NETWORK CODES

Sonya Twohig

System Operations Manager

Energy Community Security of Supply Coordination Group on Electricity
13 December 2016

WHAT IS A NETWORK CODE/GUIDELINE?

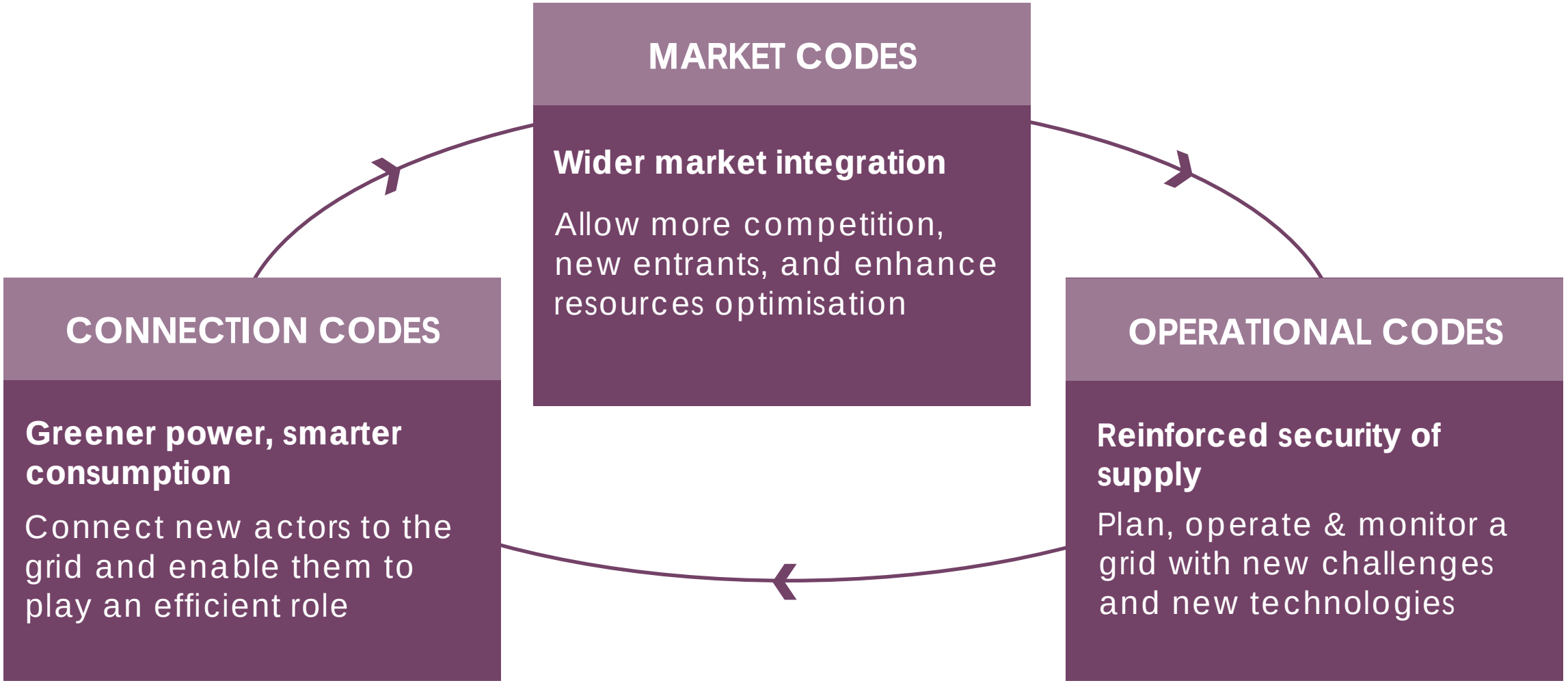
1. A set of rules applying to a cross-border or market integration issue in the electricity sector

2. Developed by the European Commission, ACER, ENTSO-E & market participants under Art. 8 of the Regulation (EC) No 714/2009

3. Going through a EU law-making process called ‘Comitology’

4. Which at the end make network codes and guidelines binding EU regulations to be implemented in all member states

STRIVING FOR EUROPEAN HARMONISATION OF OUR PROCESSES



NETWORK CODES/GUIDELINES:
THE FOUNDATIONS OF THE INTERNAL ENERGY MARKET

3 CONNECTION CODES

Requirements for:

- Generators
- Demand side
- HVDC connections

…paving the way for offshore wind…

3 MARKET CODES

Rules for:

- Capacity calculation
- Day ahead / Intraday
- Forwards
- Balancing

…market coupling…

2 OPERATIONAL CODES

Rules for:

- System Operation
- Emergency situations

…regional cooperation to increase security…

STATE OF PLAY

3 CONNECTION CODES

- Requirements for generators
- Demand connection
- HVDC connections

3 MARKET CODES

- Capacity allocation & Congestion management
- Forward Capacity Allocation
- Balancing

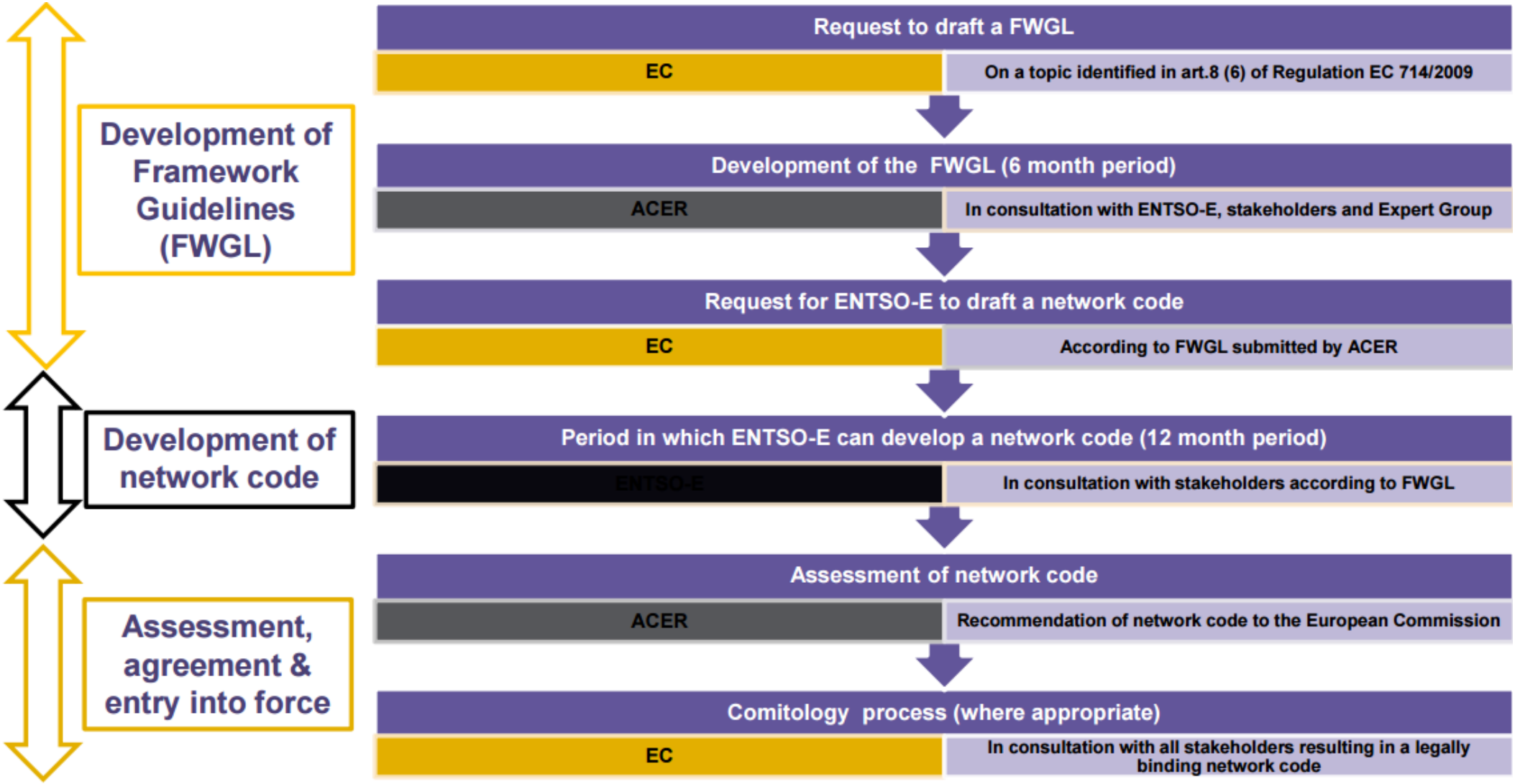
2 OPERATIONAL CODES

- System Operation Guideline
- Emergency situations

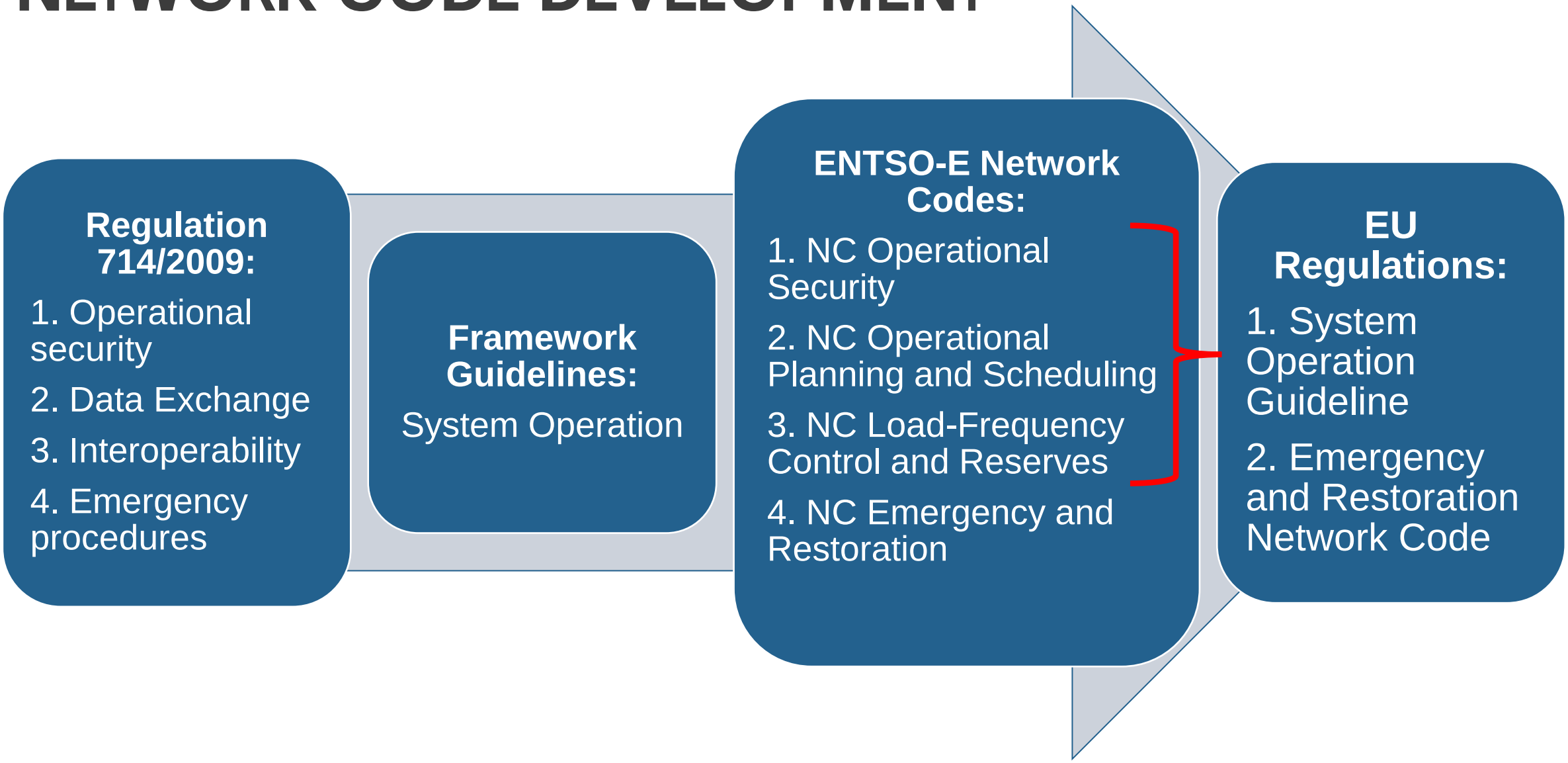
Published in the EU Official Journal and/or in force	Validated by member states' representatives, awaiting validation by EU Council & Parliament	Pending validation by member states' representatives

entsoe

NETWORK CODE DEVELOPMENT



NETWORK CODE DEVELOPMENT



NETWORK CODE EMERGENCY AND RESTORATION

NETWORK CODE EMERGENCY AND RESTORATION

System defence plan

Restoration plan

Market interactions

Information exchange and communication, tools and facilities

Compliance and review

Implementation and general provisions

NETWORK CODE EMERGENCY AND RESTORATION – SYSTEM DEFENCE PLAN

Technical and organisational measures *to prevent the propagation or deterioration of a disturbance in order to avoid a wide area state disturbance and blackout state*

General

- Conditions for activating the system defence plan
- Instructions to be issued by TSO
- Measures subject to real-time coordination
- List of the measures and implementation deadlines

System protection schemes

- Automatic under-frequency control scheme
- Automatic over-frequency control scheme

System defence plan procedures

- Frequency deviation management
- Voltage deviation management
- Power flow management
- Assistance for active power
- Manual demand disconnection

NETWORK CODE EMERGENCY AND RESTORATION – RESTORATION PLAN

Technical or organisational measures *for the restoration of the system back to normal state*

General

- Conditions for activating the restoration plan
- Instructions to be issued by TSO
- Measures subject to real-time coordination
- List of the measures and implementation deadlines

Technical and organisational measures

- Re-energisation procedure
- Frequency management procedure
- Resynchronisation procedure

NETWORK CODE EMERGENCY AND RESTORATION – MARKET INTERACTIONS

Suspension of market activities:

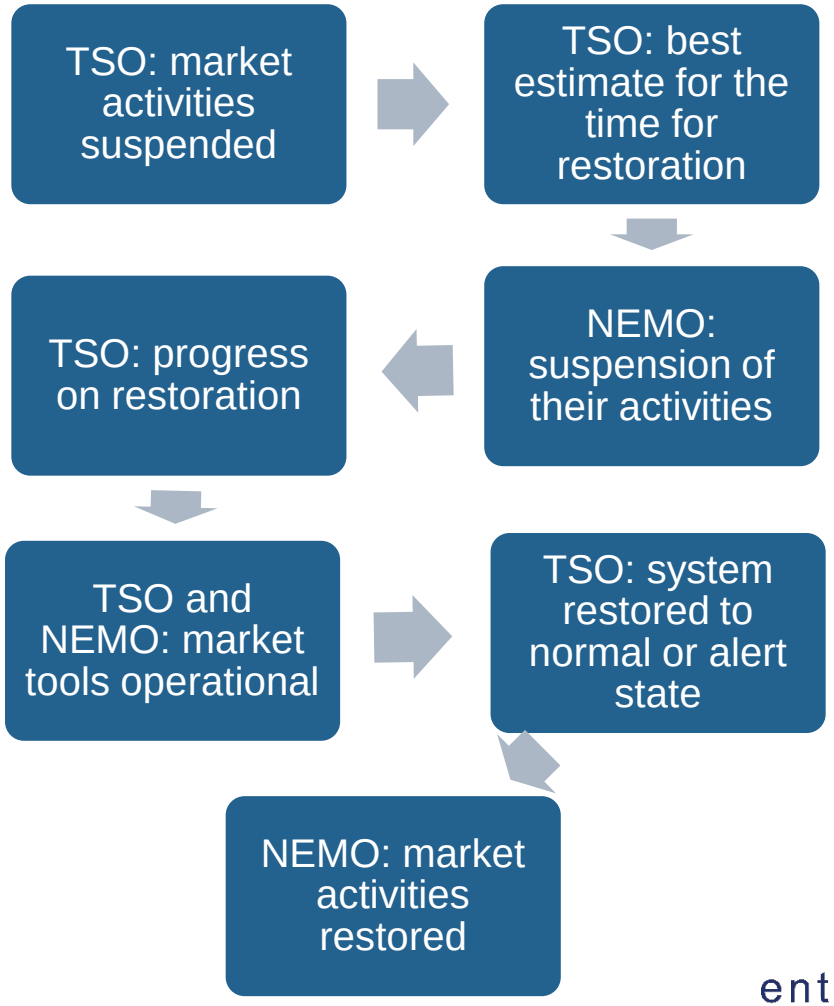
Transmission system in blackout state

Continuation of market activities under emergency state:

- would deteriorate conditions for classification of system state
- would decrease significantly the effectiveness of the restoration process

Tools and communication means for facilitating market activities not available

Communication procedure:



SYSTEM OPERATION GUIDELINE

SYSTEM OPERATION GUIDELINE

STRUCTURE

General provisions

- The scope, definitions and objectives
- Regulatory aspects
- Monitoring and annual reports

Operational security

- Classification and monitoring of system states
- Remedial actions
- Operational security limits
- Data Exchange
- Training

Operational planning

- Common grid model & OPDE
- Operational security analysis
- Regional security coordinators
- Outage planning
- Adequacy analysis
- Scheduling

Load-frequency control and reserves

- Synchronous area operational agreements
- Provision, exchange and sharing of reserves
- Frequency quality parameters
- Load-frequency control

Final provisions and Annexes

- Voltage ranges
- Values of frequency quality parameters
- FCR technical minimum requirements

SYSTEM OPERATION GUIDELINE

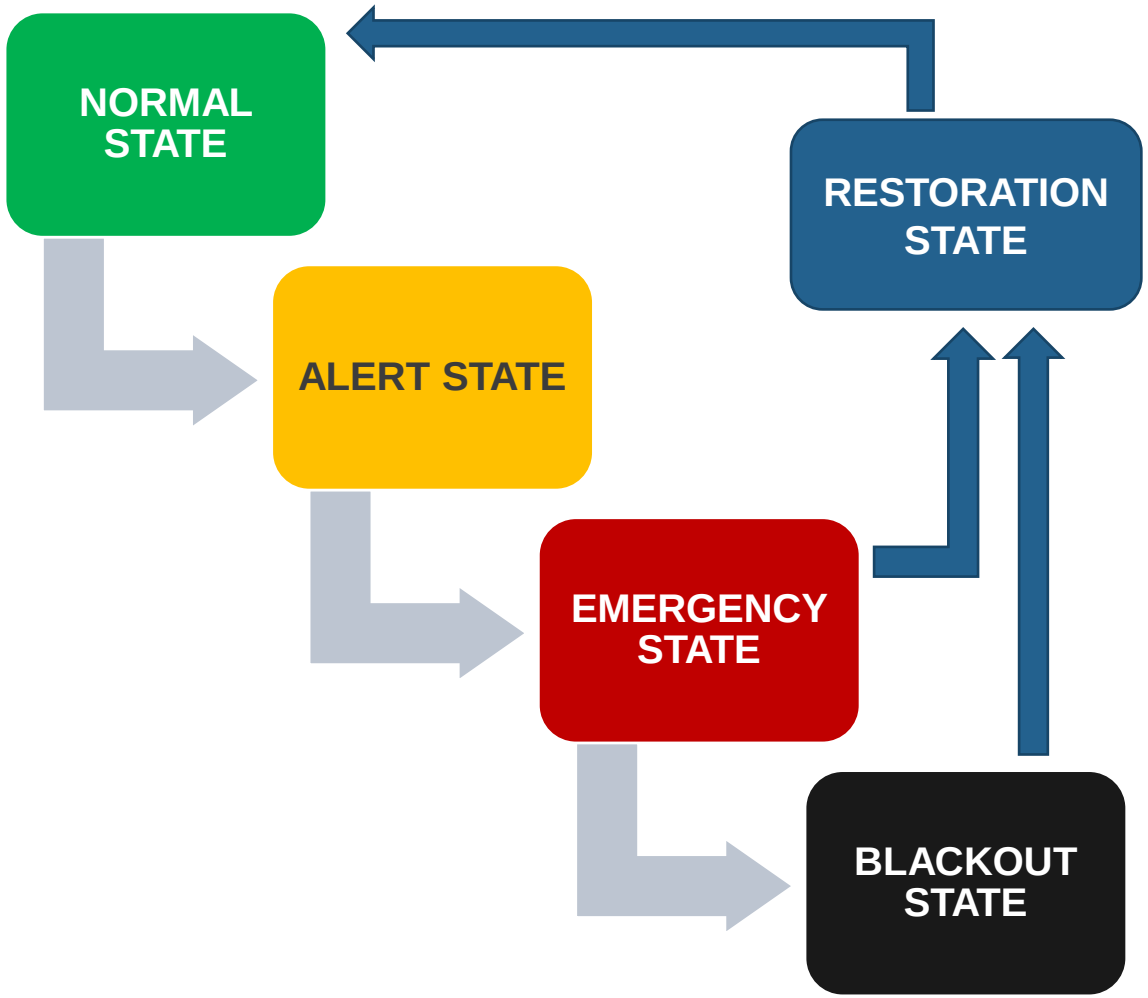
SCOPE & OBJECTIVES

Main addressees:
TSOs, NRAs, DSOs, SGUs, RSCs

- Common principles for operational security, operational planning and load-frequency control
- Ensure conditions for maintaining operational security and frequency quality
- Promote coordination of system operation and operational planning
- Transparency and reliability of information on transmission system operation
- Efficient operation and development of the electricity transmission system

SYSTEM OPERATION GUIDELINE

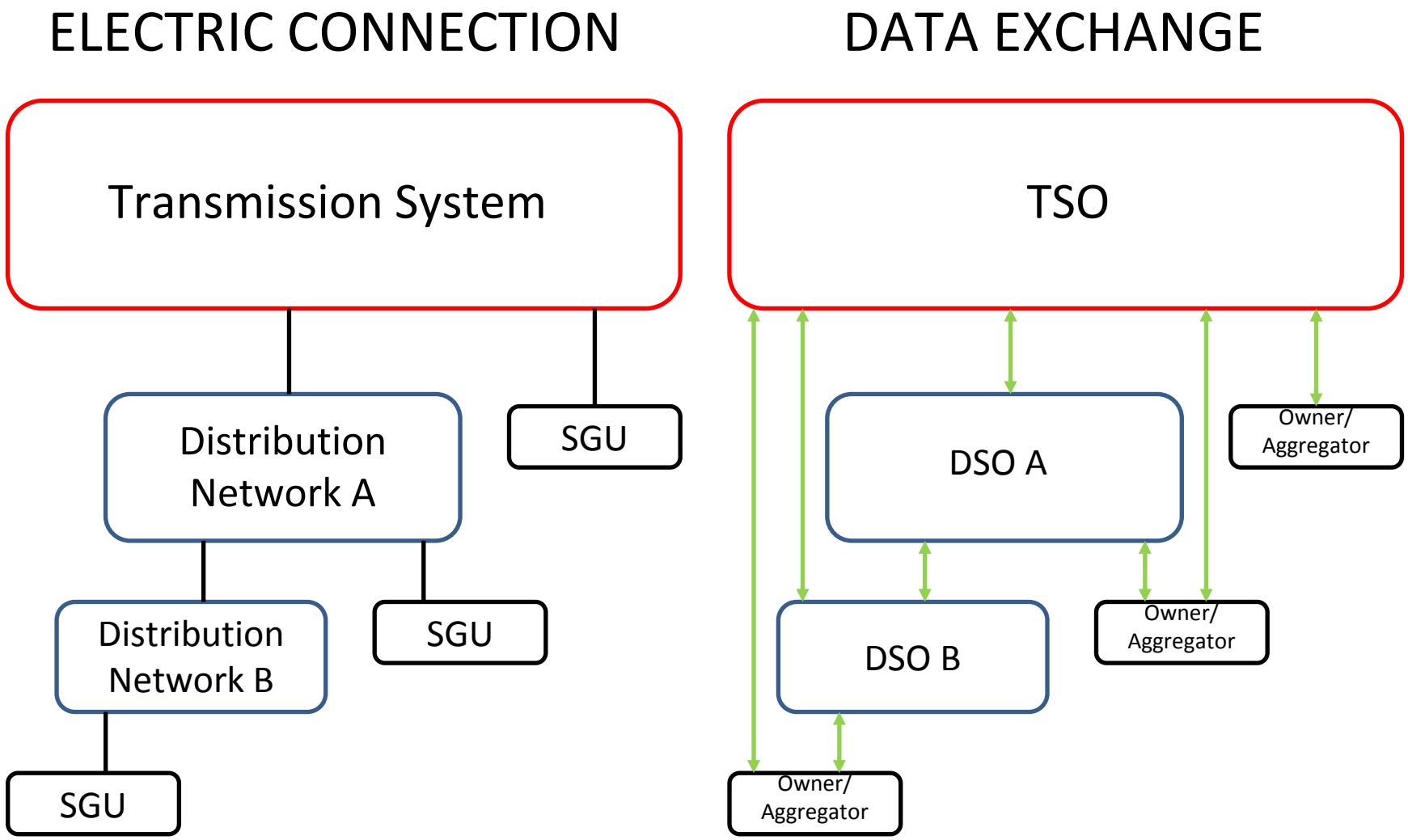
OPERATIONAL SECURITY



Monitoring and determination of system states in real-time:

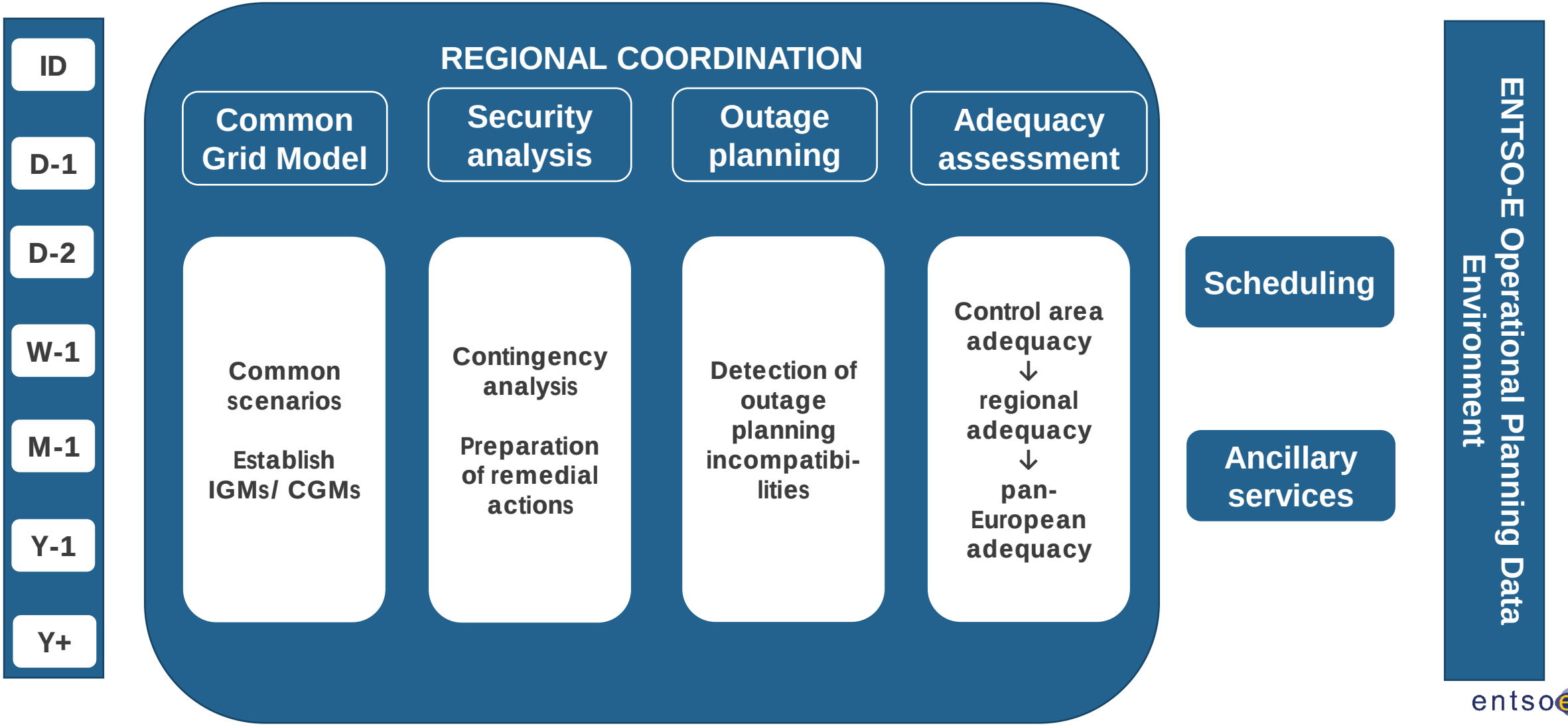
- Contingency analysis every 15 minutes
- Monitor system parameters against operational security limits
- Monitor the level of available reserves
- Declare system state on EAS

SYSTEM OPERATION GUIDELINE
DATA EXCHANGE

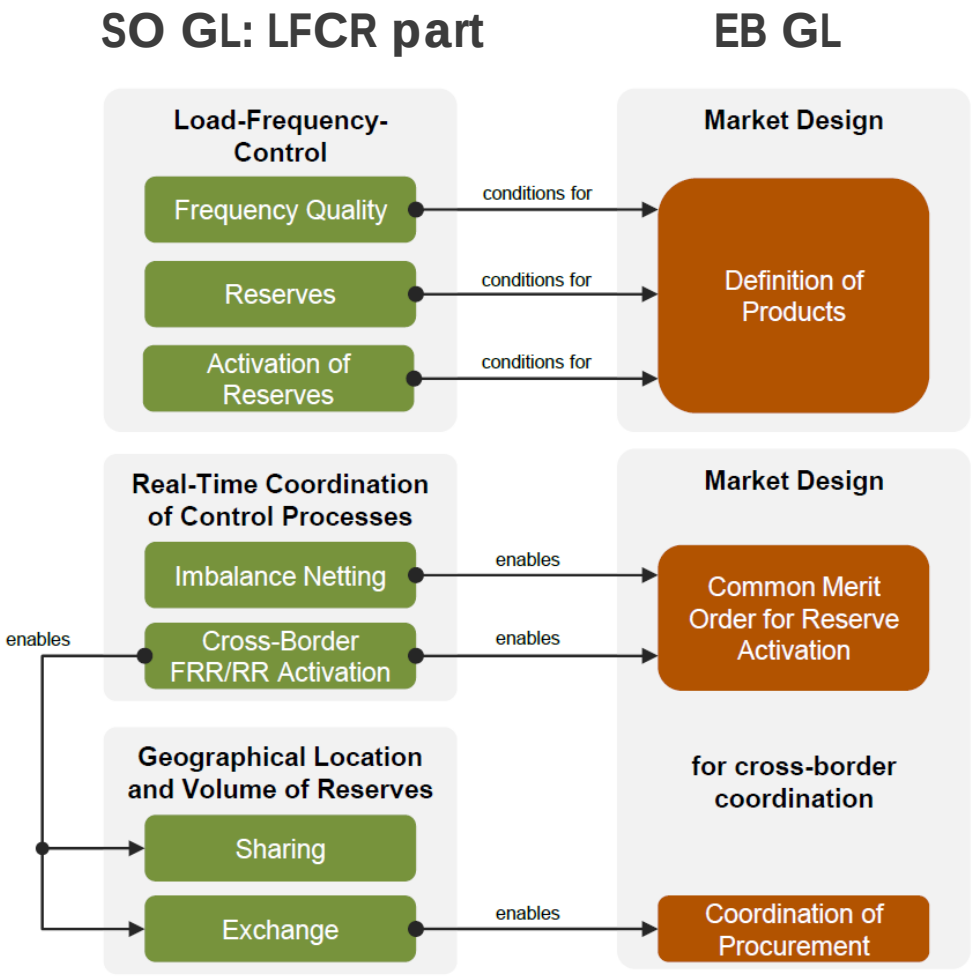


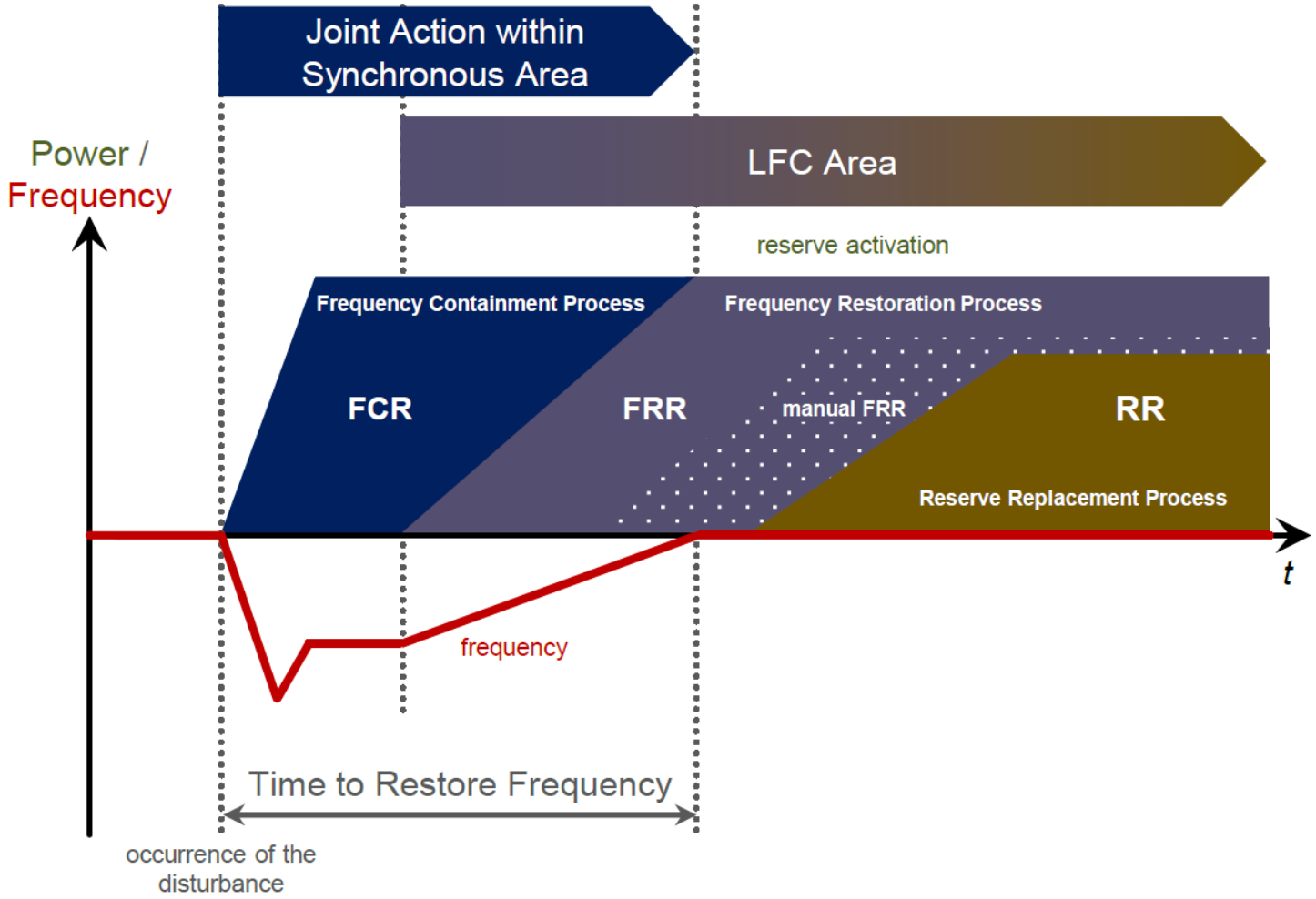
SYSTEM OPERATION GUIDELINE

OPERATIONAL PLANNING

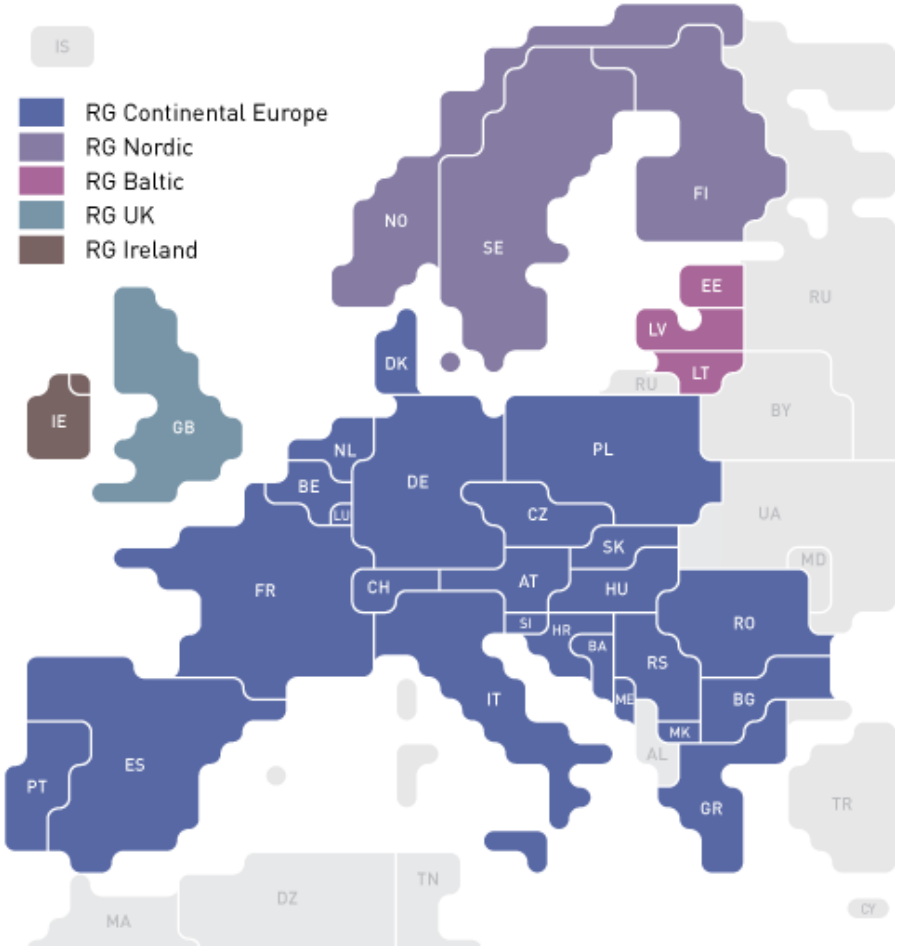


SYSTEM OPERATION GUIDELINE
LOAD-FREQUENCY CONTROL AND RESERVES





SYSTEM OPERATION GUIDELINE
LOAD-FREQUENCY CONTROL AND RESERVES



Synchronous area operational agreements

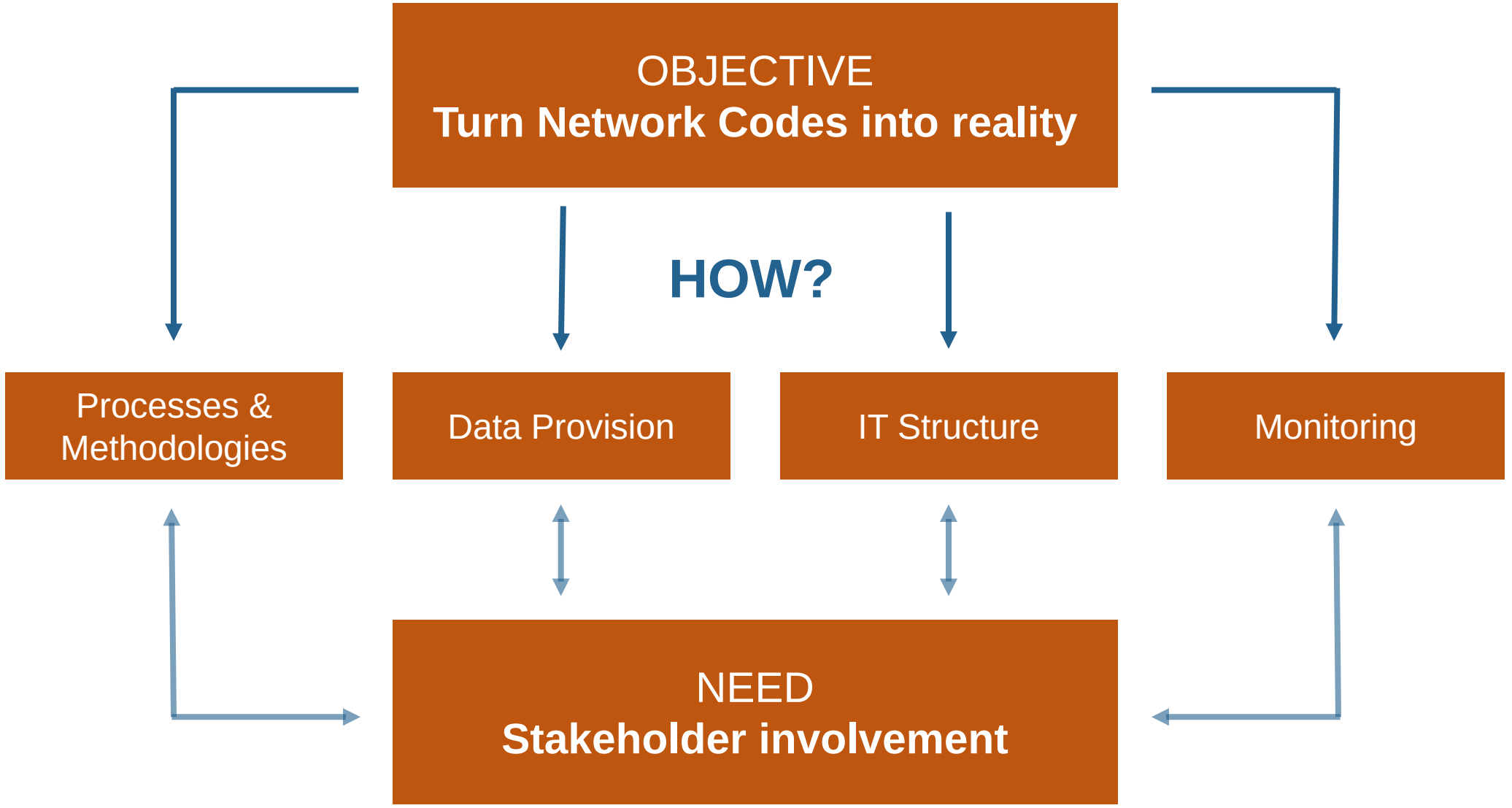
Subject to NRA approval:

- Dimensioning rules for FCR
- Minimum FCR activation period
- Frequency quality parameters
- FCR, FRR and RR exchange and sharing limits

Not subject to NRA approval:

- Common rules for the operation in normal and alert states
- Procedure to reduce system frequency deviation to return to normal state
- Frequency restoration control error target parameters
- Methodology to assess the risk of exhaustion of FCR
- Procedure for exhausted FCR
- Etc.

AND NOW?


OBJECTIVE
Turn Network Codes into reality
HOW?
Processes & Methodologies
Data Provision
IT Structure
Monitoring
NEED
Stakeholder involvement

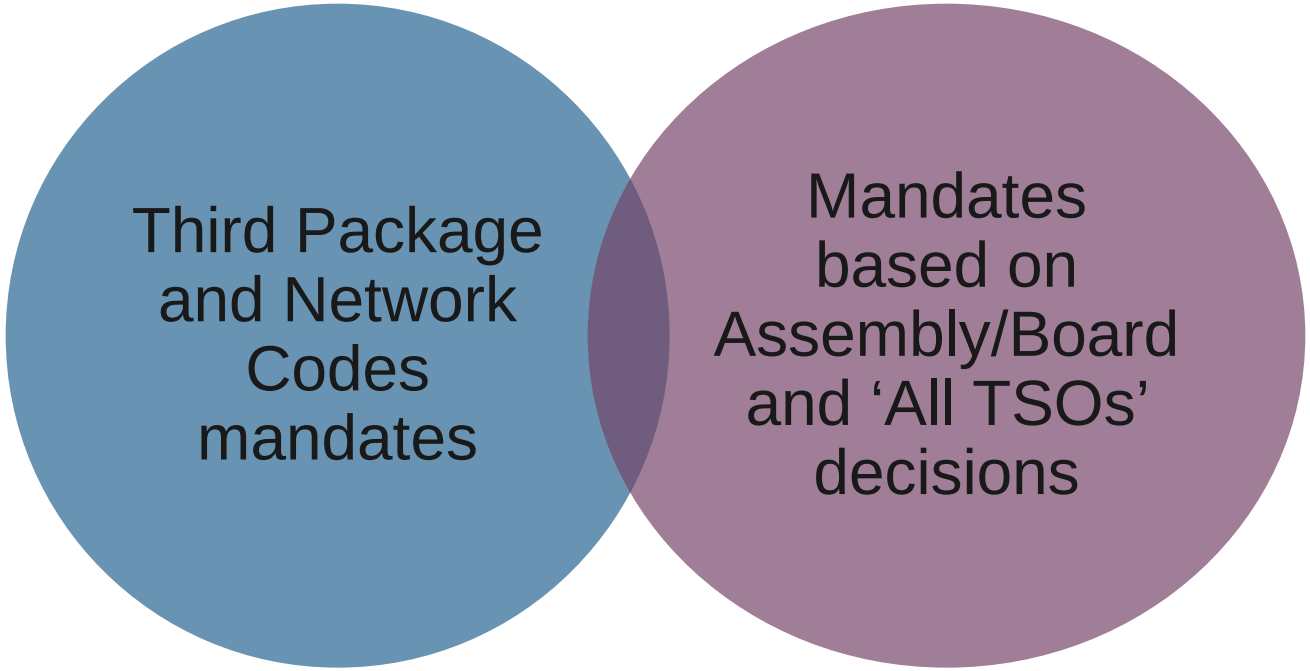
NETWORK CODE IMPLEMENTATION

Task	Responsibility	Approval
ENTSO-E	ENTSO-E	ACER
Pan-European "All TSOs"	EU TSOs	All NRAs
Regional "All TSOs"	TSOs of the regions	NRAs of the region
National	Depending on national legislation	National NRAs

“All TSOs” PROCESS: WHICH ROLE FOR ENTSO-E?

➔ **Responsibility on the TSOs**

- Facilitation of “all TSOs” tasks
  - Established for pan-EU tasks
  - Can be applied for regional tasks
- Specific rules apply
  - ToRs approved by the TSOs
- Use of ENTSO-E as platform
  - Gather TSOs, Secretariat support
- Inter-operability, stakeholders engagement and communication



NETWORK CODE IMPLEMENTATION

System Operation Guidelines	
Data Exchange	2017
Common Grid Model: methods, data	2017
Coordinated operational security analysis	2018
Synchronous area operational agreements	2018
Regional Security Coordination	2019
Operational planning data environment	2019

Emergency & Restoration	
Regionally coordinated system defence and system restoration plans	2018
Coordinated automatic over-frequency control	2019

REGIONAL SECURITY COORDINATION

Sonya Twohig

System Operations Manager

Energy Community Security of Supply Coordination Group on Electricity
13 December 2016

TSO COOPERATION & EU LAW

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

PLANNING

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

TYNDP used as basis for the EU Projects of Common Interests

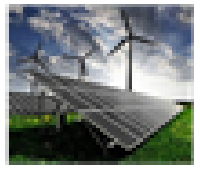
entsoe

WHY SEAMLESS TSO COOPERATION IS NEEDED

From
Where we were in the past

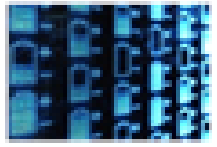
- Large, predictable, and centralised generation portfolio
- One-way flow to consumers with predictable demand patterns, hence no need for smart technologies / smart grids

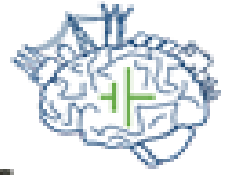
Today
Where we are now



- Increasing proportion of small, intermittent and decentralised generation with bidirectional flows at all voltage levels
- Reduced fossil plant load factors and thermal plant closure
- Increasing EU interaction
- Increasing smart technologies

TO
Where we might go in the future



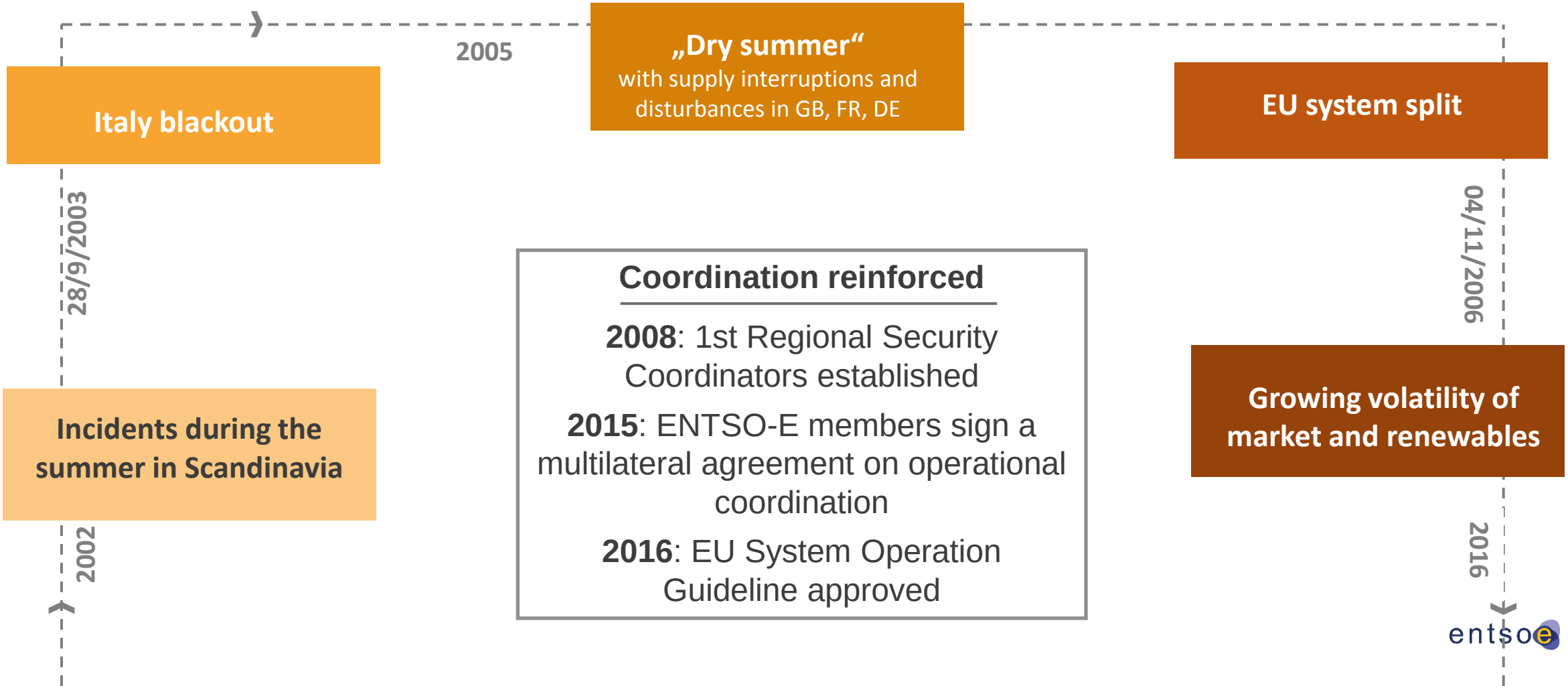


- Mixed generation portfolio of distributed, CCGTs and low carbon technologies
- Suite of new technology assets and services
- Engaged, active, prosumers
- Further electrification of transport (focus on e-cars)
- Smart, data-centric system

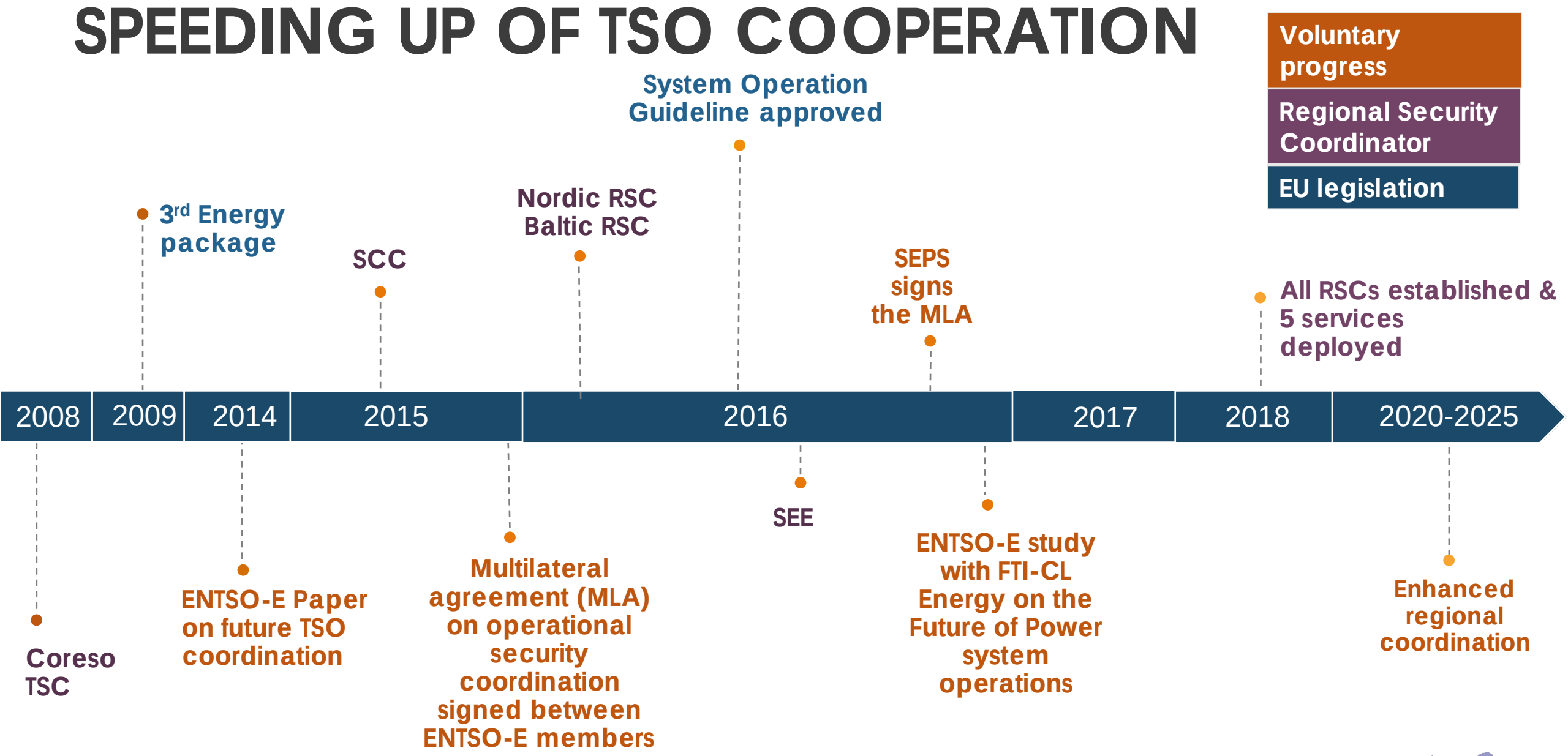
A changing electricity market requires an evolving System Operator

entsoe

TSO COOPERATION: RESPONSE TO SECURITY RISKS

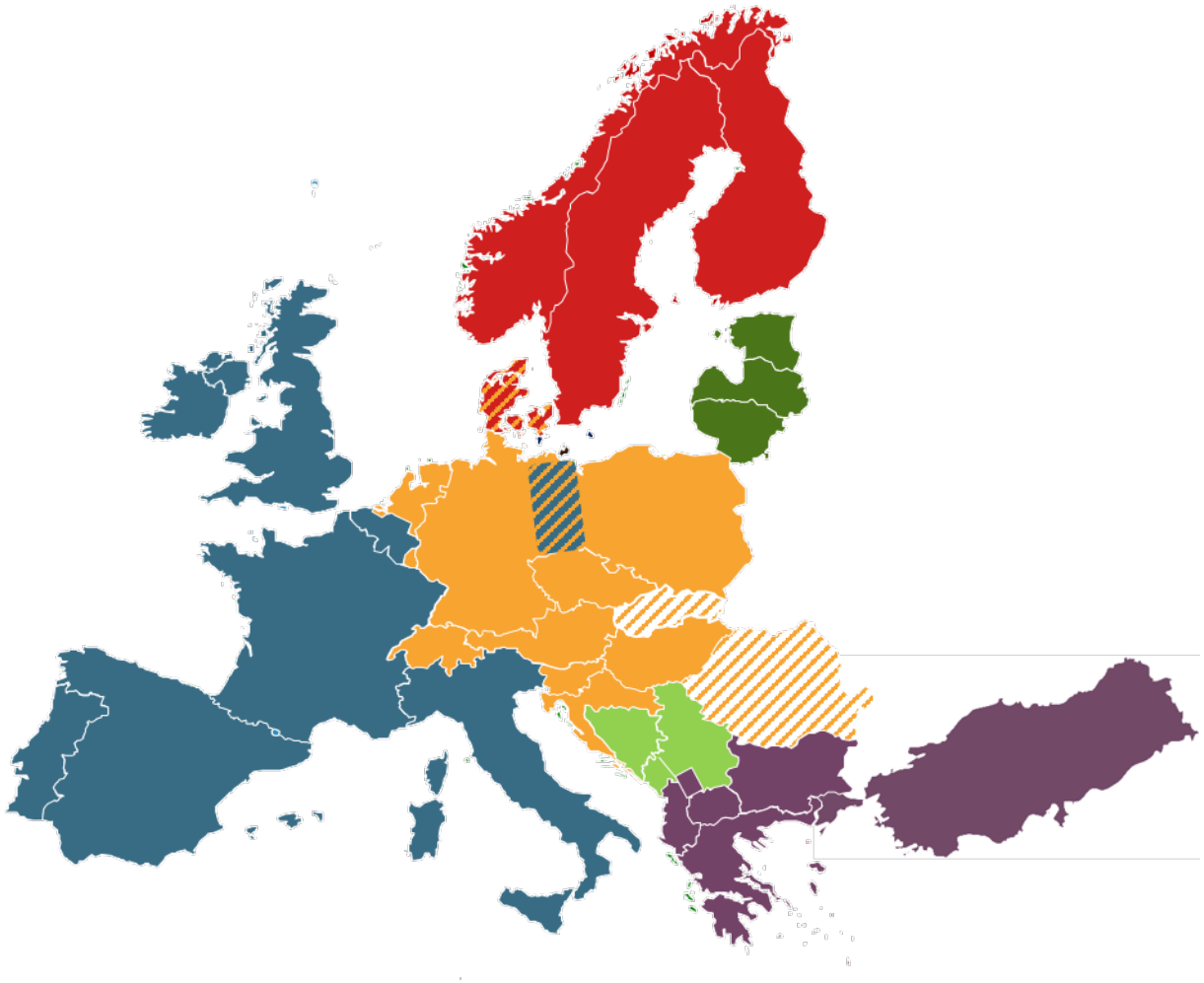


SPEEDING UP OF TSO COOPERATION



entsoe

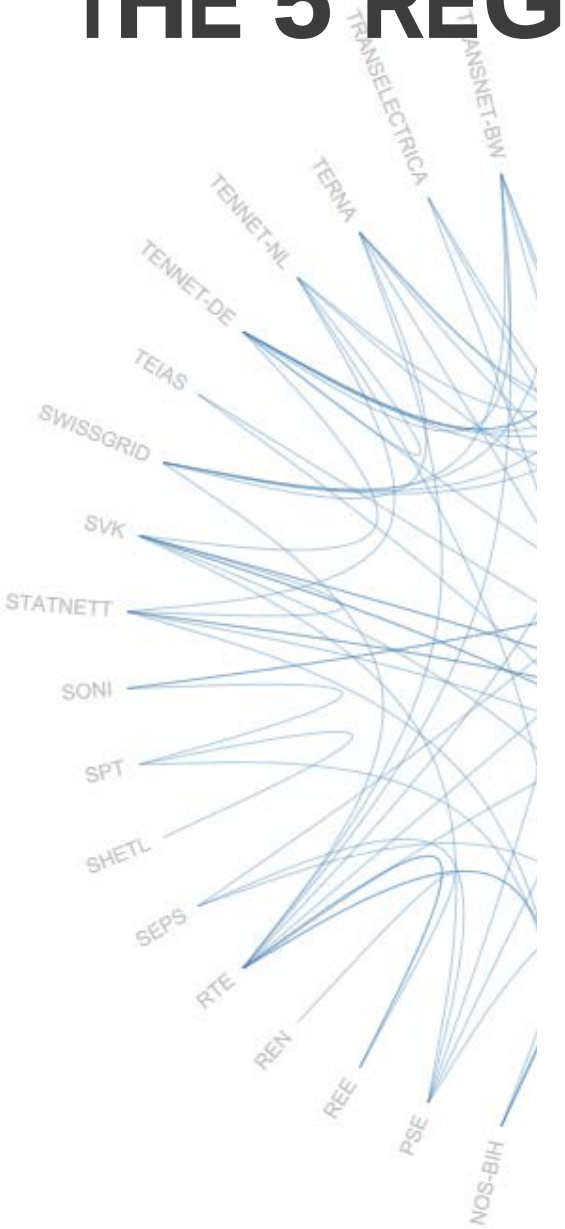
REGIONAL SECURITY COORDINATORS: THE NEW FACE OF COOPERATION



- CORESO (2008)
- TSC (2008)
- SCC (2015)
- Baltic RSC (2016)
- SEE-Thessaloniki RSC (2016)
- Nordic RSC (2016)
- TSO in TSC and Nordic RSC
- TSO in TSC and CORESO
- TSO procuring services from TSC

entsoe

THE 5 REGIONALLY COORDINATED SERVICES



HOW COOPERATION WORKS

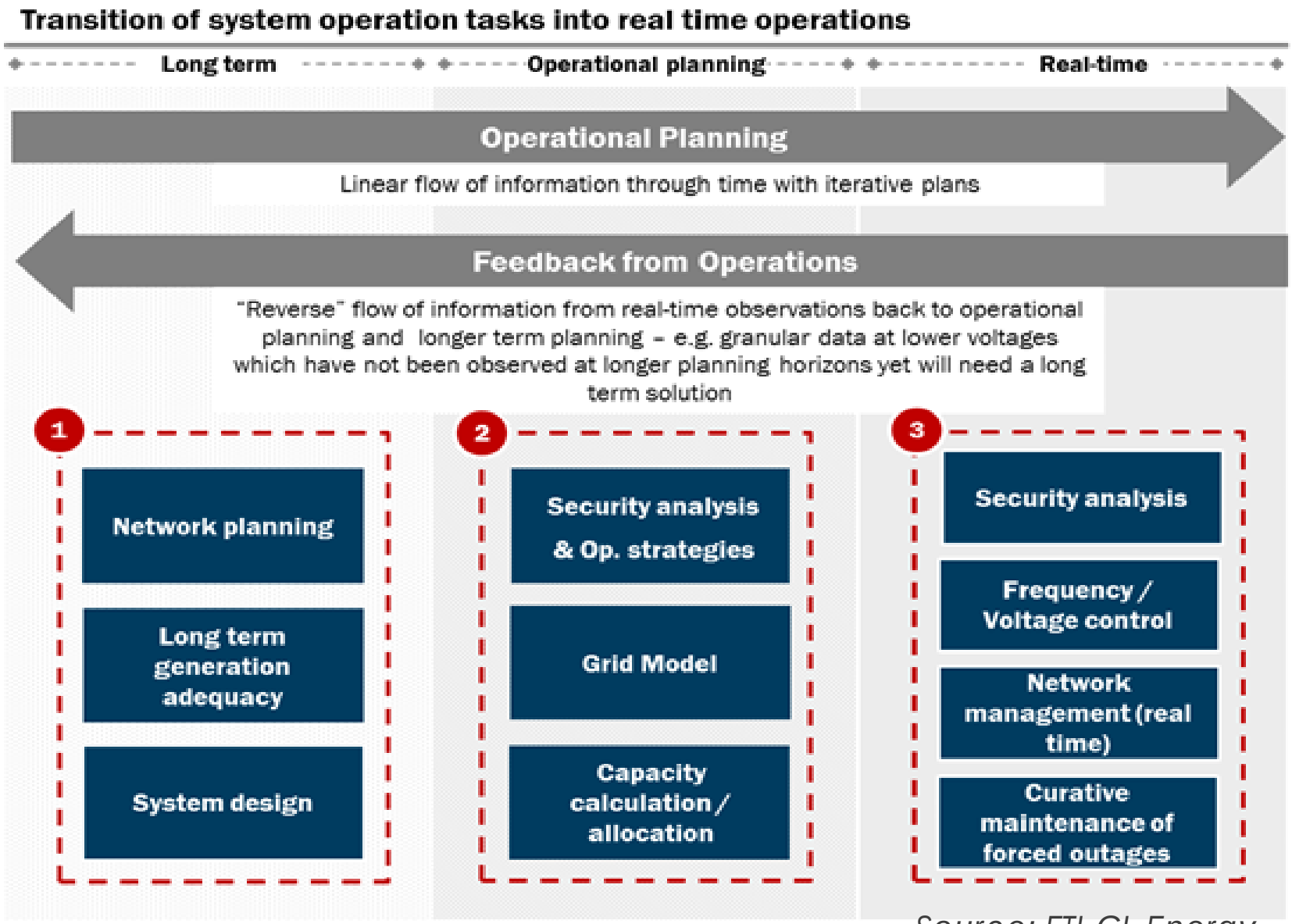
TSOs provide data to RSCs

RSCs perform analyses and provide results to TSOs

TSOs take the final decisions

Full decision-making responsibility remains with the TSOs based on the real-time operational conditions.

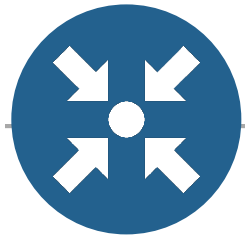
WHY SPLITTING OPERATIONAL PLANNING IS RISKY



Source: FTI-CL Energy

entsoe

THE PROs OF THE RSCs' MODEL



MORE COORDINATION BRINGS:

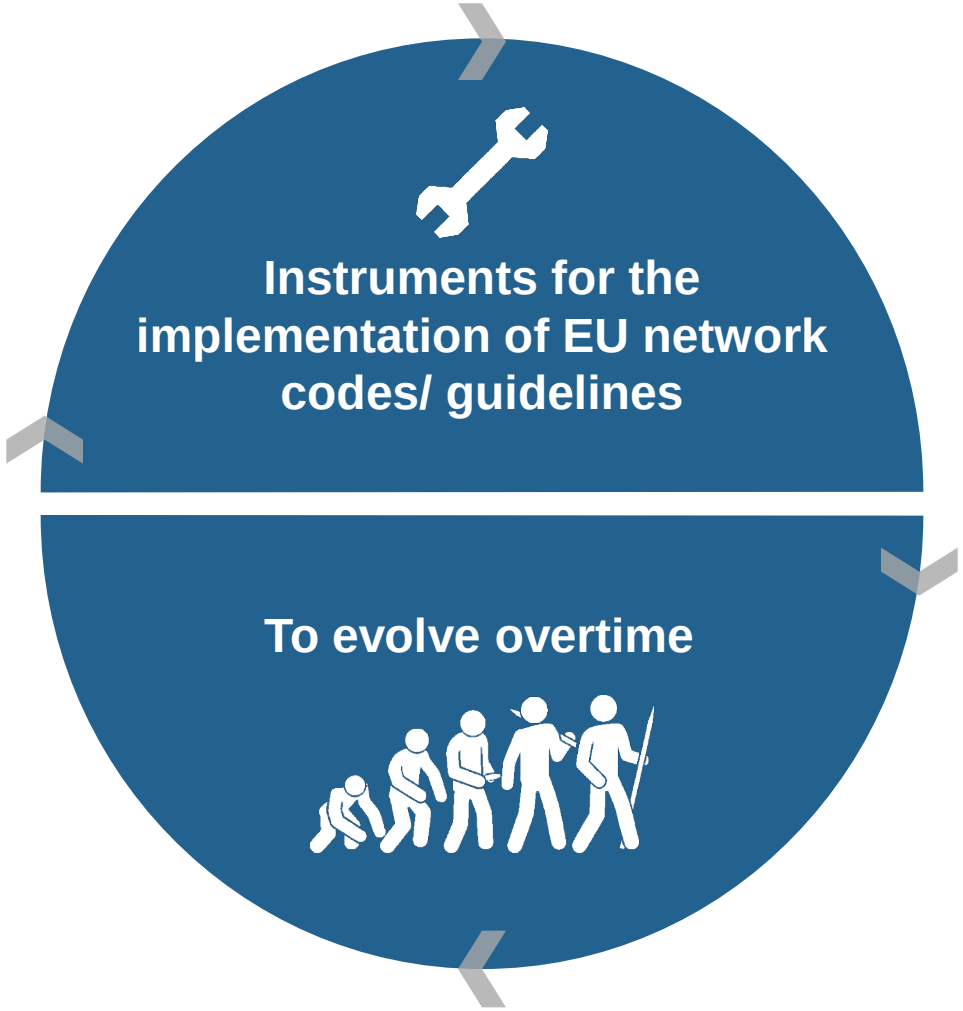
- More security
- Optimised operation
- Economies of scale
- Market integration
- Maximised transmission capacity to markets
- Links between operational security analysis and market support functions

TSOs MAINTAINING OPERATIONAL DECISION MAKING:

- Minimises risk of wide area events
- Minimises risk of cyber and terrorist attacks
- Cost control

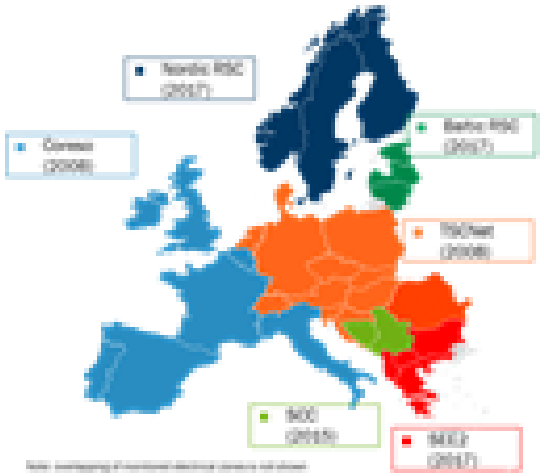
entsoe

RSCs WILL EVOLVE OVER TIME



EVOLUTION OF OPERATIONAL COORDINATION

2016 | 2018 | By 2021-2022 | Beyond 2021/2022



European RSCs established

Full RSCs implementation with 5 standard services

Full NCs & Guidelines implementation completed

?

Source: FTI-CL Energy

entsoe

THANK YOU!

FOR YOUR ATTENTION

Sonya.Twohig@entsoe.eu

+32 2 741 09 50

For more information:
http://www.entsoe.eu

Av. de Cortenbergh 100
1000 Brussels Belgium