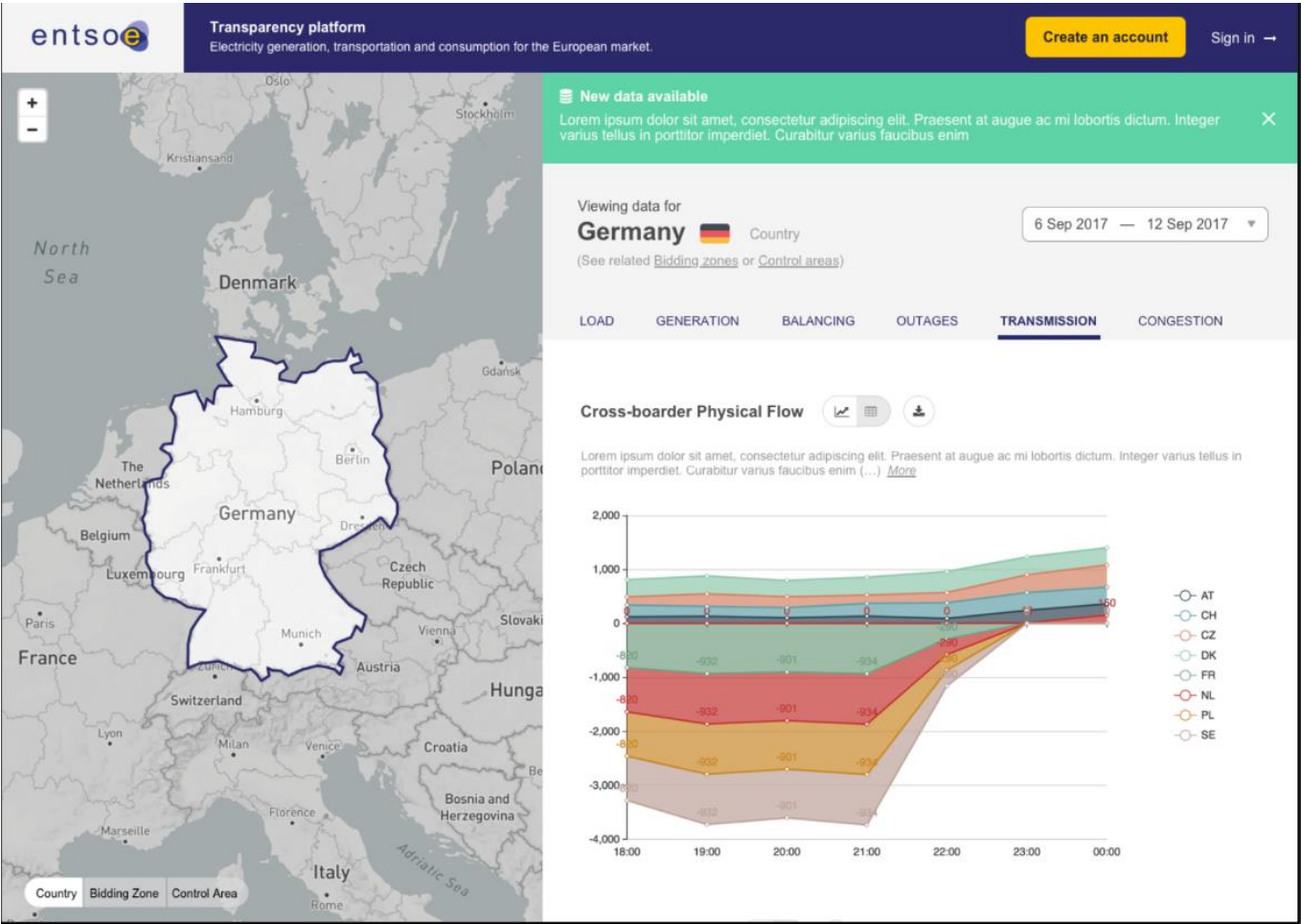


An evolving Energy market model



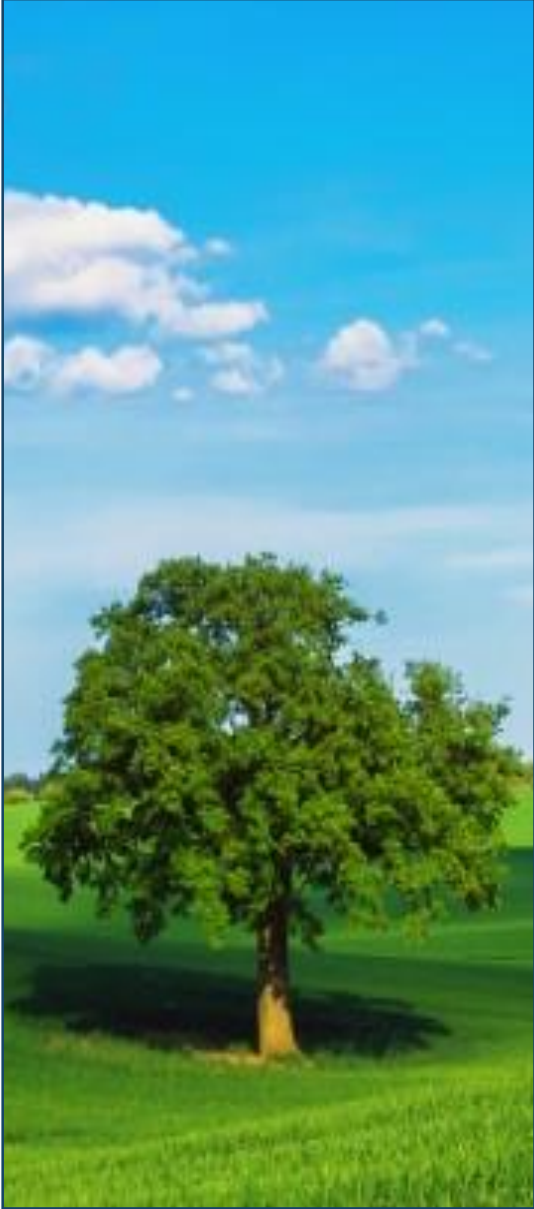
ENTSO-E Pan European Data Hub

423 Gigawatt
installed capacity



New orchestrator role of the next '4D' revolution

Decarbonisation



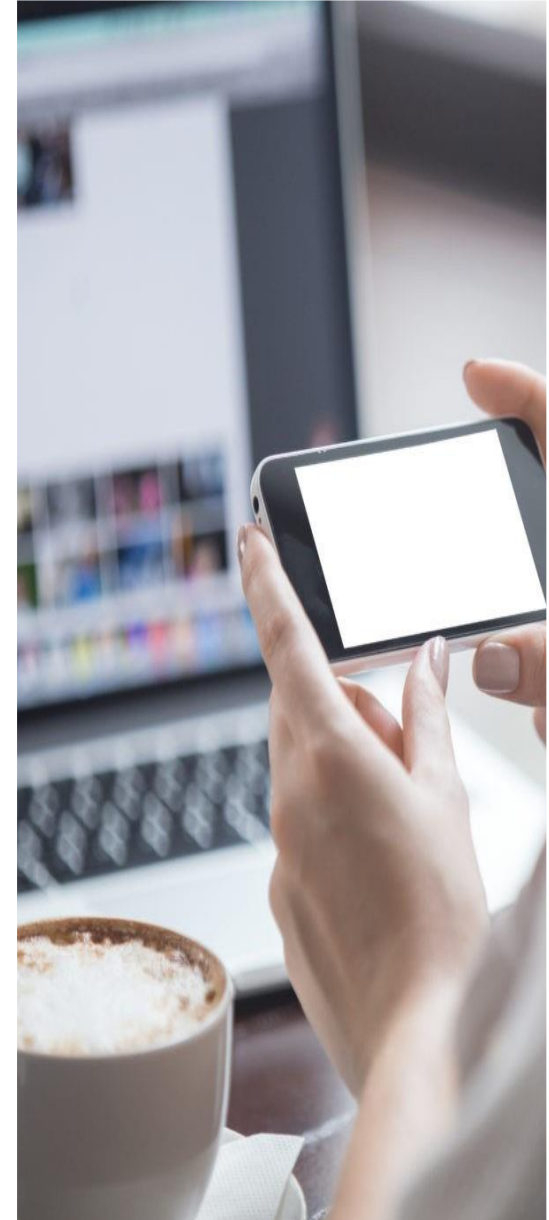
Digitisation



Decentralisation



Democratisation



#DigitalGrids, enablers of future system of systems



Power to Gas / Green Gas & Hydrogen / Combined Heat & Power

Electromobility

TSO-DSO coupling

Microgrid coupling at Gridedge through #Blockchain

Technology Disruption

Utilities are disrupted by four types of technology – and this disruption has a huge impact on markets and regulators

I. Energy Technology

Distributed Energy Resources



Solar PV



Storage

Wind



Fuel Cells

Microgrids



Electric Vehicles



Energy from Waste

Automated Demand Response

Embedded Systems

Process Equipment



Smart Grid/Grid Digitization



Situational Awareness

IV. Grid / Operational Technology

II. Consumer Technology

Smart Appliances



Prosumer Enablement



Convergence of Industries

Energy Efficient Equipment (LED Lights)

Social Networks



Disruption

- New participants driving bottom up change enabled by new technology
- Setting affordable cost & service targets reflecting rise of microgrids
- Designing Regulatory models fit for the future, not based on the past

Cognitive Computing



Blockchain Big Data & Analytics

Internet of Things



Mobile



Cloud



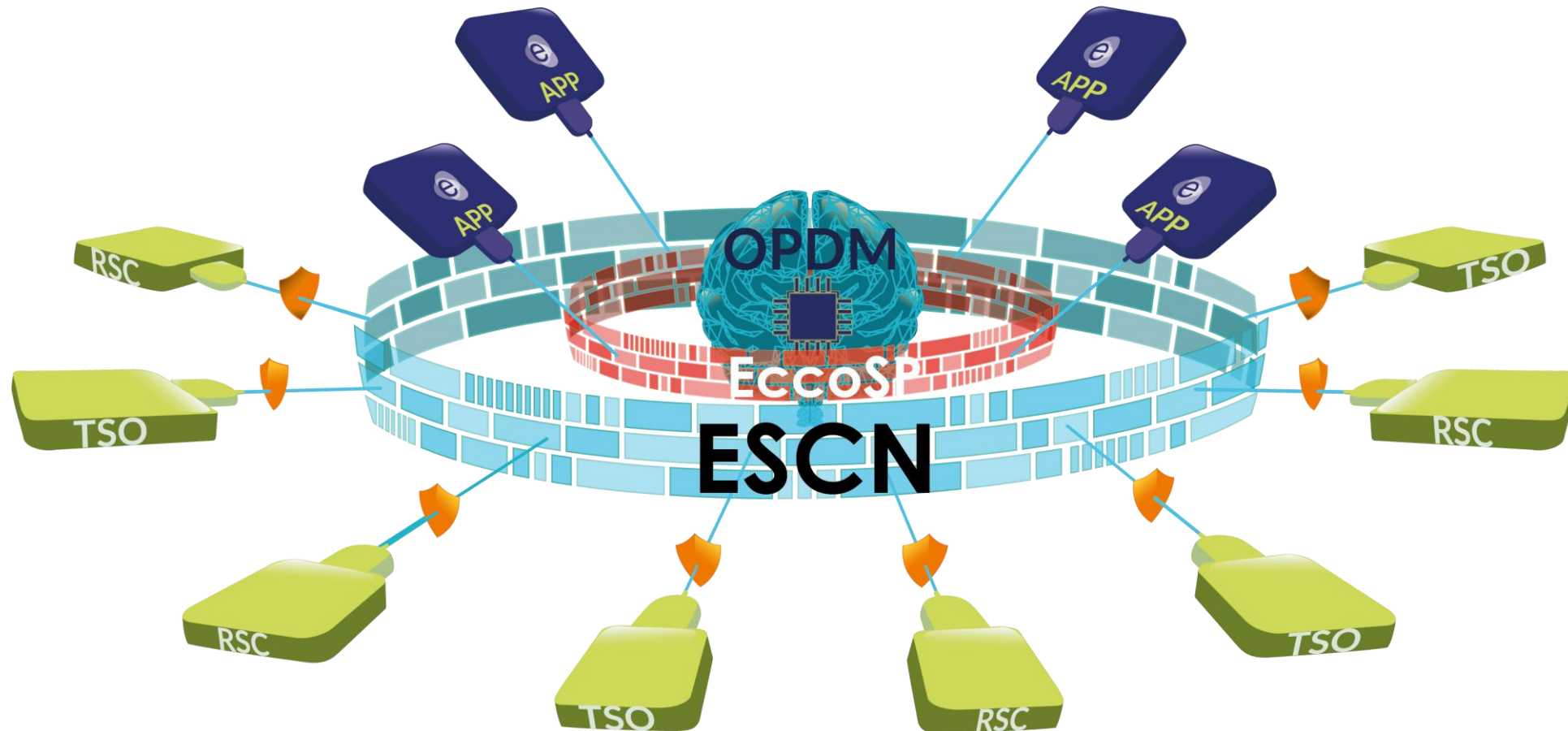
III. Information Technology

New Multi Sided Orchestration Platforms

ESCN - ENTSO-E Secure Communication Network

Eccosp - ENTSO-E Communication & Connectivity Service Platform

OPDM - Operational Planning Data Management



Common Grid Model across Time Horizons



Grid Planning



Market & Operational Planning



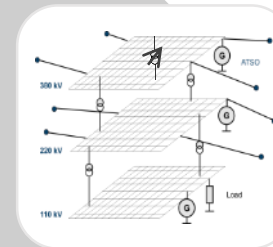
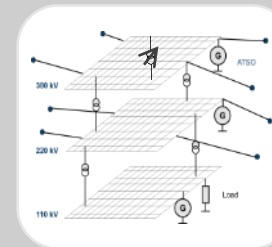
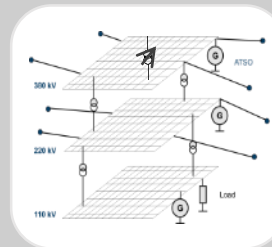
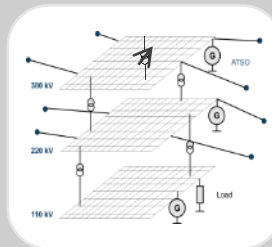
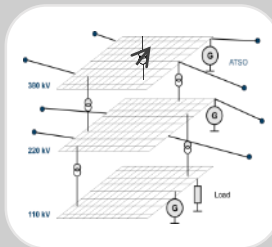
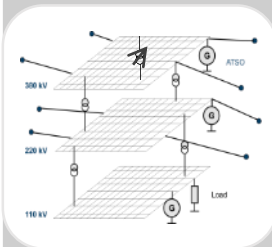
Grid extension

Maintenance

Capacity & Security

Security

Execution



Year ahead

Month ahead

Week ahead

Day ahead

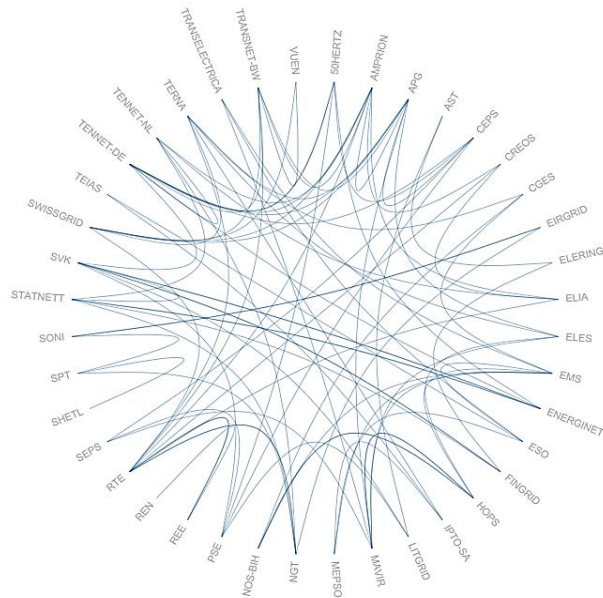
Intraday

Real-time

Confidence level

The Common Grid Model

Smarter data sharing among TSOs for both market and security of supply



New expertise

- MOUs with **ENCS, ENISA, ACER & CENELEC**
- Strengthened implication into **EC SmartGrid Taskforce / EG2**
- New ENTSO-E Cyber Strategy Paper



New tools

- Roll-out of the **Integral Security Framework (Sep 2017)**
- New cooperation tool for **Cyber Incidents (2018-19)**



New Infrastructures

- New robust security plans e.g. **CGM Security Plan (Oct 2017)**
- Evolve TSO Electronic Highway into new **E-SCN (COMO) architecture**

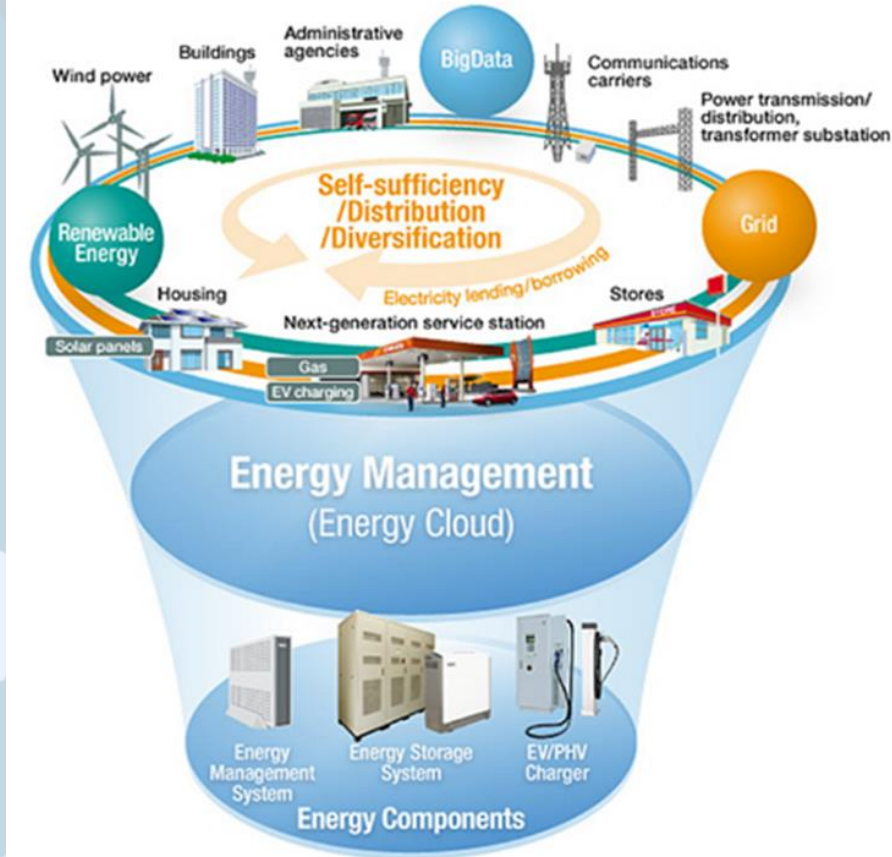


Developing a new Grid Operation & Market Design Vision for 2030

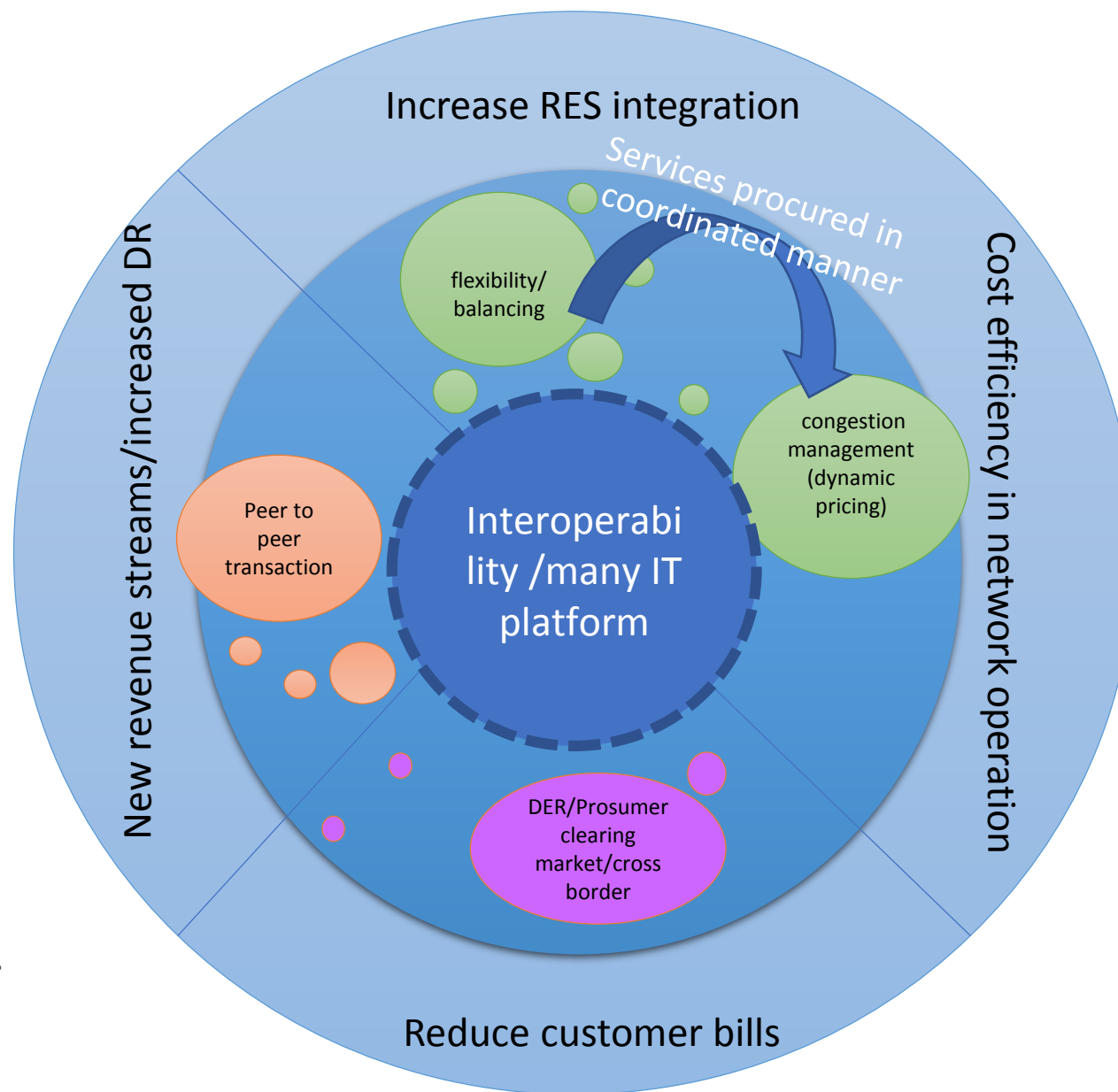


The Clean Energy Package is the right framework to address future challenges

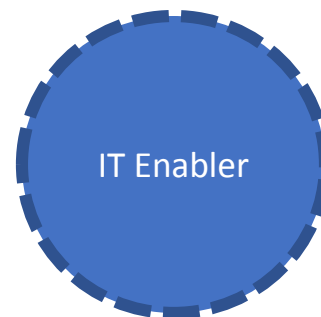
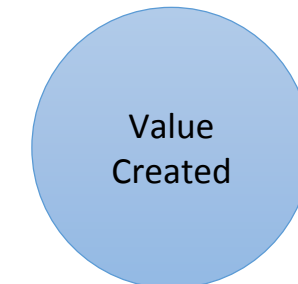
- Enhancement of wholesale price signals
- RES integration
- DSR, retail markets, role of DSOs & aggregators
- European resource adequacy
- Risk preparedness framework and security of supply
- Regional Cooperation
- TSO-DSO cooperation and coordination
- Governance



New multi sided flexibility market platforms



Legend



What:

- TSO-DSO –Customer
- Digital towards 2030

Who: TSO/DSO/Aggregators/IT service providers

ENTSO-E the 'TSO innovation hub'



entsoe

eu2018bg.bg
Bulgarian Presidency of the Council
of the European Union

EDSO
for smart grids

INNOGRID2020+
the innovative power conference

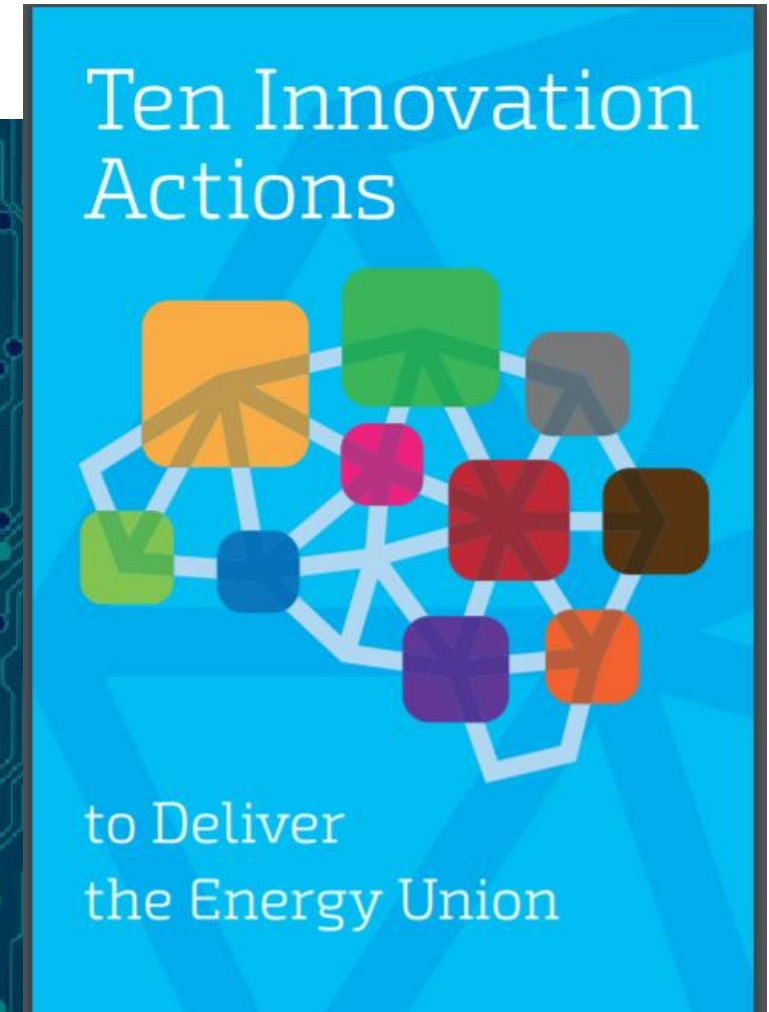
MAY 15-16
BRUSSELS

SMART WIRES
REIMAGINE THE GRID

eit InnoEnergy
Knowledge Innovation Community

N-SIDE
OPTIMIZING YOUR DECISIONS

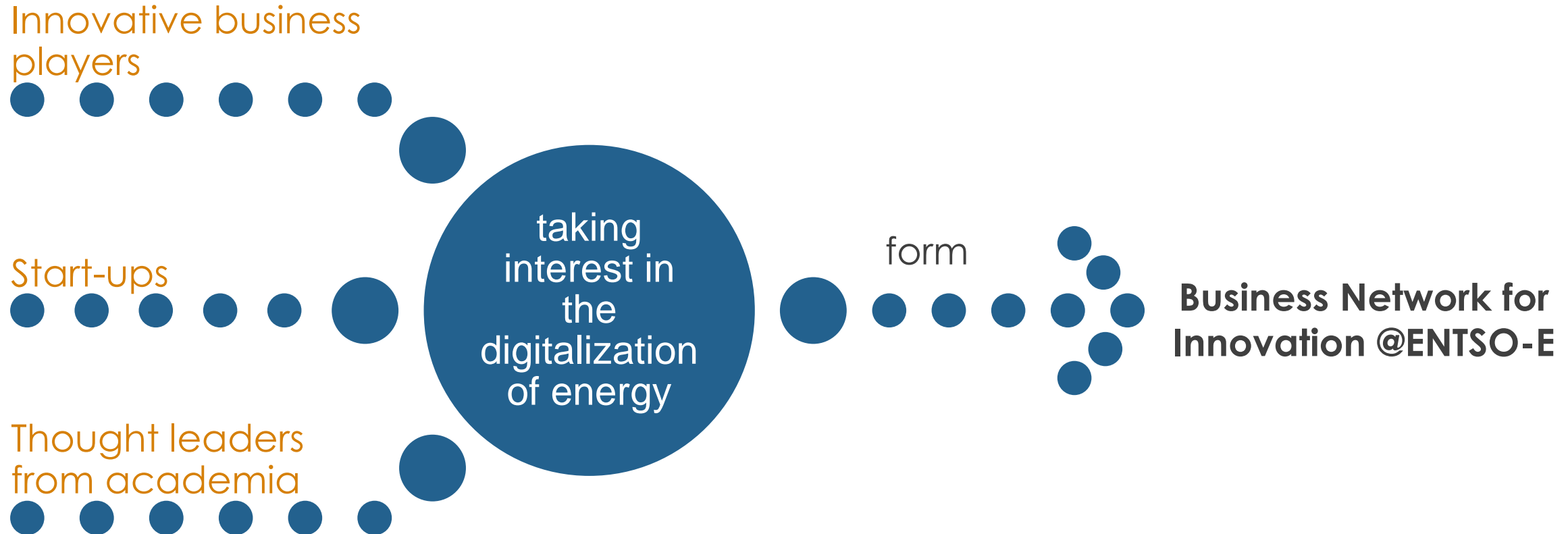
European University Institute
FSR ENERGY
Netherlands School of Regulation



Ten Innovation
Actions

to Deliver
the Energy Union

New Business network for innovation



THANK YOU FOR YOUR ATTENTION

The logo for entsoe, featuring the word "entsoe" in a white, lowercase, sans-serif font. The letter "e" at the end is stylized with a blue circular graphic element behind it. The logo is centered on a dark blue background with a pattern of golden-yellow stars, similar to the European Union flag.

entsoe

info@entsoe.eu - entsoe.eu – Follow us on



entsoe