**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

MARKET CODES
Wider market integration
Allow more competition, new entrants, and enhance resources optimisation

OPERATIONAL CODES
Reinforced security of supply
Plan, operate & monitor a grid with new challenges and new technologies

CONNECTION CODES
Greener power, smarter consumption
Connect new actors to the grid and enable them to play an efficient role
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

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<th>MARKET CODES</th>
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**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**
NETWORK CODE DEVELOPMENT

1. Request to draft a FWGL
   - EC
   - On a topic identified in art.8 (6) of Regulation EC 714/2009

2. Development of the FWGL (6 month period)
   - ACER
   - In consultation with ENTSO-E, stakeholders and Expert Group

3. Request for ENTSO-E to draft a network code
   - EC
   - According to FWGL submitted by ACER

4. Period in which ENTSO-E can develop a network code (12 month period)
   - ENTSO-E
   - In consultation with stakeholders according to FWGL

5. Assessment of network code
   - ACER
   - Recommendation of network code to the European Commission

6. Comitology process (where appropriate)
   - EC
   - In consultation with all stakeholders resulting in a legally binding network code
NETWORK CODE DEVELOPMENT

Regulation 714/2009:
1. Operational security
2. Data Exchange
3. Interoperability
4. Emergency procedures

Framework Guidelines:
System Operation

ENTSO-E Network Codes:
1. NC Operational Security
2. NC Operational Planning and Scheduling
3. NC Load-Frequency Control and Reserves
4. NC Emergency and Restoration

EU Regulations:
1. System Operation Guideline
2. Emergency and Restoration Network Code
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
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

- 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

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

**Technical and organisational measures**

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

**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
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

Suspension of market activities:

Communication procedure:

- TSO: market activities suspended
- TSO: best estimate for the time for restoration
- NEMO: suspension of their activities
- TSO: progress on restoration
- TSO and NEMO: market tools operational
- TSO: system restored to normal or alert state
- NEMO: market activities restored
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
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
ELECTRIC CONNECTION

Transmission System

Distribution Network A

Distribution Network B

SGU

DATA EXCHANGE

TSO

DSO A

DSO B

Owner/
Aggregator

Owner/
Aggregator

Owner/
Aggregator
SYSTEM OPERATION GUIDELINE
OPERATIONAL PLANNING

REGIONAL COORDINATION

- Common Grid Model
  - Common scenarios
  - Establish IGMs/CGMs

- Security analysis
  - Contingency analysis
  - Preparation of remedial actions

- Outage planning
  - Detection of outage planning incompatibilities

- Adequacy assessment
  - Control area adequacy
  - Regional adequacy
  - Pan-European adequacy

Scheduling
Ancillary services

ENTSO-E Operational Planning Data Environment
### SYSTEM OPERATION GUIDELINE

#### LOAD-FREQUENCY CONTROL AND RESERVES

**SO GL: LFCR part**
- Load-Frequency-Control
  - Frequency Quality
  - Reserves
  - Activation of Reserves
- Real-Time Coordination of Control Processes
  - Imbalance Netting
  - Cross-Border FRR/RR Activation
  - Geographical Location and Volume of Reserves
    - Sharing
    - Exchange

**EB GL**
- Market Design
  - Definition of Products
- Market Design
  - Common Merit Order for Reserve Activation
- for cross-border coordination

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**Power / Frequency**

**Joint Action within Synchronous Area**

**LFC Area**
- reserve activation

**Frequency Containment Process**
- FCR

**Frequency Restoration Process**
- FRR
- manual FRR

**Reserve Replacement Process**
- RR

---

**Time to Restore Frequency**

- occurrence of the disturbance

- frequency

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[entsoe]
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

NEED
Stakeholder involvement

HOW?
Processes & Methodologies
Data Provision
IT Structure
Monitoring
# NETWORK CODE IMPLEMENTATION

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<td>Depending on national legislation</td>
<td>National NRAs</td>
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“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

Third Package and Network Codes mandates

Mandates based on Assembly/Board and ‘All TSOs’ decisions
## NETWORK CODE IMPLEMENTATION

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REGI O NAL SEC U R I T Y COORDINATION

Sonya Twohig
System Operations Manager

Energy Community Security of Supply Coordination Group on Electricity
13 December 2016
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
WHY SEAMLESS TSO COOPERATION IS NEEDED

From
Where we were in the past

Today
Where we are now

To
Where we might go in the future

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

- 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

- 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
TSO COOPERATION: RESPONSE TO SECURITY RISKS

- **2005**: „Dry summer“ with supply interruptions and disturbances in GB, FR, DE
- **2002**: Incidents during the summer in Scandinavia
- **2003**: Italy blackout
- **2005**: EU system split
- **2008**: 1st Regional Security Coordinators established
- **2015**: ENTSO-E members sign a multilateral agreement on operational coordination
- **2016**: EU System Operation Guideline approved
- **2016**: Growing volatility of market and renewables
SPEEDING UP OF TSO COOPERATION

- 2008: Coreso TSC
- 2009: 3rd Energy package
- 2014: ENTSO-E Paper on future TSO coordination
- 2015: Multilateral agreement (MLA) on operational security coordination signed between ENTSO-E members
- 2016: Nordic RSC Baltic RSC System Operation Guideline approved
- 2017: SEPS signs the MLA
- 2018: All RSCs established & 5 services deployed
- 2020-2025: Enhanced regional coordination

Voluntary progress
Regional Security Coordinator
EU legislation

- SEE
- ENTSO-E study with FTI-CL Energy on the Future of Power system operations
REGIONAL SECURITY COORDINATORS: THE NEW FACE OF COOPERATION
THE 5 REGIONALLY COORDINATED SERVICES

- Security Analysis
- Capacity Calculation
- Outage Planning
- Common Grid Model
- Adequacy Forecast

THE 5 SERVICES OF RSCs
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
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
RSCs WILL EVOLVE OVER TIME

Instruments for the implementation of EU network codes/ guidelines

To evolve overtime
EVOLUTION OF OPERATIONAL COORDINATION

Source: FTI-CL Energy
THANK YOU! FOR YOUR ATTENTION

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GIVE US YOUR FEEDBACK!