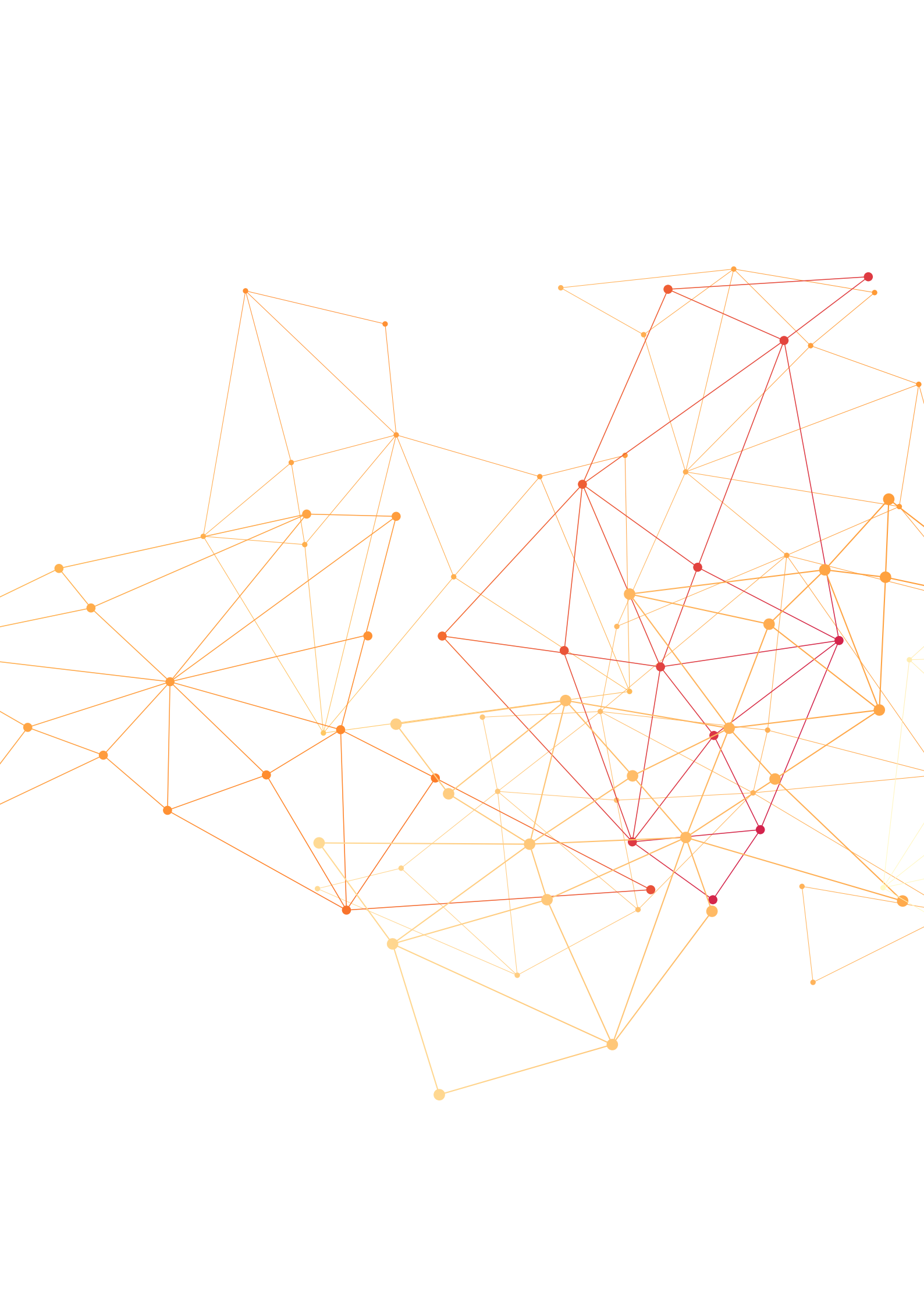

TSO – DSO **DATA MANAGEMENT REPORT**

» This report provides input to the European Commission in their work on identifying an appropriate TSO – DSO framework, being part of the forthcoming “Market design and Renewables package”.







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1 INTRODUCTION

With the energy transition, the **customer moves centre stage**: active customers, increasing penetration of decentralised renewables, new actors like aggregators, the need for flexibility, and the development of demand response are parts of the story. And Europe is only at the beginning of the transition: By 2020, 36% of power generation is expected to come mostly from variable renewables, many of them distributed, and by 2030, this number is anticipated to reach 46%.

At the same time, an increasing number of European consumers (households and Small and Medium Enterprises) will have smart meters in the coming years, thus enabling a more digital energy system of the future. In the light of this fundamental change, and proactively, rules have to be defined, governance conceived, and systems reconsidered. **Effective coordination between TSOs and DSOs** becomes increasingly important to ensure cost efficient, sustainable and reliable system operation and to facilitate markets throughout Europe. Operating the electricity system closer to its limits translates into the need for smarter grids, the precondition for which is the efficient exchange of information and data.

Flexibility, which is the prime response to variable renewables, can only be used efficiently for balancing and congestion management purposes if the appropriate data and information are exchanged between TSOs, DSOs and market players.

What information is needed by whom to unleash the flexibility potential? It is indeed necessary to have a clear understanding of the information and data needs of all concerned parties, particularly TSOs and DSOs, to efficiently fulfil their missions.

Roles and responsibilities have to be defined on a European level, while national implementation can take different shapes, taking stock of national differences,

but indeed respecting the overall EU framework yet to emerge. Agreement should also emerge on the requirements on processes and data management in European countries.

This report provides input to the European Commission in their work on identifying an appropriate TSO – DSO framework, being part of the forthcoming “Market design and Renewables package”. It aims in particular at sharing recommendations on common European principles and criteria for data and information exchanges. This report lays the ground for further work yet to be undertaken by TSOs and DSOs, which are united by their commitment to close collaboration with respect to the TSO – DSO interface and data management: Thus, work on criteria for the data management models has yet to be undertaken.

The **cooperation process between TSOs and DSOs**, supported by the European Commission, which led to this joint work, is described in Appendix 2.

A dedicated TSO – DSO data management Project Team (short: Project Team) composed of experts from CEDEC, EDSO for smart grids, ENTSO-E, EURELECTRIC and GEODE has realised this report (see Appendix 4), which has formally been approved by all participating associations and submitted to the European Commission while being shared with a broader audience through publication.

2 OBJECTIVES OF THE WORK

The Project Team's work was organised around two objectives

A **first objective** was to agree upon a common terminology for the concepts discussed by all participants. It was identified as a prime objective that experts have a common understanding of the concepts discussed in their debates. Inter alia, the EFET/ebIX/ENTSO-E Harmonised Role Model¹⁾ and the results of the EvolvDSO²⁾ project were to be used as input for the discussions, which should be based on roles and responsibilities instead of specific parties like TSOs and DSOs.

A **second objective** was to reach a common understanding of data needs that come from (certain) roles and

responsibilities (especially those generally allocated to TSOs and/or DSOs). This was identified as a critical building block for more advanced discussions on data management. Regarding models of data management across Europe, different models are being built within the energy system in Europe in response to different local conditions. TSOs and DSOs believe that in the longer term, a more harmonised solution should be targeted, based on key principles shared at a European level.

TSOs and DSOs recognised the need to first discuss and agree upon common principles for data management in general, instead of getting directly into specific data management solutions. Therefore, this report proposes some key messages, but discussion on precise data models is still an open issue.

1) The Harmonised Role Model is mutual work between ENTSO-E, EFET and ebIX and can be found [here](#).

2) The relevant results of the EvolvDSO project can be found [here](#).



3 APPROACH USED

The Project Team based their work on an agreed-upon working plan and held four physical meetings. This working plan focused on four core questions. For each question, materials and contributions from TSOs and DSOs have been shared and discussed to extract common views.

A. AGREE UPON COMMON DEFINITIONS AS A FIRST STEP

TSOs and DSOs aimed at establishing a common understanding of terms related to data management. The work on this topic resulted in a set of definitions and can be found in Appendix 3 of this report.

The Project Team shared ideas on a so-called data life cycle, which in a generic sense describes the overall process of data management from data creation to data use for decision or publication. This process is described in chapter 4.

B. WHAT ARE THE CONTEXT AND OBJECTIVES OF DATA MANAGEMENT?

The objective of collecting, exchanging and using data and information is to enable the performance of roles and subsequent tasks in the electricity system and market. Therefore, TSOs and DSOs initiated work on sharing definitions and descriptions of the main roles and subsequent tasks in the electricity system and market. The objective is to associate data needs with a specific role rather than a specific party to focus on data management questions and avoid creating a data management model that only works with a static governance framework.

The work of the Project Team has been inspired by two preceding reports, namely the Harmonised Role Model established by EFET/ebIX/ENTSO-E (this document is already used in some standardisation processes and shared among Member States, mainly on the TSO level) and the EvolvDSO project (this research and development project introduces prospective roles related to distribution grid operation and market facilitation), as mentioned in chapter 1.

It was agreed that arriving at a common role model is necessary because it will create transparency and consistency for market parties in setting up their interaction with TSOs and DSOs.

The advantage of such an approach was recognised as being that the definition of data exchange between roles is independent of how roles are assigned to parties. The market model is defined by assigning different roles to market parties, TSOs and DSOs or new regulated entities. This role allocation can differ between Member States.

Such an approach would also facilitate the work of European standardisation organisations (ESOs) and other specialised associations to come to the required role-based standards (ICT, data), if those standards are not available today.

Defining and agreeing on a common role model, however, require deep understanding and agreement of electricity system functioning and market design in each Member State, and such work requires more time and expertise on the different processes.



C. WHAT ARE THE KEY PRINCIPLES FOR DATA MANAGEMENT?

Based on these questions and following the discussions between TSOs and DSOs, the Project Team focused on defining shared key principles on data management in general, data management models, rules for access and collection, and principles related to format, protocol and

channels and related to security and confidentiality. These key principles are summarised in chapter 4 of this report: They give a top-down approach and a generic view on data management, complemented by the bottom-up approach given by the use cases in chapter 5.

D. WHAT ARE THE NEEDS AND USES FOR THE DATA?

The Project Team has studied relevant and illustrative use cases that clarify data management and data exchange between TSOs and DSOs in the overall context of the energy transition. These use cases are related to different processes of the electricity system and market and are relevant examples for the definition of data exchanges on the TSO – DSO interface.

The Project Team prioritised the following five use cases:

- ❖ Congestion management
- ❖ Balancing
- ❖ Use of flexibility
- ❖ Real-time control and supervision; and
- ❖ Network planning.

The use cases were elaborated in five subgroups (with participants from both TSOs and DSOs in each subgroup). To come to comparable results, a specifically developed use case template was used by all five groups.

TSOs and DSOs worked together on these five use cases to describe non-exhaustive examples of use cases-related processes to outline the main data that need to be exchanged between the involved roles. This work led the group to relevant conclusions on data management for each use case, without, however, concluding on roles and responsibilities of the different entities. These conclusions contributed to building the key principles and recommendations of this report. These deducted key messages are described in chapter 5. The use cases, which consist of high-level descriptions of the five relevant processes, should be the basis for further work and elaboration in close TSO – DSO cooperation.

Based on the key principles in chapter 4 and results presented in chapter 5, TSOs and DSOs formulated recommendations for the European Commission in chapter 6.

TSOs and DSOs aimed at establishing shared and agreed messages, but they also stated their different views with corresponding reasoning on those topics on which at this moment agreement was not possible.

4 KEY PRINCIPLES

4.1. GENERAL PRINCIPLES

From TSOs' and DSOs' point of view, the following principles should be applied when defining a data management model, particularly for the interface between TSOs and DSOs.

4.1.1. TSO AND DSO MISSION

TSOs and DSOs have different roles and responsibilities in different Member States as both neutral market facilitators and system managers. TSOs are responsible for transmission system security and for frequency control, congestion management and voltage support in transmission networks. As system managers, both TSOs and DSOs are responsible for the secure operation of their respective networks, which involves managing congestions and voltage levels of their grids (see also: [General Guidelines for reinforcing the cooperation between TSOs and DSOs](#)).

Furthermore, TSOs and DSOs should ensure operational security and economic efficiency. Thus, they should contribute to the formation of an integrated European energy market. They enable the energy transition and empower prosumers' contribution by ensuring transparency, confidentiality and neutrality in data management, no matter which data governance is established, to prosumers and market actors. TSOs and DSOs should contribute to the social welfare maximisation with a fair cost and benefit allocation.

4.1.2. ROLES AND RESPONSIBILITIES

Clear roles and responsibilities, defined at the European level and allocated to TSOs, DSOs and market parties at the national level, should be the basis for their mutual interactions. These mutual interactions (formalised in regulations and guidelines, market rules, and different contractual agreements) that will lead to business processes in which data are collected, processed, delivered and/or exchanged. In this specific context, the data exchange between TSOs and DSOs needs to be defined

because other approaches will lead to inconsistencies with market design. TSOs and DSOs remain of course responsible for the functioning of their respective grids, and the legal tasks they are obliged to fulfil; their roles and responsibilities should align with these legal tasks.

4.1.3. TSO AND DSO INTERACTION WITH MARKET PLAYERS

TSOs and DSOs, as regulated system operators, have to support neutral market functioning. DSOs facilitate the market by connecting parties to the distribution grid, enabling supplier switching, providing metering data from customers connected to the distribution grid (in most European countries), and providing the associated allocation and reconciliation services. TSOs facilitate the market by connecting parties to the transmission grid, providing metering data from parties connected to the transmission grid, managing the specific balancing and other ancillary services markets, and, in some European countries, also providing allocation and reconciliation services. With the contribution of market actors, TSOs design and operate the balancing market and are responsible for imbalance calculation and settlement in most European countries. TSOs also contribute to efficient allocation of interconnection capacities.

In line with the Third Package, both TSOs and DSOs have to ensure neutrality (appropriate level of independence, confidential data protection, fairness regarding different market actors) and a level playing field that enables new market parties to emerge. They should also guarantee commercial confidentiality for all actors so to facilitate competition.



The way TSO- and DSO-interaction with market players is implemented differs across Member States (decentralised or centralised solutions, or even other solutions). As for the emerging data management models, we see different options across the EU too: In some countries, data hubs are ran by the TSO, in some by the DSO, in some by both, and in some even by a third party under regulatory supervision (new or joint venture of TSOs and DSOs). Data exchanged via the TSO – DSO interface, however, should support interaction from TSOs and DSOs with the market in their current and future roles and responsibilities.

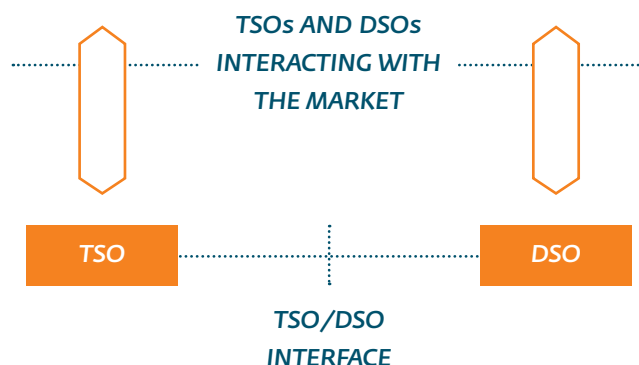


Figure 1: Interaction between TSO, DSO and the market

4.1.4. FLEXIBILITY

With the empowerment of the customer and the growth of renewable energy sources and demand response, the role of flexibility increases and is more and more needed both on TSO and DSO grids. The activation of flexibility services will influence grid operation and balancing of the electricity system and should be used efficiently from both a technical and economical point of view. This will require a well-coordinated process between TSOs, DSOs and market parties. Coordination between TSOs and DSOs is of utmost importance to avoid system disturbances. Data exchanges between TSOs, DSOs and market parties are important to optimise the value customers can bring to different markets (use of flexibility by BRPs, balancing, congestion management, etc.).

Regarding grid operation, data exchanges should lead to an overall view of the grid state and allow TSOs and DSOs to perform the most efficient actions, with respective required timeframes that could be very close to real-time.

Regarding markets, the different market mechanisms need to be coordinated to guarantee four key points.

1. Let a market participant offer its flexibility services for different purposes (e.g., portfolio optimisation, congestion management, and system balancing) on equal terms for all providers of flexibility, independent of the grid they are connected to (transmission and distribution).
2. Ensure that the flexibility offered will be used based on market principles.
3. Ensure that the firmness of the offers of all flexibilities is guaranteed: Flexibility can be offered for different purposes, but should be only used once in any timeframe.
4. Measure, calculate and allocate the activated flexibility to the relevant market parties.

Solving these key issues depends on well-designed processes and data exchanges between the relevant parties (TSOs, DSOs and market parties).

Coordination between TSOs and DSOs is necessary to efficiently deal with the interaction between different use options for flexibility, to ensure the optimal utilisation of flexibility services and to avoid counterproductive behaviour.

4.1.5. RELATIONSHIP TO CONNECTED GRID USERS

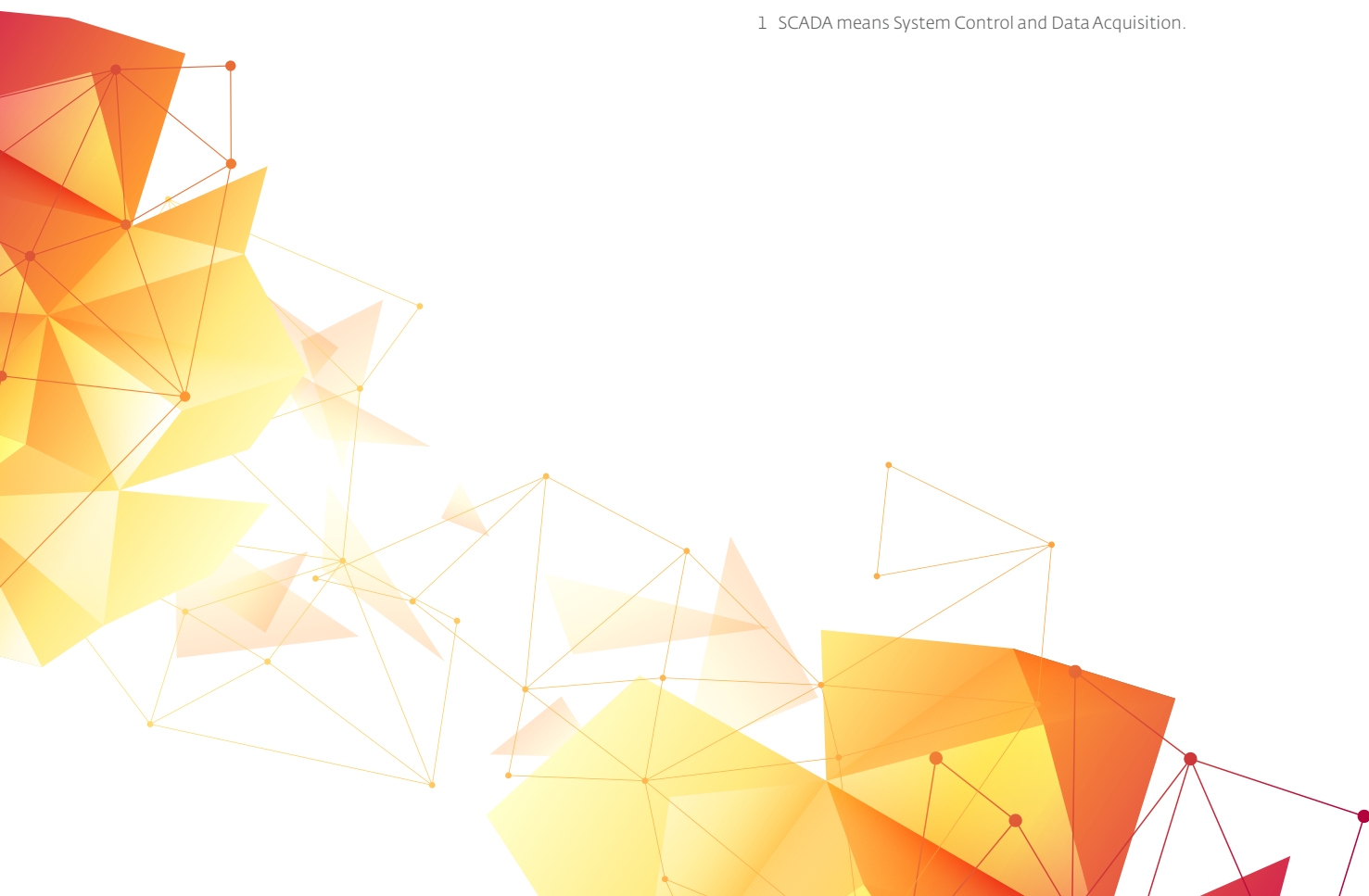
Regarding grid operation data needs, TSOs and DSOs should be able to access data from users connected to their grid (generators, consumers, storage, etc.) and distribute it to those who need it, following their legal tasks and market design.

For TSOs to perform their legal tasks, they require data from a user connected to a distribution grid (when the data have a specific level of detail, a specific timeframe for delivery, etc.). When this data are linked to technical needs (e. g., fast reserve control) and acknowledged by the responsible NRA, TSOs should be able to receive that data with sufficient reliability and quality. It is the responsibility of the DSO to provide the TSO with the relevant data, in accordance with the task the TSO is assigned to perform (access to the relevant needed data is mandatory).

For example, implementation options can be:

1. TSOs could have access to the required data from a DSO-connected grid user through an aggregator or balance service provider. However, data integrity and visibility must be ensured for TSOs, DSOs and other market players;
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 SCADA¹⁾ systems. This would be relevant if the required data, or parts of this data, would also be used in DSO system management processes (not being the balancing process); and/or
3. For specific needs and under specific conditions discussed and agreed upon with DSOs, TSOs should be able to access this data through a direct technical solution of the TSO with DSO-connected grid users without transferring DSO metering responsibility (to avoid confusion for requiring DSO-connected grid users to have contracts with multiple system operators).

1 SCADA means System Control and Data Acquisition.



4.2. PRINCIPLES OF DATA MANAGEMENT

4.2.1. DATA MANAGEMENT

TSOs and DSOs formulated the following objectives related to data management:

- guarantee data privacy, data security, and communication security;
- increase transparency (particularly in joint TSO – DSO initiatives) regarding the different actors within the electricity system and market and towards national regulation authorities to ensure fairness of cost and benefit allocation;
- guarantee fair, equal access to the data and/or information in accordance with the legal mission of each party (eligibility, transparency, availability, required level of detail, availability delay, accuracy, and data quality);
- deliver non-discriminatory processing and preserving integrity of the data;
- target simplicity in supporting existing and new business models and processes and robustness;
- support competition;
- offer proven cost efficiency, as accepted by the National Regulatory Authority (NRA);
- strive for European harmonised standards when applicable and efficient, and at least on the national level if European ones are not reachable; and
- facilitate innovation by opening, as much as possible and legally allowed, access to the data (this should be incentivised by regulation).

The party or parties responsible for data management must ensure neutrality (independence, confidential data protection, and with respect to different market actors). In any case, the role must be subject to regulatory oversight. Furthermore, the data management model should support a level playing field enabling new market parties to emerge and support all electricity system and market actors in their missions. TSOs and DSOs believe that no one-size-fits-all model is applicable in all European countries, but that common principles have to be set on a European level, providing a framework to the different

models in Europe. The information exchange following the data management model implemented in each Member State should be evaluated, possibly by the NRA, based on relevant principles including those mentioned above.

4.2.2. DATA MANAGEMENT MODEL

Data management model refers to the framework of roles and responsibilities assigned to any party within the electricity system and market and the subsequent duties related to data collection, processing, delivery, exchanges, publishing and access.

If the roles and responsibilities as laid down in the market model change, the data management model between TSOs and DSOs should be adapted accordingly.

The main types of data, classified by timeframe, that have to be collected are:

Planning data (declared):

- Forecasts;
- Scheduled data; and
- Master data (contractual), declarations.

Measured data (certified):

- Real-time measurements; and
- Ex-post measurements: metered data.

TSOs have the view that the data management model should not necessarily follow the metering data governance. Indeed, the data management model and the rules for data exchanges could be different depending on the data type.

DSOs are of the opinion that it could be efficient to combine data collection for grid management (e.g., via SCADA) with the data collection by the metering point operator (MPO) on smart meter data, because DSOs seek a coordinated implementation of the data management model. Some DSOs already exchange data from SCADA systems with market parties (e.g., aggregators) and TSOs. Moreover, data collected from meters by meter operators must also be used for grid operation and planning.

Cost efficiency and effectiveness of the different data management models must be assessed for each national context under the condition to meet reliability, safety and security standards. Furthermore, technological decisions need to be transparent (e.g., which customers are equipped with smart meters, when and by whom) for regulated missions.

4.2.3. DATA COLLECTION AND ACCESS

All parties performing a regulated task should have access to the data and/or information needed for that task at the appropriate level of detail according to the respective processes, while respecting data privacy. Permission of the data owner, however, is required for any commercial task. Thus, clarity is needed about roles and responsibilities of each party to grant access to data. Defined roles and responsibilities approved by NRAs will set the level of detail needed for the delivered data.

Aggregated data at the interface between the TSO and DSO grid could be used when sufficient, but detailed data could also be required depending on the role to be performed and for which task these data are required. For example, TSOs might need information on consumption and generation flows at the physical interfaces between

TSO and DSO, with detail on the generation type. In some countries, TSOs might need detailed information on grid users to control the performance of a flexibility offer. Equally, DSOs might need geographically differentiated information on planned loads, directly from BRPs or via TSOs, to validate the available grid capacity before the market can be cleared and to evaluate the necessity of requesting flexibility for congestion management on distribution grids. On the other hand, TSOs and DSOs also need relevant and required data from market parties. The timeframe for receiving data is important because the need of real-time and near real-time data will increase.

Data collection should also avoid multiplication of metering systems by providing fair access to data and/or information to any, by its role, mandated party.

The different steps of a data life cycle defined in chapter 5.2 (data collection, data processing, data analysis, etc.) could be performed by different actors.

From TSOs' and DSOs' points of view, the one who collects the data is not per definition the one who manages access to it. However, data collection, for other than a regulated task, can only be done with permission of the data owner, and data management is done according to consent of the data owner.

4.3. PRINCIPLES OF FORMAT, PROTOCOLS AND CHANNELS FOR DATA EXCHANGE

While respecting national requirements, data exchanges should be based as much as possible on existing communication formats, standards and protocols. Furthermore, European harmonisation should be strived for when applicable and efficient.

However, where this is not possible, Member States should at least strive for standardisation on the national level. TSOs and DSOs should mutually agree on technical data models, data formats and communication protocols for exchanging data and/or information. These principles are fully consistent with the need for a coherent design of the architecture of IT and data exchange interfaces within a TSO's control area (and can even go beyond the control area and include several TSOs). This architecture of IT and

data exchange interfaces should encompass all DSOs in a TSO control area, although this does not necessarily imply that all DSOs (independent of their size and network level) will have a direct interface to the respective TSO.

As a consequence of this increasing data exchange, TSOs' and DSOs' IT systems will be more vulnerable to external threats. This threat should be addressed seriously, and TSOs and DSOs should therefore be strongly involved in cyber security.

5. USE CASES – MAIN OUTCOME

5.1 USE CASES

The Project Team has been working on five use cases (see Appendix 1) that are relevant for data management. The objective was to study illustrative processes of the electricity system and market in which the interaction of TSOs and DSOs is of interest.

To ensure an efficient and secure functioning of the grid and efficient market facilitation, effective and efficient coordination regarding data management between TSOs and DSOs is key. It requires:

- Clear roles and responsibilities to be defined in the market design, taking into account all interactions (e.g., interactions between balancing and congestion management); and
- efficient and reliable data exchanges between TSOs and DSOs arising from this coordination that.

It is important to recognise the energy system as one complete system instead of several separate systems like TSO grids, DSO grids, etc. When looking at the system as a whole, it is clear that all parties involved should work together in achieving a safe and reliable electricity system and social welfare optimisation via regulatory oversight. This cooperation, with the process of discussions among TSOs and DSOs, has started well, but needs further work.

5.1.1 CONGESTION MANAGEMENT

Being a local phenomenon, congestion management is something TSOs and DSOs are responsible for from an operational point of view and for their respective grids. Since the energy system is becoming more complex as a result of more decentralised and renewable generation, congestions might happen more frequently. Congestion management processes (ahead of real-time and in real-time) in operation are thus expected to evolve, inter alia because distributed resources increase both the possibility of congestion and their possible remedies.

System operators might be able to timely avoid or solve congestions in their own perimeter of responsibility (by changing their grid topology, or through an action from market players connected to their grid), but in doing so, they also might need to cooperate with other system operators and market parties to find remedies. It should be ensured that each system operator can fulfil its legal duties when it comes to the responsibility for its own grid.

To deal with congestions properly, the following key aspects need to be taken into account.

- To ensure safe and reliable operation at all levels, information and data exchanges between system operators in all relevant timeframes (network planning, operational planning and scheduling, real-time) should be enhanced. This requires a coherent design of the architecture of IT and data exchange interfaces within a TSO's control area (and can even go beyond the control area and include several TSOs). The architecture of IT and data exchange interfaces should encompass all DSOs in a TSO control area, although this does not necessarily imply that all DSOs (independent of their size and network level) will have a direct interface to the respective TSO.
- It should be ensured that each system operator has sufficient data, both structural, market-related and in real time, on its observability area¹⁾ needed to maintain safe operation when it comes to congestions.

1) Each system operator is responsible for its own grid, also called "responsibility area". To operate this grid properly, it is important to also know what is happening in part of the surrounding grids. The responsibility area together with this part of surrounding grids that can affect the responsibility area is called the "observability area".

- System operators should have the necessary information and data to check whether certain flexibility bids, when activated, could create congestions in their grid. Furthermore, if a flexibility bid could indeed create congestion, the respective system operator needs to have the ability to provide the necessary information, define limits for or prevent bids activation in areas that will lead to grid constraints¹⁾.

TSOs and DSOs should discuss further how to deal with these issues on a practical level. DSOs are concerned about possible misalignment of actions between TSOs and DSOs and also between other market players in some cases that could lead to a loss of control of the distribution grid and drive inefficient grid expansion. At the same time, TSOs are concerned about their ability to perform efficient balancing of the overall electricity system, ensuring security of supply and fair market functioning. With the increasing amount of (renewable) generation facilities in distribution networks, both TSOs and DSOs would like to unlock as much of the potential of these distributed resources as technically possible.

The key intertwined questions follow.

- How can TSOs maintain good practice in balancing the overall system, also with reserves on the distribution grid and without endangering market functioning?
- How can DSOs maintain control over the load and power quality of their distribution grids to avoid or mitigate congestions in their distribution grids in the required timeframe?
- How can the regulatory framework evolve to ensure that the use of flexibility does not jeopardise system stability?

5.1.2 BALANCING

According to the draft network code on electricity balancing, balancing means all actions and processes in all timeframes through which TSOs ensure, in a continuous way, to maintain the system frequency within a predefined stability range and comply with the amount of reserves needed. Balancing is performed by the TSOs at a larger

scale to mutualise outage risks and variability (especially of RES), reduce the overall need of reserve and optimise balancing energy allocation.

With the growth of generation in the distribution networks and the empowerment of consumers through markets and technology, distribution grid users constitute a substantial source of flexibility that can benefit the power system, both at a local and system scale. These sites can be aggregated in pools by aggregators, which in turn will increase the need for further management of local networks by DSOs.

The participation of these new assets in the balancing market requires the supervision of DSOs and their further involvement in the balancing process and an extended exchange of information between operators to ensure safe grid operation.

Flexibility activation can cause congestions (active power and voltage) within a connecting grid, as well as unnecessary curtailment of distributed generation. To prevent these congestions, the connecting system operator should supervise the process, having, at least and according to its own evaluation, the possibility to assess the prospective impact on the grid and potentially limit the flexibility activations at different timeframes.

A general principle should be that actions of TSOs and DSOs can affect connecting grids, which should be taken into account.

- DSOs should receive relevant data that allows them to assess the impact of activation of balancing services and other flexibilities on their grid at different timeframes (e. g, within the prequalification and day-ahead process, balancing market gate closure time, etc.), supervise the effect on their grid, and set the necessary predefined limits before activation. If potential constraints are identified, DSOs need to be able to make the aggregator/BRP/TSO aware of the potential impact, and additional measures shall be decided. This could be supported by coherent design of the architecture of IT and data exchange interfaces encompassing all DSOs within a TSO's control area.

¹⁾ This usually involves compensation questions, which are beyond the scope of this discussion

- Exchanges of information between TSOs and DSOs should be reinforced, taking the increased need for cooperation into consideration, e.g., the non-exhaustive list:
 - Product;
 - Maximum/minimum upwards/downwards flexibility amount (kW) delivered for each relevant balancing period of the day;
 - Location (connection point);
 - Depending on the level of capacity/assets size, extra information is required.
 - Offers (amount of flexibility offered, assets portfolio, etc.);
 - Activated offers; and
 - Limits needed by the DSO.

From DSOs' points of view, some balancing actions could be devolved to them to procure balancing services on their networks to support the TSOs as a subsidiary activity. This could help manage the impact of distribution generation within specific parameters as set out by the TSO. This assures the TSO that balancing interventions are occurring on the DSO network without the TSO needing to check with the DSO every time a balancing action is needed on the DSO network.

TSOs, on the other hand, believe that balancing should be managed on a wider scale because local balancing cannot ensure overall optimisation of the system balancing. Indeed, some areas are structurally unbalanced (industrial areas with a lot of consumption, rural areas with a lot of renewables, etc.). The electricity grid aims to optimise the use of energy resources on a wide area by combining the differences of local territories in the best way. Thus, balancing should be performed on a wide scale by the TSOs, which are the only ones with an overall overview of the system state and frequency.

Flexibility connected to the distribution grid could of course contribute to system balance, and then efficient data exchanges, IT interface operability and market design should ensure that interferences with congestion management are dealt with and under control.

5.1.3 FLEXIBILITY

Flexibility is used for different purposes (e.g., portfolio optimisation, congestion management, and system balancing) and is thus related to other use cases. Uses for flexibility in the future system can be grouped into three main categories.

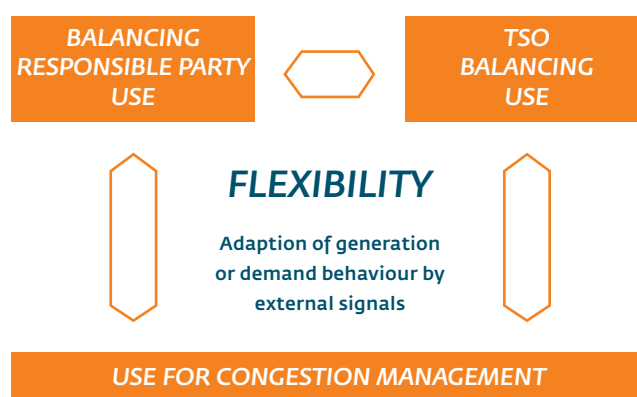


Figure 2: Flexibility use

Against this background, some key aspects of flexibility were identified which should be taken into account.

- **Transparency to the market players** meaning that system operators should work together in clarifying what their respective flexibility needs are in the long term, thereby avoiding gaming, and what thresholds might exist in their grids that are limiting the use of flexibility potentials that exist in single installations or that are based on limitations in distribution grids in case of flexibility activation via aggregation of multiple installations. (This transparency could take the form of statistical values and information instead of raw data, as is already the case in all TSO congestion management and especially all market coupling.)
- **Coordination between TSOs and DSOs**
 - Using distributed flexibility will require extensive cooperation and clear boundaries between TSOs' and DSOs' rights and duties.
 - System operators can use flexibility to manage their grids (responsibility area), but they also need data from part of the connecting grids (observability area) to manage the grid properly, taking into account that the market works as freely as possible.

• Coordination of flexibility options

- Flexibility can be used for different purposes and by different parties:
 - TSO for balancing (power balance for frequency control);
 - TSO and DSO for congestion management;
 - TSO and DSO for power quality control; and
 - BRP for portfolio balancing (energy balance).

Therefore, a coordination process is needed to ensure that a flexibility bid can only be activated once and will not cause problems in either the grid they are connected to or in grids that might be influenced (see also congestion management). Flexibility options on the one hand affect TSOs and DSOs, but on the other hand even more directly affect the generators, customers and loads, prosumers

and storage operators, suppliers and aggregators that offer them. Those parties thus need to have access to and benefit from certain data being exchanged between TSOs and DSOs, and they own certain data that are being exchanged. This shows yet another advantage of a coherent architecture of IT and data exchange interfaces encompassing all DSOs within a TSO's control area: It lends itself easily to access and partial control by customers, generators, prosumers, storage operators, suppliers and aggregators.

Aggregators can play a major role in unlocking flexibility and will play a growing role in the market. The regulatory framework and subsequent data management model should support data exchange needed for such a development, foreseeing the needs of TSOs and DSOs to receive relevant information.

5.1.4. REAL-TIME CONTROL AND SUPERVISION

European TSOs and DSOs perform real-time control and supervision to benefit the European electricity system. SCADA systems and control centres of the grid and system operators are a prerequisite to provide this service and turning this use case into reality. Thus, the regulatory framework should encompass the costs of SCADA systems and TSO – DSO data interfaces.

It is essential that each system operator (both TSO and DSO) is responsible for its own IT systems and data communication networks. Since these IT systems and communication networks are of vital importance for maintaining the security of supply for customers and society as a whole, it is up to the system operator (both TSO and DSO) to organise it as long as the highest security of supply standards (defined by the NRA) is guaranteed.

- Generally, each system operator should be responsible for directly collecting data from users connected to its grid (generators, consumers, storage, etc.). Cascading systems/energy information systems or SCADA systems can be used for this and to forward information based on this data to TSOs and/or DSOs. TSOs, in order to perform their legal tasks, need data with a specific level of detail, specific timeframe for delivery, etc., linked to technical needs (e.g., fast reserve control) and acknowledged by NRAs. They should meet this need either via a technical cooperation with the DSO

or by setting up a direct technical solution with DSO-connected grid users without transferring the metering responsibility.

- When taking into account the cascading principle, it seems logical that relevant data from distributed generation and other users is being channelled from distribution network users to the connecting DSO and TSO through the DSO control centre(s). SCADA systems could support the TSO and DSO in the acquisition of relevant data from third parties.
- Starting at the Member State level, TSOs and DSOs should mutually agree on data management models, data format and communication protocols for these data exchanges. If beneficial to society, this harmonisation should be on the European level.
- TSOs and DSOs should proactively develop the TSO – DSO interface to support data acquisition and data exchange between grid operators in real-time for market parties to perform better portfolio optimisation and therefore facilitate the integration of RES and customer connections.

5.1.5 NETWORK PLANNING

Network planning comprises both long-term network development (from one year ahead and onwards) and operational planning (from hour ahead to year ahead). Both long-term network development planning and operational planning require cooperation and exchange of data between TSOs and DSOs.

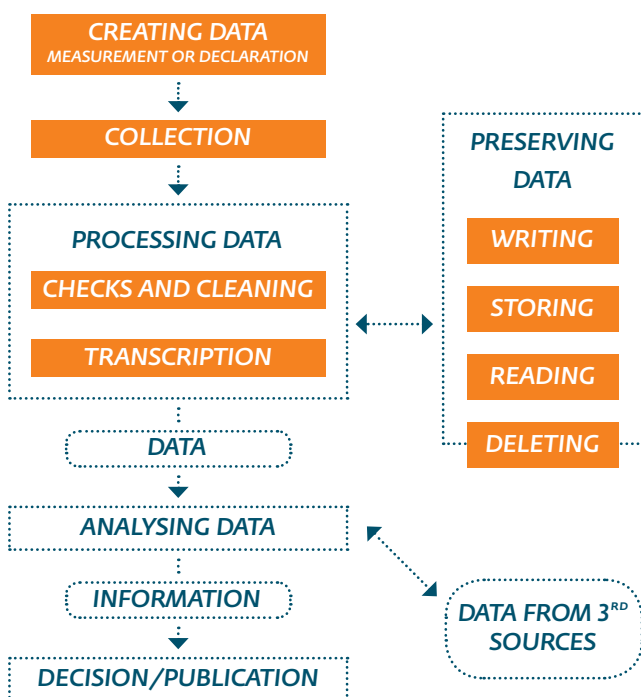
- TSOs and DSOs should work towards common assumptions for planning purposes (e.g., economic growth, resilience and national carbon reduction plans, etc.) and common parameters for planning methodology (e.g., definition of connection requirements from grid users, simplified electrical grid models, etc.).
- Information exchange between TSOs and DSOs supporting long-term network development process could

include simplified electrical grid models, including foreseen and planned grid expansion projects as well as annual demand/generation forecasts per physical TSO – DSO interface.

- Information exchange between TSOs and DSOs supporting operational planning could include, as long as it respects confidentiality issues, the year-ahead availability plan, outages and business continuity/emergency plans and information related to upfront activities for operational security analysis. Also periodically, demand/generation forecasts on the TSO – DSO interface could be exchanged and/or published, which also would facilitate integration of RES and new customer connections. The periodicity of these forecasts exchanges could evolve over time.

5.2 DATA LIFE CYCLE

TSOs and DSOs shared their views on a so-called data life cycle, defining the different steps of data management. This data life cycle provides an overall view of different actions that can be performed on the data, from data creation until final data use for decision or publication. The data life cycle is defined in the scheme below.



Measurement: Value that can be read from a (calibrated) measuring instrument

Declaration: Declaration by the concerned party (result of a decision, forecast...). Schedules, contractual information, load forecast, etc.

Collection: Actual reading of measuring instruments by physical inspection or remotely.

Checks and cleaning: No raw data is considered "correct" per se; it is therefore checked and cleaned/corrected when necessary (this act is documented).

Transcription: Change in format to provide, for instance, standardised data.

Analysing data: Could include data aggregation to the appropriate granularity and data interpretation.

Figure 3: Data life cycle

For each process of the electricity system and market within each specific regulatory context, the interface between TSO and DSO can be set differently in this chart, depending on the roles and responsibilities allocated to each party.

6. RECOMMENDATIONS

This chapter proposes recommendations based on the previous chapters and are refined further at the request of the European Commission (EC). It highlights what the European Commission should include in its legislative proposals (6.1) and what has to be done through cooperation of TSOs and DSOs (6.2).

The Project Team considers that high level principles regarding data exchange and a common definition of roles and responsibilities have to be ensured at the European level; a framework, to put it simply, within which different models can exist while taking stock of national specificities. Data exchange must deliver benefits to the customer, support efficient market functioning and enhance the security of supply. In its upcoming legislation, the EC should thus promote data management and data exchange between TSOs and DSOs in particular to ensure an efficient functioning of the market and a level playing field, enabling new market parties to emerge, as well as supporting all electricity system and market actors in their missions. TSOs and DSOs should provide data to the markets securing neutrality, privacy and adequate data quality across the market.

As the increasing deployment of RES and the roll-out of smart meters will make sound data management for power more urgent, the appropriate framework has to be developed with no delay. In the process, and through co-creation, TSOs, DSOs, and other stakeholders will help shaping the Commission's proposals with their technical knowledge on opportunities and limits on the ground.

As a next step, TSOs and DSOs will engage with the Commission and make the recommendations in this report more detailed and concrete once the Commission has clarified further the options being considered in the frame of data management for the upcoming legislative measures.

6.1. RECOMMENDATIONS FOR LEGISLATION

The starting point: An integrated electricity system approach

It is essential that the TSO – DSO cooperation and policymaker proposals are based on an integrated electricity system approach. Only such an approach can ensure that customer welfare at large is ensured and maximised.

Well-managed transmission and distribution grids are an essential prerequisite for system operation.

The increase of decentralised sources, however, has several consequences:

- **The flexibility potential will increasingly come on the DSO grid.**
- **The need for flexibility increases for the purpose of:**
 - preventing and solving congestions (both on the transmission level and the distribution level, including the local level);
 - ensuring system balance to manage challenges from the changing generation mix; and
 - ensuring power quality.

It is essential that TSOs and DSOs agree on mutual processes and data exchanges to guarantee a reliable and an efficient and affordable operation of the electricity system and grid, and to guarantee non-discriminatory and efficient market operation. A corresponding regulatory framework has to be designed and implemented by NRAs.

RECOMMENDATION 1:

DATA EXCHANGE HAS TO SUPPORT EFFICIENT MARKET FUNCTIONING

In the electricity system and market, many data exchanges are needed between the different players. When looking at TSO – DSO data exchange, the focus should also ensure that data interaction of TSOs and DSOs with market parties (data needs and deliveries) should be ensured. The way of implementation, however, may differ per Member State, as within Europe different options for facilitating the market exist.

In its forthcoming legislation, the EC should clearly state that data management and data exchange in general, and between TSOs and DSOs in particular, should support efficient functioning of the market and a level playing field enabling new market parties to emerge as well as support all electricity system and market actors in their missions.

RECOMMENDATION 2:

FOCUS ON SERVICES RATHER THAN ON PLATFORMS

The actual exchange of data between parties is executed via ICT-based services. We recommend the EC communicate in its forthcoming regulation more in terms of (data exchange) services rather than in terms of data coming from platforms. For proper market functioning, well-defined (data exchange) services from TSOs and DSOs are essential, independent from the question of which systems/platforms they are offered and how the governance related to these systems/platforms is organised.

Making a clear distinction between services and platforms enables TSOs and DSOs to firstly focus on which (data exchange) services should be offered to the market and to system operations to function, and, secondly, to focus on how to harmonise their platforms (including governance), easing the data exchange between TSOs and DSOs (the publication of their service catalogues is also a task for TSOs and DSOs as explained in 6.2.).

RECOMMENDATION 3:

ESTABLISH THIRD-PARTY ACCESS TO DATA

To improve the internal energy market functioning, data access should be granted to all parties who need it, subject to customer consent in the case of commercial activities (the customer is the owner of its own data) and to TSOs and DSOs based on these parties' legal tasks. This means that, **at the European level**, TSOs and DSOs should be given the right to access all data needed so they can perform their tasks. The relevant European legislation should also include 'third-party access to data', enabling other players to access all the data relevant to their activities. Moreover, the EC should have a clear policy on data privacy.

Individual customers should be able to control (by themselves) which commercial market party/parties should be granted access to their data. Granting access should be organised in an efficient and customer-friendly way to ensure that the customers can easily give their consent.

The level of granularity for the different data exchanges depends not only on the task to be performed and the consent given, but also on the market rules.



RECOMMENDATION 4:

PARTY OR PARTIES RESPONSIBLE FOR DATA MANAGEMENT MUST BE NEUTRAL

Party or parties responsible for data management will gain importance in time, since the relevance of data and the amount of data exchanged will increase.

So, at the European level, European legislation should clearly state that the party or parties responsible for data

management must ensure independence, confidential data protection, high quality, and neutrality with respect to different market actors. In any case, the role must be subject to regulatory oversight.

RECOMMENDATION 5:

STANDARDISATION OF TSO – DSO DATA EXCHANGE IS NEEDED

Increased importance and amount of data will require more standardisation of formats.

First, at the national level, TSOs and DSOs should agree on a harmonised set of relevant data formats and protocols to exchange information.

In the longer term, TSOs and DSOs should promote further harmonisation of all electricity data formats at the EU level, closely involving market parties and regulators.

The cost of a potential transition to new data formats and protocols should be recognised by the NRA and recovered in a timely manner.

RECOMMENDATION 6:

USE FLEXIBILITY ACCORDING TO MARKET RULES WHILE SINGLING OUT SYSTEM RISKS

It is key that flexibility be allocated optimally and in the most efficient way (social welfare maximisation, security of supply).

Market participants (the customers themselves, or via an intermediary such as a supplier or an independent demand response operator) should be able to offer flexible services for different purposes (e.g. portfolio optimisa-

tion, congestion management and system balancing), on equal terms for all providers of flexibility, independent of the grid they are connected to (transmission or distribution). The EC should include this point in its forthcoming legislation



RECOMMENDATION 7:

AVOID HARMFUL INTERFERENCES BETWEEN CONGESTION MANAGEMENT AND BALANCING

Coordination between TSOs and DSOs is necessary to efficiently deal with the interaction between different use options for flexibility, to ensure the optimal utilisation of flexibility services and to avoid counterproductive behaviour. Solving these key issues depends on well-designed processes and data exchanges between the relevant parties (TSOs, DSOs and market parties).

At the European level, a new article on general principles of congestion management for distribution grids should be added to the relevant legislation. This article could be inspired by a similar article targeting TSOs, article 16 in regulation 714/2009 EC ('General principles of congestion management') and adapted to fit DSOs.

This new article should take into account that several ways could exist to solve local congestion, market-based or not market-based, and ensure that:

- Flexibility can be offered for different purposes, but can only be used once in any timeframe.
- The quality of BRPs' forecasts are improved, including locational aspects of their prognosis and avoiding gaming, to facilitate the day-ahead and intraday processes and avoid interferences between congestion management and balancing.
- TSOs can perform an efficient balancing based on market principles while allowing DSOs to assess the impact of the activation of balancing services on their grid at different timeframes and set the necessary predefined limits before activation.
- TSOs and DSOs can perform congestion management, while ensuring no harmful interference with system balancing by the TSOs or with congestion management of any other System Operator.

- The process supports fair market functioning.
- TSOs and DSOs should be responsible for qualifying, certifying and validating the execution of the flexibility services contracted. For the purposes of the prequalification processes of involved flexibility resources for Frequency Containment Reserve (FCR), Frequency Restoration Reserves (FRR) and Replacement Reserve (RR), each TSO must develop and specify, in an agreement with its reserve connecting DSOs, the terms of the exchange of information required for these prequalification processes for reserve providing units or groups located in the distribution networks and the delivery of active power reserves.
- Furthermore, based on technical reasons affecting security of supply on their system, such as geographical location of flexibility providers, TSOs and DSOs should also be able to set limits to or exclude the delivery of flexibility services.

The above-described processes require a coherent design of the architecture of IT and data exchange interfaces within a TSO's control area (and can even go beyond the control area and include several TSOs). Such an IT architecture should be developed in common by TSO and DSO, for example, within the framework of a future piece of legislation on distributed flexibility. This architecture of IT and data exchange interfaces should encompass all DSOs in a TSO control area. This could also include cross-border data exchange interfaces.

There is a need to identify cost efficient solutions for the IT architecture, to control costs and to cover the costs of change in a timely manner.

RECOMMENDATION 8:

ENSURE DATA ACCESS FOR TSOs RELATED TO USERS CONNECTED TO THE DISTRIBUTION GRID

The different data access options listed below should be recognised. TSOs should specify their data needs related to their respective roles, and an agreement should be reached between TSOs, DSOs and NRAs.

Regarding grid operation data needs, each System Operator should be able to access data from users connected to its grid (generators, consumers, storage, etc.) and distribute it to those who need it, following their legal tasks and market design.

In case TSOs, in order to perform their legal tasks, require data from a user connected to a distribution grid (when the data has a specific level of detail, a specific timeframe for delivery etc.), and when this data is linked to technical needs or specific products (e.g. fast reserve control, Load-Frequency Control (LFC), automatic Frequency Restoration Reserves (aFRR)) and acknowledged by the responsible NRA, TSOs should be able to receive that data with sufficient granularity, reliability and quality. It is the responsibility of the DSO to provide the TSO with the relevant data, in accordance to the task the TSO is assigned to perform (access to the relevant needed data is mandatory). For example, implementation options could include:

1. TSOs could have access to the required data from a DSO-connected grid user through an aggregator or balance service provider. However, data integrity and visibility must be ensured for TSOs, DSOs and other market players.
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. This would be relevant if the required data, or parts of this data, would also be used in DSO system management processes (not being the balancing process).
3. For specific needs and under specific conditions, discussed and agreed upon with DSOs, TSOs should be able to have access to this data through a direct technical solution of the TSO with DSO-connected grid users, without transferring the DSO metering responsibility (to avoid confusion for DSO-connected grid users to have contracts with multiple System Operators).

The data collection should also avoid the multiplication of metering systems by providing fair access to data and/or information to any mandated party in accordance with its legal role.



6.2. TASKS FOR TSOs AND DSOs

While refining the recommendations section of the TSO – DSO data management report, TSOs and DSOs recognised some specific tasks they should perform. TSOs and DSOs believe the European Commission should be aware of and support the tasks they set for themselves to complete in the future.

TASK 1:

DEVELOP A ROLE MODEL AT THE EUROPEAN LEVEL

Establishing an agreed-upon data management model and well-defined data exchanges between TSOs and DSOs requires clarity about roles and responsibilities. TSOs and DSOs should work on building a common, agreed-upon role model focussed on unlocking the full potential of distributed flexibility. This role model will form the basis for all future processes and data exchanges between TSOs, DSOs and market parties and will be the basis for data management models to be established. This role model should then be the reference at the European level.

TASK 2:

DATA EXCHANGE MUST SUPPORT EFFICIENT MARKET FUNCTIONING

TSOs and DSOs should publish a service catalogue describing the different services they provide on data exchanges, data delivery and transparency. Such a service catalogue will support NRAs to define their national regulatory framework accordingly and serve as a basis for market parties to develop their (new) business models.

TASK 3:

TSOs AND DSOs SHOULD CLEARLY EXPRESS THEIR NEEDS FOR FLEXIBILITY TO SUPPORT PRODUCT DEVELOPMENT

To be able to use specific products in their processes and efficiently deal with the interference between different purposes such as congestion management and balancing, TSOs and DSOs should clearly define specific flexibility needs for fulfilling their respective tasks and estimate the necessary volume of their services. Based on those needs, market parties should propose products with a clear and accurate description and the associated data.

TASK 4:

TSOs AND DSOs WILL FURTHER DEVELOP DATA PRIVACY AND SECURITY STANDARDS

As customers become more active, TSOs and DSOs will further develop data privacy and security standards in a cost-effective manner.

TASK 5:

THE LEVEL OF DATA GRANULARITY SHOULD BE DEFINED DEPENDING ON THE TASK

The defined roles and responsibilities approved by NRAs will set the level of detail needed for the delivered data. Aggregated data at the interface between the TSO- and DSO-grid could be used when sufficient, but detailed data could also be required depending on the role for which this data is needed.

TASK 6:

FURTHER WORK ON THE USE CASE BALANCING

TSOs and DSOs will work further on the identified diverging positions on specific topics in the use case balancing and try to converge their positions as much as possible.

The use cases (see Appendix 1) will be used as input for executing the above described tasks.

APPENDIX 1

DETAILED USE CASES



USE CASE – CONGESTION MANAGEMENT

BACKGROUND

Observability area for each System Operator: the portion of a grid operator's grid that affects flows in another operator's grid (cf. Art. 33, 34 and 40 System Operation Guideline). This concept is related to meshed grids (at low renewable energy (RES) levels) as grids connected radially only affect the connecting grid on the border (however, collective behaviour of multiple radial grids may have a system impact). Grids connected in a meshed way or with large-scale deployments of RES may affect connecting grids at more points.

To help determine where congestion management is needed, and the principles in this paper implemented, a minimum threshold size should be defined. This threshold size should consider not only the individual MW limits/size on the radial network but also define the system impact that requires compliance with these principles.

There are several methodologies to determine such thresholds. While any proposed methodology should be consistent with the guidelines and network codes, they also need to be cognisant of the long-term needs of the system to meet the multi-objective energy policy. These procedures should be regularly reviewed to ensure that this is maintained.

1. SCOPE

Measures of congestion management or remedial actions can be differentiated into three types: preventive, curative, reactive (i.e. restoration etc.). Under these three types of measures the following use cases should be analysed separately, considering the level of influence on the connecting network of another System Operator and on the process of balancing. The need for information exchanged is case-dependent:

- a) The responsible System Operator faces congestion (too much load, too much production in relation to the technical limitations etc.) in its own network, and the congestion can be solved by purely grid-related measures, e.g. reconfigurations of substations and switching actions like moving disconnection points etc., or by modifying the reactive power flows within the System Operator's network, e.g. change of reactive power behaviour of grid users or switching the shunt reactors or capacitors if the responsible System Operator is legally and technically able to do so, as long as these measures do not influence other System Operators' networks.
 - The responsible System Operator has no need to inform the other System Operators in any timeframe when such actions are applied.
 - In case a grid customer has to adapt its reactive power, operation and information exchange is needed between the responsible System Operator and the grid customer connected to its network, as well as the BRP, supplier, etc. if necessary.
 - If the settlement of a grid customer is affected, the entity or entities responsible for the settlement must be informed.
- b) The responsible System Operator faces a congestion in its own network and the congestion can be solved by changing the active power of grid users connected to its own network, if the responsible System Operator is legally and technically able to do so, and as long as these measures do not significantly influence other System Operators' networks:

- As this action impacts system balancing and/or the perimeter of BRPs, if the active power changes are made after the scheduling process, the responsibilities related to the counter-balancing of the active power modification must be clearly allocated. Depending on the applicable regulatory framework, such responsibilities and the implementation of the active power change may be allocated to the market party (e. g. BRP), to the responsible DSO or to the TSO.
 - In case the responsible System Operator is a DSO, there should be an information exchange between the responsible DSO and the TSO to inform of the change of active power.
 - In case the action taken has an impact on the ability to provide balancing, flexibility or other system services managed by the TSO, the TSO must be informed by the DSO or by the market party (e. g. BRP), depending on the regulatory framework. Such regulatory framework must clearly allocate the responsibilities of the impact on balancing, flexibility or the other system services affected.
 - Information exchange is needed between the responsible System Operator and the grid customer connected to its network as well as the market party, BRP, supplier, etc. to whose perimeter the installations that are influenced are assigned.
 - If the settlement of a grid customer is affected, the entity or entities responsible for the settlement must be informed.
- c) The responsible System Operator faces a congestion in its own network and the measures applied affect another System Operator or the measures to be applied modify the active or reactive power of a grid customer connected to the network of another System Operator, or by topological changes of one or more different System Operators if the System Operators are legally and technically able to do so:
- There must be cooperation with the other System Operators to apply the required measures in a coordinated manner. The affected System Operators should cooperate to try to find the globally most efficient solution for the system as a whole.
 - The coordination agreements must include all aspects related to information exchange and take into account the applicable regulatory framework affecting all System Operators. The agreements may imply that the responsible System Operator must inform the affected System Operators of his/her actions in case they are affected, ex-ante and/or ex-post depending on the agreement.
 - The coordination agreements may include establishing a certain desired value of flow of active/reactive power to be exchanged through a connection point between System Operators or between a System Operator and a grid user for a given timeframe in absolute value or compared to the current situation/schedule or the change of active power of grid users connected to another System Operator.
 - If the measures applied include changes to active or reactive power, the aspects mentioned in paragraphs a) and b) regarding the implementation of the changes and the necessary information exchange apply. The regulatory framework must contemplate the case that active power changes are needed on grid users connected to the network of a System Operator different than the responsible System Operator.
 - With the described processes, all involved System Operators can fulfil their assigned responsibilities while ensuring stable system operation on all voltage levels.



2. MARKET RELEVANCE

This use case has little market relevance if the System Operator can solve the contingency solely by his/her own grid measures; just the information issue remains.

In any other case it is highly relevant, especially for the use case b) described above. Experience from markets with high levels of RES penetration shows that peaks in feed-in that often cause congestion in distribution or transmission systems are produced by installations that are not directly connected to the system of the operator facing the congestion. Practical examples exist in which congestions are occurring at a 1st level DSO, but really caused by Distributed Generation (DG) installed in an underlying grid by a connecting 2nd level DSO. It could be also the case between a TSO and DSO grid.

Market parties, in the case they have to change their energy schedules, are affected in such a way that they cannot produce/consume as scheduled. Some parties might also

be affected financially since the power supply needs to be shut down for a certain period of time (load-shedding).

It is important that interactions between System Operators and markets are well defined to enable efficient and transparent market competition. In short, there is a 'common good of network adequacy' in real and close to real time, for which there is no current mechanism to determine value or wealth allocation to contribution sources/polluters.

Furthermore, the provision of services between the System Operators and flexibility providers due to congestion management must not prevent these flexibility resources to develop or to participate in other markets.

3. HIGH-LEVEL PROCESS DESCRIPTION

Congestion management exists in different timeframes, as it can play a role in:

- Real-time operation
- Operational planning
- Longer-term planning (e. g. if curtailment is an option for certain installations connected to the System Operators grid and is allowed by the corresponding National Regulatory Authority (NRA))

In all three timeframes, congestion management can generally be divided into six steps:

1. Detection of constraints through security assessment from the operational planning phase to real-time operation;
2. Design of remedial actions, including flexibility contracting if allowed by the corresponding NRA;
3. Selection of the most efficient market-based action with the least influence on other grid users;
4. Remedial action preparation, including coordination with other System Operators, if affected, and verification of the efficiency of the remedial action;
5. Activation (topological actions, flexibility activation, ...) and monitoring to assess in real time the effectiveness of the remedial action;
6. Ex-post performance assessment and, if applicable, financial settlement, including flexibility remuneration or compensation.

4. ROLES USED FROM THE 'ROLE TOOLBOX'

System Operators (TSO, DSO), BRPs, suppliers/retailers, balance coordinator, traders, RES power plant proprietors, aggregators and grid users.

Grid users (consumers, prosumers or generators) can deliver flexibility through demand response and more flexible use of their distributed energy. In doing so, they need to be metered and measured accurately for settlement, real-time necessities, etc. and need to be enabled by market parties.

Suppliers have contracts with the grid users and can offer different contracts to grid users.

Balance Responsible Parties (BRPs) have contracts with

suppliers and have grid users in their portfolio. When grid users participate in flexibility, including demand response, this affects the portfolio of the BRP.

TSOs take care of system security through balancing (frequency control), and of transmission grid security through congestion/constraint management, voltage control etc.

DSOs take care of distribution system security through congestion/constraint management, voltage control etc.

Settlement entities calculate and execute the settlement of a part or the total of grid users, and these could be TSOs, DSOs or third party entities to which the management of the settlement process is allocated.

5. RELEVANT COMMON DEFINITIONS FOR THIS USE CASE

- See Appendix 3 with list of definitions

6. HIGH-LEVEL DESCRIPTION OF INFORMATION THAT NEEDS TO BE EXCHANGED BETWEEN THE IDENTIFIED ROLES

Each System Operator needs information on the grids that are part of their observability area. Generally, there is a need to exchange structural, forecast/schedule and real-time data, as observability is a key question for congestion management and security analysis in all timeframes. Scheduling information has to be exchanged, i.e. the System Operators in question will also need more information from connected parties using the network or from their suppliers/BRPs/aggregators.

Most aspects of the necessary data exchange are already included in articles 40 to 53 of the SO GL, including exchange of data between TSOs, DSOs, power-generating modules and demand facilities, both connected to the corresponding TSO or to a DSO.

The process of information exchange during the application of remedial actions is described below for the three use cases described in section 1 on a generic level:

a. Information to be exchanged between System Operators:

Sender System Operator:

- a certain desired value of flow of active/reactive power to be exchanged through the connection point for a given timeframe in absolute value or compared to the current situation/schedule
- limits during a certain timeframe for feed-in or consumption applying to grid users

Recipient System Operator:

- acknowledgement
- confirmation that the results of the remedial actions have been achieved. In case the remedial action cannot be applied or can be applied only to a certain extent, there must be coordination to apply alternative measures to solve the congestion

b. Between System Operators and other grid users (BRP, market parties, aggregators)¹⁾:

Sender System Operator of the grid to which the user is connected:

- a certain desired value of flow of active/reactive power to be exchanged through the connection point for a given timeframe in absolute value or compared to the current situation/schedule

- limits during a certain timeframe for feed-in or consumption applying to grid users.

Recipient system user:

- acknowledgement
- confirmation that the agreed-upon remedial actions have been achieved

Some of these processes might be automated for some grid users, meaning an automated ACKnowledge (ACK) sent by electronics and confirmation of a new operating mode by direct measurement or state estimation.

1 If the measures taken affect the settlement of grid users, the settlement entities must be informed

7. PRINCIPLES AND RECOMMENDATIONS FOR THE EUROPEAN COMMISSION THAT ARE RELEVANT FOR THIS USE CASE

1. Increase observability between grids. The SO GL explicitly enables TSOs to obtain adequate visibility on the distribution grid. A reciprocal right would help DSOs better manage their grids. The exact level of observability and controllability needed by both parties should then be adjusted at the national level.
2. The European Commission should draft a new article on general principles of congestion management for distribution grids, to be added to the relevant legislation. This article should take into consideration that:
 - The TSO is ultimately responsible for managing the impact of active power management on system balancing and on the transmission system. Whenever involving users connected to distribution networks, actions should be carried out either through the

DSO, directly by the TSO or through a market party.

- **From the DSO point of view**, each DSO should be entitled to decide which of the implementation alternatives should be applied to users connected to their networks.
- **From the TSO point of view**, the Member State regulatory framework should establish which of the options maximises grid user value in the corresponding member state.
- Active power management actions with an impact on the distribution system should be managed by the DSO either directly, through the TSO or through a market party. In the case of DSO management directly or through a market party, the TSO should be informed of the result of the actions taken by the DSO.

8. LINKS TO RELEVANT REGULATORY DOCUMENTS

- Directive 2009/72/EC
- Regulation 714/EC/2009
- NC RfG
- NC DCC
- Guideline on System Operation



USE CASE – BALANCING

1. SCOPE

TSOs and DSOs are currently in charge of maintaining a stable electricity system for all consumers in a society ever more reliant on an uninterrupted power supply. In general, electricity balancing at the EU-level is one of the key roles of TSOs, in which they act to ensure that overall generation equals demand on cross-border connections in real time, e. g. in Germany, TSOs are always equipped with about 4 GW¹⁾ of positive and negative balancing power.

Frequency containment, frequency restoration and replacement balancing reserves have to be available within the timeframes specified in the upcoming Guideline for System Operation for each of the synchronous areas. The potential for balancing resources to be effectively shared between countries can enhance the security of supply and reduce overall system costs, so there is a strong rationale to further develop cross-border capacities and balancing markets in Europe.

The Guideline on Electricity Balancing is expected to ensure that the correct framework will be put in place for this to happen. According to the existing draft, balancing means all actions and processes that TSOs ensure, in a continuous way, to maintain the system frequency within a predefined stability range and to comply with the amount of reserves needed per Frequency Containment Process, Frequency Restoration Process and Reserve Replacement Process with respect to the required quality.

DSO POINT OF VIEW

- From a DSO perspective and depending on future developments (i.e. on RES Integration in DSO networks, decentralised storages, electrification of transport), the balancing regime needs to evolve and maybe even to involve more decentralised approaches, e. g. local balancing.
- As RES integration continues, especially on lower network levels, congestion management and the need for the aggregation of flexible consumers at the DSO level is emerging, DSOs will need to engage more, depending on the effects of such changes on their systems. For instance, during the pre-qualification phase of any installation that wants to engage in any kind of system service, DSOs might need to analyse, and, in case of an actual activation, manage the impact of the requested actions. They will have to calculate the available flexibility at a given consumer connection point. As part of the same process, DSOs must aggregate – whenever needed or requested – the corresponding information (e. g. metered data) from all TSO/DSO connection points or within balancing zones, as well as select and activate flexibility within network limits.

TSO POINT OF VIEW

- The definition established in the Guideline Electricity Balancing contemplates all aspects related to balancing and provides the framework to work together towards coordinated balancing areas, including more than one TSO. In this direction the introduction of additional balancing areas for the purpose of local balancing is not in line with such work.
- The involvement of DSOs in the Frequency Containment Process, Frequency Restoration Process and Reserve Replacement Process and, therefore, in all processes related to balancing, is established in the Guideline for System Operation, including during the prequalification phase. DSOs will therefore be increasingly engaged in these processes considering RES integration, congestion management and the need for aggregation of flexible consumers, thus acting as a facilitator in the corresponding markets. The role of aggregation of data may correspond to DSOs or to market parties in order to facilitate that each reserve provider can choose with which market party or BRP they wish to participate in those markets.

The information/data mentioned above includes – but is not limited to – available flexibility connected to the respective DSO system and the ability to use it aggregated either at a connection point, TSO/DSO connection point or within a balancing zone.

As frequency on the cross-border level is only one important measure, it is important to mention that local voltage stability must also be ensured locally. This will still be a DSO task. In this context, TSOs might need – either via DSOs or directly – to make use of flexibility in the distribution grid to reduce cross-border imbalances or between balancing zones (when this is foreseen by national regulation), thereby encouraging information and data exchange. The DSOs should be enabled by the TSO – DSO interface to fulfil their task. High automation of the pro-

cess close to SCADA systems could support the security of supply throughout the process.

Both operators should define the data they need from each other and mutually agree on the procedures (e. g. using transparent registries to list respective connection points/consumers interested in participating in the balancing market) to be used to securely channel the information between control centres. Therefore, the system perspective and sufficient standardisation efforts are needed to maximise the possible utilisation of loads for balancing activities.

This use case describes the main requirements related to data exchange between TSOs and DSOs regarding the use of flexibility for balancing purposes.

❖ IN SCOPE

- DSO – TSO cooperation and sufficient information exchange within the balancing process in order to ensure overall safe grid operation.
- Data exchanges for flexibility requests and options for the DSO to intervene in case of local constraints (voltage, operational reasons) or to make use of smart grid approaches.

❖ OUT OF SCOPE

- BRP's activity of the DSO (sourcing the difference between profiled load and actual consumption)
- Coordination between balancing and other uses of flexibility (see Flexibility Use Case)
- Actual procurement process for flexibilities
- Local balancing activities of DSOs, concept not supported by TSOs, are not within the scope of this use case.

1 which is 5% of the peak demand and 2.7 % of the total installed power generation capacity in Germany.



2. MARKET RELEVANCE

DSOs, as System Operators responsible for distribution system operation, and TSOs, as System Operators responsible for transmission system operation and system balancing, are in charge of ensuring the continuity of supply in a cost-efficient manner. The increasing penetration of RES (e.g. in Germany almost fully integrated at the distribution level or in Spain where a large proportion of RES is connected to the transmission level), leads to strong impacts on energy markets and increasing congestion (partially due to insufficient network development), and together with the production forecast error, system operation (for both TSO and DSO) and system balancing is becoming more challenging.

COORDINATION OF BALANCING AND DISTRIBUTION SYSTEM OPERATION

With the growth of generation in the distribution networks and the empowerment of consumers through markets and technology, distribution grid-connected sites constitutes a substantial source of ancillary services that can benefit the power system, both on the distribution and transmission scale. These sites can be aggregated in pools by suppliers or aggregators. This in turn will increase the need to ensure seamless integration, sufficient control, observability and enhanced management of local networks by DSOs.

The growing participation of distributed flexibilities in the balancing market requires further involvement of the DSOs in the balancing process and an extended data and information exchange between operators in order to ensure safe and efficient grid operation. Especially

for efficient grid operation, it is crucial to prevent DSOs throughout Europe to develop their networks based on marginal grid costs. Flexibility activation via TSOs can cause instance constraints and congestion (active power and voltage) within the connection grid, as well as unnecessary curtailment of distributed generation. In order to prevent these congestions, the connecting System Operator should have at least and accordingly to its own evaluation, the possibility to assess the prospective impact on their grid and potentially limit the flexibility activations.

Different options can be considered to fulfil these requirements. TSOs and DSOs will play a crucial role in defining the most appropriate ways to manage the interaction between balancing and distribution grid operation.

DSO POINT OF VIEW

- The interaction between balancing and distribution grid operation should be managed by local flexibility procurement.

TSO POINT OF VIEW

- The interaction between balancing and congestion management in the DSO and in the TSO grid should be managed by balancing offers limitation, by local flexibility procurement or both, depending on the Member State regulatory framework.





It should be noted that the cooperation between System Operators in providing ancillary services will have greater importance if ancillary services from distribution grids will be provided either via aggregators or suppliers based on market-driven approaches and under the supervision of DSOs. On the one hand, aggregation of loads is a value-creating phenomenon, i.e. enabler, which allows the creation of an environment in which parties (Small

and Medium-sized Enterprises (SMEs), households) via suppliers or aggregators could enter highly professional market segments (for instance, the balancing markets) and increase the reliability of ancillary services through the multitude of assets aggregated in their portfolio. On the other hand, controlling the actual delivery of ancillary services becomes more challenging if they are provided from hundreds or thousands of installations.

DSO POINT OF VIEW

- The DSO duty to expand the network has to be weighed against any (new) right to limit network usage. In order to maximise social welfare (e. g. by minimising overall system costs) a proper assessment is needed.
- From a DSOs' point of view, ancillary services provided via aggregation increase the insecurity in planning and operation, e. g. as they might increase simultaneous loads on single feeders or stations, which might cause congestions (voltage or thermal). There is also an additional probabilistic phenomenon that needs to be reflected as more than one aggregator or supplier will be active on the grid, and these actors follow their own economic optimisation which (without any regulatory oversight) may not reflect the DSOs' restrictions.

TSO POINT OF VIEW

- A coordinated access to grid capacity has to be achieved. DSOs and TSOs should work in cooperation towards a compromise between limitless aggregation, which is creating market value, and a constraining grid capacity management scheme, needed for safe operation.
 - Furthermore, performance control methods exist and are successfully applied across Europe for ancillary services delivered by large aggregated portfolios.
-

3. HIGH-LEVEL PROCESS DESCRIPTION

The current regulated balancing regime in Europe is described by the upcoming Guideline, which needs to be finalised and adopted by the Member States.

However, it has to be noted that the limitations in DSO networks are, from the DSO perspective, like a new layer to the existing overall framework. From the TSO viewpoint the activation is just a matter of the process out-

lined in the aforementioned Guideline. The following chart provides a first impact analysis according to the respective time frames.

❖ LONG-MEDIUM TERM

- Assess available flexibilities on the TSO and DSO levels
- Assess network capacity regarding flexibility pools (prequalification)
- Inform the Balancing Service Providers of possible limitations due to TSO and DSO network constraints

❖ DAY-AHEAD/INTRADAY

- Assess network capacity regarding balancing offers
- Assess other flexibility options
- Limit the activation of offers that might cause congestions
- Inform the actors about limitations

❖ CLOSE TO REAL TIME

- Limit the activation of offers that (could) cause (additional) congestions
- Activate flexibility options
- Several additional options are possible for implementing this step

4. ROLES USED FROM THE 'ROLE TOOLBOX'

Roles used:

- System Operator
- Grid Operator
- Balancing Service Provider
- Aggregator
- Supplier
- Generator
- Prosumer
- Party connected to the grid



5. RELEVANT COMMON DEFINITIONS FOR THIS USE CASE

See attached file ‘Guideline on Balancing – Draft’. Smart Grid Task Force, Report: Regulatory Recommendations for the Deployment of Flexibility, January 2015. Annex to the EG3 Report ‘Refined recommendations’, September 2015.

6. HIGH-LEVEL DESCRIPTION OF INFORMATION THAT NEEDS TO BE EXCHANGED BETWEEN THE IDENTIFIED ROLES

This information includes – but is not limited to – available flexibility, aggregated for balancing purposes either by connection point or balancing zone. Other examples include any requests for flexibility activation or the impact measurement of any relevant actions taken.

As RES integration and the need for the aggregation of flexible consumers at the DSO level emerge, DSOs will need to engage more, depending on the effects of

such changes on their systems. For instance, during the pre-qualification phase they might need to manage the impact of the requested actions.

DSO POINT OF VIEW

- For flexibilities proposed to be eligible for balancing activities and pre-qualified at the respective connection points by qualified actors, TSOs should be able to access this information. It has to be ensured during the pre-qualification that the party connected to the grid is appropriately included in the process.
- Further DSO involvement includes calculating available flexibility at a given consumer connection point or to provide baselines. As part of the same process, DSOs must aggregate – whenever needed – the corresponding information from all TSO/DSO connection points or balancing zones, as well as spearhead the selection and activation of flexibility within network limits or existing voltage obligations.

TSO POINT OF VIEW

- As established in SO GL, the prequalification and therefore which flexibilities are eligible to provide balancing services is the task of the TSO, which should be performed in collaboration with the DSOs in case the activation of those flexibilities affect the security in the DSO network.
- The necessary exchange of information for the process of prequalification and activation of balancing bids is also included in the data exchange chapter of SO GL.
- DSOs will be therefore increasingly engaged in these processes considering RES integration, congestion management and the need for the aggregation of flexible consumers, but acting as a facilitator on the corresponding markets. The role of the aggregation of data may correspond to DSOs or to market parties.

7. PRINCIPLES AND RECOMMENDATIONS FOR THE EUROPEAN COMMISSION THAT ARE RELEVANT FOR THIS USE CASE

Distributed flexibilities are already successfully participating in the balancing and energy markets across Europe. Thus, existing models allow their participation today, but the national approaches are not fully harmonised, and the upcoming Guideline needs to be implemented at a Member State level.

Examples from Belgium or Spain show that registries are an important source to list, e. g. the prequalified installations (task of the connecting operator in Belgium or of the TSO in Spain) and provide this access information to the TSOs or the DSOs in a transparent way. Registries could be also used after a new asset connected to DSO networks is activated by the TSO. In addition, the DSO must be able to inform the TSO that a planned activation is not possible due to local grid constraints or operational reasons at any time. The TSO must also increase transparency on the planned activation in terms of volumes, load and duration.

Aggregators and suppliers are able to offer a transformation service, i.e. they make flexibility offers based on portfolios of small- and medium-sized assets that otherwise

would not be able to enter the balancing markets on their own. This creates value from a system perspective but introduces a new kind of probabilistic uncertainty in the grid operation process (e. g. localisation of assets effectively contributing to the balancing service, switching of assets responding to market signals and to balancing prices).

System Operators (TSOs and DSOs) should be able to fulfil their respective duties, including safe grid operation at all times.

Prequalification for balancing services is – based on the draft of the existing Guideline – a task allocated to the TSO to assure non-discriminatory approaches between providers. Art. 155, 159, 162 and 182 of SO GL establish how the process should be performed, including the DSO involvement.

DSO POINT OF VIEW

Balancing services based on assets connected on the DSO level should, for economic reasons, not lead to any additional constraints in DSO networks. If this is the case, TSO and the market actor interested in using this asset connected to the DSO network on the balancing market should cover the full costs of any grid enforcement according to the national regulations on the allocation of network expansion costs.

TSO POINT OF VIEW

In case of additional constraints in DSO's networks, a regulatory framework should be established in which the compromise between the additional value of the flexibility not available to the balancing markets due to these constraints and the network expansion that resolves those congestions is evaluated and, in any case, ensures a proper allocation of the corresponding additional costs. From a TSO point of view, prequalification of the DSO should not lead to static limitations in case the grids are not under constraints. It is therefore necessary that potential constraints are identified by the DSO (in relation to the localisation of the installation) as soon as possible. DSOs should, if possible, ensure identification of risky assets/portfolios or DSO limitations during the prequalification phase. In this case, additional measures can be decided.

1. DSOs should at any time be able to assess the impact of the activation of balancing services on their grid at different timeframes (e. g. within the prequalification process, balancing market gate closure time to real time). The registries of the connecting DSOs listing possible assets/installations interested to participate on balancing markets, should be used to support the prequalification process.
2. Depending on future developments in the power sector and in relation to available (cross-border) capacities in transmission networks, the balancing regime needs to further evolve. In case of possible network constraints (identified because of point 1), System Operators need to have the means in place to prevent unintended effects of the aggregated flexible actions. If network constraints are detected close to real time, different options can be envisaged and further discussion is required (different national regulations could lead to different solutions).
3. Exchange of information between DSOs and TSOs should be further reinforced, taking the increased need for cooperation into consideration, e. g. (this list is not exhaustive):
 - access-identification and prequalification of the installation by the connecting operator, and definitions of possible limitations to grant access to balancing markets;
 - product, provider, capabilities;
 - maximum/minimum upwards/downwards flexibility amount (kW) delivered for each hour of the day, location (connection point);
 - depending on the level of capacity/assets size, extra information is required;
 - offers (amount of flexibility offered, assets portfolio...);
 - activations;
 - TSOs should inform the respective DSOs of the forecast on respective connection points to ensure seamless system integration.



USE CASE – USE OF FLEXIBILITY

BACKGROUND

In 2015, the EC led an expert group of stakeholders – the EG3 – in developing a report, ‘Regulatory Recommendations for the Deployment of Flexibility’ (later complemented by an annex of concrete recommendations).

This report represents an important piece of work that took into account the views of all relevant stakeholders, so its findings have been used as background references for the ideas and proposals here jointly developed by TSOs and DSOs, with interlinks to the following areas:

- Tasks for System Operators in view of the digitalisation of their activities.
- Rights for consumers related to smart meters and access to data.
- Aggregators, roles and barriers for new entrants to access markets.
- Smart metering systems with the right functionalities, not jeopardising privacy, linked to the deployment of DSR (flexibility).
- Data handling, data management, TSO – DSO interaction.

1. SCOPE

Out of scope:

- Congestion management (already in congestion management use case)
- Flexibility contracting for network planning (closer to congestion management)
- Balancing (already in balancing use case)
- Definition of market design
- Household level (e.g. applications used)

In scope:

- Effects on the grids when flexibility is used by a system or grid operator
- Identification of existing market mechanisms that can be used for trading of flexibility
- Data to be exchanged between [grid and] System Operators for the use of flexibility
- New technology needed to support these exchanges
- All market parties that want to access markets
- Privacy and cyber security

The following should be looked at:

1. Data from DSO > TSO
2. Data from TSO > DSO
3. Data from DSO > DSO and TSO > TSO
4. Data from third parties to DSO and/or TSO
5. Data commonly agreed-upon between the DSO and TSO



2. MARKET RELEVANCE

1. System Operators (SOs) face a number of new issues because of increasing levels of variable generation, which translates into the need for flexibility in the system to ensure that supply and demand match at all times and that congestions in the grid can be managed properly by both operators (TSO and DSO). With forthcoming Demand Side Response (DSR) and the expansion of Distributed Energy Resources (DER), significant solutions of flexibilities will appear on the distribution network.
2. SOs have to identify the flexibility that is available, to monitor its impact (where relevant for its grid), to agree on contractual terms with their providers to access the service, to be able to activate the service when needed and to monitor the effectiveness of the service provided. SOs cannot solely rely on conventional generation resources to get these services, while these sources will remain very important towards 2030. Both TSOs and DSOs have to include distributed and centralised assets: aggregators, suppliers, BRPs and customers to provide or use the relevant services.
3. By applying new technology combined with IT and telecommunications, customers in the future will be able to monitor their electricity consumption in real time and then manage their electricity demand with the corresponding reward of savings. New technology will allow the customer connected to the grid to take an active role in the consumption and supply of the electricity, thus balancing the system and local congestion management. Flexibility, in this regard, can be offered by different market parties, even at a household level, through demand response, which is expected to increase the market liquidity. Besides System Operators (TSOs and DSOs), BRPs can also make use of this flexibility, meaning that the use of flexibility is important for market parties both in offering and in using for portfolio balancing. The integration of the flexibility into the existing energy system using existing and new market mechanisms will ensure overall system optimisation.
4. The activation of flexibility services might have an impact on system operations that should be prevented (e.g. cause congestion or other constraints). Therefore, processes involving distinct System Operators as well as market activations must follow a guiding principle, a set of pre-established rules, guidelines and pre-agreed arrangements.

3. HIGH-LEVEL PROCESS DESCRIPTION

The next-generation grid will serve as a backbone upon which a new generation of technologies, services and business models will be built. This is happening while utility owners experience it being increasingly difficult to reinforce the electrical power system by installing new assets. We therefore have to ensure that we capitalise on the existing installation and make better use of the existing infrastructure.

Today's power industry has been operated through a top-down, vertically integrated architecture. The future energy system must, in addition, cope with DER, distributed energy storage, DSR, and several new service providers working bottom-up in the new energy system, while further promoting price signals and better incorporating costs incurred in the transmission or distribution grids. As the amount of RES and DER increases in the power system, the need for flexibility to operate the system and as well the local grid also increases.

The energy system value chain is already becoming more digital. The capabilities, however, have not been adopted at scale. Some DSOs, for instance, still lack data, information exchange and analytical capabilities needed to evaluate capital investment based on real-time conditions, rather than static planning or congestion assumptions. TSOs also need to have continuous access to and exchange data to provide their analysis and to properly assess their needs.

As shown in Fig 1, flexibility could be provided by different sources such as generators, customers (directly, via suppliers or via aggregators), storage and new or existing tradable or regulated products in an enhanced marketplace. This marketplace has to be part of the energy system; System Operators should therefore participate in its design. Such a development will require a new cooperation

across TSO – DSO boundaries, including the exchange of information and ultimately the way the transmission and distribution network is operated. It is therefore important to understand the impacts and use appropriate strategies to ensure that we are able to operate the new energy system as efficiently as possible.

EXECUTING FLEXIBILITY SERVICES

Flexibility actions can be of different natures and based on distinct needs. The actions to be executed must follow a strict set of rules in order to facilitate market-based operations and guarantee Security of Supply and Quality of Service at the same time at both the local and larger system level.

- **In the DSOs' view**, each DSO already has contractual agreements with all end-users and relevant market actors. The DSO, therefore, should be trusted to validate, monitor and interact with its own grid users and, if this is foreseen in the national regulatory scheme, coordinate the data exchange between market actors and consumers on behalf of the consumer. At the same time, this is a prerequisite to ensure sufficient local facilitation of the DSO and, if demanded by the consumer or a market actor, develop local services according to the different sources of flexibility.
- **However, from a TSO perspective**, TSOs should also be allowed to directly monitor and interact with grid users connected to underlying networks. This is already the case for TSOs that have contracts for ancillary services with DSO-connected users, while duly informing the connecting DSOs. This will ensure that TSOs are able to rely on all flexibilities (not just the ones connected to the transmission grid) to balance the grid. In order to ensure a smooth coordination between local and national/European needs, the implementation of local flexibility services should not prevent flexibilities to participate in other markets and fulfil other system needs (and vice versa). This could lead to sub-optimal solutions and inefficiency in the system.

Assessing data needs: For each type of flexibility service involving more than one System Operator, namely TSOs and DSOs, both parties should define the data they need from each other and their own grid users and mutually agree on the data models, data format and communication protocols to be used to exchange this data. For this purpose, interoperability and standardisation should be promoted.

Analysing data: The System Operator connecting the affected users calculates the impact on the grid; the SO activating the flexibility calculates its delivery, the Balance Responsible Party checks its balancing position, and the supplier (ex-post) checks whether its customer delivered as agreed.

Exchanging data: In general, each System Operator should collect data from all of the users connected to their grid, and, if deemed necessary, data from distributed generation and other users should be channeled from the users of one grid through the control centre(s) connecting to other System Operators.

However, for certain specific users and specific services (e. g. FCR and aFRR), DSOs may not be able to provide the necessary metered data to measure that service. In that case, TSOs may access data directly or from third parties. In any case, provision of ancillary services to TSOs should allow DSOs to assess the impact of flexibility activations on their grid.



PROVIDED THE DSO IS RESPONSIBLE FOR METERING, AND NECESSARY DATA FOR FLEXIBILITY SERVICE IS METERED BY THE DSO, THE FOLLOWING DATA LIFE CYCLE APPLIES:

- **Creating data:** A party delivering flexibility (producer or consumer with demand-side response) will be metered and the data from this meter is/these meters are collected by the System Operator of the network to which the installation is connected.
- **Processing data:** The System Operator of the network to which the installation is connected will process the data.
- **Data:** The data is being used by System Operator s for system operation, billing and network calculations, by Balance Responsible Parties for portfolio balancing and billing, and by suppliers for billing. Therefore, each party will process the data individually for their specific purpose after receiving it from the System Operator connecting the affected users. Timing: close-to-real-time for System Operator s and BRPs and ex-post for suppliers and grids.
- **Information:** Inform whether the flexibility agreement has been made (before real time) and whether the flexibility is indeed delivered as agreed (ex-post), subject to any restrictions that may apply from the directly impacted System Operator .
- **Decision/Publication:** Grid calculations can be performed (close-to-real-time) and the billing process can start (ex-post).

4. ROLES USED FROM THE 'ROLE TOOLBOX'

Roles used:

- Balance Responsible Party
- Billing Agent
- Customer
- Data Provider
- Grid Operator
- Metered Data Collector
- Metered Data Responsible
- Metered Data Aggregator
- Party connected to the grid (incl. Consumer and Producer)
- Supplier
- System Operator

5. RELEVANT COMMON DEFINITIONS FOR THIS USE CASE

Existing definitions:

- Allocation
- Balance Responsible Party
- Demand Side Flexibility
- Demand Side Management
- Distributed Generation
- Distribution System Operator
- Flexibility
- Transmission System Operator



6. HIGH-LEVEL DESCRIPTION OF INFORMATION THAT NEEDS TO BE EXCHANGED BETWEEN THE IDENTIFIED ROLES

- Observability of flexibility activations is key for System Operators and should be ensured (e. g. based on a central data hub or registry of the respective DSOs or TSOs, depending on national regulatory schemes or other existing data handling mechanisms).
- Grid users are free to activate their flexibility within the boundaries of their grid connection and/or access contracts and therefore should dispose of the necessary signals from SOs (based on grid constraints) to assess the impact or cost implications of their activations (e. g. based on a traffic light concept or other effective information mechanisms) if relevant for that specific market timeframe.
- If DSOs can provide data to TSOs to build baselines to enable the calculation of activated flexibility, DSOs should be in charge of providing such data (except in countries where third parties are in charge of metering) in a non-aggregated way and in due time.
- DSOs flexibility activation for local congestion management: need for a compensation bid to restore system balance (ideally at the control area level).
- In those cases where market parties (whether independent aggregators, BSPs or BRPs) operate flexibility at the DSO network level, TSOs and DSOs should agree on how individual data is efficiently exchanged (via data hubs or other means such as electronic data interchange, e. g. SCADA coupling, etc.).
- Metering data (not yet information) from those parties connected to the grid that are delivering flexibility. For balancing purposes this should be at least per ISP (Imbalance Settlement Period). Location and energy should be known.
- Information about the flexibility is indeed delivered. There are three types of data that have to be collected (see also our answer to EC question n.1):
 - **Grid data**, which includes both planning and operational data (also real time): covers all technical data (e. g. voltage, power quality, reactive power, frequency, etc.) collected by sensors in the network – including all customer meters allowing System Operators to plan, operate and manage their networks. Such data is generally anonymised. It also includes information from market parties about generation and load forecast, maintenance, capacity availability, real-time measurements and from external sources (e. g. meteorological data). Grid data is needed for network monitoring and management (e. g. to predict or identify congestion) and network planning. It also provides the information needed to be exchanged on the interface between TSOs and DSOs. Also, data related to the configuration of the grid (e. g. connection point identification such as EAN, metering assets, congestion points) is part of grid data that might need to be exchanged.
 - **Meter data**: covers end user consumption data (i.e. energy usage, historical consumption) and production data (historical, current). Meter data is under the customer's control, is usually collected at the customer's premises and should be accessible to all System Operators or market players that need to process it either to fulfil their regulated obligations (supply, settlement, balancing, etc.) or to develop commercial services.
 - **Market data**: data from other sources that enriches smart meter and grid data, e. g. from commercial energy contracts (e. g. customer name, customer ID [client number], addresses, supplier, balance responsible party, price information, first day of supply, payment method, etc.), from smart appliances (e. g. devices of HomeArea Network such as smart plugs, smart thermostats installed at the customer premises, which can provide additional usage and service-related data) or from external sources (e. g. meteorological/ weather data, energy spot prices, demography, social media, public databases and registers). Market players use this to create innovative services.

- With increased DSR and DER participation, conventional power system operation is changing. The same is true for the conventional unidirectional flow of information from the field equipment and user premises to the distribution and transmission control system. In the future energy system, bidirectional flows (power flowing out from consumer premises to the grid and real-time information

flowing towards the customer premises) will be the standard model.

- New products may include not only power and energy, but also products such as (conventional) ancillary services as well as system services.

7. PRINCIPLES AND RECOMMENDATIONS FOR THE EUROPEAN COMMISSION THAT ARE RELEVANT FOR THIS USE CASE

The interaction between parties will lead to contractual agreements, and subsequently to business processes and information exchange, supporting these processes and agreements. Information exchange is defined in this context. The job of the policymakers is to balance the interest of the different groups to best serve the public interest.

TRANSPARENCY IN COMMUNICATION TO THE MARKET

More transparency on the actual status of grid constraints must be visible to relevant players such as DER or flexibility providers connected to the grid. This would further support new business models that will be more dependent on the provision of transparent and trustworthy data. A standard data format for communicating to the market could be developed.

- Using system flexibility services will require extensive cooperation and clear boundaries between TSOs' and DSOs' rights and duties.
- Systems need to manage their grids, while the market acts as freely as possible. Each System Operator is responsible for operating its own grid (control area), however, the needs to know the impact on that from adjacent grids. Therefore, System Operators should communicate in a well-established way about the grids that can impact their grid (the observability area) in order to manage their own grid (control area) properly.

CONTROLLING IMPACTS OF FLEXIBLE ACTIONS

- System security is a joint responsibility of the distinct System Operators. Activation of flexibility requires close control by the respective TSO and DSO to avoid jeopardising the quality of service and security of supply when performing the actions. Data exchanges should be defined properly.
- Taking into account the different uses and sources of flexibility, coordination and data exchange (e.g., flexibility activation register, SCADA to SCADA coupling, etc.) is necessary.
- System Operators should be responsible for qualifying, certifying and validating the use of the flexibility

and handle all related information, including during the execution of flexibility contracts. For the purposes of the prequalification processes of involved flexibility resources for FCR, FRR and RR, each TSO will develop and specify, in an agreement with its reserve connecting DSOs, the terms of the exchange of information required for these prequalification processes for reserves providing units or groups located in the distributed networks and the delivery of active power reserves.¹⁾

1) As per article 182 of the System Operation Guideline

FLEXIBILITY PRODUCTS SERVING DIFFERENT MARKETS

- As flexibility products are intended to serve different needs, it is essential that it becomes clear which products could be offered to which markets and that flexibility is only activated once. In that respect, BRPs, TSOs and DSOs should clearly express their needs. The

adequate level of information in relation to DSR activation should allow the TSO and DSO to check if the local conditions allow the execution of the planned flexibility service.

UNLOCK THE VALUE OF FLEXIBILITY

- The use of flexibility for mitigating constraints in distribution networks represents a new approach and, next to the traditional way of working (grid expansion), may lead to more optimal grid expenditure. It is important that interaction between DSOs and markets is well defined to enable efficient and transparent market competition.
- A transition towards a more dynamic, near real-time grid constraint management is a valuable contribution for further unlocking the flexibility. For instance, solutions using the Active Network Constraint Management System (ANCMS), the Traffic Light Concept, or other efficient mechanisms to monitor and manage flexibility in regional and local networks should be further explored and deployed.
- Flexibility at high-voltage levels is currently mostly used already, since the players there mostly have access to all markets; data exchanges are therefore mostly already in place.
- Flexibility in distribution networks should be unlocked, not only to improve the quality of electricity distribution, but also in such a way that it can be further used for transmission level constraints or for system balancing. Hence, data exchanges need to be in place so DSOs

are informed about flexibility activations as close as possible to real time and to prevent problems in the distribution system operation. A possible solution is that TSOs and DSOs jointly develop and operate a flexibility activation register to ensure timely and accurate information exchange. Another possible solution in the presence of a contract between the TSO and the flexibility providing party foresees the control action to be either sent via a SCADA to SCADA coupling from the TSO to the connecting DSO, or flexibility-providing parties will notify or submit schedules with information of unit activation.

- Flexibility on a distribution level can be unlocked through suppliers, aggregators or directly via pro/consumers. A clear framework with roles and responsibilities to ensure a level playing field and efficient flexibility development is necessary, at least at the Member State level.

The existing framework that we know today as cost service regulation may prove insufficient for meeting the future challenges faced by grid and System Operators. One reason is that the existing regulation sets tariffs based on past costs, not on future potentials, thus not incentivising innovation. A new regulatory framework is needed to be able to value the potential benefits that flexibility offers.

USE OF FLEXIBILITY LOCALLY

- TSOs and DSOs should be allowed, in certain circumstances, to have bilateral flexibility contracts with customers in a given geographical area, where it is efficient to do so and as long as these contracts are

transparent and non-discriminatory. Bilateral contracts, however, must not prevent a flexibility market to develop or prevent flexibilities to participate in other markets.

8. LINK TO RELEVANT REGULATORY/LEGISLATIVE DOCUMENTS

- System Operation Guidelines

9. OTHER RELEVANT DOCUMENTS RELATED TO THIS USE CASE

- EG3 report and recommendations



USE CASE – REAL-TIME CONTROL AND SUPERVISION

1. SCOPE

For a safe and reliable operation of the electrical network/energy system on various voltage levels, special System Operators are required. In general, they are responsible for the real-time control and supervision 24/7 in any corresponding grid. For the realisation of real-time control and supervision, the awareness of the current system state described through real-time data is the main prerequisite. Furthermore, information about the system state of physical connected neighbouring grids are also required. Safe and secure DSO-TSO communication interfaces are needed for bi-directional system status data exchange, data aggregation and proper coordination on the operational level.

The general objective of real-time control and supervision is the safe and reliable operation of an electrical network/energy system 24/7.

In order to fulfil all required tasks for system operation, special tools like 'Supervisory Control and Data Acquisition' systems (SCADA) are used for real-time system monitoring and control. SCADA is a system that operates with coded signals over communication channels to provide control of remote equipment. The control system may be combined with a data acquisition system by adding the use of coded signals over communication channels to acquire information about the status of the remote equipment for display or for recording functions.

The physical connections between different electrical networks/energy systems on the various voltage levels requires data exchange in real time. This is one essential contribution to secure a stable system state in general. Exchanged data can be direct coded signals or summarised, aggregated data based on special data acquisition functions of the SCADA system. From the communication point of view, the data exchange is realised between involved SCADA systems. Today, the data exchange between different SCADA systems is based on various standards such as the 'Inter-control Center Communications Protocol' (ICCP per IEC60870-6 TASE.2).

In addition to the DSO – TSO data exchange, data and information exchange between System Operators and network users is also required.



2. MARKET RELEVANCE

Real-time control and supervision play a crucial role in grid management and grid operation on all voltage levels. Decentralised energy production based on renewables will become a more important pillar next to conventional power plants in the future energy system. Many of these dispersed and intermittent renewable generators are connected to distribution grids. In the future, bi-directional and more volatile power flows in the system have to be managed by grid s at any time, while at the same time sufficient data exchange and information provision between s is needed.

It is crucial for all operators to ensure a seamless and efficient integration and sufficient monitoring in/close to real time. If bottlenecks are emerging in the grid, real-time supervision (in case more than one System Operator is affected), data exchange based on SCADA systems increases situational awareness and helps minimise congestions

and outages. Operator intervention must be announced to the market (orange regime or 'yellow phase'). This means that not all market rules apply anymore in this congestion area and that the operator responsible is trying to steer the system back to the green (normal) state. The market must also be informed in/close to real time.

3. HIGH-LEVEL PROCESS DESCRIPTION

Real-time control and supervision enable all System Operators with SCADA systems and control centres (transmission and distribution) to monitor and to supervise their respective grid. If proper data exchange is implemented, awareness of the system state of neighbouring System Operators' rises, and higher levels of system coordination are possible.

Only a small number of events on a lower voltage level have effects on higher or even the highest voltage level. It is therefore sufficient to inform neighbouring System

Operators only about events that affect their respective system. Neighbouring System Operators must be able to work closely together in or close to real time.

A rough process description for the use case 'real-time control and supervision':

1. Collecting all relevant real-time data resulting from the current operation of the electrical network / energy system to visualise the current system state;
2. Analysis, evaluation and assessment of current system state;
 - Objective: detect congestions, out of range voltages, brown- or blackouts, islanding, etc.
3. Predictions, derivation of spheres of activity and resulting actions;
 - In case another network operator or plant operator is affected, information exchange, coordination of action,
 - In case another market actor is effected Information – exchange about the actions.
4. Decisions about actions to be performed;
5. Execution of actions, including the relevant information exchange;
6. Evaluation of results.

4. ROLES USED FROM THE 'ROLE TOOLBOX'

Roles used:

- Data Provider
- Grid operator
- Metered Data Collector
- Metered Data Responsible
- Metered Data Aggregator
- Party connected to the grid
- Distribution constraints market operator
- System Operator

5. RELEVANT COMMON DEFINITIONS FOR THIS USE CASE

Existing definitions:

- Allocation
- Balance Responsible Party
- Demand Side Flexibility
- Demand Side Management
- Distributed Generation
- Distribution System Operator
- Flexibility
- Transmission System Operator

Additional definitions used for this use case:

- DER
- SCADA
- SCADA (supervisory control and data acquisition) is a system that operates with coded signals over communication channels to provide control of remote equipment (using typically one communication channel per remote station). The control system may be combined with a data acquisition system by adding the use of coded signals over communication channels to acquire information about the status of the remote equipment for display or for recording functions.
- Direct control
- Frequency control
- Voltage control
- Grid extension planning
- Flexibility operator



6. HIGH-LEVEL DESCRIPTION OF INFORMATION THAT NEEDS TO BE EXCHANGED BETWEEN THE IDENTIFIED ROLES

For the use case ‘real-time control and supervision’, a large volume of information needs to be exchanged. According to the different roles, the following information exchange is required.

PARTY CONNECTED TO THE GRID, TO THE SYSTEM OPERATOR (TSO, DSO)

- Plant register (via public Plant register /Time constraint ... Monthly update, if changes exist)
 - Master data
 - Contact master data to the owner of plant
 - Official plant number
 - Energy source for producing electricity
 - Information about financial sponsorship
 - Data for approval
 - Date of initial operation
- Location of plant
 - Address
 - Geographic coordinates
- Technical Data (partly depending on energy source)
 - Installed power plant
 - Voltage level of plant connection
 - Network connection point, including the name of the network operator
 - Master data of plant producer
 - Plant type
- Data about the controllability of plants through the System Operator or other market roles
- Detailed information about the energy source for producing electricity
- Operating data
 - Current feeding in real time /current load

SYSTEM OPERATOR (TSO, DSO) TO THE PARTY CONNECTED TO THE GRID

- Information about external control through the System Operator includes details like
 - Expected range, expected time duration, reasons for external control
 - Time constraint for that ...
 - Previous day, if possible
 - Immediately, in any other case
 - On demand, information / certification about the past requisite external control
 - Time constraint for that

INFORMATION EXCHANGE BETWEEN THE DISTRIBUTION CONSTRAINTS MARKET OPERATORS AND SYSTEM OPERATOR

- Current status of the grid
- Event affecting neighbouring System Operators
 - first step: announce the amount of load (kW or MW) actually curtailed
 - in the future: node reaching limits, customer curtailed at node ..., etc.
- P, Q, U, R
- Control setpoints for congestion management
- Schedules and forecasts (DER)
- Needed flexibilities in terms of load and generation
- Currents
- Positions of tap changers for critical nodes
- Set points critical wind farm
- Curtailments of critical wind farms
- Forecasts of DER



WHAT DATA?	FROM WHOM?	TO WHOM?
<ul style="list-style-type: none"> Generated active power Active load 	Party connected to the grid	Meter Data Collector
<ul style="list-style-type: none"> Generated active power Active load 	Meter Data Collector	Meter Data Responsible
<ul style="list-style-type: none"> Generated active power Active load 	Meter Data Responsible	Meter Data Aggregator
<ul style="list-style-type: none"> Generated active power per grid node Active load per grid node 	Meter data aggregator	System Operator
<ul style="list-style-type: none"> Grid topology Description of grid elements Geographical area Generated active power per grid node Active load per grid node 	System Operator	Distribution constraints market operator
<ul style="list-style-type: none"> Participation in balancing 	System Operator	<ul style="list-style-type: none"> Distribution constraints market operator Transmission System Operator
<ul style="list-style-type: none"> Capacity participation to flexibility mechanism 	Balance Responsible Party (?)	Distribution constraints market operator
<ul style="list-style-type: none"> Activated flexibilities Congestions Generated active power per connection point Active load per connection point 	Distribution Constrains Market Operators	System Operator

7. PRINCIPLES AND RECOMMENDATIONS FOR THE EUROPEAN COMMISSION THAT ARE RELEVANT TO THIS USE CASE

- Each System Operator should collect data from all of the users connected to its grid (generators, consumers, storage, etc.) and distribute it to those who need it, following their legal tasks and market design.
 - Some extensions
 - System Operators can / must aggregate, summarise and make data anonymous
 - Relevant data from distribution connected generation and other users should be channelled using three implementation options:
 - from the distribution network users to the TSO, through the DSO control centre(s),
 - through an aggregator or balance service provider and
 - for specific needs and under specific conditions,
- discussed and agreed with DSOs, TSOs should be able to access this data through a direct technical solution.
- The same way is valid for other market roles / third parties
 - TSOs and DSOs should mutually agree on the data models, data format and communication protocols to be used to exchange this data. Well-known EU standards should be used.
 - To facilitate the integration of renewable energy sources (RES) and customer connections, TSOs and DSOs should regularly exchange and publish information regarding their available network capacity at the TSO/DSO interface.

8. FORESEEN FUTURE CHANGE RELATED TO THE CURRENT SITUATION FOR THIS USE CASE

Hardware: More monitoring sensors need to be installed on all voltage levels. More DSOs need to create a monitoring system and control room or contract the related services.

DSO control rooms of first level DSOs need to be connected with TSO control rooms; second level DSOs (if existent) need to be connected to first layer DSOs (and so on).

The regulatory framework should ensure a market model that incorporates congestion management, including the distribution system, where clear roles and responsibilities are defined.

9. LINKS TO RELEVANT REGULATORY DOCUMENTS

Identification of the relevant regulatory documents relevant for this Use Case (EU regulation, EU network codes, market rules etc.)

- Guideline on System Operation
- Draft Guideline on Electricity Balancing

10. OTHER RELEVANT VIEWPOINTS RELATED TO THIS USE CASE

Real-time control and supervision are closely related to congestion management and flexibility usage. This use case monitors the grid in search of congestion or voltage problems. When congestion or voltage problems are registered, the congestion management use case starts.

To discuss:

- Free format, open field
- Technical point of view – control of DER and flexibilities
- Regulatory issues > grid codes and TSO DSO control issues (information cascade, energy information network, DER control and supervision in DSO networks)

REFERENCES:

- 1) <https://en.wikipedia.org/wiki/SCADA>
- 2) http://ec.europa.eu/energy/sites/ener/files/documents/xpert_group1_sustainable_processes.pdf
- 3) <http://www.gridinnovation-on-line.eu/Articles/Library/State-Of-The-Art-In-TSOs-DSOs-Cooperation.kl>
- 4) E-bridge: Moderne Verteilernetze für Deutschland, BMWi Germany
- 5) Consentec i.a. Bfe Switzerland: Zukünftige Energiemärkte und die Rolle der Netzbetreiber



USE CASE – NETWORK PLANNING

INTRODUCTION

This Use Case describes network planning and provides an initial overview of processes related to network planning and the related data exchange between TSOs and DSOs. It takes the existing roles & responsibilities as identified in the “roles toolbox” as a starting point.

Currently work is going on in finalising the guideline on transmission system operation (GL SO), which already contains significant references (direct or indirect) to data exchange between DSOs and TSOs related to the identi-

fied activities. In order to avoid inconsistencies with the text of the GL SO and also to create generic proposals from a European perspective, this template on network planning used therefore the GL SO as a starting point.

1. SCOPE

In the framework of this use case the scope is defined as follows:

- Network planning is considered the long term planning of grid capacity (and the related grid reinforcement and/or refurbishment). In this respect long term is bounded from very long time to week ahead (this to avoid overlap and inconsistencies with work on other use cases).
- Information provided from third parties to DSOs and TSOs is also taken into account, as far as this informa-

tion is relevant for effective collaboration between DSOs and TSOs on network planning.

- In this exercise the focus will be on the joint planning between TSO and DSO. It relates to the physical TSO/ DSO interface, to joint required planning data, and to significant power related generation units and demand facilities connected to the distribution grids.

Following this scope definition, and reading the guideline on system operation, the scope of network planning can then be defined more explicitly:

IN SCOPE:

(the figures between brackets are the article numbers from the GL SO version of 6/10/2015 to which the described topic is related to).

1. Generic grid planning data

- 1.1 Planning parameters, market development assumptions, including long term load and production forecast (22, 24)
- 1.2 Significant grid user: distributed connected generation modules and demand facilities (43, 44, 46, 48)
- 1.3 Relevant information for outage planning: list of power generating modules, demand facilities & grid elements (80, 82)

2. Long-term grid development

- 2.1 Detected relevant bottlenecks on distribution and transmission grid
- 2.2 Analysis of the optimal solution to dispose of the bottlenecks
- 2.3 Information exchange regarding the realisation of the selected infrastructure projects

3. Operational Planning (xx – week ahead)

- 3.1 Year ahead availability planning (proposals, provisioning, validation, update) (89, 91, 94, 95)
- 3.2 Upfront activities for operational security analysis
- 3.3 Outage planning (70, 85)
- 3.4 Business continuity planning (contingency analysis) (28)

Out of scope

- Operational security analysis (35, 60, 67)
- Operational security and remedial actions (18)

- Use of tooling (19)
- Real-time data exchange (39, 45)
- Data exchange from relevant grid users to TSO and/or DSO (49, 2nd – 5th paragraph)
- Commissioning projects and Operational testing (51, 96)
- Training and certification Handling of forced outages (97)
- Outage coordination
- Real-time execution of availability plans (98)

2. MARKET RELEVANCE

Network planning is not directly related to a market, but the final objective is to provide sufficient capacity to the grid users so they can participate with as few limits as possible to the different time frames of electricity markets.

Hence, network planning is relevant for the market in the respect that if DSOs and TSOs do not properly plan their networks, this will hinder the market from operating. Adequate network planning is a prerequisite for correct market operations.

3. HIGH-LEVEL PROCESS DESCRIPTION

The process of network planning on a high level can be subdivided in several blocks:

GENERIC GRID PLANNING DATA: COMMON DATA FOR DSOS AND TSOS

This generic grid planning data should be agreed upon between TSOs and DSOs at the beginning of the LT planning cycle.

LONG-TERM GRID DEVELOPMENT

- (Customer driven) request for the connection of a new load/generator facility or the adjustment of an existing one towards the TSO or DSO.
- Forecast of the evolution of the demand and production on the distribution and transmission grid, resulting in a forecast of the power exchange on every connection point between the distribution and transmission system.
- Load flow analyses to determine the possible existing and future relevant bottlenecks.
- Detection of other needs: refurbishment due to grid ageing, environmental or safety concerns, etc.
- If needed, joint TSO – DSO analysis to find the optimal solution for the detected bottlenecks.
- Include the needed projects in the investment program.
- Realisation of the program and reporting for the concerned stakeholders.

Typically, TSOs and DSOs have a common planning cycle process, in which once every [x] year(s) a [y] year forward looking plan is agreed with a granularity of [z] year (e. g. in Netherlands: x=2, y=10, z=1)

OPERATIONAL PLANNING (XX- WEEK AHEAD)

Operational planning starts with the year-ahead availability planning, based on the scheduled unavailability of large generators and demand facilities in order to check the operational security.

Based on the previous analysis, the System Operator plans the outages of important grid elements. For outages planned by a System Operator that have an impact on another System Operator, the latter should be consulted.

The planning of outages is updated and refined on a regular basis (month ahead, x weeks ahead), taking into account all new information or requests from grid users, adding the outage scheduling of grid elements with a lesser impact. During every phase of this process, operational security is analysed and the other concerned System Operator is consulted.

4. ROLES USED FROM THE 'ROLE TOOLBOX'

Consumer, producer, party connected to the grid, consumption responsible party, production responsible party, scheduling coordinator, System Operator TSO, System Operator DSO.

5. RELEVANT COMMON DEFINITIONS FOR THIS USE CASE

Since reference is made to and most of the information is coming from the GL SO, we refer to the definitions list of the GL SO for the terms used in the GL SO. Some definitions (such as relevant grid elements or significant grid users) have to be seen from the perspective of TSO – DSO collaboration (and not as neighbouring control areas), meaning grid elements or grid users of one System Operator have an impact on the other.

An 'outage planning agent' is defined in the GL SO as an entity with the task of planning the availability status of a relevant power-generating module, a relevant demand

facility or a relevant grid element. For a relevant grid element of the distribution grid in this use case, the concerned DSO is considered the outage planning agent.



6. HIGH-LEVEL DESCRIPTION OF INFORMATION THAT NEEDS TO BE EXCHANGED BETWEEN THE IDENTIFIED ROLES

Four categories of data can be identified:

1. Data from DSO > TSO
2. Data from TSO > DSO
3. Data from third parties to DSO and TSO
4. Data commonly agreed upon between DSO and TSO

In the following descriptions, reference will be made to these categories.

1. GENERIC GRID PLANNING DATA

1.1 Planning parameters, market development assumptions, including long-term load and production forecast

- Analysis of load and production metering/measurement data serve as the basis for the forecast, in order to detect irregularities and exceptional circumstances that would distort the forecast.
(art. 35; category 4)
- Assumptions of the market conditions: economic growth, evolution of fuel prices, CO₂ prices, support schemes, etc. (art. 35; category 4)
- Based on the above assumptions, the DSO makes a forecast of the production and demand capacity, with an agreed-upon level of detail, per connection point, including the requests for new connections on the distribution grid and adjustments of existing ones, taking into account the planned grid reconfigurations having an impact on the power flow on the connection points between the transmission and distribution grid. (art. 35; category 1)
- Voltage control and reactive power (art. 22 & 24; category 4)
 - Each TSO shall agree with the transmission-connected DSO on voltage ranges in a steady-state at the connection points below 110 kV with the transmission-connected DSOs and the transmission-connected significant grid users (if these are relevant for maintaining operational security limits) and on the reactive power set points, power factor ranges and voltage set points for voltage control at the connection point between the TSO and the DSO.
 - Each TSO shall agree with the transmission connected DSO on the reactive power set points, power factor ranges and voltage set points for voltage control at the connection point between the TSO and the DSO. To ensure that these parameters are maintained, each DSO shall utilise its reactive power sources and have the right to give voltage control instructions to distribution connected significant grid users.
- Structural information concerning the distribution systems is part of the TSO's the observability area (art. 38; category 1)
 - The structural information related to the observability area is that each DSO shall provide to the TSO at least:
 - (a) substations by voltage;
 - (b) lines that connect the substations from (a) above;
 - (c) transformers from the substations from (a) above;
 - (d) significant grid users; and
 - (e) reactors and capacitors connected in the substations from (a) above.
 - Each transmission connected DSO shall provide the TSO with an update of the structural information in accordance with Article 38(3) at least every six months.
 - Each DSO shall provide to the TSO it is connected to, per primary energy sources, the total aggregated generating capacity of the type A power-generating modules, subject to Commission Regulation No [000/2015 RfG] and the best possible estimates of generating capacity of type A power-generating modules not subject to or which are granted a derogation according to Commission Regulation No [000/2015 RfG], connected to its

distribution system, and the related information concerning their frequency behaviour.

- Transmission-connected significant grid users and DSOs shall have access to the data related to their commissioned network installations at that connection point. (art. 35; category 2)

- Each TSO shall agree with the transmission-connected DSOs on the scope of additional information to be exchanged between them concerning commissioned network installations. (art. 35; category 4)

1.2 Significant grid users: distributed connected generation modules and demand facilities

- Structural data: each power-generating facility owner of a power-generating module, which is a significant grid user pursuant to Article 1(2)(a) and Article 1(2)(d), shall provide the data as defined in article 43 to the TSO and the DSO to which it has a connection point (art. 43; category 3).
- Scheduled data: each power-generating facility owner of a power-generating module, which is a significant grid user pursuant to Article 1(2)(a) and Article 1(2)(d), shall provide at least the scheduled data as listed in article 44, data to the TSO and the DSO to which it has the connection point (art. 44; category 3).
- Each DSO shall provide to its TSO the information specified in Article 43, Article 44 and Article 45 with the frequency and level of detail requested by the TSO (art. 46; category 1).

- Each TSO shall make available the information specified in Article 43, Article 44 and Article 45 to the DSO to whose distribution system significant grid users are connected, as requested by the DSO (art. 46; category 2).
- Each significant grid user that is a distribution-connected demand facility and that participates in demand-side response other than through an aggregator shall provide at least the following scheduled and real-time data directly to the TSO or via the DSO (art. 48; category 1 or category 3).
- Each significant grid user shall notify the TSO or DSO to which it has a connection point about any planned modification of its technical capabilities or operational disturbances, which could have an impact on its compliance with the requirements of this Regulation, prior to its execution (art. 49; category 3).

1.3 Relevant information for outage planning: list of power-generating modules, demand facilities and grid elements

- List of relevant power-generating modules and relevant demand facilities. For every internal relevant asset that is a power-generating module or demand facility, the TSO shall inform the DSOs about the relevant power-generating modules and the relevant demand facilities that are connected to their distribution system (art. 80; category 2).

- List of relevant grid elements. For each internal relevant asset that is a grid element, the TSO shall inform DSOs about the relevant grid elements that are connected to their distribution system (art. 82; category 2).



2. LONG-TERM GRID DEVELOPMENT

2.1 Detected relevant bottlenecks on the distribution and transmission grid

- List of relevant bottlenecks that have been detected by load flow analysis. (category 1 & 2)
- List of other relevant needs due to grid ageing, environmental or safety concerns. (category 1 & 2)

2.2 Analysis of the optimal solution to dispose of the bottlenecks

- For each relevant bottleneck and relevant other situation TSO and DSO identify the optimal solution. (category 4)
- For each solution, TSO and DSO determine the scope of the project they have to realise and align the timing. (category 4)

2.3 Information exchange regarding the realisation of the selected infrastructure projects

- During the realisation of different projects, TSO and DSO inform each other about the progress and changes in scope or timing. If needed, TSO and DSO agree on an adjustment of the scope and timing to keep their mutual project aligned. (category 4)
- If a TSO uses a special protection scheme, the TSO shall coordinate the special protection scheme functions, activation principles and set points with neighbouring TSOs and affected transmission-connected DSOs, including closed distribution systems and significant grid users. (art. 32; category 4)

3. OPERATIONAL PLANNING (XX – WEEK AHEAD)

When applying the provisions of this regulation, TSO shall consult with relevant DSOs and account for potential impacts on their system. (art. 3; category 4)

3.1 Year ahead availability planning (proposals, provisioning, validation, update)

Long-term indicative availability plans

- Two years prior to the start of any year-ahead outage coordination, each TSO shall assess the corresponding indicative availability plans for internal relevant assets, provided by the outage planning agents in accordance with Articles 4, 7 and 15 of Regulation (EU) No 543/2013, and provide its preliminary comments, including any detected outage planning incompatibilities, to all affected outage planning agents. (art. 88; category 1 & 2)

Provision of year-ahead availability plan proposals

- Before 1 August of each calendar year, an outage planning agent, other than a TSO taking part in an outage coordination region (a DSO or a CDSO) shall submit to the TSO(s) participating in an outage coordination region, and when relevant to the DSO or CDSO, an availability plan covering the following calendar year for each of its relevant assets. (art. 89; category 3)

Year-ahead coordination of availability plans

- Each TSO, DSO and CDSO shall plan the availability status of the relevant grid elements for which they are the outage planning agents and which are not interconnecting different control areas, using as a basis the availability plans developed in accordance with paragraph 1. (art. 91; category 1+ 4)
- If a TSO detects an outage planning incompatibility, the TSO must be entitled to propose a change to the availability plans of the internal relevant assets for which the outage planning agent is neither a TSO taking part in an outage coordination region, nor a DSO or a CDSO, and shall identify a solution in coordination with the concerned outage planning agents, DSOs and CDSOs, using the means at its disposal. (art. 91; category 4)
- If the 'unavailable' status of a relevant grid element has not been planned after taking the measures in paragraph 4, and if the absence of planning would threaten operational security, the TSO shall notify the relevant National Regulatory Authorities, the

affected DSO or CDSO if any and the affected outage planning agents of the actions taken, including the rationale for such actions, the impact reported by affected outage planning agents and the DSO or CDSO where relevant. (art. 91; category 2)

Provision of preliminary year-ahead availability plans

- Before 1 November of each calendar year, for every internal relevant asset located in a (closed) distribution system, the TSO shall provide the preliminary year-ahead availability plan for this relevant asset to the(C)DSO. (art. 92; category 2)

Validation of year-ahead availability plans

- If a TSO detects an outage planning incompatibility, the involved TSOs of the concerned outage coordination region(s) must jointly identify a solution in coordination with the concerned outage planning agents, DSOs and CDSOs, using the means at their disposal, while respecting to the extent possible the availability plans submitted by the outage planning agents, which are neither a TSO taking part in an outage coordination region, nor a DSO or a CDSO, and developed in accordance with Article 90 to Article 91. Following the identification of a solution, all TSOs in the concerned outage coordination region(s) must update and validate the year-ahead availability plans for all relevant assets. (art. 93; category 4)

- If an outage planning incompatibility remains without a solution after the application of paragraph 3, each concerned TSO must notify the actions taken to the relevant national regulatory authorities, the affected DSOs or CDSOs, if any, and the affected outage planning agents of the actions taken. The notification shall include the rationale for such actions, the impact reported by affected outage planning agents and the DSO or CDSO where relevant.

(art. 93; category 2)

Final year-ahead availability plans

- Before 1 December of each calendar year, the TSO shall provide the final year-ahead availability plan for each internal relevant asset located in a (closed) distribution system to the relevant (C)DSO.

(art. 94; category 2)

Updates

- If outage planning incompatibilities are detected, the involved TSOs of the outage coordination region must jointly identify a solution in coordination with the concerned outage planning agents and, if relevant, the DSOs and CDSOs, using the means at their disposal. (art. 95; category 4)



3.2 Upfront activities for operational security analysis (35, 60, 67)

- Each TSO shall gather the following information to the extent that it is necessary to carry out the operational security analysis in accordance with Article 67, such as planned outages and substation topologies. **(art. 35; category 1)**
- Within six 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, which shall encompass the following elements:
 - obligations for DSOs directly connected to the transmission system to inform the TSOs they are connected to of any changes in the data and information from this Chapter within the agreed-upon timelines. **(art. 35; category 1)**
 - obligations for significant grid users to inform their TSO or DSO within the agreed-upon timelines, about any relevant change in the data and information from this chapter. **(art. 35; category 3)**

From year-ahead to and including week-ahead operational security analysis

- Each TSO (and DSO) shall perform year-ahead and, when applicable, week-ahead, operational security analyses to detect at least the following constraints:
 - power flows and voltages exceeding operational security limits;
 - breaches of stability limits of the transmission system identified according to Article 33; and
 - violation of short-circuit thresholds of the transmission system.
- When a TSO (and DSO) detects a possible constraint, it shall design remedial actions. If remedial actions without costs are not available and the constraint is linked to the planned unavailability of some relevant assets, the constraint shall constitute an outage planning incompatibility and the TSO (DSO) shall initiate outage coordination in accordance with Article 96. **(art. 68; category 4)**

3.3 Outage planning

Treatment of relevant assets located in a distribution system or in a closed distribution system

- Each TSO shall coordinate with the (C)DSO the outage planning of internal relevant assets connected to its (closed) distribution system. **(art. 85; category 4)**

Regional coordination

- Each TSO shall provide the transmission-connected DSOs located in its control area with all relevant information at its disposal on the infrastructure projects related to the transmission system that may have an impact on the operation of the distribution system of these DSOs. **(art. 78; category 2)**

3.4 Business continuity planning (contingency analysis)

Contingency lists

- Each transmission-connected DSO and significant grid user that is a power-generating facility shall deliver all information relevant for contingency analysis

as requested by the TSO, including forecast and real-time data, with possible data aggregation in accordance with Article 46. **(art. 28; category 1)**



7. PRINCIPLES AND RECOMMENDATIONS FOR THE EUROPEAN COMMISSION THAT ARE RELEVANT TO THIS USE CASE

(as presented on 7 December 2015)

DEFINITION

1. Network planning comprises both long-term network development (up to one year in advance) and operational planning (from one year ahead to one week ahead). Both long-term network development planning and operational planning require cooperation and exchange of data between TSOs and DSOs.

SPECIFIC ON DATA EXCHANGE:

2. For planning purposes, DSOs and TSOs shall agree on common assumptions relevant for planning (e. g. economic growth) and common parameters for planning methodology (e. g. definition of connection requirements for grid users, simplified electrical grid models, etc.).
3. The information exchange between DSOs and TSOs supporting the long-term network development process should include simplified electrical grid models, including foreseen and planned grid expansion projects as well as annual demand/generation forecasts per physical DSO-TSO interface.
4. The information exchange between DSOs and TSOs supporting operational planning should include the year-ahead availability plan, outage and business continuity/emergency plans and information related to upfront activities for operational security analysis. Demand/generation forecasts on the DSO/TSO interface also need to be exchanged and/or published periodically to facilitate the integration of renewable energy sources (RES) and new customer connections. The frequency of these forecast exchanges could evolve over time.

Based on the analysis of the use case network planning, the additional following recommendations were also formulated:

PROCESS

5. TSOs and DSOs shall agree on a network planning process, which is adequately synchronised with the Ten Year Network Development Plan (TYNDP). Typically, a common planning cycle process would be a process in which once a [x] year, a [y] year forward looking plan is agreed with a granularity of [z] year (e. g. in Netherlands: x=2, y=10, z=1)

Investments related to the outcome of these processes should be reflected in the regulatory regime as quickly as possible.

SIGNIFICANT GRID USER CONNECTION

6. For new significant generators (according to the maximum power level for nomination in each member state) requiring connection to the electricity grid, a joint analysis should be carried out by the DSO and TSO upfront as already prescribed by regulation).

IMPLEMENTATION AGNOSTIC

7. The definition of what data needs to be exchanged shall not determine how the information is exchanged to accommodate different implementations in different Member States (e. g. with/without a central data hub).

8. FORESEEN FUTURE CHANGE RELATED TO THE CURRENT SITUATION FOR THIS USE CASE

TSOs and DSOs need, for future network planning (long-term and operational), an even better view of the decentralised generation and its effect on the power flow at the interchange points between TSO and DSO. Information exchange for operational planning will have to be done in the future in a structured way.

9. LINKS TO RELEVANT REGULATORY DOCUMENTS

- Draft Guideline on System Operations (version of 10 October 2015). In the meantime, a newer version of 27/11 is available, but it does not change the content of the data exchanges.
- Although it is not a document with legal value, the EG3 final report from January 2015 (and its addendum: refinement of recommendations EG3 report from September 2015) is an important contribution to these issues.

10. OTHER RELEVANT VIEWPOINTS RELATED TO THIS USE CASE

The DSO/TSO data management workgroup focusses specifically on data exchange at the DSO/TSO interface.

TWO IMPORTANT VIEWPOINTS:

1. It is important to recognise that in general, data exchange supports a business process between actors, fulfilling their 'contractual relations', which follow from their roles and responsibilities. The result from this 'relation' on data exchange should be consistent with it.
2. The data exchange between DSOs and TSOs should also be consistent in the context of what data exchange occurs between DSOs and TSOs with market parties to ensure that data exchange is consistent and supports the emerging market models (e. g. market models on flexibility (EG3)).

These generic viewpoints should be considered for inclusion in the key messages or principles of the end report.

11. FUTURE ELEMENTS TO BE ADDED IN THE NEXT VERSION OF THIS TEMPLATE

According to the European NIS directive, to be issued soon, Information Security (Management) shall be a topic. At least a reference to the valid rules and laws must be given.

Gathering the ideas and best practices of other Member States' practices on content and format of data exchange might be helpful.

OVERVIEW

			RELEVANT DSO-TSO INTERACTION IN GL SO				
ARTICLE	DESCRIPTION	IN SCOPE	SCOPE OF PLANNING				OUT OF SCOPE
			1	2	3	4	
			DSO > TSO	TSO > DSO	TP > DSO & TSO	TSO & DSO	
Generic grid planning data							
22	Obligations of TSOs regarding voltage limits	●				●	
24	Obligations of TSOs concerning voltage and reactive power management in system operation	●				●	
38	Structural data exchange	●	●				
35	Organisation, roles, responsibilities and quality of data exchange	●	●	●	●	●	
60	Year-ahead scenarios	●	●		●		
43	Structural data exchange	●			●		
44	Scheduled data exchange	●			●		
46	Data exchange between TSOs and DSOs concerning significant power generating modules	●	●	●			
48	Data exchange between TSOs and distribution connected demand facilities or their aggregators	●	●		●		
49	Responsibility of the significant grid users	●	●		●		
80	Lists of relevant power generating modules and relevant demand facilities	●		●			
82	Lists of relevant grid elements	●		●			
Long term grid planning							
32	Special protection schemes	●				●	
Operational planning							
3	Regulatory aspects	●				●	
88	Long-term indicative availability plans	●	●	●			
89	Provision of year-ahead availability plan proposals	●			●		
90	Year-ahead coordination of the availability status of relevant assets for which the outage planning agent is not a TSO taking part in an outage coordination region, nor a DSO or a CDSO	●		●			
91	Year-ahead coordination of the availability status of relevant assets for which the outage planning agent is a TSO taking part in an outage coordination region, a DSO or a CDSO	●	●	●		●	
92	Provision of preliminary year-ahead availability plans	●		●			
93	Validation of year-ahead availability plans within outage coordination regions	●		●		●	
94	Final year-ahead availability plans	●		●			
95	Updates to the final year-ahead availability plans	●				●	
28	Contingency lists	●	●				
67	Operational security analysis in operational planning	●	●		●		
68	From year-ahead to and including week-ahead operational security analysis	●				●	
78	Regional coordination	●		●			
85	Treatment of relevant assets located in a distribution system or in a closed distribution system	●				●	

			RELEVANT DSO-TSO INTERACTION IN GL SO				
ARTICLE	DESCRIPTION	IN SCOPE	SCOPE OF PLANNING				OUT OF SCOPE
			1	2	3	4	
			DSO > TSO	TSO > DSO	TP > DSO & TSO	TSO & DSO	
Operational planning (continued)							
103	Ancillary services	●		●			
177	Reserve providing units connected to the DSO grid	●				●	
17	Categories of remedial actions						●
18	Preparation, activation and coordination of remedial actions						●
19	Availability of TSO's means, tools and facilities						●
39	Real-time data exchange						●
45	Real-time data exchange						●
49	Responsibility of the significant grid users	●	●*		●		
51	Purpose and responsibilities						●
53	Training program						●
54	Training conditions						●
69	D-1, intraday and close to real-time operational security analysis						●
96	Detailing the "testing" status of relevant assets						●
97	Processes for handling forced outages						●
104	Reactive power ancillary services						●

* see above



APPENDIX 2

BACKGROUND PROCESS IN 2015

On 26 January 2015, a first trilateral meeting was organised between the European Commission (EC), ENTSO-E and the European associations of DSOs (CEDEC, EDSO for smart grids, EURELECTRIC and GEODE) to assess the current status of the TSO – DSO relationship and pave the way for joint action.

A series of workshops was planned. The first one, held in mid-March 2015, focused on the roles and responsibilities of TSOs and DSOs, reactive power exchange and flexibility, while those organised in May and June 2015 dealt with data management. During these meetings, a better understanding of the challenges and needs of TSOs and DSOs was established, although time constraints did not allow experts to formulate clear recommendations or concrete proposals. So far, one paper was published as a result of this process ("[General Guidelines for reinforcing the cooperation between TSOs and DSOs](#)").

On 7 July 2015, during a second trilateral meeting, the EC, ENTSO-E and the four DSO associations agreed to establish a common Project Team with clearly defined terms of reference organise to hold three meetings. In all, 16 experts (eight from the TSOs and eight from the DSOs) from all over Europe were included in the Project Team, supplemented with members of the five associations' secretariats and occasionally with officials from the EC.

The first Project Team meeting on 26 October 2015 focused primarily on setting up the work under the new agreement and on development of a common understanding of the roles involved, their responsibilities, rights and duties and information needs (and subsequently concrete data

needs) that stem from them. The Project Team agreed to work on five relevant and illustrative use cases to be executed continuously in the real world (congestion management, balancing, use of flexibility, real-time control and supervision and network planning). The use cases were developed in between official meetings in smaller groups in which TSOs and DSOs were equally represented.

On 9 November 2015, the first drafts of the use cases were discussed and developed further, including feedback from all Project Team members. Also a discussion of possible key messages was started. In the meeting on 7 December 2015, these discussions were continued, and some valuable intermediate feedback from the European Commission was collected. It was therefore agreed that the final report should reflect at least the following aspects: objectives of the work, approach chosen by the group, results and key messages from the use case discussions, key principles that can be deduced from these key messages and recommendations for the future.

This paper will be used by the EC as input for their Market Design and Renewables package. Therefore, the EC has been involved and is expecting to receive a common view from TSOs and DSOs, which is new in the energy world.



APPENDIX 3

DEFINITIONS

DATA MANAGEMENT – DEFINITIONS

Term	Definition	Source
Aggregator	A demand service provider that combines multiple short-duration consumer loads for sale or auction in organised energy markets.	Directive 2012/27/EU
Allocation	The provisional settlement based on both metering values (as far as they are known) and on standardised consumption for connection points for which the metering values are not available yet.	
Ancillary Service	A service necessary for the operation of a transmission or distribution system.	Directive 2009/72/EC
Balancing	All actions and processes on all timelines through which TSOs ensure, in a continuous way maintaining the system frequency within a predefined stability band and comply with the amount of reserves needed per Frequency Containment Process, Frequency Restoration Process and Reserve Replacement Process.	EG3 report on flexibility
Balance Responsible Party	A market-related entity or its chosen representative responsible for its imbalances.	EG3 report on flexibility
Balancing Services	A service provided to a Transmission System Operator from a Balancing Service Provider.	EG3 report on flexibility
Balancing Service Provider	A market participant providing Balancing Services to a Transmission System Operator.	EG3 report on flexibility
Congestion Management	Set of actions that the network operator performs to avoid or relieve a deviation of the electrical parameters from the limits that define the secure operation. This term includes congestion management and voltage control.	EG3 report on flexibility
Cross-border flow	A physical flow of electricity on a transmission network of a Member State that results from the impact of the activity of producers and/or consumers outside that Member State on its transmission network.	Regulation 714/2009
Demand Side Flexibility	Changes in energy use by end-use customers (domestic and industrial) from their current/normal consumption patterns in response to market signals such as time-variable electricity prices or incentive payments or in response to acceptance of the consumer's bid, alone or through aggregation, to sell demand reduction/increase at a price in organised electricity markets.	EG3 report on flexibility
Energy efficiency/ Demand Side Management	A global or integrated approach aimed at influencing the amount and timing of electricity consumption to reduce primary energy consumption and peak loads by giving precedence to investments in energy efficiency measures or other measures such as interruptible supply contracts or overinvestments to increase generation capacity if the former are the most effective and economical option, taking into account the positive environmental impact of reduced energy consumption and the security of supply and distribution cost aspects related to it.	Directive 2009/72/EC
Distributed Generation	Generation plants connected to the distribution system.	Directive 2009/72/EC
Distribution System Operator (DSO)	A natural or legal entity responsible for operating, ensuring the maintenance of and, if necessary, developing the distribution system in a given area and, where applicable, its interconnections with other systems and for ensuring the long-term ability of the system to meet reasonable demands for the distribution of electricity.	Directive 2009/72/EC



Flexibility	<p>Active management of an asset that can impact system balance or grid power flows on a short-term basis (from day-ahead to real time). Flexibility can be provided by different assets. The first three can be both directly or through an aggregator:</p> <ul style="list-style-type: none"> • generation (part of the dispatchable units, RES); • load facilities (involved in a demand response programme); • storage (pumped storage power station, batteries, etc.); and/or • interconnectors (intraday energy exchanges). <p>Flexibility can be used by:</p> <ul style="list-style-type: none"> • the TSO for balancing and congestion management in the short term and planning in long-term contracting; • the DSO for congestion management in the short term and planning in long-term contracting (see Third Package article 25.7); and/or • the BRP for portfolio management both in the short and long term (investment). 	
Imbalance Settlement	Financial settlement mechanism aimed at charging or paying Balance Responsible Parties for their imbalances.	EG3 report on flexibility
Reconciliation	Process of final settlement based on metering values for all connection points in the electricity market.	
Settlement	Process in which correct energy volumes are assigned to the different market parties.	
Smart metering system	Electronic system that measures energy consumption, provides more information than a conventional meter, and can transmit and receive data using electronic communication.	Directive 2012/27/EU
Transmission System Operator (TSO)	A natural or legal entity responsible for operating, ensuring the maintenance of and, if necessary, developing the transmission system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the transmission of electricity.	Directive 2009/72/EC
Voltage Control	Distribution system control managed by distribution system operators to maintain voltage in their networks within limits and to minimise reactive power flows and consequent technical losses and to maximise available active power flow.	EG3 report on flexibility

DEFINITIONS OF TERMS RELATED TO DATA MANAGEMENT

Term	Definition	Source
Aggregation	Joint individual components merged into one entity.	
Cyber security	Preservation of confidentiality, integrity and availability of information in cyberspace.	EG2 deliverables
Data	Representation of facts as text, numbers, graphics, images, sounds or videos. These facts are captured, stored and expressed as data.	DAMA-DMBOK
Data access	Activities related to valid and appropriate access to data for storing and retrieving.	
Data collection	Gathering and measuring data on variables of interest.	Inspired by DAMA-DMBOK
Data exchange	Process of sending and receiving data so that the content or meaning assigned to the data is not altered during the transmission.	OECD
Data format	Usually refers to a specific, possibly proprietary, set of data structures within a software system.	OECD
Data governance	<p>The exercise of authority, control and shared decision-making (planning, monitoring, and enforcement) over the management of data assets</p> <p>Goals:</p> <ul style="list-style-type: none"> • To define, approve, and communicate data strategies, policies, standards, architecture, procedures, and metrics; • to track and enforce regulatory compliance and conformance to data policies, standards, architecture, and procedures; • to sponsor, track, and oversee the delivery of data management projects and services; • to manage and resolve data related issues; and • to understand and promote the value of data assets. 	DAMA-DMBOK
Data hub	A collection of data from multiple sources organised for distribution, sharing and often subsetting and sharing.	
Data management	<p>The business function of planning, controlling and delivering data and information assets. This function includes:</p> <ul style="list-style-type: none"> • The disciplines of development, execution and supervision ... • of plans, policies, programs, projects, processes, practices and procedures ... • that control, protect, deliver, and enhance • the value of data and information assets. 	DAMA-DMBOK
Data storage	Capacity to record, retrieve and access data. The action to send/receive data to be stored.	
Information	<p>Information is data in context. Without context, data are meaningless; we create meaningful information by interpreting the context around the data. The context includes</p> <ul style="list-style-type: none"> • the business meaning of data elements and related terms; • the format in which the data are presented; • the timeframe represented by the data; and • the relevance of the data to a given usage 	
Meter	A physical device containing one or more registers.	ENTSO-E Harmonised Role Model
Personal data	Any information relating to an identified or identifiable natural person ('data subject'). An identifiable person can be identified, directly or indirectly, in particular by reference to an identification number or one or more factors specific to his or her physical, physiological, mental, economic, cultural or social identity.	Directive 95/46/EC
Processing of personal data	Any operation or set of operations performed on personal data, whether or not by automatic means, such as collection, recording, organisation, storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, blocking, erasure or destruction.	Directive 95/46/EC

DEFINITIONS PROPOSED BY THE ENTSO-E HARMONISED ROLE MODEL

Actor/Domain	Terms	Definitions
Actor	Market Information Aggregator	A party that provides market-related information compiled from figures supplied by different actors in the market. This information may also be published or distributed.
Actor	Meter Administrator	A party responsible for keeping a database of meters.
Actor	Meter Operator	A party responsible for installing, maintaining, testing, certifying and decommissioning physical meters.
Actor	Metered Data Aggregator	A party responsible for establishment and qualification of metered data from the Metered Data Responsible. Such data are aggregated according to defined market rules.
Actor	Metered Data Collector	A party responsible for meter reading and quality control of the reading.
Actor	Metered Data Responsible	A party responsible for the establishment and validation of metered data based on the data received from metered data collector. The party is responsible for the history of metered data for a Metering Point.
Actor	Metering Point Administrator	A party responsible for registering the parties linked to the metering points in a Metering Grid Area. He or she is also responsible for maintaining the Metering Point technical specifications and for creating and terminating metering points.
Domain	Meter	A physical device containing one or more registers.
Domain	Metered grid area	A physical area where consumption, production and exchange can be metered. It is delimited by the placement of meters for period measurement for input to and withdrawal from the area. It can be used to establish the sum of consumption and production with no period measurement and network losses.
Domain	Metering point	An entity where energy products are measured or computed.



APPENDIX 4

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