Webinar – National implementation of KORRR

11th December, 2020

Introduction

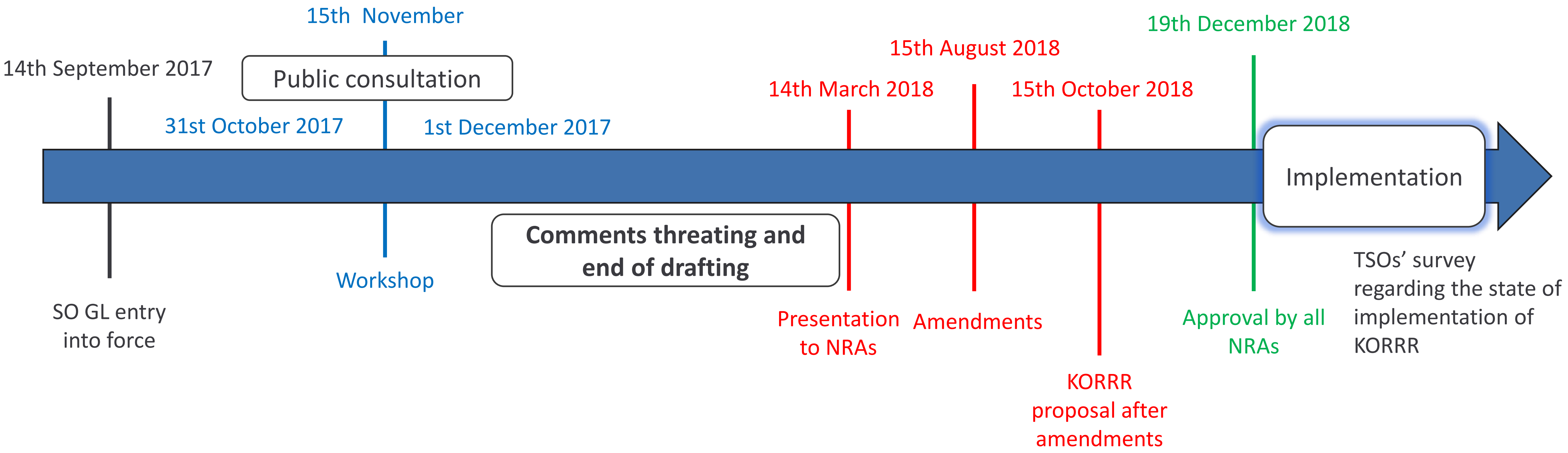
Introduction

The context

- KORRR stands for Key Organisational Requirements, Roles and Responsibilities related to data exchange in accordance with Article 40(6) SO GL.
- KORRR is an All TSOs´common proposal drafted by the Project Team under StG Operational Framework. It serves as an umbrella to all the SOGL data exchange requirements, trying to harmonize where needed but at the same time leaving space for national peculiarities.
- KORRR was approved by NRAs on 19th December 2018. Since then, TSOs have been dealing with the national implementation of KORRR.

Introduction

KORRR Methodology: Timeline



Introduction

KORRR Methodology

What does the KORRR methodology adress?

- It stablishes responsabilities and rights on data exchange.
  - **Who** has to exchange the information?
  - **How** shall the information be exchanged?
  - **When** does the information have to be exchanged?
  - **Which** information has to be exchanged?

Type of information and involved parties:

Type of data
- Structural data
- Scheduled data
- Real time data

Interested parties
- Transmission system operators (TSOs)
- Distribution system operators (DSOs)
- Significant Grid Users (SGUs)

Introduction

KORRR Methodology

	Structural Data	Scheduled Data	Real Time data
Responsibilities of TSOs. Art. 6 to 10	Chapter 1 Arts. 7 and 8	Chapter 1 Art. 9	Chapter 1 Art. 10
Responsibilities of DSOs. Art. 6 to 10	Chapter 2 Arts. 11	Chapter 2 Arts. 12	Chapter 2 Arts. 13
Responsibilities of SGUs Art. 14 to 17	Chapter 3 Arts. 14 and 15	Chapter 3 Arts. 16	Chapter 3 Arts. 17

Introduction

Implementation of KORRR

Article 3 - National approval

- Data exchange scheme of SGUs connected to the distribution grid
  - Structural data
  - Scheduled data
  - Real time data
- Installation, maintenance and settings of communication channels
- Validation criteria for data quality

Articles 12 y 16 - National approval

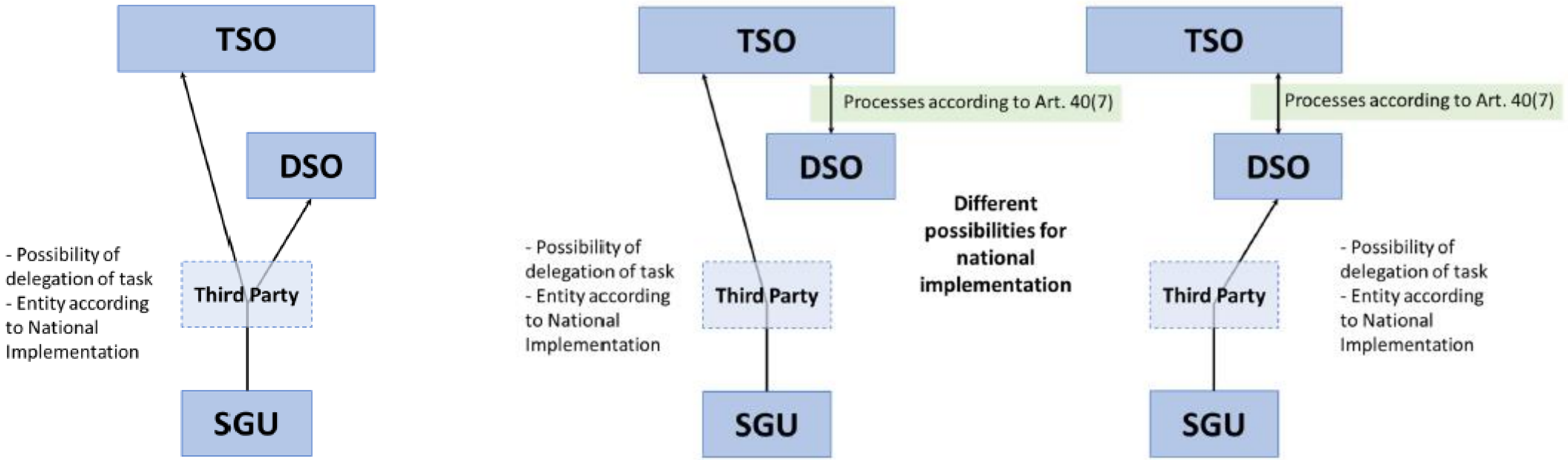
  - Frequency of scheduled data exchange with the TSO

Article 7 - Agreement between TSOs and relevant DSOs

  - Format of the SGU’s structural data exchange between TSOs and DSOs

Introduction

National implementation of Article 3.3 of KORRR

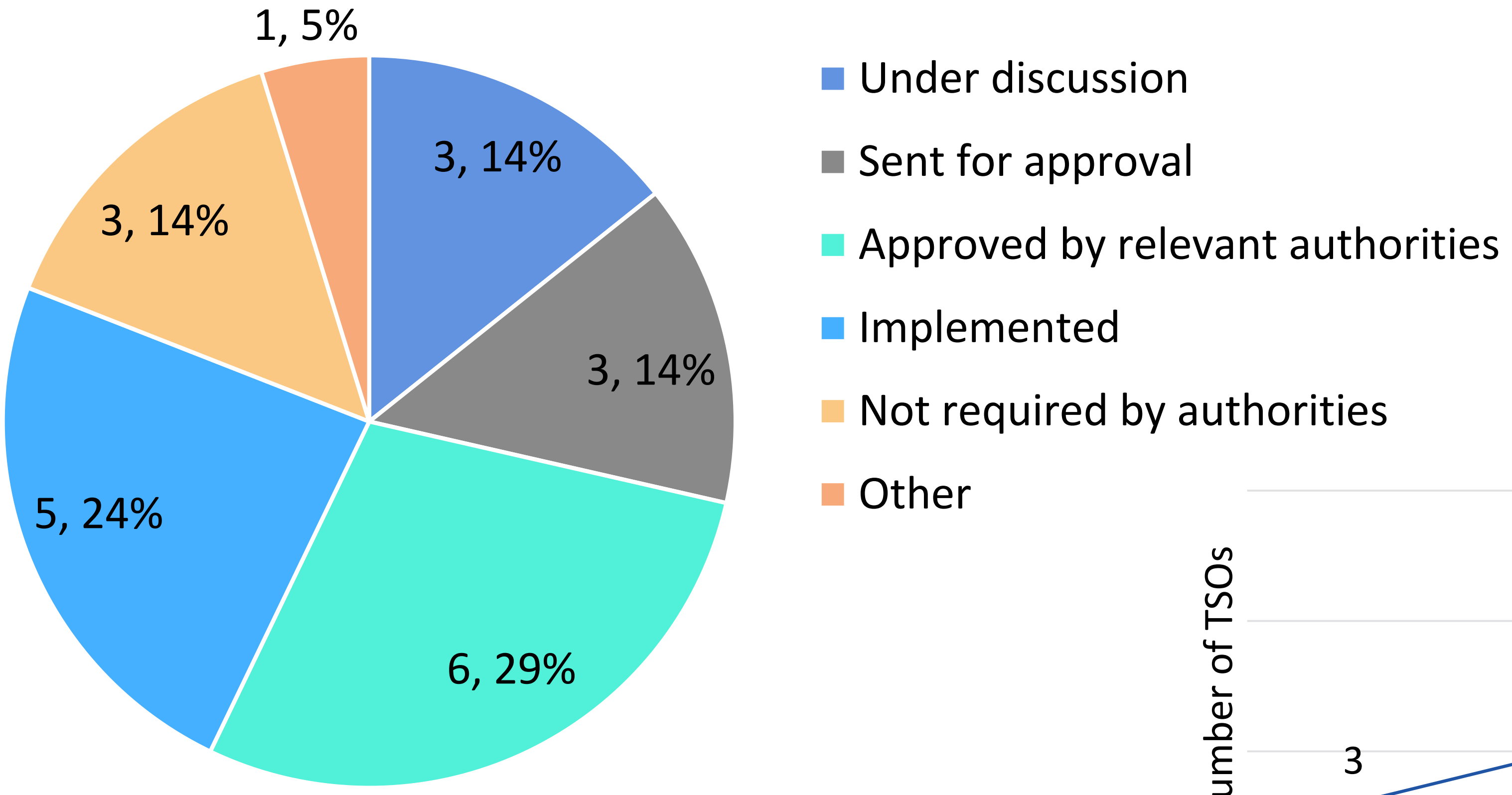


According to Article 3.3 of KORRR, it is the National Regulatory Authority, or another entity designated by the Member State, the one in charge of approving the data exchange scheme on distributed SGUs

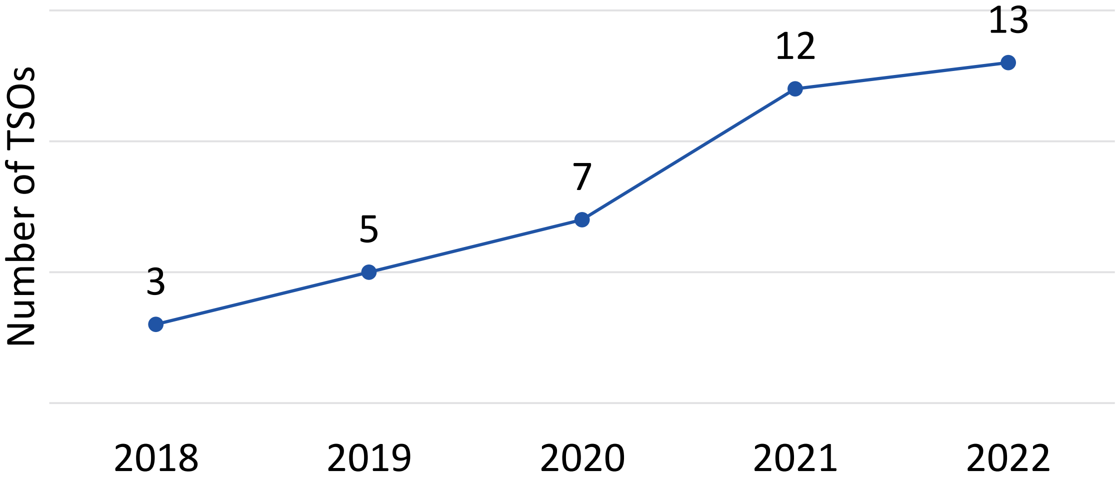
General overview of the status of national implementation of KORRR
Updated survey results

General status of national implementation of KORRR

State of national implementation of Article 40.5:

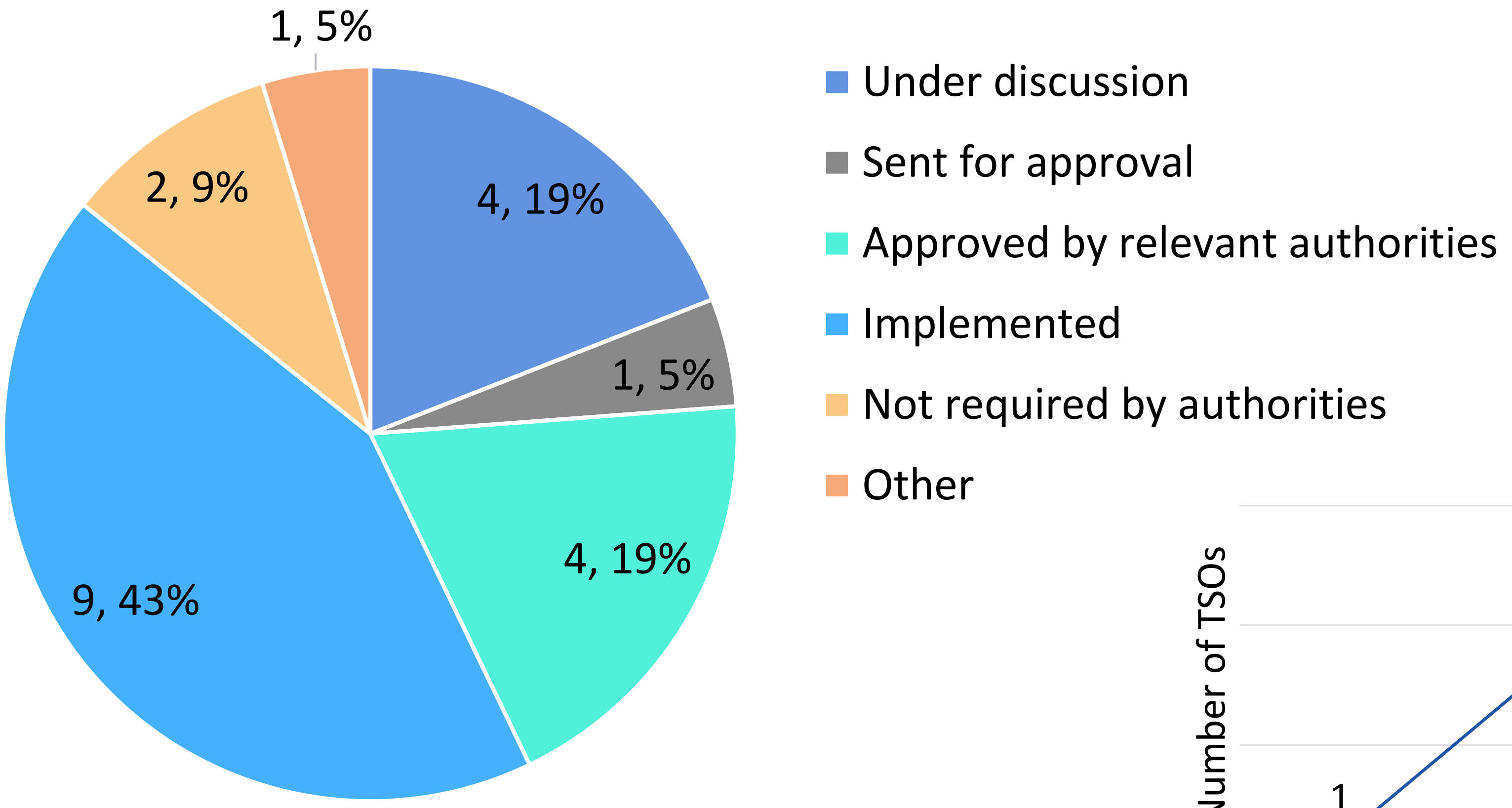


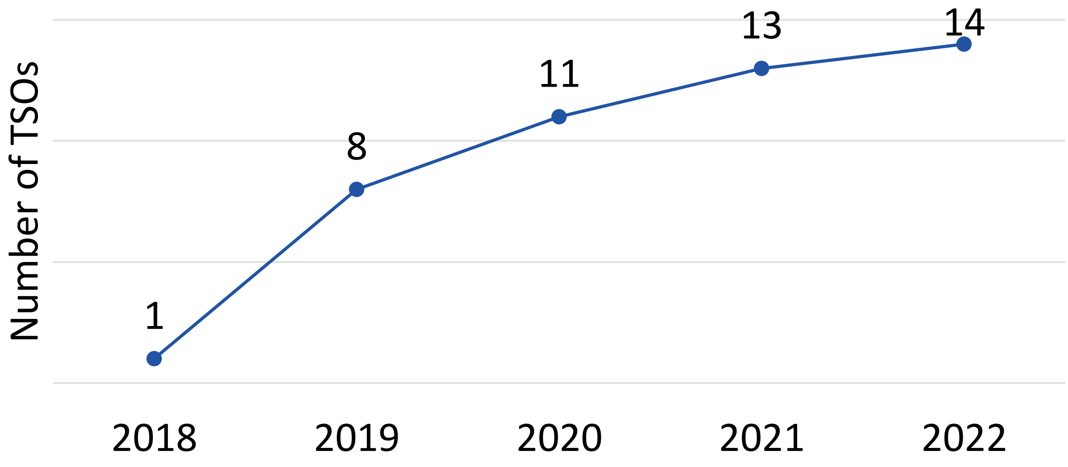
Date or expected implementation date



General status of national implementation of KORRR

State of national implementation of Article 40.6:

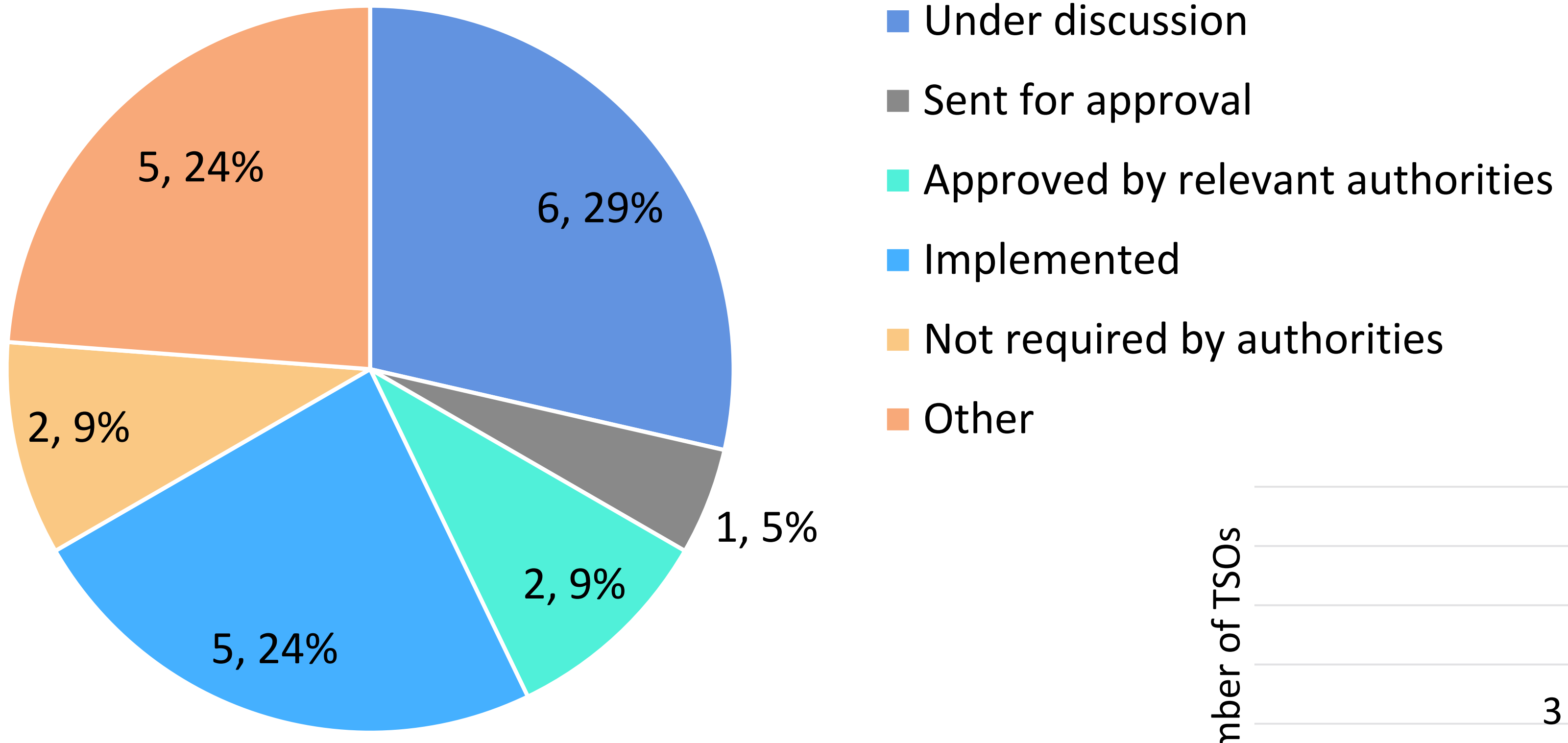


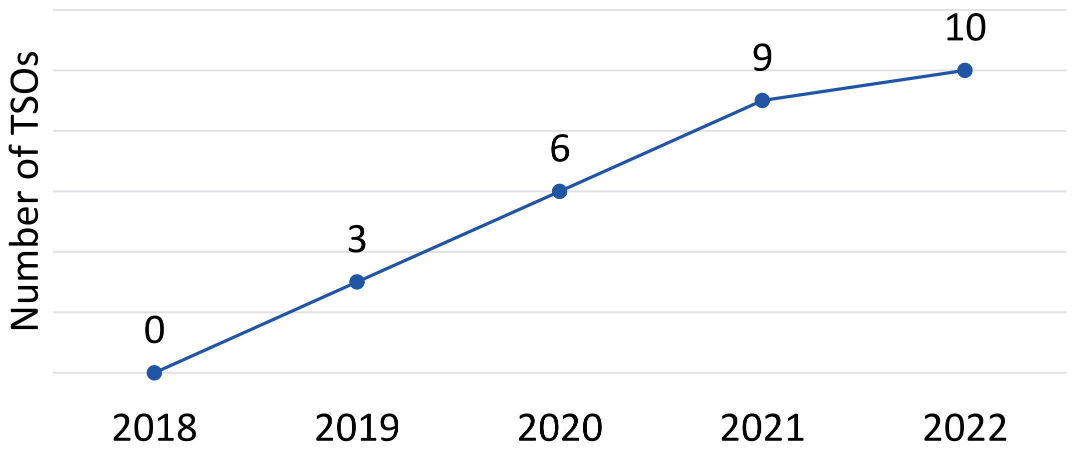


Date or expected implementation date

General status of national implementation of KORRR

State of national implementation of Article 40.7:

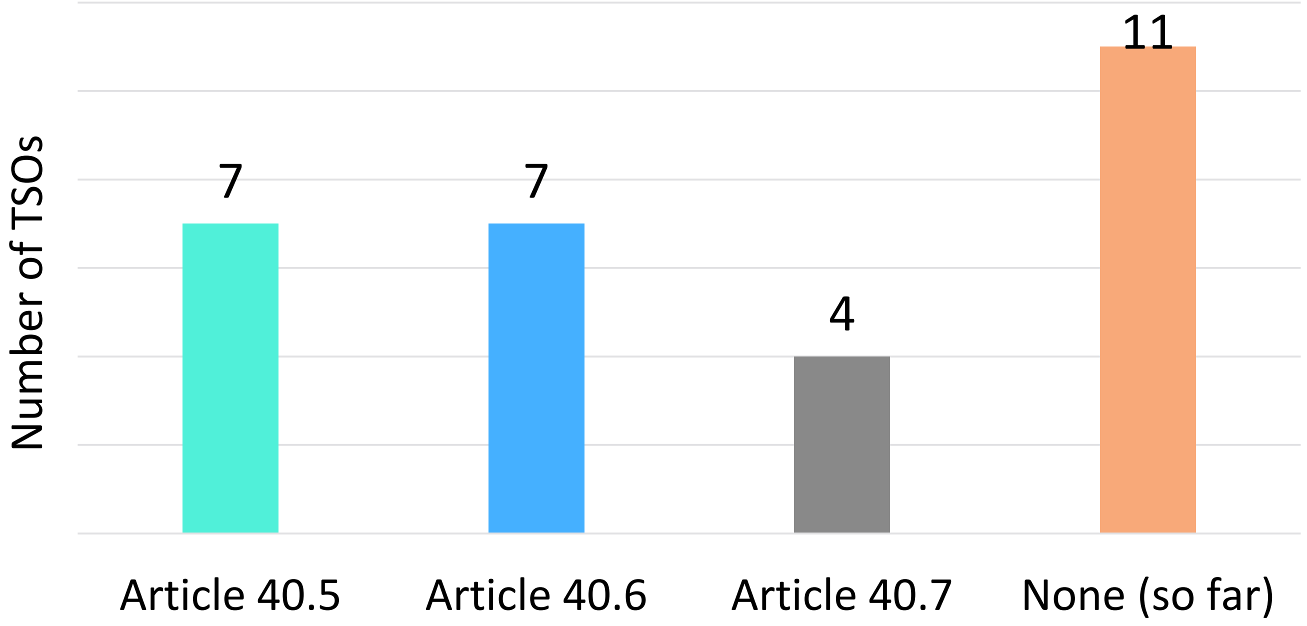




Date or expected implementation date

General status of national implementation of KORRR

Which requirements of SO GL / KORRR have implied any important change in the national requirements or rules?

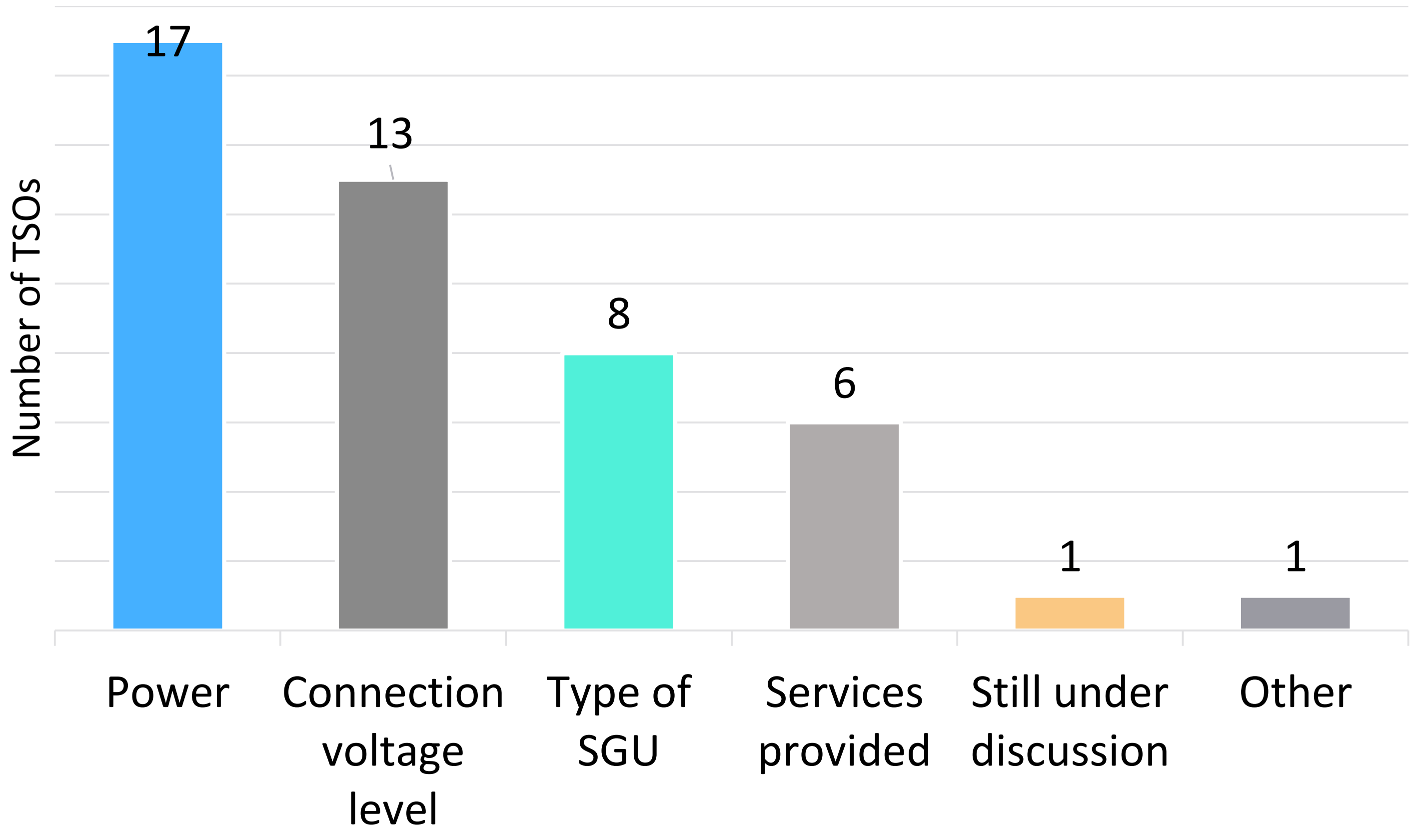


Some of these changes are related to:

- New requirements related to real time refreshing data times
- The implementation of new IT system requirements related to new technical solutions when looking for a cost reduction of data exchange channels and protocols

General status of national implementation of KORRR

Which parameter is considered to define the responsibility of SGUs to exchange data and the level of data they shall exchange?



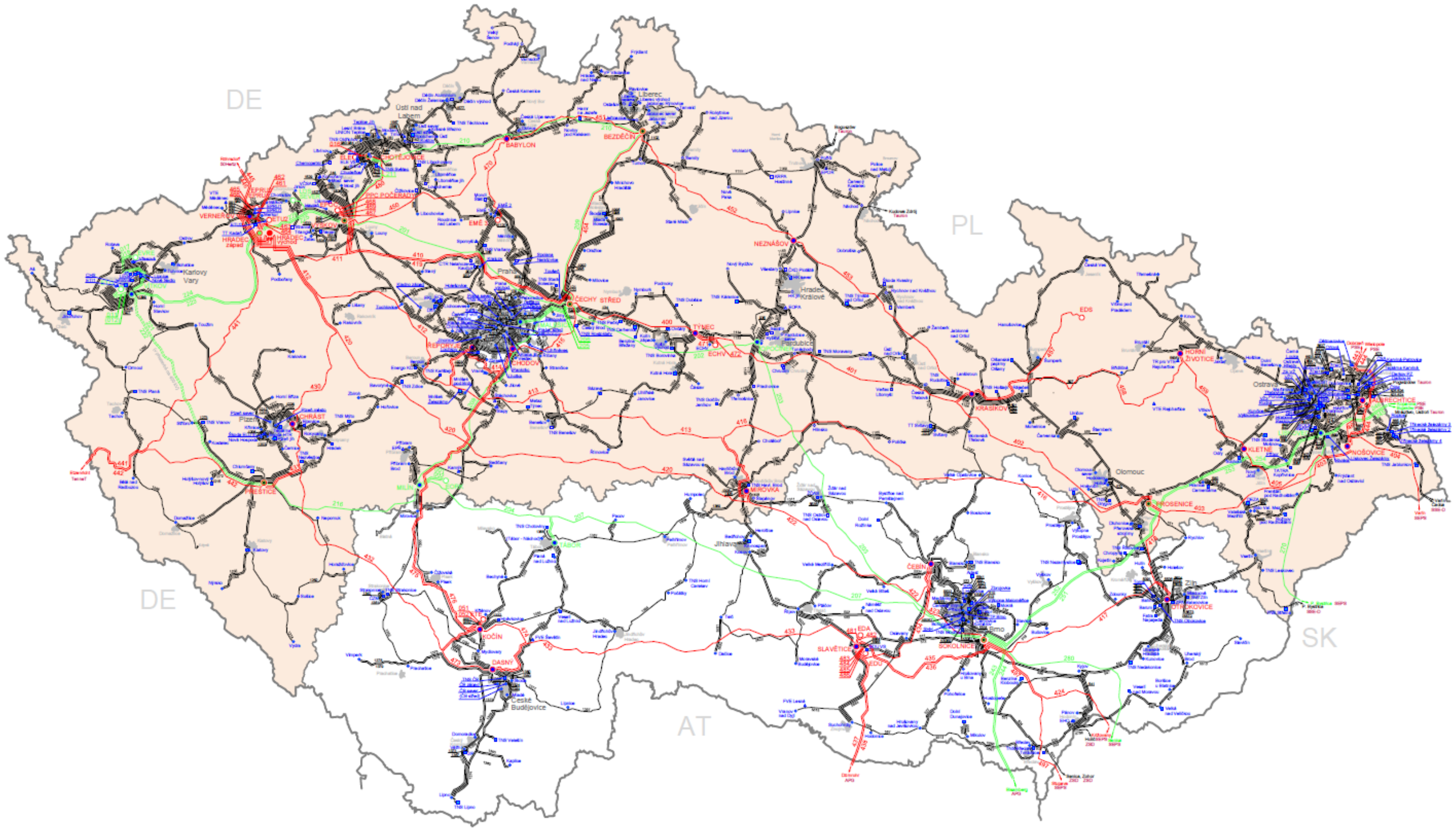
- Even though many TSOs resort to the same parameters to define the responsibilities of data exchange, the implemented thresholds are very different from one country to another.

National experience: *CEPS*
Czech Republic case

National case: *CEPS*

Introduction

- **1 TSO**
  - 42 Substations
  - 3 780 km of 400 kV
  - 1 737 km of 220 kV
- **3+1 DSOs**
  - 14 591 km of 110 kV
- **Installed Electrical Capacity**
  - 21 996 MW



National case: *CEPS*

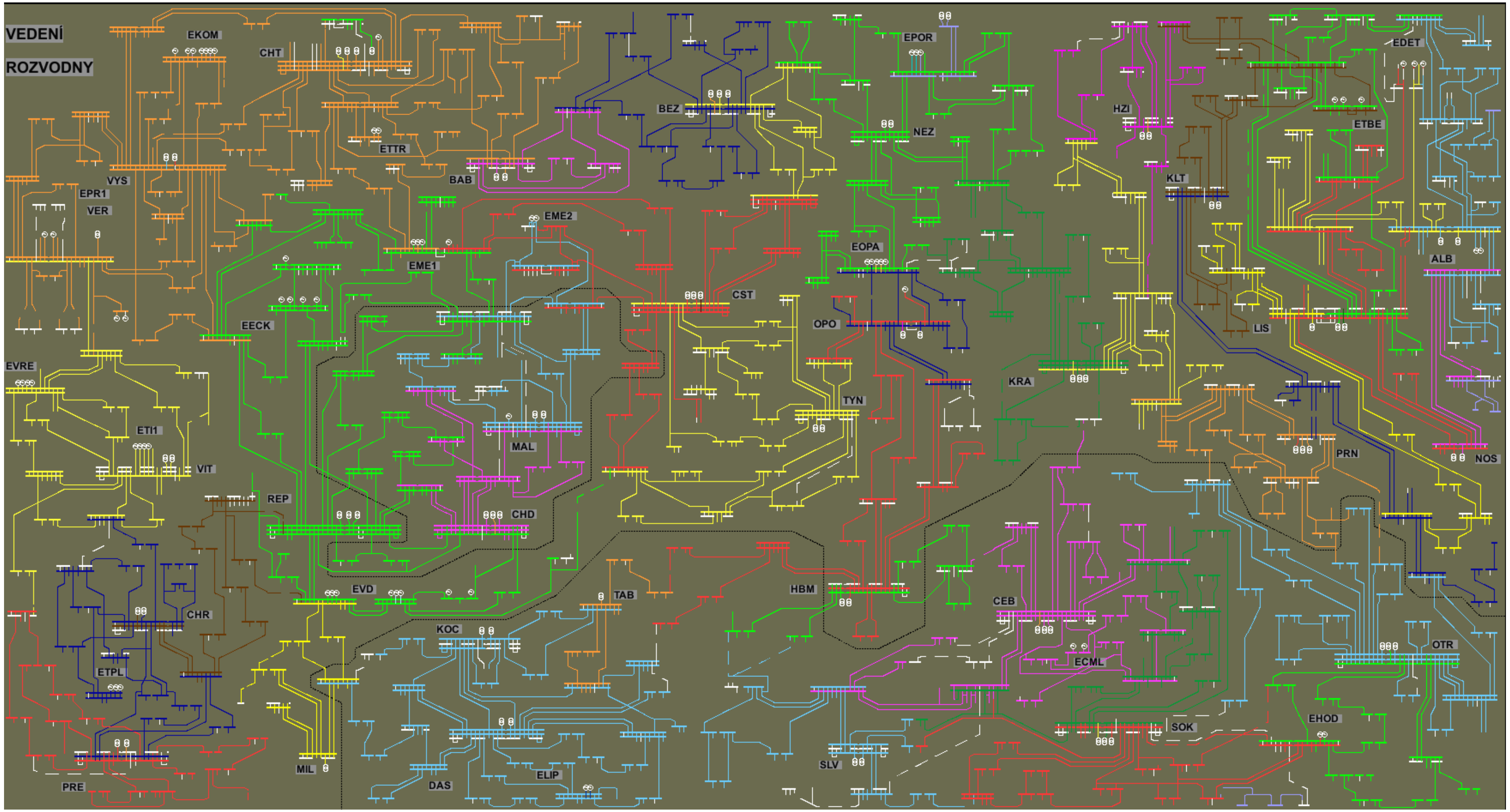
Data Exchange before KORRR

DSO	• 110 kV Topology only Model • No Real-time Circuit Breaker or Isolator • Manual Adjustment
PGM in TS	• Measurement Data only • Not all House Load Data • No Local Load Data
PGM in DS	• Only Balancing Service Providers • Selected RES Measurement

*PGM – Power Generating Module

National case: *CEPS*

110 kV Grid Model in SCADA before KORRR

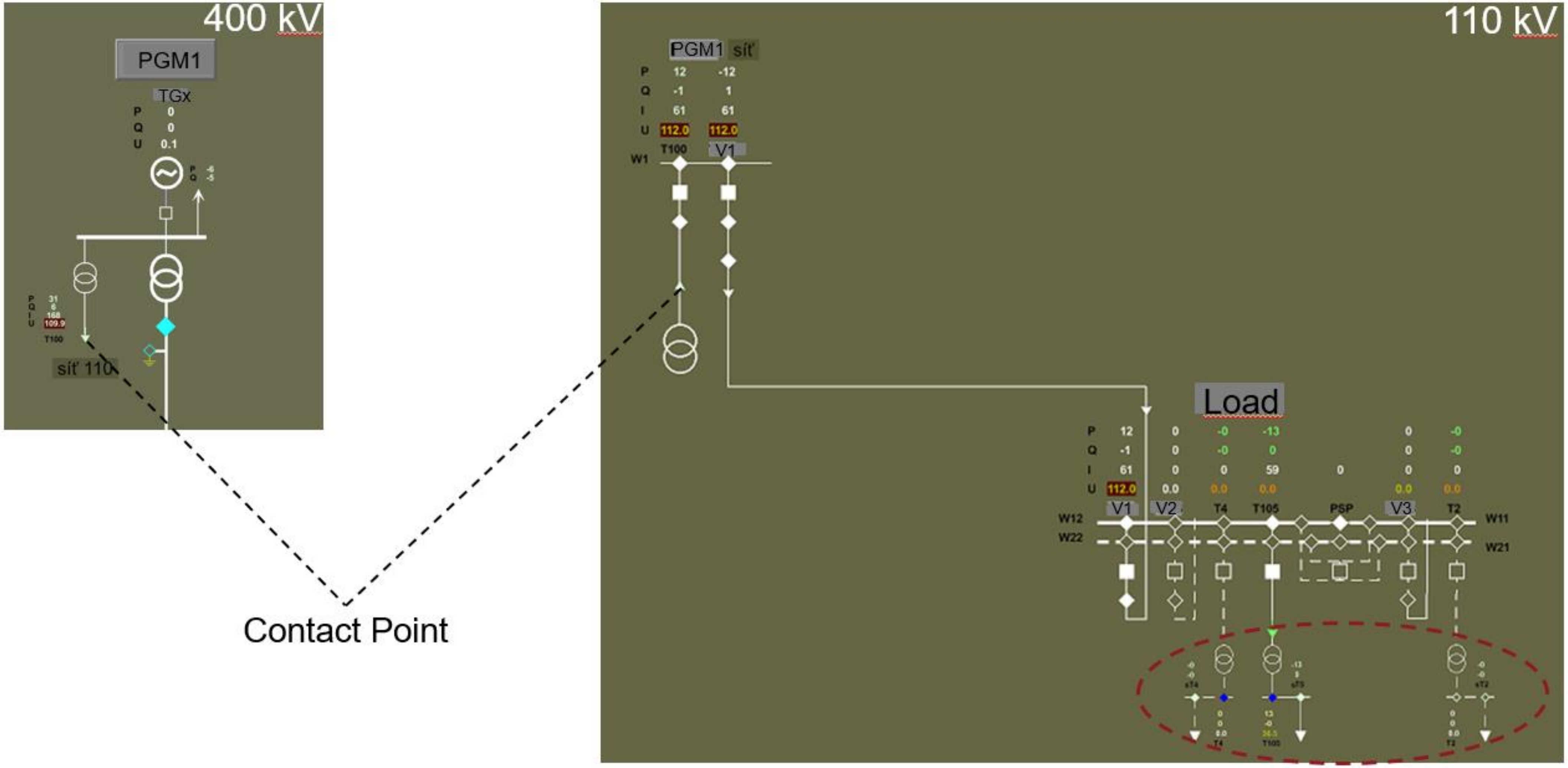


National case: *CEPS*

Changes with KORRR implementation

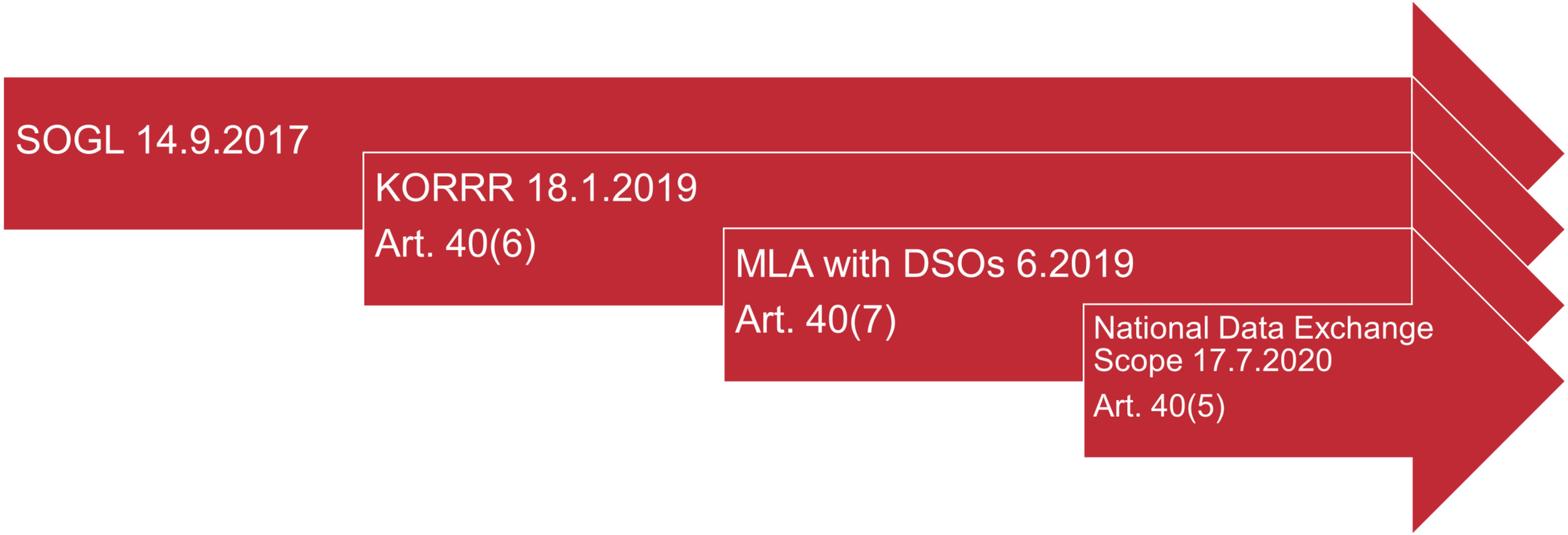
DSO	• 110 kV Breaker oriented Grid Model (for LF, N-1, estimation, SCC…)
PGM	• Topology and Measurement of Local connected Load (e.g. Mines, Accumulation)
TS-connected Demand	• No Demand yet • Data Exchange Requirements already in place and approved

Local Load – Coal Mine



National case: *CEPS*

Timeline for data exchange implementation



National case: *CEPS*

Approval process of data Exchange with DSOs and SGUs in accordance with Article 40(5)

Submitted
28.8.2019

Challenged by NRA twice
- Form
- Content

Challenged by producers
- Reluctant to share some data (e.g. house load)
- Compromise reached

Approved
17.7.2020

National case: *CEPS*

110 kV Grid Model in SCADA

Entire 110 kV Grid Model

- Real-time Topology and Measurement
- Bay Order kept
- Inclusion in IGM.

PGM

- ≥ 5 MW individually
- < 5 MW aggregated per transformer 110 kV/HV

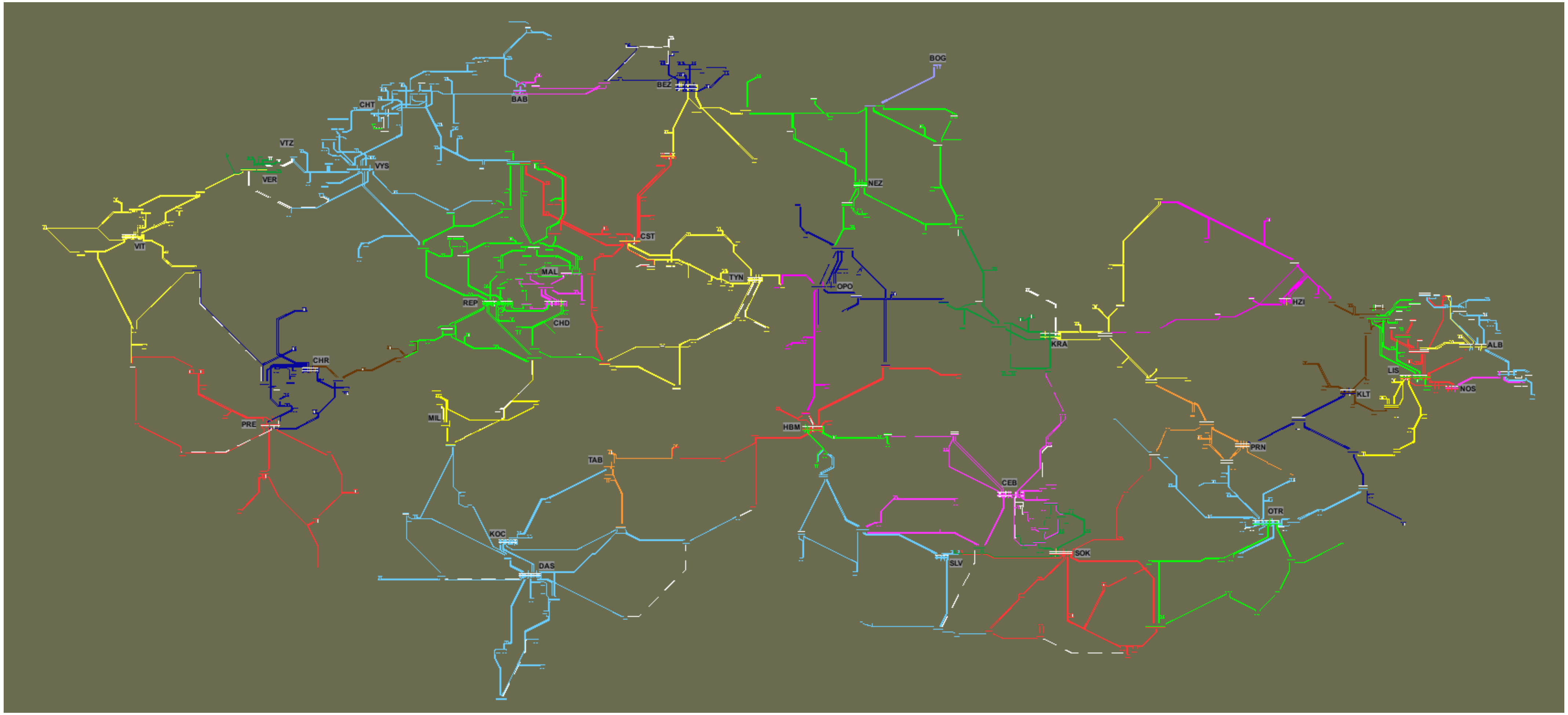
Demand aggregated per transformer

Use of the Model

- Contingency Analysis
- Short-Circuit Current Calculation
- Dynamic Stability Assessment
- Voltage Optimization
- …

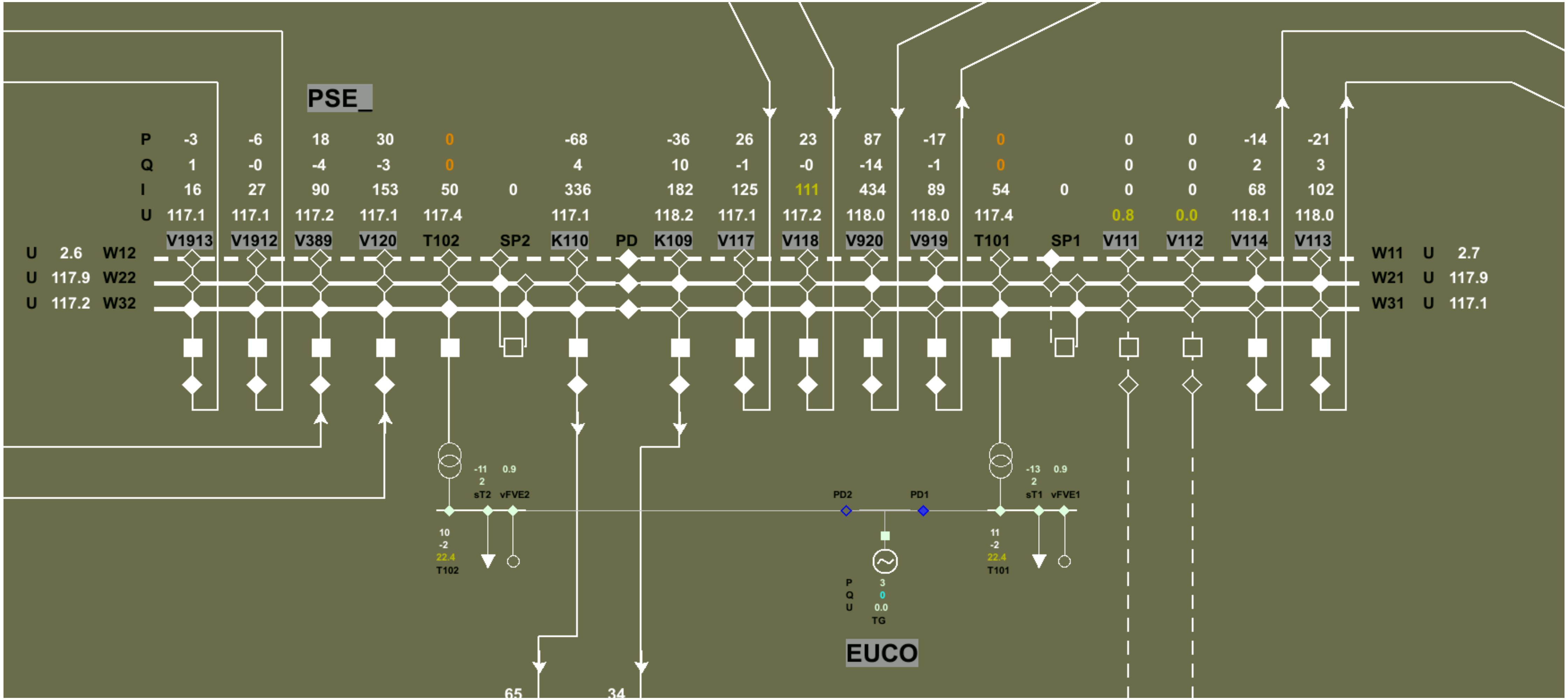
National case: *CEPS*

110 kV Grid Model in SCADA



National case: *CEPS*

110 kV Grid Model in SCADA - Details



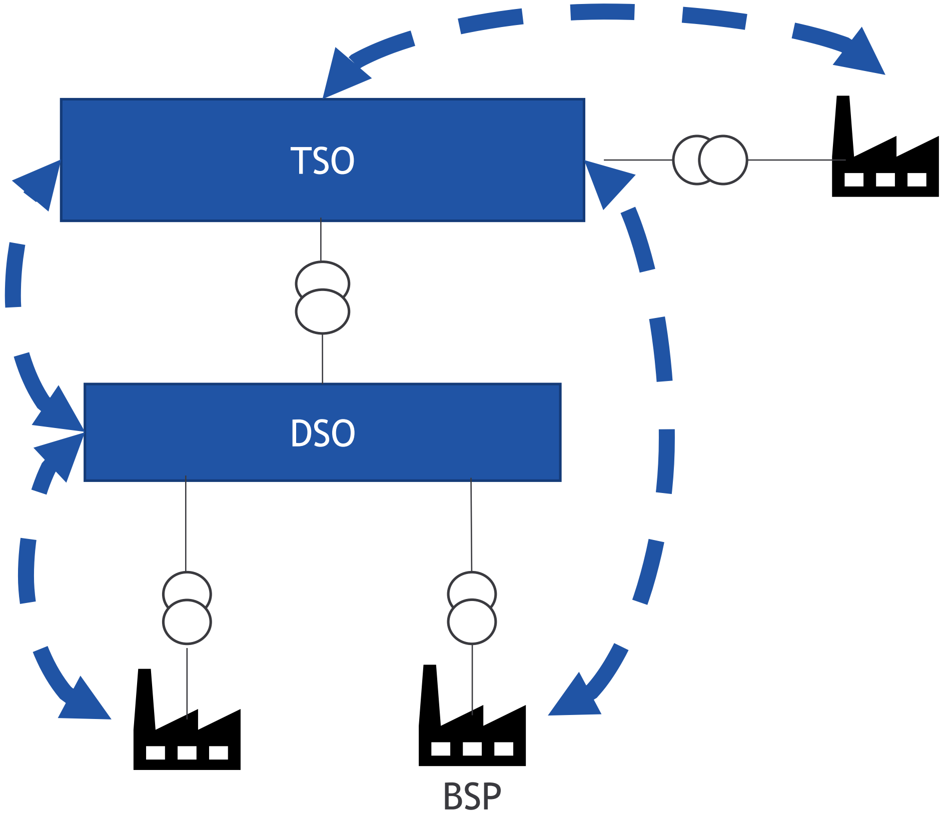
National case: *CEPS*

Data Exchange scheme

- **Defined by the National Methodology**

- **Direct**
  - PGM in TS
  - BSP in DS

- **Indirect**
  - PGM in DS



National case: *CEPS*

Remaining steps

- **Address PGM in TS**
  - Real-time Data on Generator Circuit Breakers, Isolators, Grounders

- **DSO**
  - Scheduled Data Exchange PGM ≥ 5 MW
  - Grid Code Modification needed

National case: *CEPS*

Summary

- **Data Exchange successful**
- **Complete 110 kV Grid in SCADA**
- **Final Implementation in a few years**
- **Great Interest of Expert Community**
  - Press Release + Expert Article published

National experience: *TransnetBW*
German case

National case: *TransnetBW*

Data exchange project of the four German TSOs

10/2017 – 04/2018	04/2018 – 12/2018	05/2018 – 03/2019	03/2019 - today
Applicability and scope (Art. 40 (5))	**Approval by NRA (Art. 40 (5))**	**Agreements with DSO (Art. 40 (7))**	**Implementation**
• Consultation by the TSO • Taking into account DSOs opinion • **Real time data** • **Schedule data** • **Structural data**	• One more consultation by NRA • Final approvement on 20.12.2018	• Process drafting by the TSO • Taking into account KORRR • Organisation between TSO, DSO and SGU • Creating / choosing the formats	• TSO or DSO has to request the data • SGU and DSO were given specific deadlines for the implementation
Done	Done	Done	Ongoing

National case: *TransnetBW*

Scope of the data exchange

Real time data from DSO

- Aggregation for different energy sources / asset types and grid areas
- Single values from large generators and from generators in the observability area

Schedules from DSO (legally not part of SO GL)

- Grid models from DSO
- Using new data exchange formats.

Real time data from SGU

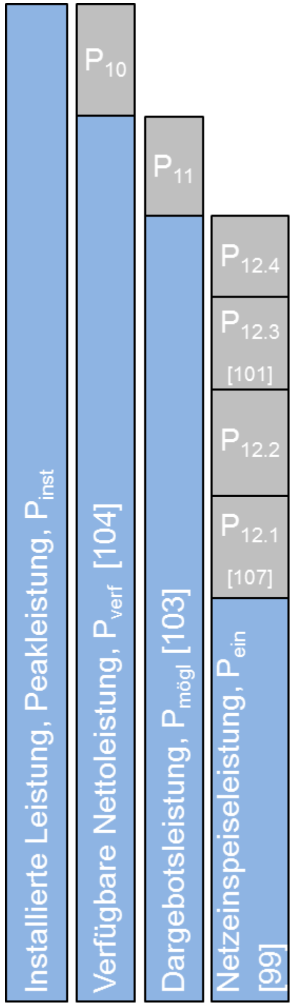
- Real time data from all units above 1 MW capacity
- Real time information about possible generation
- Real time information about available capacity

Schedules from SGU

- Schedules from all conventional SGU above 10 MW, all transmission-connected REE and consumers above 50 MW.
- New timeseries
- New process for forwarding the relevant data to the DSO
- Using the ENTSO-E RESERVE RESOURCE PROCESS (ERRP)

National case: *TransnetBW*

Real time data exchange



- **PINS: Installed capacity (not a real time information)**
- **PVERF: Available capacity: Capacity that available and not affected by maintenance or failures**
- **PMOG: Possible generation: Calculated possible generation based on the available capacity, the wind speed at the site and losses**
- **P: Active power generation at grid connection point: The actual measured power generation**
- **Difference between PMOG and P:**
  - PMOG is what the plant operator could generate. Due to possible restrictions (ice, birds, noise) or to market signals (negative prices) the operator could decrease the generation
  - The TSO/DSO needs to know if and why the generation is decreased
- **The values can be aggregated if the asset type, the operator, the net connection point are the same**
- **IEC standards (101, 104) are to be used**

National case: *TransnetBW*

Scheduled data exchange

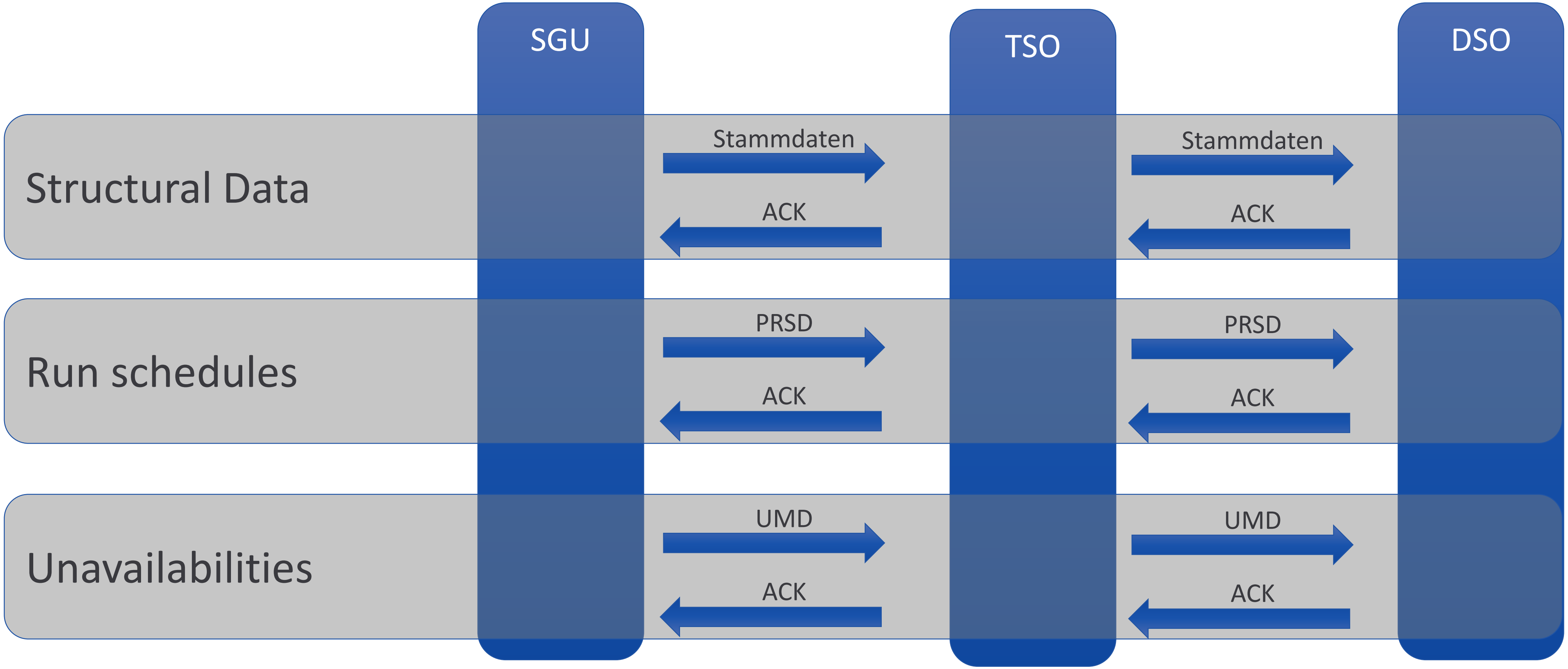
Criteria	Biomass	Solar PV, Wind	Conventional generation	Consumers
P ≥ 1 MW	Unavailability	Unavailability	-	-
P ≥ 10 MW	Unavailability Run schedules	Unavailability	Unavailability Run schedules	-
P ≥ 50 MW	Unavailability Run schedules	Unavailability	Unavailability Run schedules	Unavailability Run schedules
Transmission-connected	-	Unavailability Run schedules	-	-

Formats to be used:

- ENTSOE RESERVE RESOURCE PROCESS (ERRP) for run schedules and
- ENTSOE OUTAGE TRANSPARENCY PROCESS for unavailabilities

National case: *TransnetBW*

Data organization for schedules



- Centralised approach per TSO
- TSO forwards the relevant data to the DSO

National experience: *REE*
Spanish case

National case: *REE*

Red Eléctrica de España (REE) is the sole transmission agent and operator of the Spanish electricity system. The transmission grid in Spain includes 400 kV and 220 kV national grid, as well as lower voltage installations that could affect the transmission operation or the generation dispatch.

Installed capacity in Spain

The installed generation capacity in Spain is 105.154 MW, from the ones:

- **71%** corresponds to 1.327 facilities connected to the **transmission grid**
  - 42,5 % are small-scale power plants (P ≤ 1MW)
  - 1,4 % are medium-scale power plants (1MW < P ≤ 5MW)
  - 56,1 % are large-scale power plants (P > 5MW)
- The remaining **29%** belongs to 63.783 facilities connected to **the distribution grid.**
  - 96,9 % are small-scale power plants (P ≤ 1MW)
  - 1,5 % are medium-scale power plants (1MW < P ≤ 5MW)
  - 1,6 % are large-scale power plants (P > 5MW)

National case: *REE*

Installed capacity in Spain

The **transmission grid gathers a much lower number of generating facilities** than the distribution grid, while the corresponding **installed capacity is higher** in the first one.

Almost all units that are connected to the distribution grid have an installed capacity lower or equal to 1 MW, while they **only represent a 11,5% of the overall** distributed installed power.

Considering these statements, **the implementation of KORRR in Spain was addressed in a way that it could guarantee enough observability and an efficient data exchange** between all parties, in an effort to ensure the right functioning of the electricity system and the continuity and security of supply.

National case: *REE*

Implementation planned schedule

KORRR Approval

- 40.5 implementation prop.
- 40.6 implementation prop.
  - Workshop (DSO and SGU) (21st January 2019)
  - Public consultation of draft (1st February 2019 – 1st March 2019)
  - Sent for approval (14th March 2019)
- 40.7 implementation prop.
  - Agreed document between TSO and DSOs
  - No approval required by relevant authorities

Under discussion → Depends on 40.5 and 40.6 approval

40.6 national implementation → Approved (13th November 2019) **and implemented**

40.5 national implementation → Not approved yet (expected before 2020 ends)

National case: *REE*

Art. 40.5 national implementation

<u>**General principles:**</u>

- The national implementation of Art. 40.5 determines the **applicability and scope of data exchange** between SGUs, DSOs and the TSO.
- All the **TSO and DSOs must have access to all the information they need to guarantee the grid safety**.
- The proposal **follows the current** data exchange **requirements.**
- All requirements were agreed, although REE proposed a power threshold of 1 MW for distributed SGUs, while DSOs proposed 100 kW. Both thresholds were included in the public consultation.
- All data must be exchanged throughout the channels stablished in the final document of national implementation of Art. 40.6.

National case: *REE*

Art. 40.5 national implementation

Data exchange: SGUs connected to the distribution grid to TSO and DSOs

Power generation modules connected to the distribution grid			
Type of data	**Installed capacity**	**Description**	**Data exchange**
Structural	P ≤ 1 MW	Balance services or demand response services	TSO and DSO
		No balance services or demand response services	-
	P > 1 MW	-	TSO and DSO
Scheduled	P ≤ 1 MW	Balance services or demand response services	Aggregated information for all SGUs that provide the same balance services to TSO
	P > 1 MW		Individual information for each SGU to TSO
Real Time	P ≤ 1 MW	Balance services or demand response services	Aggregated information to: TSO and DSO if desired
	P > 1 MW		Individual information to: TSO and DSO if desired
	P ≤ 1 MW	No balance services nor demand response services	-
	P > 1 MW		TSO and/or DSO (freedom to choose)

TSO and DSOs have access to all the data of those SGUs that are connected to their observability grid area. In case only the TSO or just the DSO receives the information, they shall send it to the DSO or the TSO, respectively.

National case: *REE*

Art. 40.5 national implementation

Data exchange: SGUs connected to the distribution grid to TSO and DSOs

Demand facilities connected to the distribution grid			
Type of data	**Installed capacity**	**Description**	**Data exchange**
Structural	All facilities	Balance services or demand response services	TSO and DSO
		No balance services nor demand response services	-
Scheduled	P ≤ 1 MW	Balance services or demand response services	Aggregated information for all SGUs that provide the same balance services to TSO
	P > 1 MW		Individual information for each SGU to TSO
Real Time	P ≤ 1 MW	Balance services or demand response services	Aggregated information to: TSO and DSO if desired
	P > 1 MW		Individual information to: TSO and DSO if desired
	All facilities	No balance services nor demand response services	-

TSO and DSOs have access to all the data of those SGUs that are connected to their observability grid area. In case only the TSO or just the DSO receives the information, they shall send it to the DSO or the TSO, respectively.

National case: *REE*

Art. 40.5 national implementation

Data exchange: SGUs connected to the distribution grid to TSO and DSOs

- Demand facilities connected to the transmission grid shall send their structural, scheduled and real time data to the TSO. DSOs shall have access to data of those facilities included in their observability area.

Data exchange: SGUs connected to the transmission grid to TSO

Power generation modules connected to the transmission grid			
Type of data	**Installed capacity**	**Description**	**Data exchange**
Real Time	P ≤ 1 MW	Balance services or demand response services	Aggregated information to: TSO
	P > 1 MW		Individual information to: TSO
	P ≤ 1 MW	No balance services nor demand response services	-
	P > 1 MW		TSO

DSOs shall have access to all the data of those SGUs that are connected to their observability grid area. They receive this information from the TSO.

Also, interconnectors, HVDCs… shall send real time data to the TSO.

National case: *REE*

Art. 40.6 national implementation

General principles:

- **SGUs are free to choose to whom they send their information**, no matter which parties can finally access it. The only exception are the Balance Service Providers (BSPs), which must send their real time data directly to the TSO (considering that the TSO is responsible for the system balance and that times are critical to do so).
- The **TSO and DSOs must exchange the SGU's information** that they are not directly receiving.
- The solution scheme must be **efficient, independent and transparent**, and have a **minimum global cost** for all parts.
- The system needs to work as a **sole and integrated system**, considering the data that all parts need and the market systems.

National case: *REE*

Art. 40.6 national implementation

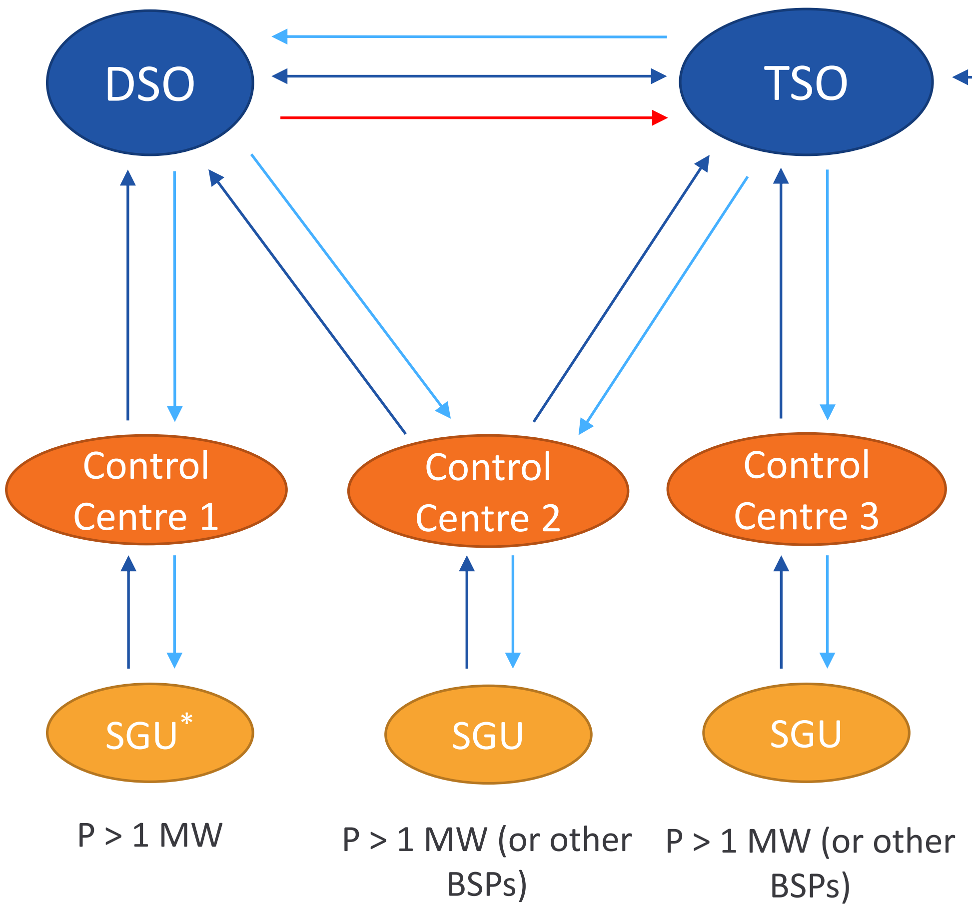
Data exchange:

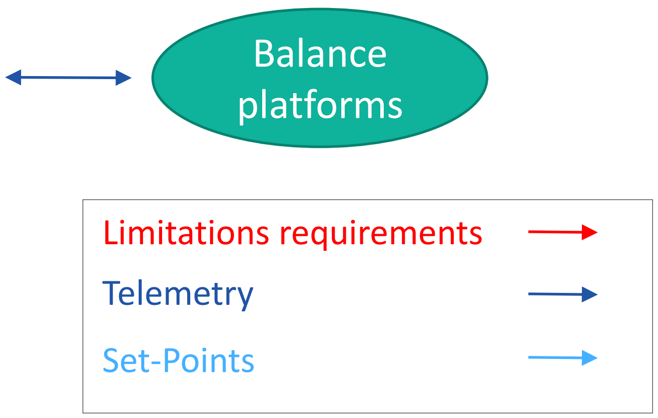
- **Structural data:**
  - Distributed SGUs must send their structural data to the TSO and connected DSO by e-mail.
  - All structural data of SGUs that are included in the DSO observability area shall be provided to the corresponding DSO by the TSO or the DSO that owns the grid to the one the SGU is connected.

- **Scheduled data:**
  - SGUs send their data to the TSO platform (SIOS).
  - DSOs can access the information from the SGUs that are connected to their grid or that are included in their observability area.

National case: *REE*

Art. 40.6 national implementation: Real Time information exchange





* The 1 MW threshold allows to keep a **right level of observability** for distributed SGUs.
* Communication channels are **coherent and efficient**.
* It **integrates congestion management** into the transmission and distribution grids.
* This scheme is **ready to face the expected higher load of information** without collapsing the data exchange channels.
* It **eases the participation** of distributed SGUs in **market mechanisms.**

* Not allowed option for Balance Service Providers

National case: *REE*

Art. 40.7 national implementation

Status:

- **Not agreed yet.**
- **Once the national implementation of Art. 40(5) is approved** and implemented, the document that defines the format of data exchange will be written and signed by the TSO and the relevant DSOs.
- Still, meetings are being organized and a first draft has already been shared.

WindEurope
Making wind farms and the power system more interoperable

ENTSO-E Stakeholder Workshop on the National implementation of KORRR

Making wind farms and the power system more interoperable: Focus on data exchange

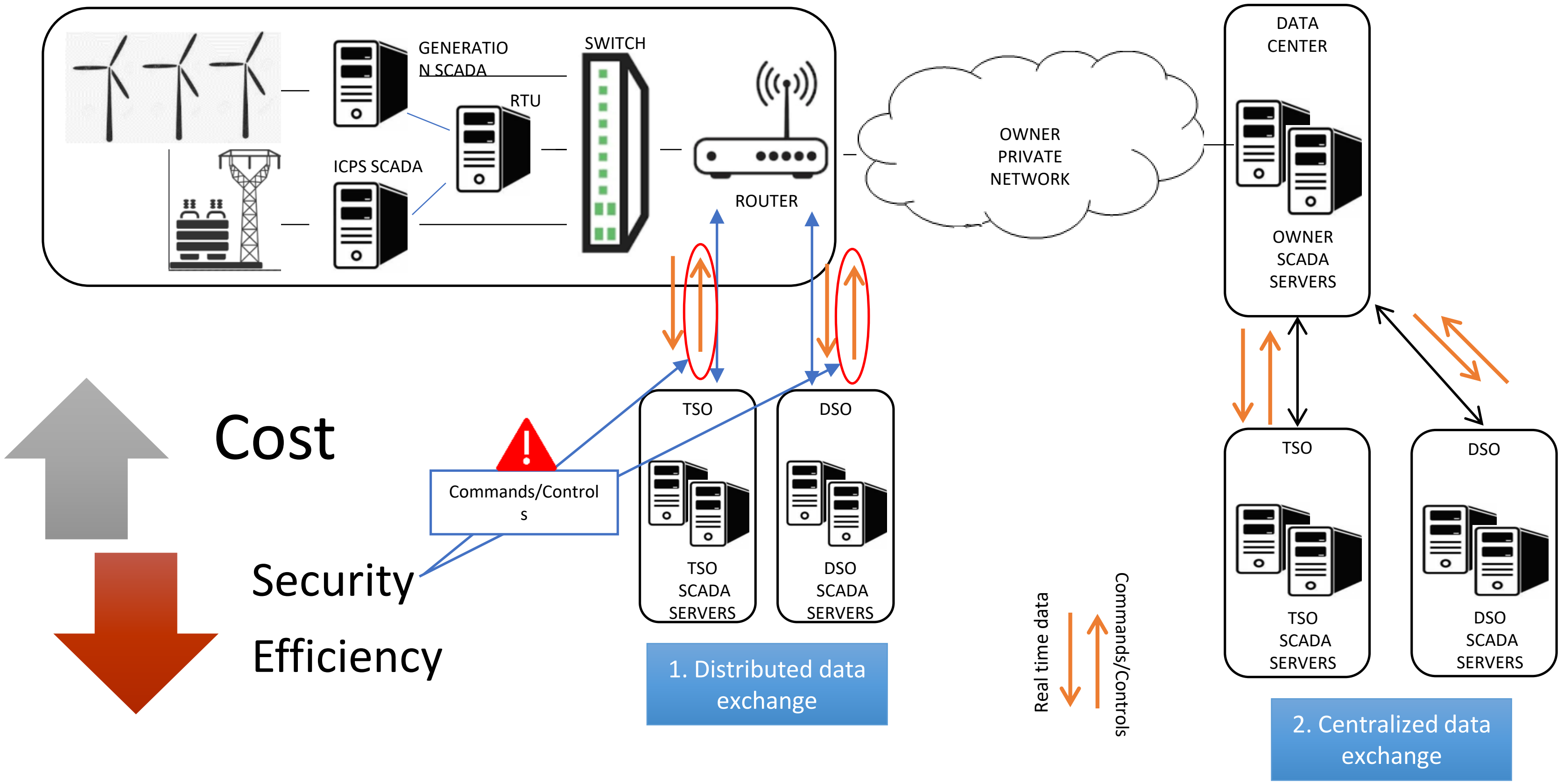
Ricardo Rodrigues, EDP Renewables

Vasiliki Klonari, WindEurope

Data communication between wind farms and system operators: current practices

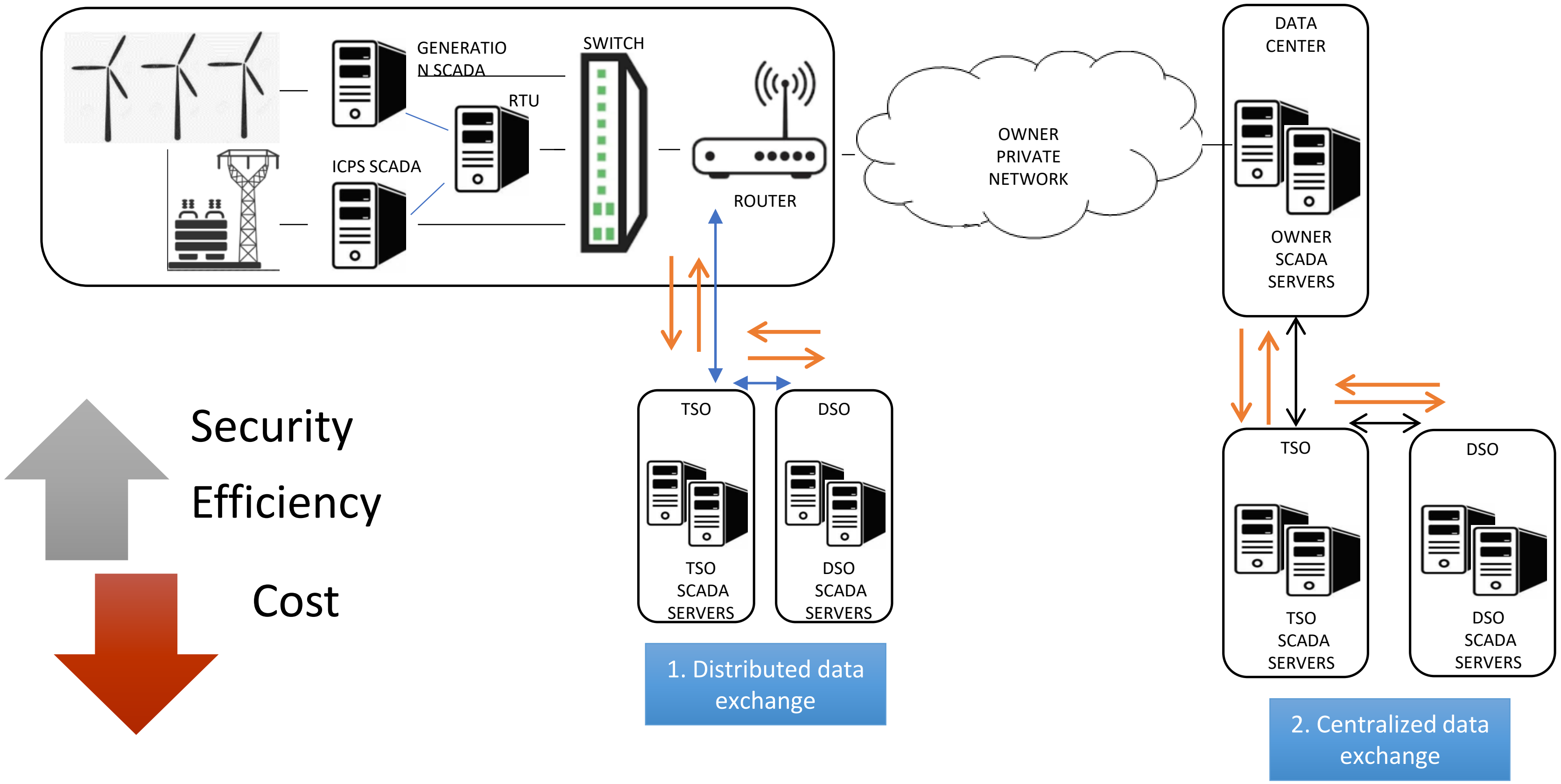
Data Architecture

Multiple interlocutor



Data Architecture

Unique interlocutor



Data Standardization

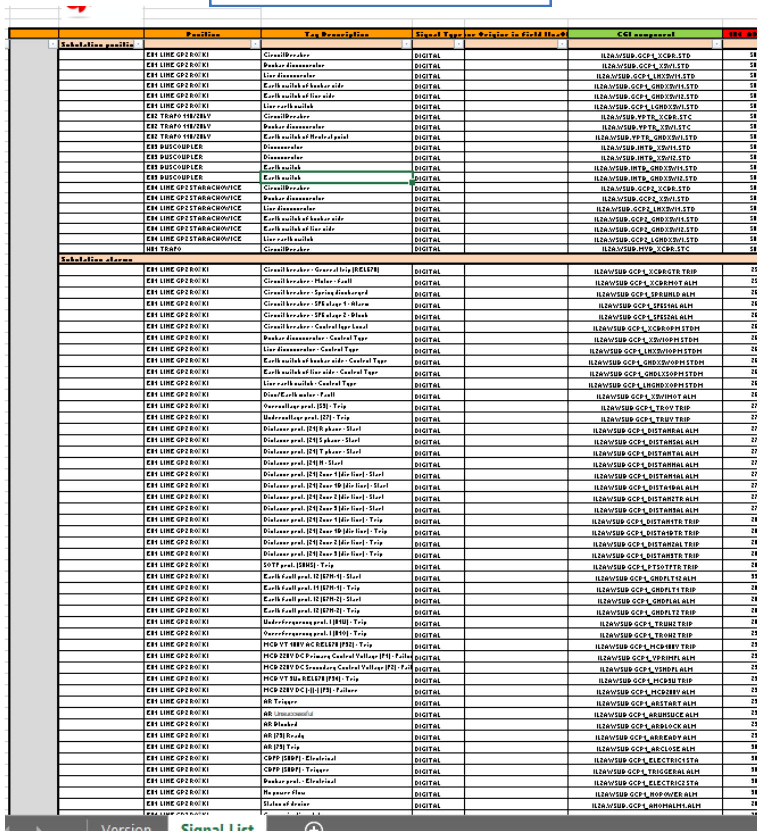
Dataset PT

- Pauto (Authorized power)
- Active Power
- Reactive Power
- Voltage
- Temperature
- Wind speed
- Wind Direction
- Connectivity
- Operability
- Quality (Owner)
- Quality (TSO)
- Reason for TSO Setpoint
- Reason Feedback of the TSO Setpoint
- TSO Active Power setpoint
- TSO Active Power Feedback Setpoint
- Number of available WTG
- Line Circuitbreaker
- Line Disconnector
- Line earth Disconnector

19 variables exchanged

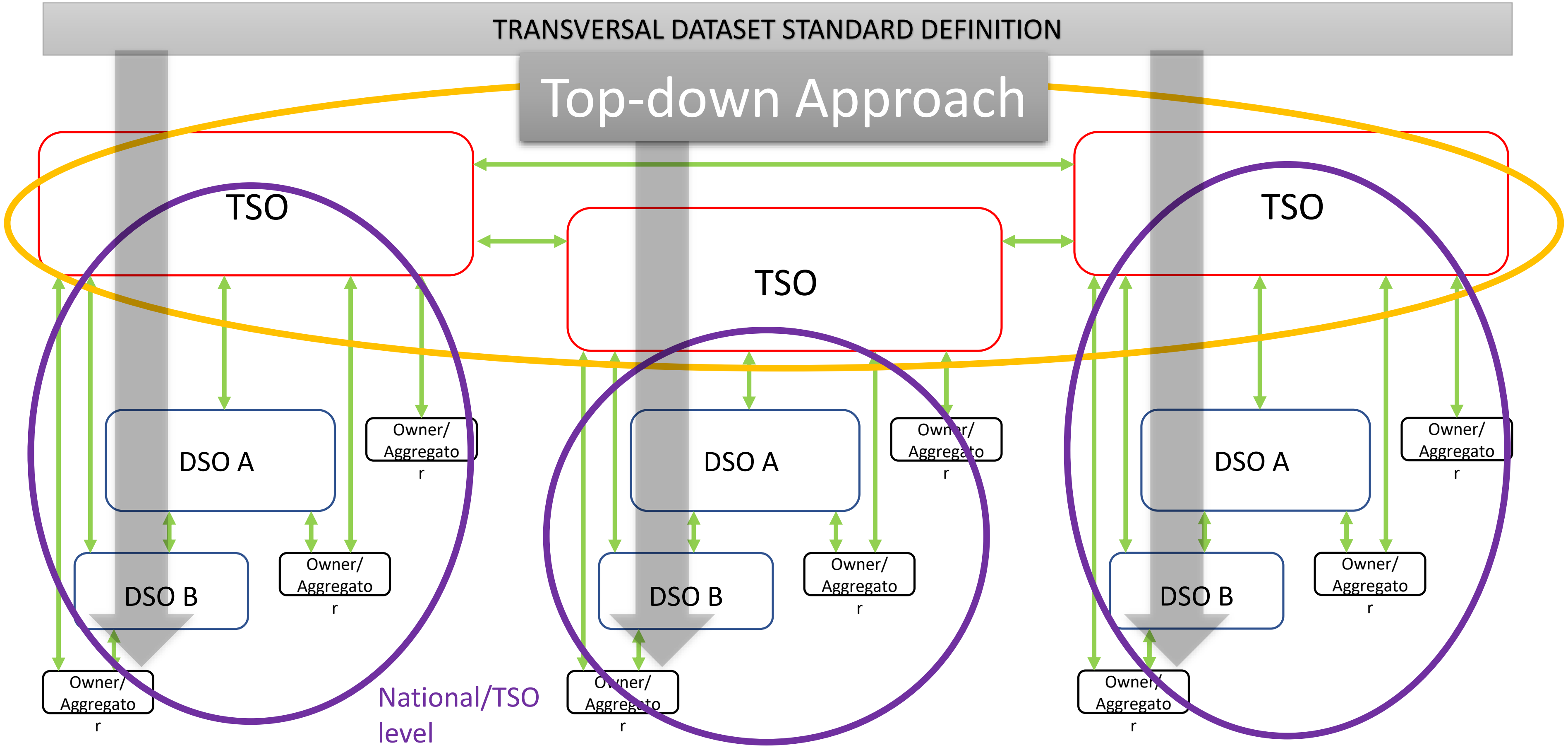
VS

Dataset PL



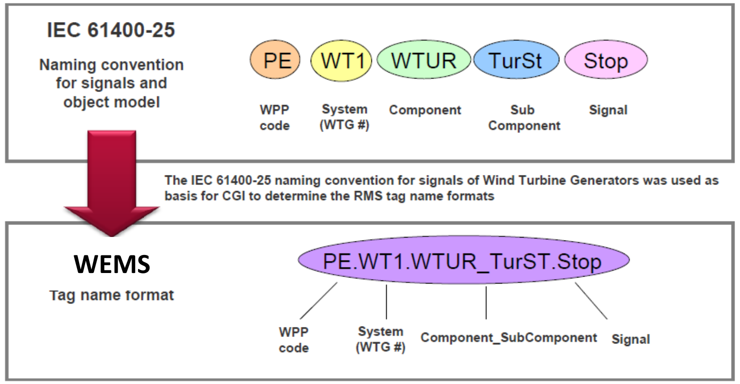
… > 300 variables exchanged
(54 MW Wind farm)

Data Standardization



Data Standardization

IEC 61400-25 – Wind Generation units

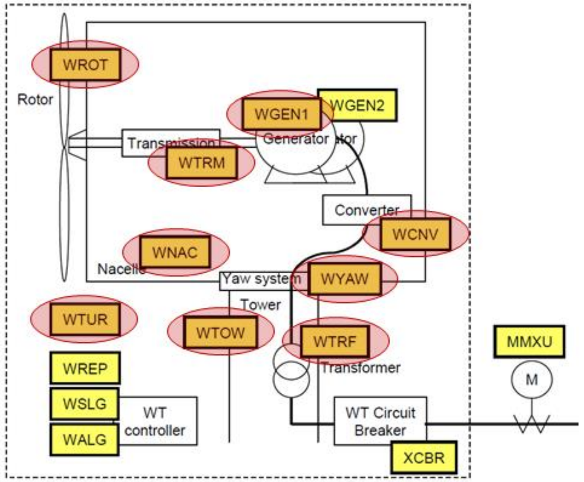


- The Object Model conventions from the IEC Standard 61400-25 is used to determine the data normalization formulas and to create a uniform database for WTGs and WPPs data.
- This naming convention, adopted in WEMS objects components, is being used across all the data flow process.

WTGs Components Definition

Specific logical nodes classified by physical turbine decomposition

Used in WEMS-OPMS



LN Classes	Description
WTUR	Wind Turbine General information
WROT	Wind Turbine Rotor information
WTRM	Wind Turbine Transmission information
WGEN	Wind Turbine Generator information
WCNV	Wind Turbine Converter information
WTRF	Wind Turbine Transformer information
WNAC	Wind Turbine Nacelle information
WYAW	Wind Turbine Yawing information
WTOW	Wind Turbine Tower information
WALM	Wind Power Plant Alarm information

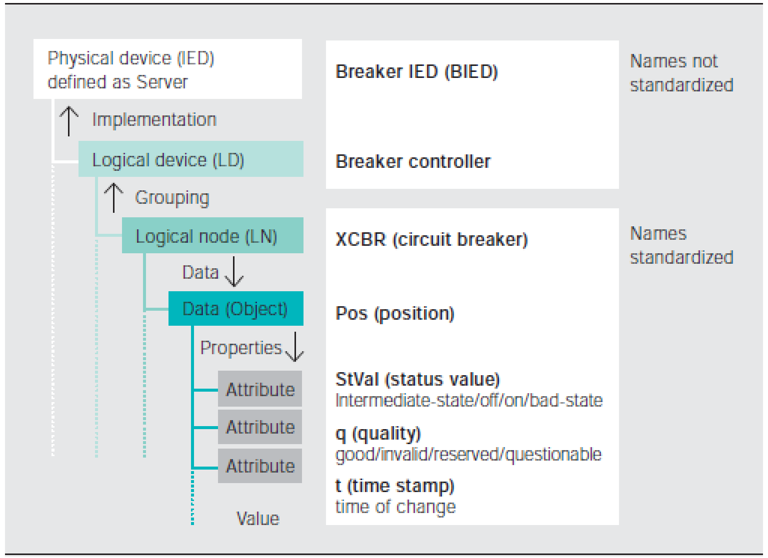
Data Standardization

IEC 61850 - Substation

The services of the data model

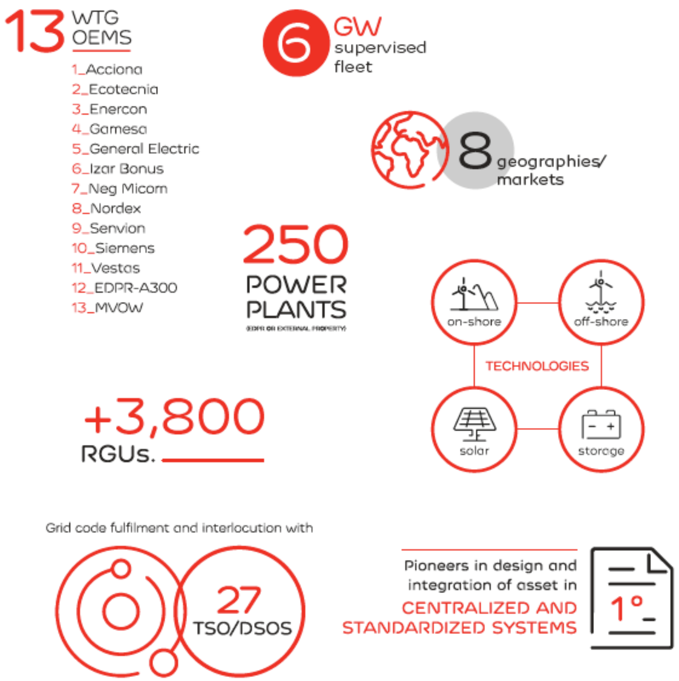
Interoperability requires the standardization of not only the data objects but also the access to them.

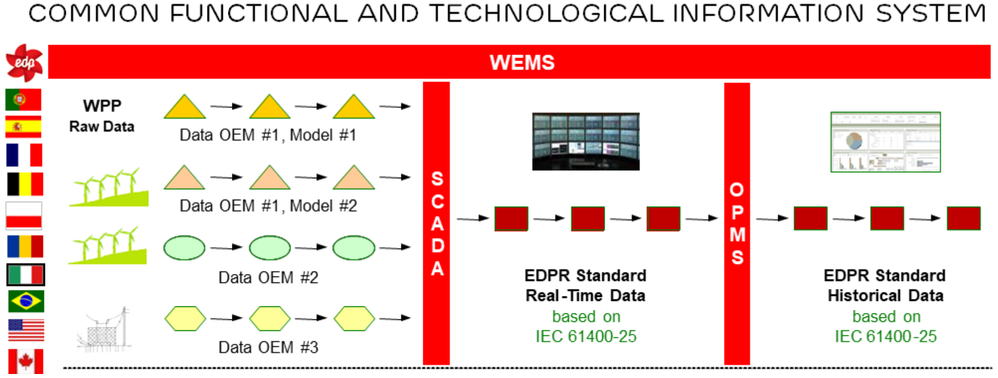
Therefore, standardized abstract services also belong to IEC 61850.



Utility Fleet

Use Case: Standardization process



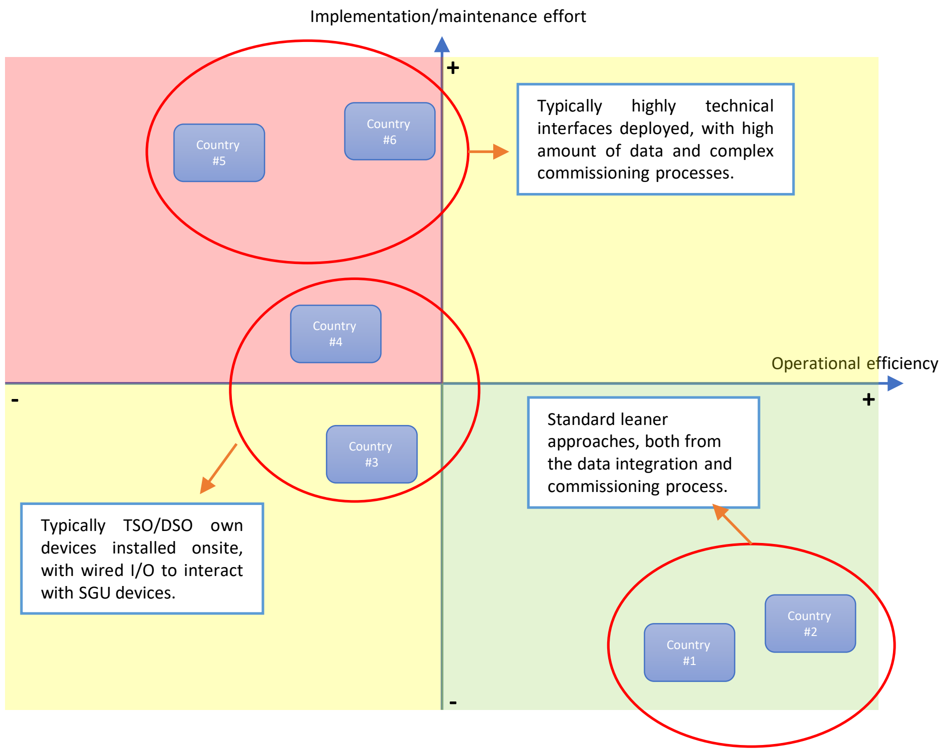


- ❑ Great diversity of Manufacturers with different maturity levels
  - ○ Acknowledge of legacy systems with different data and control functionalities available
- ❑ SGU's are working together on the standardization of all data available

Current status of TSO/DSO interoperability with SGU’s

Current situation perceived:

- ❑ Lack of standardization across Europe, both in dataset definition and functionalities required/operated.
- ❑ Implementation effort vs Operation efficiency.
    - ➢ Email or phone is still used for interaction, despite of the highly technical interfaces deployed.
- ❑ Diversity of communication protocols/interfaces:
    - ○ IEC104/DNP3
    - ○ IEC101 (RS232)
    - ○ Wired information to TSO/DSO own devices



Recommendations

- Centralized and unified dataset definition both for real time and scheduled information - based on standards -, providing all national authorities the guidelines towards the same common goals, enhancing efficiency and security.

- Provide guidance to all the stakeholders in the sector, acting a driver to enhance requirements defined, and ensure their transversal implementation in the most efficient and secure manner across Europe.

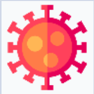
- Create an expert group to discuss the improvement opportunities regarding the harmonization of the required exchange of information.

WindEurope Task Force Interoperability

Timeline 2020

WindEurope - ENTSO-E interoperabilty workshop, action plan 2020

Sept - 2019



WindEurope Task Force kick-off

Mar - 2020

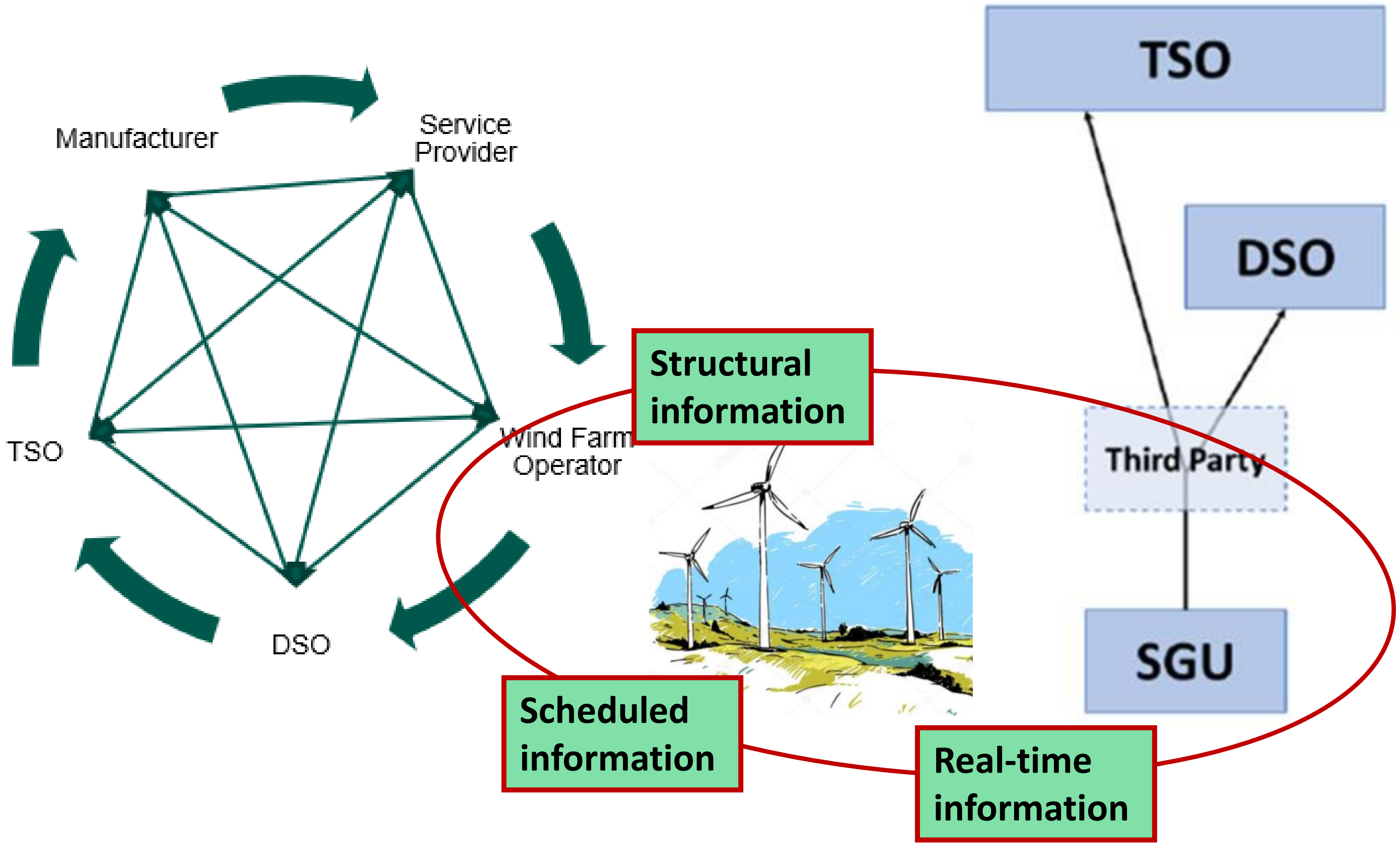
WindEurope position paper on KORRR data exchange

Jul – Nov 2020

ENTSO-E workshop on KORRR implementation

Dec - 2020

Data exchange between TSOs, DSOs & wind farms



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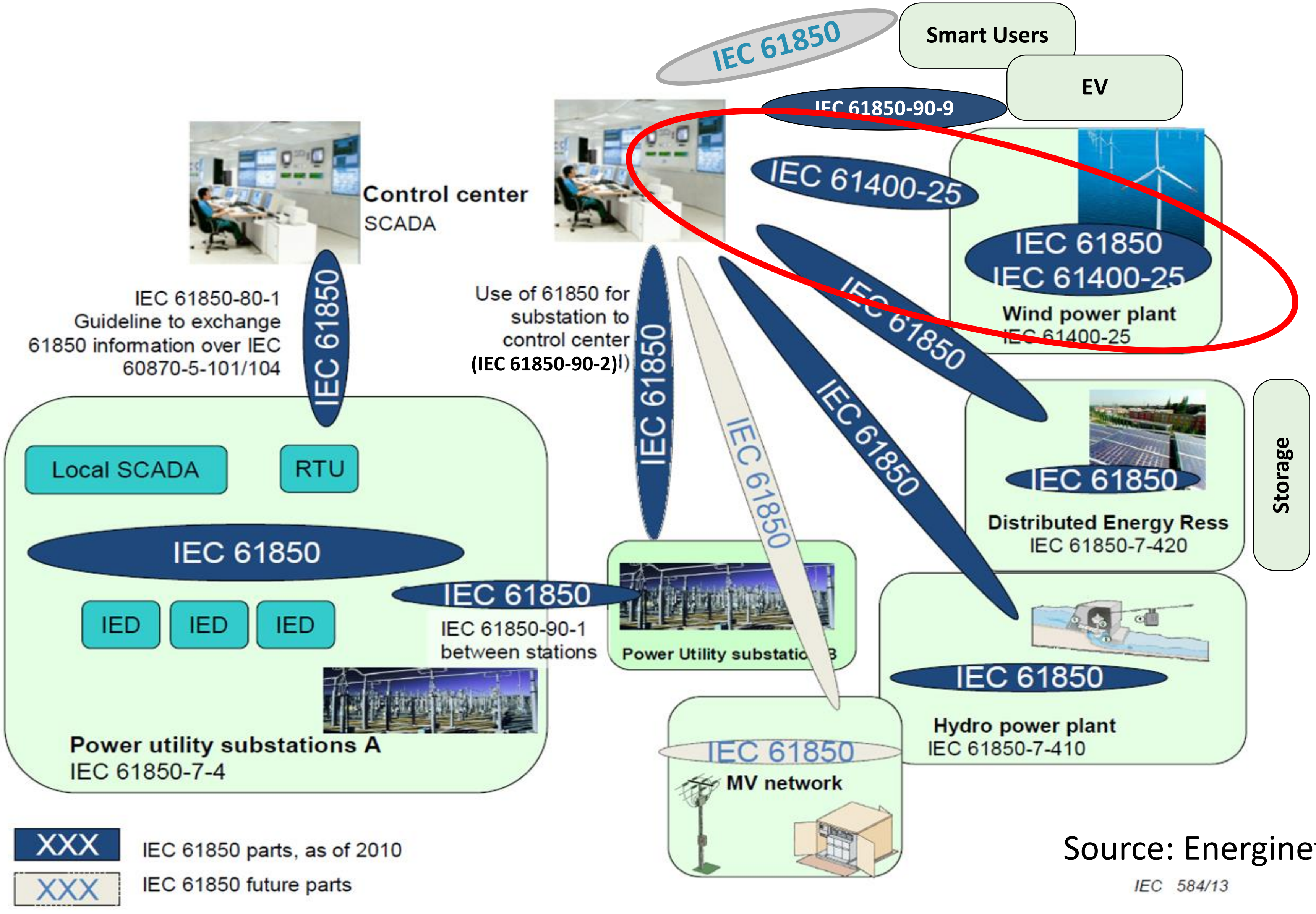
Data standards



Source: Energinet

For interoperability we need

EU Harmonisation

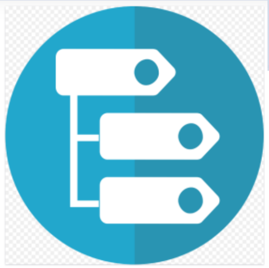
- Agreed TSO – DSO – SGU data sets
- Requirements
- Consider legacy systems

Common default exchange datasets

- Parameters
- Time stamping

Common default taxonomies

- Default use of common standards
- Standardisation gaps



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Recommendations – open questions

- Dedicated Expert Group in 2021?
- KORRR Implementation Guidance Document?
- Objective of this workshop: next steps?
- Feedback from DSO implementation?

WindEurope

THANK YOU

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Lessons learnt and discussion

Lessons learnt

1. The answers received from the updated TSOs' survey regarding the status of national implementation of KORRR showed that certain requirements related to data exchange are shared by all TSOs (mainly those ones harmonized by KORRR methodology). However, the decisions that were taken at national level show that there are evident differences between electricity systems that require a separate and unique analysis at national level, for example, the level of detail of the information to be exchange between TSOs and significant stakeholders, as well as some other key aspects, such as the applicability of data exchange. KORRR framework was considerably helpful when doing so, as it establishes the responsibilities of who shall define and approve the detailed information to be exchanged and the scope of data exchange (based on the a) to d) categories in Article 40(5) of SO GL.
2. It is challenging to create legally binding agreements within 18 months with all relevant parties. The approval process of the national methodology can take a long time and compromises are needed.
3. Sometimes, it was hard to find the limits for the national implementation of Articles 40.5 and 40.6. This was even more difficult in cases where the National Authority in charge of their approval was not the same for both articles. Some issues may arise when, for example, defining the confidentiality of data. Furthermore, if the different authorities ask for amendments and they are not exactly the same, there might be discrepancies between articles that might be defining the same.
4. Having a defined methodology such as KORRR was found to be very helpful when moving forward on implementing SO GL data exchange requirements. Basically, it made it much easier and gave a suitable framework to define the so highly important process of data exchange between parties.

Lessons learnt

5. In those cases in which the threshold that defines the requirements and responsibilities related to data exchange was defined to a different value (meaning new applicability requirements), systems had to be upgraded to process the new higher amount of data and to adapt to new communication protocols and cybersecurity requirements. Also, in some cases, implementing new data exchange formats could be challenging.

Discussion