SUPPORTING DOCUMENT TO ALL TSOS' PROPOSAL FOR THE KEY ORGANISATIONAL REQUIREMENTS, ROLES AND RESPONSIBILITIES (KORRR) RELATING TO DATA EXCHANGE

27.02.2018

1. PURPOSE AND OBJECTIVES OF THE SYSTEM OPERATION GUIDELINES

European Network of Transmission System Operators for Electricity (hereinafter referred to as "ENTSO-E") drafted the Commission Regulation (EU) 2017/1485 guideline on electricity transmission system operation (hereinafter referred to as "SO GL") to set out clear and objective minimum requirements for Operational Security and achieving the main goal of keeping the European interconnected Transmission Systems in continuous operation, in order to contribute to a harmonised framework for completion of the EU Internal Electricity Market (IEM) and to ensure non-discrimination, effective competition and the efficient functioning of the IEM.

Based on the SO Framework Guideline and on the Initial Impact Assessment provided by ACER, the SO GL states the Operational Security principles in terms of technical needs, considering market solutions compatible with and supporting security of supply.

2. PURPOSE AND OBJECTIVES OF KORRR

This document has been developed by the ENTSO-E to accompany the Key Organizational Roles, Requirements and Responsibilities (hereinafter referred to as "KORRR") and should be read in conjunction with that proposal.

It aims to provide interested parties with information about the rationale for the approach set out in the KORRR, outlining the reasons that led to the requirements specified in it.

The content of the KORRR document is created based on the scope for the methodology specified in article 40(6) of SO GL. The wording of the article is:

By 6 months after entry into force of this Regulation, all TSOs shall jointly agree on key organisational requirements, roles and responsibilities in relation to data exchange. Those organisational requirements, roles and responsibilities shall take into account and complement where necessary the operational conditions of the generation and load data methodology developed in accordance with Article 16 of Regulation (EU) No 2015/1222. ***They shall apply to all data exchange provisions in this Title and shall include organisational requirements, roles and responsibilities for the following elements****:*

a) Obligations for TSOs to communicate without delay to all neighboring TSOs any changes in the protection settings, thermal limits and technical capacities at the interconnectors between their control areas;

b) Obligations for DSOs directly connected to the transmission system to inform their TSOs, within the agreed timescales, of any changes in the data and information pursuant to this Title;

c) Obligations for the adjacent DSOs and/or between the downstream DSO and upstream DSO to inform each other within agreed timescales of any change in the data and information established in accordance with this Title;

d) Obligations for SGUs to inform their TSO or DSO, within agreed timescales, about any relevant change in the data and information established in accordance with this Title;

e) Detailed content of the data and information established in accordance with this Title, including main principles, type of data, communication means, format and standards to be applied, timing and responsibilities;

f) The time stamping and frequency of delivery of the data and information to be provided by DSOs and SGUs, to be used by TSOs in the different timescales. The frequency of

information exchanges for real-time data, scheduled data and update of structural data shall be defined; and

g) *The format for the reporting of the data and information established in accordance with this Title.*

The purpose of the KORRR is to define organizational requirements, roles and responsibilities regarding points a) to g), this means that the KORRR shall address how the exchange of information shall be and who shall define the details of that exchange of information, not to define specifically the details for each of those points.

Main added value of the KORRR is to define a general framework to organize the exchange of information between the different parties involved in the security of the electric system. The KORRR will address the organization of the data exchange so each party can get the necessary data to have observability of the part of the network with impact in their facilities to comply with the requirements defined in the SO GL.

2.1 LEGAL STATUS

Legal considerations of KORRR

The development of this document has been done within ENTSO-E, as the primary delivery body for the coordinated proposals relating to the implementation of the network codes. However, as the scope of TSOs required to produce it goes beyond membership those additional parties have also been included during internal review and approval.

The responsibility of providing data remains in the owner of the facility, even when it would be possible to delegate the task of providing the information. The responsibility of ensuring confidentiality remains with the collecting party. However, all data that is required to be shared under SO GL or any other legislation is then subsequently expected to also be covered under the respective confidentiality clauses of such a legislation. When data is required to be provided to the respective National Regulatory Authority (hereinafter referred to as “NRA”) for the purposes of compliance monitoring the responsibility for such data provision is expected to be done directly on a national basis.

Many parties referred to in SO GL and subsequently within the KORRR are by the generic term used within the scope article 2(1) of SO GL. However, it is acknowledged that other designations for similar parties with similar or overlapping roles may exist, e.g. TO, DNO etc. When possible, additional guidance will be given on the inclusion or application of these requirements on such parties. However, the overarching expectation is that the respective member state will determine the correct interpretation and application of these responsibilities on other parties.

The development of the KORRR is done according to the requirements from SO GL. It stablishes responsibilities to transmission system operators (TSOs), distribution system operators (DSOs), closed distribution system operators (CDSOs) and significant grid users (SGUs).

Those TSOs from countries not members of the European Union are not directly bound by this methodology. It needs to be reflected in the wording of the KORRR the possibility for those TSOs to join the methodology in a voluntary basis.

Network Codes (hereinafter referred to as "NC") shall apply at ENTSO-E level and replace former UCTE Operational Handbook. When it is necessary to reach agreements at Synchronous Area level, a Synchronous Area Operational Agreement (SAOA) will be formalized.

Legal status of the Supporting Document

This document accompanies the KORRR and is provided for information purposes. Consequently, this document has no legally binding status.

2.2 GENERAL PRINCIPLES

SO GL defines the tasks and responsibilities that TSOs shall fulfil to safeguard Operational Security in Normal State and Alert State. Responsibilities in Emergency, Blackout and Restoration system state are defined in Regulation (EU) 2017/2196 Network Code on Emergency and Restoration (NC ER).

The content of the SO GL is divided into three main parts with technical requirements as follows:

Part II – Operational Security (OS) requirements of the SO GL deal with detecting system states, frequency control, voltage control, short-circuit current, power flows, contingency analysis, protection, dynamic stability limits.

Part III – Operational Planning and Scheduling (OPS) requirements of the SO GL deal with data for operational security analysis in operational planning, Operational security analysis, Outage coordination, System adequacy, ancillary services, operational scheduling, as well as the specifications for the ENTSO provided platform for Electricity operational planning data environment (OPDE).

Part IV – Load-Frequency Control and Reserves (LFCR) of the SO GL deal with Operational agreements, Frequency quality, Load-frequency control structure, Operation of load-frequency control, frequency containment reserves (FCR), frequency restoration reserves (FRR), replacement reserves (RR), exchange and sharing of reserves, time control process, co-operation with DSOs and transparency of information.

To be able to carry out the provisions of System Operation Guideline, TSOs needs a crisp and clear status of the system. A crisp and clear status can only be obtained with an adequate exchange of information between the parties involved in keeping the stability of the system.

Stakeholders considered to be significant for the system stability are the following:

- TSO of the control area, control block;
- Neighbouring TSOs;
- DSOs within the control area, control block;
- CDSOs within the control area, control block;
- SGUs in the control area, including both generator and demand facilities according to article 2(1) of SO GL.

The information exchanged shall be adequate to have accurate representations of the status of the electric system in the different timeframes covered by the SO GL, from year-ahead to real time.

In SO GL Part II, Title 2 - Data exchange, the three main categories of information to be considered in the information exchange are:

- **Structural information**: includes all the general and permanent characteristics and attributes of the facility and represents the capabilities of the equipment and is necessary to prepare static and dynamic models of the facilities;
- **Scheduled information**: represents the expected behaviour of the facilities and networks elements in the scheduled time frame and near future, considering near future up to one year according to provisions of SO GL. It includes information related to outage planning and generation/ consumption schedules;
- **Real time information**: represents the present behaviour of the facility.

To perform security analysis in real time and thereby, secure operational security limits in the present, a combination of the structural and the real-time information is compulsory. To be able to reach real time safely, security analysis need to be performed in advance. Structural and scheduled information is needed to prepare cases with the expected situation on the system in the near future.

The objective of the KORRR is to define common rules at European Union (EU) level to address the exchange of the required information between the significant stakeholders of the European electricity system.

To complement this explanation, chapter 6 of “Supporting Document for the Network Code on Operations Security” can be consulted.

Level of Detail

Data exchanged following SO GL shall be the necessary one to perform security analysis and guarantee operational security in the Electric System. Regulation shall achieve a certain level of harmonization between ENTSO-E members and also allow flexibility for future developments. Title 2 of SO GL currently achieves harmonization addressing the required exchange of information without defining all details. Stablishing a specific level of detail in European regulation will be too tight and inflexible because it will need long times to adapt if new developments or requirements of the system appear.

In line with this, to allow national or regional specificities, as the KORRR shall not define the detailed information to be exchanged between TSOs and significant stakeholders but shall establish the responsibilities at national level of **who shall define** and approve the detailed information to be exchanged.

In the end, horizontal TSO-TSO, harmonization shall be reached, adopting ENTSO-E proposal for applied international standards, leaving flexibility for vertical TSO-DSO and TSO-SGU exchange of information, to be defined at national level. In this case, the KORRR shall refer to who defines the exchange of information.

Reciprocity

Title 2 of SO GL provides the framework for the exchange of information between TSOs and the other significant stakeholders of the System to safeguard Operational Security. To achieve it, each agent in the system shall be able to gather the necessary information to comply with the tasks defined by SO GL. Articles 40(8), 40(9) and 40(10) of SO GL consider and regulate the exchange of information from TSOs to DSOs and/or SGUs. In this sense, the KORRR needs to consider bidirectional flows of information between all affected parties and takes it into account in the articles related to confidentiality and accessibility of data.

The TSOs:

- as responsible for balancing shall gather information from SGUs connected both at Transmission and Distribution level.
- as Transmission Network Operators shall gather information from
    - SGUs connected at Transmission level and
    - DSOs regarding Observability Area in the distribution network.
    - Neighbouring TSOs regarding Observability Area in the neighbour Transmission Systems

The DSOs and CDSOs, as Distribution Network Operators shall gather information from:

- SGUs connected to distribution level and
- TSOs regarding their Connection Point(s) in the Transmission System and other assets with relevance for their network
- Neighbouring DSOs

The SGUs gather information from:

- TSOs regarding their Connection Point when they are connected to the transmission system or
- DSOs regarding their Connection Point when they are connected to the distribution network
- Instructions from TSOs regardless of the SGU Connection Point.

Significant Grid Users

The KORRR includes organizational requirements, roles and responsibilities of all the parties involved in the interconnected networks operation: TSO, DSO, SGUs. In particular, according to article 2 of SO GL, the list of the SGUs is the following:

- existing and new power generating modules classified as type B, C and D;
- existing and new transmission-connected demand facilities;
- existing and new transmission-connected closed distribution systems;
- existing and new demand facilities, closed distribution systems and third parties if they provide demand response directly to the TSO;
- providers of re-dispatching of power generating modules or demand facilities by means of aggregation and providers of active power;
- existing and new high voltage direct current (HVDC)

The Grid Users included in the previous list shall provide data to DSOs and TSOs; and they are responsible for the data and its modifications. SGUs are the owners of the information from their

facilities or the services they provide to the System so they are responsible for that information. Indirect exchange through a third party, for example Balancing Service Provider (BSP) or Balance Responsible Party (BRP), shall be allowed but the final responsibility of the exchange and quality of the information shall rely always in the owner of the facility.

Distribution connected facility: Article 2 of SO GL defines significant grid users as used in the guideline. SGU Demand is defined in Art d) and e). Demand facilities can only be SGU if they are directly connected to the Transmission System or they provide demand response directly to the TSO or if they provide re-dispatching with their facility. This definition ensures that households or very small loads won't be considered in the SO GL.

When a grid user is qualified to provide services to the system, it becomes a SGU and it will have to fulfil the requirements settled in the SO GL, the KORRR or any other relevant European regulation. Regarding Data Exchange, once a grid user is considered significant, it will have to comply with the requirements of the proposal: communications, infrastructures, quality… In those occasions where the SGU is also providing services, then it will have also to provide the data to the system operator. In the occasions where the SGU is not providing services, it may not be obliged to send data.

Clarity

The KORRR includes specific terms in order to describe the general data exchange in an appropriate detail level. All of the terms that are used are defined in the KORRR itself or in the SO GL. The following terms need a clarification as they were mention in the public consultation:

- Modification: the modification of a facility is defined as an event for sending updated structural data. Since a modification isn't clearly defined, the KORRR can be used for defining the term "modification of a facility". Significant modification is defined in the NC RfG, def. 65. The national implementation of the connections codes shall be also considered.
- The term "Logical connection" is used to indicate the way that the data flows through the network from one device to the next without regard to the physical interconnection of the devices.
- The expression "Rules of conduct" is used to indicate the procedures used in example in the following cases:
    - event in the communication: if the principal link is lost, it's necessary to use the second one, if the second also fails it's necessary to use the email, if it also fails it's necessary to use the telephone…
    - planned outages of the communication link: to inform in advance the parties who receive the data specifying the timing and the possible consequences for the data exchange

Flexibility

One concern regarding flexibility of the KORRR are the various ways of creating the electrical simulation model of a facility may be provided, e.g. by equipment manufacturers, by facility owner, by design consultants. Definitely the responsibility for providing the complete electrical simulation model of a facility is on the shoulder of the facility owner requesting the grid connection.

Flexibility needs to cover at least the following two issues:

- What amount / scope of information to exchange, and,
- The format of that information exchange.

An example of the first aspect of flexibility is the information required to prepare static/ dynamic simulation models. Two opposite approaches can be considered:

- Simulation models to be provided to the TSO as a whole to be directly used for simulations;
- Necessary parameters to be provided to allow TSOs to build the simulation models to be used in simulations of the national grid system.

Either approaches or an intermediate one can be considered at national level. The KORRR does not prescribe neither of them.

For small scale facilities, e.g. main components of type B facilities the electrical simulation model be required as a part of the equipment certificate according to EU 2016/631 (NC RfG) Art. 2 (47). If a member state (NRA) wants to prepare the notification process in an efficient manner, a “positive list” of main components could be created with the pre-approved components included, but this is solely up to the member states to decide.

For large scale facilities, e.g. type C and D facilities the electrical simulation model of the key components could be provide directly to the relevant TSO if required in order to keep track of confidentiality. Still the responsibility for providing the complete electrical simulation model of a facility is on the shoulder of the facility owner requesting the grid connection

Another essential issue of interest for the stakeholder is the big variation in the current applied information exchange practices between the member states. It’s recommended to the TSOs to keep the flexibility in the implementation within its own control area: DSOs and SGUs; and secure a knowledge sharing across the European electricity market in this aspect. This is foreseen to be reflected in the KORRR based on open wording in order to allow flexibility for different practices in different countries.

This will affect how the information is exchanged between the TSO and the SGUs, e. g. directly or indirectly information exchange through the DSO. Each TSO may have different templates for structural information within its control area depending on the impact on the transmission capacity. Even if the double provision is considered the default option, different paths for the information to be exchanged may be coordinated at national level in order to avoid exchange of duplicated information. The same issues will be on scheduled and real-time information.

Different TSOs and DSOs may have different templates for structural, scheduled and real-time information which will be respected to the outmost extend where possible.

2.3 RELATION WITH SO GL: INTERPRETATION OF ARTICLES 40(5) AND 40(7)

Articles 48 to 50 and 53 of the SO GL relates to the exchanges of information between TSOs, DSOs and SGUs connected to the distribution network states that SGUs shall provide data both to the TSO and the DSO they are connected to. The KORRR in article 3(2), in line with it renders it as a default option. This exchange of data can be done by the SGUs through a third party like a control centre, an aggregator or any other entity considered in the national implementation of the network codes.

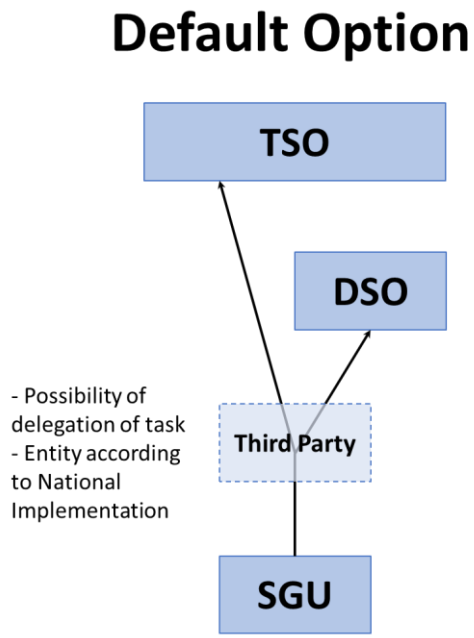

Figure 1. The arrows represent the data related to distribution connected SGUs

In order to facilitate the exchange of data and reduce the costs of SGUs, the KORRR in article 3(3) reflects to possibility that article 40(5) of the SO GL gives the TSO, in coordination with DSOs and SGUs, subject to NRA approval to determine the scope and applicability of articles 44, 47, 48, 59, 50, 51, 52 and 53 so the data is only provided to one System Operator, only to the TSO or only to the DSO. When this is the case, to ensure that both the TSO and the DSO to whose network the SGU is connected have the necessary data, system operators have to exchange between them the data related to the SGU. This has to be done according to the processes to exchange data between TSO and DSO agreed according to article 40(7) of the SO GL.

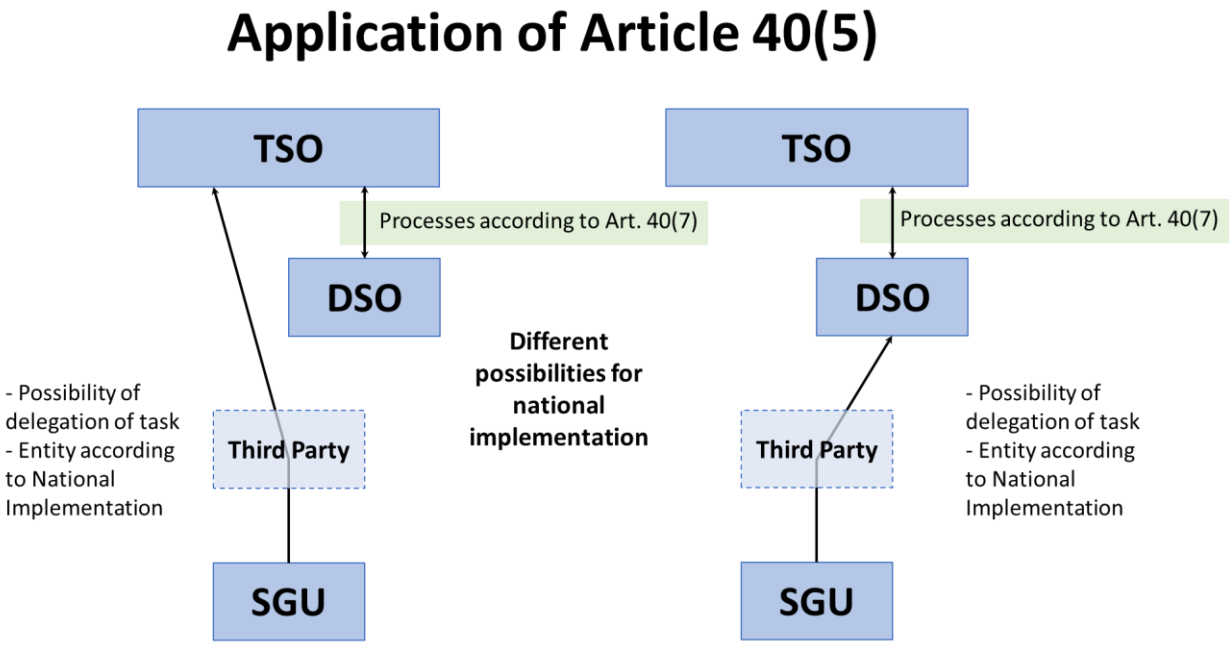

Figure 2. The arrows represent the data related to distribution connected SGUs

Provision of data by SGUs connected to distribution grids to TSOs can be implemented according to of the following three options:

1) TSOs could have access to the required data from a distribution connected SGU through an aggregator or balancing service provider (BSP).
   In many cases, the aggregator or BSP have direct contact with the plant, for example, for bidding in the day-ahead and intraday markets or for issuing instructions to balance their portfolio. The same communication channel from the plant to the aggregator or BSP that is used for participating in the wholesale markets or internal BRP or BSP management may be used for participating in the balancing markets or for other system services like congestion management. In this case, the data can also be sent from the TSOs to the connecting DSO when it is needed to perform the DSO tasks. This option is considered under paragraph 3 (9) of KORRR in which SGUs delegate part of their tasks to a third party.
2) DSOs pass relevant data in an efficient and timely way to the TSO. One option is for the DSO to create direct access to this data via their SCADA systems.
   If DSOs have direct contact and receive directly individual real-time data collected at the point of connection, another implementation option may be that DSOs send the data to TSOs.
3) TSOs could also be able to have access to distribution connected SGUs through a direct technical solution of the TSO.
   The TSO may also access the individual data of the SGU by collecting it directly at the point of connection. This option requires higher communication needs and access to the point of connection in the DSO network by the TSO.

It has to be clarified, that the KORRR national implementation should not be reduced to the three possibilities mentioned before, there will be other possibilities for exchanging data. For example, the case where SGUs enters the data on a common platform to which both TSO and DSO have access to.

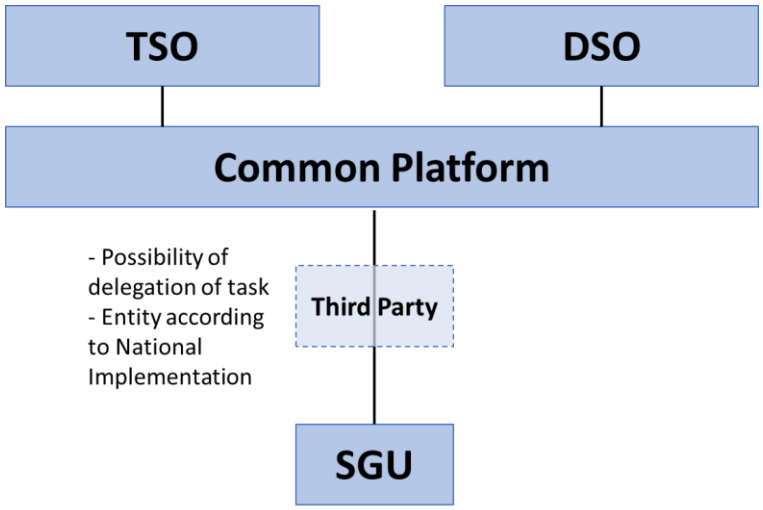

Figure 3. The arrows represent the data related to SGUs that could be share in a common platform

2.4 RELATION WITH OTHER NETWORK CODES AND GUIDELINES

2.4.1 Relation with Network Code on Requirements for Generators

(Official Journal of the European Union – 14/04/16)

General requirements

Not included.

Structural data

Article 14 defines the information exchanges of type B modules. Type B power-generating modules shall fulfil the following general system management requirements with regard to information exchange: the relevant system operator, in coordination with the relevant TSO, shall specify the content of information exchanges including a precise list of data to be provided by the power-generating facility.

Article 32 and 35 define the data exchange regarding the power-generating module document (PGMD) within the notification procedure. The format of the PGMD and the information to be given therein shall be specified by the relevant system operator. The relevant system operator shall have the right to request that the power-generating facility owner include the following in the PGMD: detailed technical data of the power-generating module with relevance to the grid connection as specified by the relevant system operator.

Article 41 defines the tasks of the relevant system operator regarding compliance monitoring. The system operator shall make publicly available a list of information and documents to be provided. The list shall cover at least the following information, documents and requirements: details of the technical data on the power-generating module of relevance to the grid connection.

Article 43 defines the data exchange regarding the compliance simulation. The relevant system operator shall provide the power-generating facility owner with technical data and a simulation model of the network.

Scheduled Data

Scheduled data is not included.

Real time data

Article 14 defines the basic capability of power generating modules regarding real time data exchange. Type B power-generating modules shall be capable of exchanging information with the relevant system operator or the relevant TSO in real time or periodically with time stamping, as specified by the relevant system operator or the relevant TSO.

2.4.2 Relation with Network Code on Demand Connection

(Official Journal of the European Union – 17/08/16)

General requirements

Article 18 defines the general requirements regarding the information exchange in terms of compliance to the standards and time stamping specified by the relevant TSO.

Structural data

Article 14 defines the information exchanged regarding the short-circuit current. The relevant TSO shall provide the transmission-connected demand facility owner or the transmission-connected distribution system operator an estimate of the minimum and maximum short-circuit currents to be expected at the connection point. TSO shall request information from a transmission-connected demand facility owner or the transmission-connected distribution system operator concerning the contribution in terms of short-circuit current.

Article 21 defines the requirements regarding the simulation models. Each TSO may require simulation models or equivalent information showing the behaviour of the transmission-connected demand facility owner or the transmission-connected distribution system operator. Content and format of simulation models or equivalent information shall be specified by each TSO.

Article 24 and 25 regarding to the interim operational notification and the final operation notification define additional information may be requested by TSO in terms of technical data, simulation models and studies.

Demand units within a demand facility or a closed distributions system connected at a voltage level of or below 1kV have to provide an installation document including technical data (Article 32).

Scheduled Data

Scheduled data is not included.

Real time data

Real time data is not included.

2.4.3 Relation with Network Code on Emergency and Restoration

(Official Journal of the European Union – 28/11/17)

General requirements

No general requirements.

Structural data

Structural data exchange is not included.

Scheduled Data

Scheduled data exchange is not included.

Real time data

Real time data exchange is not included.

2.4.4 Relation with Guideline Forward Capacity Allocation

(Official Journal of the European Union – 26/09/16)

General requirements

According to article 17 of the FCA GL, no later than six months after the approval of the GLDPM established for CACM GL, all TSOs shall jointly develop a proposal for a single GLDPM for delivering the generation and load data required to establish the common grid model for long-term time frames. The KORRR shall take into account and complement the GLDPM according to Article 16 of CACM GL.

Structural data

Structural data exchange is included in the GLDPM version 2 according to article 17.

Scheduled Data

Scheduled data exchange is included in the GLDPM version 2 according to article 17.

Real time data

Real time data is not included.

2.4.5 Relation with Network Code on High Voltage Direct Current Connections and DC connected Power Park Modules

(Official Journal of the European Union – 26/08/16)

General requirements

Not included

Structural data

If requested by TSOs, HVDC owners shall perform studies to demonstrate that no adverse interaction (for instance Sub-synchronous torsional interaction) may occur. The HVDC System Owner shall provide the TSO all relevant data and models (Articles 29, 31). TSO can require the HVDC System Owner to deliver simulation models which properly reflect the behaviour of the HVDC System in both steady-state, dynamic simulations (fundamental frequency component) and in electromagnetic transient simulations. TSO shall define the format in which models shall be provided (Article 54).

The Relevant Network Operator shall define and provide the method and the pre-fault and post-fault conditions for the calculation of at least the minimum and maximum short circuit power at the Connection Point (Articles 32, 42).

Technical data, models of the HVDC and studies shall be provided by HVDC owners and DC-connected Power Park Modules with the Interim Operational Notification (ION) and Final Operational Notification (FON) (Articles 57, 58, 62, 63).

Scheduled Data

Scheduled data is not included.

Real time data

Real time data is not included.

2.4.6 Relation with guideline on Capacity Allocation and Congestion Management

(Official Journal of the European Union – 24/07/15)

General requirements

According to Article 16, no later than 10 months after the entry into force of this Regulation all TSOs would have had to develop a proposal for a single methodology for the delivery of the generation and load data required to establish the common grid model (GLDPM).

Structural data

Structural data exchange is included in the GLDPM.

Scheduled Data

Scheduled data exchange is included in the GLDPM.

Real time data

Real time data is not included.

2.4.7 Relation with guideline on Electricity Balancing

(Official Journal of the European Union – 18/18/17)

General requirements

No general requirements.

Structural data

Requirements for data exchange specific for the balancing services: defined at European level for the exchange of balancing services between TSOs and at national level for the pre-qualification tests.

Scheduled Data

Requirements for data exchange specific for the balancing services: defined at European level for the exchange of balancing services between TSOs and at national level for the pre-qualification tests and evaluation of the provision of balancing services.

Real time data

Requirements for data exchange specific for the balancing services: defined at European level for the exchange of balancing services between TSOs and at national level for the pre-qualification tests and evaluation of the provision of balancing services.

2.5 RELATION WITH OTHER METHODOLOGIES

2.5.1 Relation with Generation and Load Data Provision Methodology

(Official Journal of the European Union – 24/07/15)

Generation and Load Data Provision Methodology (GLDPM) sets out the generation and load data which may be required by TSOs in order to establish the common grid model.

The methodology specifies:

- which generation units and loads are required to provide information to their respective TSOs for the purposes of capacity calculation: Distribution and closed distribution system operators, generation, load, HVDC links
- the information to be provided by generation units and loads to TSOs: structural data, infrequently changing variable data, variable data (Articles 5-15)
- the deadlines applicable to generation units and loads for providing the information (Article 16)

The KORRR and the GLDPM are related because both refer to the exchange of data between TSOs, DSOs and SGUs but they do not have the same purpose.

The GLDPM was developed following the two market codes CACM and FCA. The purpose is to have the data from relevant loads of generators that are cross-border relevant and may have impact at Capacity Calculation Region level. So, the affected loads and generators are the biggest ones connected to the higher voltage level. Application of this methodology in voluntary in the Member States.

The KORRR is developed following the Operational SO GL. The purpose is to allow TSOs, DSOs and SGUs to access the data to guarantee system security. Opposing to the GLDPM, the KORRR is not voluntary and it applies to all SGUs as defined in article 2(1) of the SO GL and revised at national level according to article 40(5). This means that it affects more users than the GLDPM, not only the biggest ones. The purpose of the KORRR is to be compatible with the GLDPM setting similar or more flexible requirements than the GLDPM. This way, the smaller grid users may have the same or more flexible requirements than the biggest ones and grid users sending data according to the GLDPM would comply also with the KORRR.

3. RESULTS FROM THE SURVEY OF DATA EXCHANGE FOR ENTSO-E MEMBERS

A questionnaire has been prepared by the project team and sent out to TSOs. This section provides a summary of the answers, reflecting the current practice in data exchange for more than a half of ENTSO-E members.

Note that because multiple answers were possible, the percentages do not necessarily sum up in 100% in the results interpretation below.

Main requirements for information exchanges (structural, schedule and real-time) are imposed by NRA-s (in more than 90% answers) or other non-ENTSO-E methodologies (+71%). ENTSO-E methodologies at present have the highest representation for schedule data (71% of respondents), and for structural and real-time data the representation is only in slightly over 50% of respondents.

Although NRAs mainly prescribe the requirements, information exchange does not flow through the NRA, except in seldom cases: one TSO reported to exchange Market information with their SGUs through the NRA, on intraday and daily basis and one country will implement in 2017 a process to exchange Structural information through NRAs.

3.1 SCOPE

	Structural Information	Scheduled information	Real Time information
Neighbouring TSOs	92 %	88 %	92 %
DSOs/ CDSOs	96 %	63 %	63 %
Transmission Connected SGU	96 %	92 %	92 %
Distribution Connected SGU	63 %	58 %	71 %
Ancillary Services Providers	76 %	71 %	88 %

NEMOs	17 %	71 %	17 %

Table 1: System agents that exchange information with the TSOs

Regarding structural information, most data is exchanged with those directly connected to the Transmission System: DSOs/ CDSOs (96 %), Transmission Connected SGU (96 %) and Neighbouring TSOs (92 %). It is also important the number of TSOs that exchange structural information with other agents not directly connected to the Transmission System: Distribution Connected SGU (63 %) and Ancillary Services Providers (75 %). For this type of information, NEMOs (17 %) are not very representative.

Real Time Information Exchange have a similar pattern to structural information. Almost all TSOs deal with Neighbouring TSOs (92 %), Transmission Connected TSOs (92 %) and DSOs/CDSOs (83 %). In this case, the number of TSOs that share information with Ancillary Services Providers (88 %). NEMOs (17 %) are also little represented.

The importance of NEMOS is increased in case of Scheduled Information (71 %). On the other hand, the number of TSOs exchanging scheduled information with DSOs/CDSOs is lower (63 %). Neighbouring TSOs (88 %), Transmission Connected SGU (92 %) and Ancillary Services Providers (71 %) keep similar values to Structural Information.

	Direct Exchange with SGU Generator	Direct Exchange from SGU Demand	Direct exchange from DSO	Exchange through DSO from SGU
Before 1st Commissioning	100 %	83 %	75 %	54 %
Final Removal from service	96 %	79 %	71 %	50 %
Modification of the Facility	96 %	83 %	75 %	46 %
Correction of Errors	88 %	71 %	63 %	38 %
Periodic	29 %	21 %	25 %	29 %

Table 2: Criteria/ frequency to exchange structural data

Structural information is exchanged by TSOs at least in five identified cases. This flow of information can happen directly with the owners of the information of through the operator of the network where the agent is connected. Most TSOs directly share information in some cases with SGU and DSOs. This is especially true when they are directly connected to the Transmissions System. On the contrary, only half of the TSOs share the information with Distribution Connected SGU through DSOs.

		Direct Exchange with SGU Generator	Direct Exchange from SGU Demand	Direct exchange from DSO	Exchange through DSO from SGU	Exchange through NEMO from SGU
Outage Planning	Over Year	66 %	29 %	29 %	0 %	8 %
	Yearly	96 %	58 %	58 %	21 %	13 %
	Monthly	58 %	42 %	38 %	13 %	13 %
	Weekly	54 %	38 %	42 %	8 %	13 %
	Other	17 %	8 %	4 %	4 %	4 %
	Event driven	88 %	54 %	63 %	13 %	8 %
Market	D-2	17 %	17 %	4 %	0 %	0 %
	Daily	88 %	58 %	29 %	21 %	29 %
	Intraday	58 %	42 %	13 %	8 %	25 %
	Hourly	54 %	38 %	17 %	8 %	4 %
	Below hour	38 %	25 %	13 %	4 %	8 %
	Other	8 %	8 %	0 %	0 %	0 %
	Event driven	71 %	38 %	29 %	8 %	4 %

Table 3: Criteria/ frequency to exchange scheduled data

Scheduled information can be divided in two parts depending on the time frame: Horizons over the week will be referred to as “Outage planning” and below the week as “Market”. All TSOs that answered the questionnaire said that they have an information system to exchange scheduled information.

Outage planning

- Exchange of over one year scheduled information is mainly done with generators (67 %) and to some extent with SGU Demand (29 %) and DSOs (29 %) directly connected to the Transmission System.
- More important is the Yearly planning. Almost every TSO have this process with generators (96 %) and half of them with SGU Demand (58 %) and DSOs (58 %) directly connected to the Transmission System. In some cases, information from Distribution Connected SGU flows through DSOs (21 %) or NEMOs (13 %).
- Monthly and weekly coordination also takes place. Like in the case all cases, the closest coordination takes place with generators.
- In a few cases there are different time frames to the ones mentioned in the questionnaire.
- Quite usual is the event driven exchange of information, taking place whenever a defined situation happens. There can be many different situations, for example, a change in the data.

Market

- Information exchanged in D-2 is reduced;
- With Daily market, the interlocutors of TSOs is much higher. Most Generators directly exchange with TSOs (88 %) and also SGUs (58 %). Not so frequent is to do the process directly with the DSO (29 %), through the DSO (21 %) or the NEMO (29 %).
- In the intraday market, the amount of energy is smaller and so is the exchange of information. Still, there is some information that flows through NEMOs.
- Hourly and below hour exchanges of information take place with similar distributions but the participation of NEMOs as these services are usually operated by the System Operator.
- In a few cases there are different time frames to the ones mentioned in the questionnaire.
- Quite usual is the event driven exchange of information, taking place whenever a defined situation happens. There can be many different situations, for example, a change in the data.

3.2 LEVEL OF DETAIL

In the questionnaire, we have provided three levels of detail for information exchanged with definitions as follows:

- Overall information (OI): Low level of detail. Models might not be developed with that information so they shall be provided apart;
- Detailed for further processing (DF): Medium level of detail. Further information would be necessary to develop all models; and,
- Very detailed (VD): High level of detail. It would allow to develop all models.

For exchange of structural information, most of respondents are currently exchanging it at levels VD (54%) or DF (33%). Even those that indicated mainly level OI exchange some part of information at higher levels of detail (e.g., for transmission connect at level VD, for distribution connected at level OI).

4. PROVISIONS OF THE KORRR

The KORRR organization can be seen as a matrix. At first, responsibilities of the different agents are grouped to make it easier to read for the different affected parties. Then, for each agent, chapters are grouped for each kind of information. The summary can be seen in the following diagram:

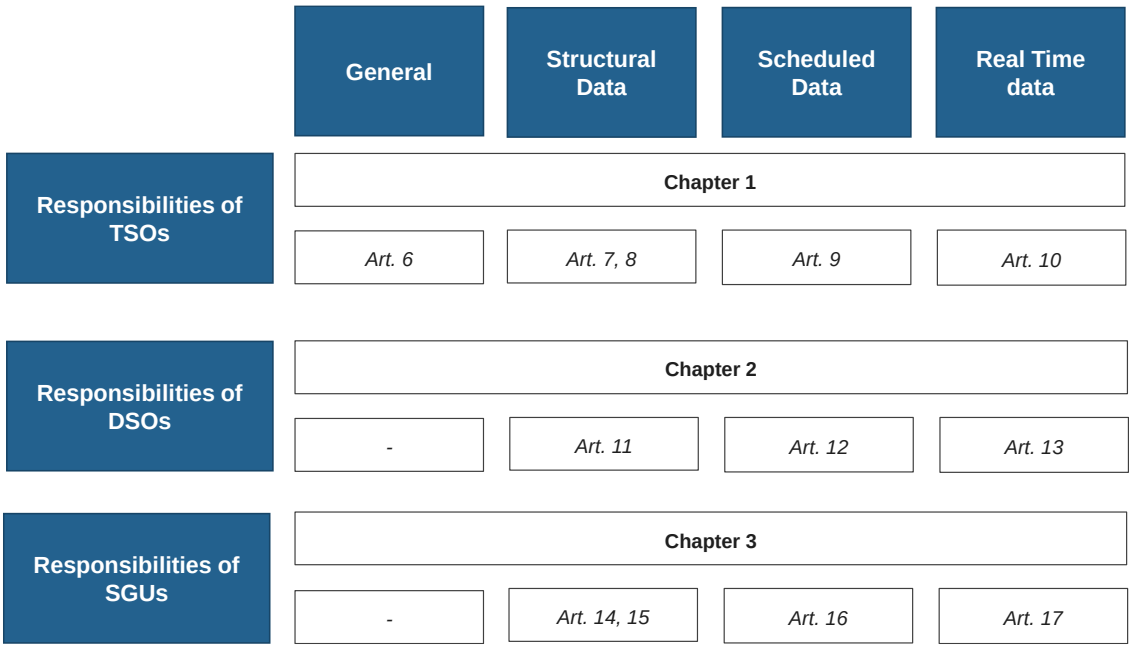

Figure 4: Aspects covered by each article of the KORRR

4.1 STRUCTURAL INFORMATION

Structural data include all the general and permanent information of the assets: characteristics, attributes, capabilities, etc. Structural data are necessary to prepare static and dynamic models of the facilities used to carry out static and dynamic security analysis.

All the parties involved have to exchange at least the list of information defined in SO GL.

The format of the structural data exchanged among TSOs is defined in the Common Grid Model Methodology (CGMM). At national level each TSO has to define the format and publish the templates to be used by DSOs and SGUs to provide structural data.

The update of the information is driven by the following events:

- new network element or facility;
- final removal from service of the network element or facility;
- significant modifications in the network element or facility;
- update of the observability area;
- error

All the data gathered by TSOs have to be stored in a data storage updated and maintained by TSOs. DSOs and SGUs can have access to the information referred to own facilities.

The following scheme summarizes the flow of information among all the parties involved. The reference to the articles of the KORRR is indicated in the scheme.

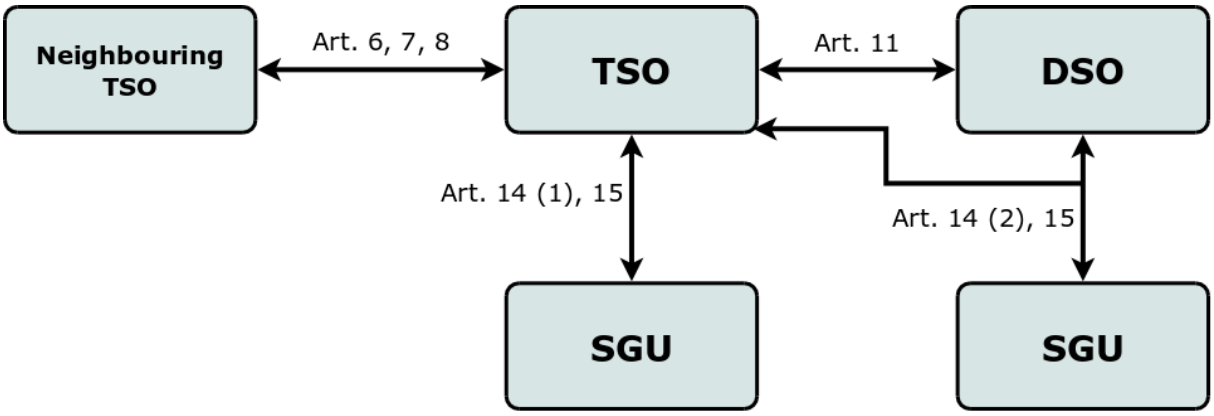

Figure 5: Exchange of Structural information

4.2 SCHEDULED INFORMATION

Scheduled information represents the expected functioning of the different elements of the System in the future. Together with structural data allow to prepare a scenario of the expected satiation of the System in a specific moment in the future to perform Security Analysis for that timeframe.

Scheduled information can be divided in two subsets of information: outage planning and generation-load programs, also referred to run-scheduled. All this information can be considered in many different timeframes depending on the moment of the future for which the Analysis are done. Title 2 of SO GL addresses exchanges of scheduled information between Day-ahead and real-time.

At national level, the exchange of run-schedules between a TSO and the DSOs and SGUs within its control area shall be addresses by means of an information system managed by the TSO. The TSO shall define and publish the format of the information and the technical requirements to connect and access the information system. TSOs shall also store information about schedules.

Regarding outage planning, TSOs and DSOs, as grid operators shall communicate the unavailability of their grid elements.

The reference to the articles of the KORRR is indicated in the scheme.

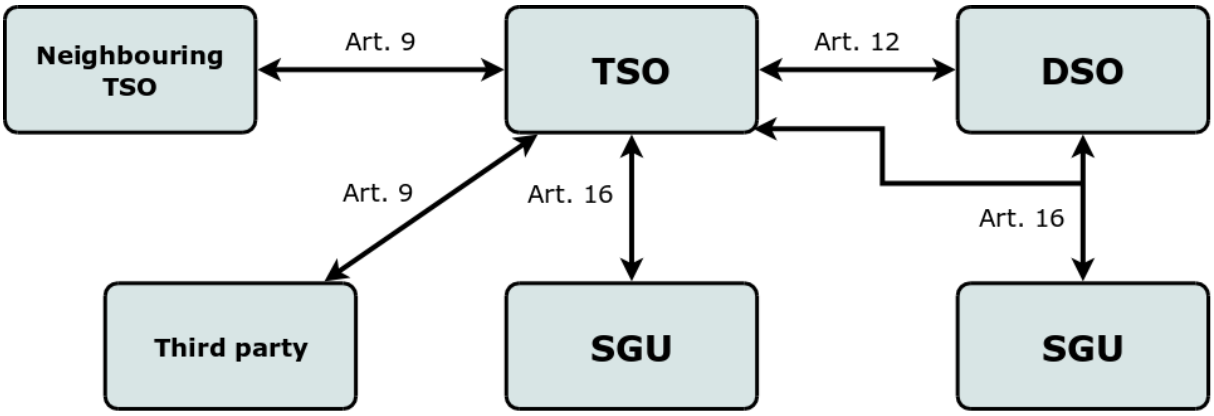

Figure 6: Exchange of Scheduled information

4.3 REAL TIME INFORMATION

Real-time data exchanges for TSO include telemetry measurements or calculated (estimated) values for the following non-exhaustive variables:

- active and reactive powers (line flows, interchange power, generation, load, reserves);
- busbar voltages;
- frequency and frequency restoration control error;
- setpoints (load-frequency controller);
- tap changer positions of transformers and compensating equipment;
- open/close position of switching equipment.

Combined with the structural data, they are used to produce study models used to carry out static and dynamic security analysis in real-time.

All the parties involved have to exchange at least the list of information defined in SO GL.

For real-time data exchange, standard but legacy communication protocols are typically used: inter-control centre protocols (ICCP) as specified in the international standard IEC 60870-6 and the device oriented information modelling and mapping to communication protocols specified in the international standard series IEC 61850, IEC 61970, IEC 61968, IEC 61400-25, IEC 62351, IEC 61325. The update of the information is driven by the protocol used and the local configuration.

The IEC and CEN/CENELEC standardization body have analysed the impressive collection of standards in the field of Smart Grid and communication and cyber security aspects. The IEC Smart Grid Standardization Roadmap provides an overview on these standards. Some of these standards are considered to be core standards for any implementation of communication and cyber security aspects within current and future electricity system.

Core standards are standards that have an enormous effect on any communication and security solution. These core standards are forming the “backbone” of the IEC standards portfolio. The fundamental standards are the following:

- IEC 61850 Power Utility Automation, Hydro Energy Communication, Distributed Energy Resources Communication. The standard series is the fundamental specifications for all communication within future electricity network systems.
- IEC 61970 Common Information Model (CIM). Generation management systems, EMS (Energy Management System)
- IEC 61968 Common Information Model (CIM). Generation management systems, DMS (Distribution Management System); DA; SA; DER; AMI; DR; E-Storage
- IEC 61400-25 communication with wind power plants
- IEC 62351 Security aspects
- IEC 61325 Market communication aspects
- IEC 62056 COSEM – smart grid metering communication
- IEC 61508 Functional safety of electrical/electronic/programmable electronic safety-related systems
- IEC 60870-6 Inter Control Centre Protocols (ICCP) secure communication between control centre.

New standards could provide a more advanced and enhanced functionality that may in the future replace these communication protocols.

All the data gathered by TSOs have to be stored in a data storage updated and maintained by TSOs. DSOs and SGUs can have access to the information referred to own facilities (which is untypical for real-time data exchange).

The following scheme summarizes the flow of information among all the parties involved. The reference to the articles of KORRR is indicated in the scheme.

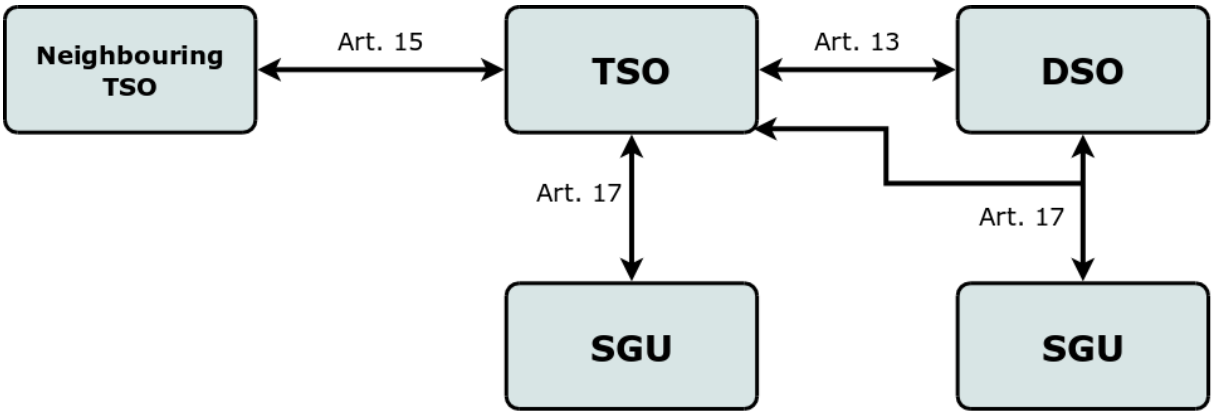

Figure 7: Exchange of Real Time information

5. REFERENCES

[1] "Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation", Official Journal of the European Union, August 2017"

[2] "NC OS Supporting Document", ENTSO-E, September 2013

[3] "OPS Supporting Document", ENTSO-E, September 2013

[4] "Final LFCR Supporting Document", ENTSO-E, September 2013

[5] "Supporting Document for the final Network Code on Emergency and Restoration" ENTSO-E, March 2015

[6] "P.O. 9: Información intercambiada por el operador del sistema" Spanish Regulation, December 2015

[7] "TSO-DSO Data Management report", ENTSO-E, CEDEC, EDSO, Eurelectric, GEODE, July 2016"

[8] SEGCG/M490/G Smart Grid Set of Standards version 4.1, Jan 6th, 2017

6. ASSESSMENT OF THE KORRR AGAINST ARTICLE 40(6)

	Requirements of Article 40(6) of SO GL	Extent to which the provision is met
40(6)	By 6 months after entry into force of this regulation, all TSOs shall jointly agree on key organisational requirements, roles and responsibilities in relation to data exchange. Those organisational requirements, roles and responsibilities shall take into account and complement where necessary the operational conditions of the generation and load data methodology developed in accordance with Article 16 of Regulation (EU) No 2015/1222. They shall apply to all data exchange provisions in this Title and shall include organisational requirements, roles and responsibilities for the following elements:	**Article 1** of KORRR states the subject matter and scope and defines this proposal as the common one by all TSOs according to article 40 (6) of SO GL. **Whereas (3)** recognizes the link with GLDPM developed according with article 16 of Regulation (EU)2015/1222 establishing a guideline on CACM. GLDPM establishes which data has to be provided by whom and when to prepare the common grid model, while the KORRR addresses who must exchange data as well as, how and when to perform the tasks defined in the SO GL. Furthermore, the GLDPM only refers to data exchange up to the day ahead, while KORRR also includes data exchange up to real time.
a	obligations for TSOs to communicate without delay to all neighbouring TSOs any changes in the protection settings, thermal limits and technical capacities at the interconnectors between their control areas;	All types of information referred to in article 40 (6) (a) are included in the structural data of elements included in observability area**. Article 7** of KORRR states the requirements for TSOs to exchange the structural data necessary to operate the system. The cases to update the structural data share with other TSOs is defined in **Article 8**
b	obligations for DSOs directly connected to the transmission system to inform their TSOs, within the agreed timescales, of any changes in the data and information pursuant to this Title;	**Article 7** states the obligation for DSOs to provide the TSO with the structural information and **article 11 (1)** defines the case when the information needs to be updated. **Article 12 (1)** defines the provision of scheduled data from DSOs to TSOs. **Article 13 (1)** defines the obligation for the DSO to provide real time data to the TSO.
c	obligations for the adjacent DSOs and/or between the downstream DSO and upstream DSO to inform each other within agreed timescales of any change in the data and information established in accordance with this Title;	**Article 3 (5)** states the obligation for adjacent DSOs and/or between the downstream DSO and upstream DSO to inform each other on the processes and formats of any change in the data and information between them. **Article 12 (1)** differentiates between transmission connected DSOs and non-transmission connected DSOs and the obligations of each one regarding the data exchange.

	Requirements of Article 40(6) of SO GL	Extent to which the provision is met
d	obligations for SGUs to inform their TSO or DSO, within agreed timescales, about any relevant change in the data and information established in accordance with this Title;	**Article 14** states the obligation for SGUs to provide the TSO/ DSO with the structural information. **Article 15** defines the cases when the information needs to be updated. Article 16 defines the obligation for the SGUs to provide schedule data to the TSO/DSO. **Article 17** defines the obligation for the SGUs to provide real time data to the TSO/DSO and the requirements that need to be fulfilled.
e	detailed content of the data and information established in accordance with this Title, including main principles, type of data, communication means; formats and standards to be applied, timing and responsibilities;	**Article 7** establishes that the TSO shall define and publish the detailed content and formats to communicate structural information. **Article 9** defines the responsibilities of the TSOs regarding the exchange of scheduled data. Among them there are the settlement of an information system to exchange that information, the format used by the information system and the requirements to connect to it. **Article 10** stated the responsibility for the TSO to define standards for real time data exchange.
f	the time stamping and frequency of delivery of the data and information to be provided by DSOs and SGUs, to be used by TSOs in the different timescales. The frequency of information exchanges for real-time data, scheduled data and update of structural data shall be defined;	**Article 9 (4)** defines timestamping for scheduled data exchanges **Article 10(2)** defines timestamping for real time data exchanges **Article 9 (1)** states the frequency of delivery of scheduled data **Article 10 (5)** states the frequency of delivery of real time data **Articles 8, 11 (1) and 15** establish the cases where structural information needs to be updated.
g	the format for the reporting of the data and information established in accordance with this Title;	**Article 7** stablishes that the TSO shall define and publish the detailed content and formats to communicate structural information. **Article 9(2) and 9(3)** stablish that the TSO shall define the format of the scheduled data for the information system. **Article 10** stablishes that the TSO shall define and publish the requirements and content for real time data exchange.
40(6)	The organisational requirements, roles and responsibilities shall be published by ENTSO for Electricity.	**Article 18(1)** states the obligation for ENTSO-E (and TSOs) to publish the proposal on internet.