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CEER Position Paper on the Future DSO and TSO Relationship

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Abstract

The ACER Bridge to 2025 Paper described the need for a greater coordination between Distribution System Operators (DSOs) and Transmission System Operators (TSOs). CEER's July 2015 Conclusions Paper on 'The Future Role of DSOs' committed to carry out further work and analysis on the key aspects of the future DSO-TSO relationship for electricity and gas, including the advantages of taking an integrated approach to electricity, gas and heating sources, focusing on these questions in the context of flexibility.

This paper explores how the relationship and regulatory arrangements between DSOs and TSOs may need to evolve to ensure that efficient system solutions (either conventional or new) can be deployed to accommodate the needs of a sustainable energy system.

Existing Network Codes, Guidelines and other legislation lay out the foundations for the DSO and TSO future relationship. This document builds on them to look at the high-level principles that are necessary to deliver benefits to customers.

Target Audience

European Commission, NRAs, network operators, energy market participants, Member States and other interested parties.

Keywords

Electricity, gas, DSO-TSO relationship, regulatory arrangements.

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Related Documents

CEER documents

- CEER 2016 Work Programme, 6 January 2016, Ref. C15-WPDC-27-06
- The Future Role of DSOs – A CEER Conclusions Paper, 13 July 2015, Ref: C15-DSO-16-03

ACER documents

- ACER in cooperation with CEER, Energy regulation: A Bridge to 2025 Conclusions' Paper, 19 September 2014

External documents

- General guidelines for reinforcing the cooperation between TSOs and DSOs, DSO/TSO Cooperation Platform, November 2015
- Refinement of Recommendations – Annex to EG3 Report, Smart Grid Task Force, September 2015
- Regulatory Recommendations for the Deployment of Flexibility – EG3 Report, Smart Grid Task Force, January 2015

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1 Executive summary

This paper explores how the relationship and regulatory arrangements between DSOs and TSOs may need to evolve, to ensure efficient system solutions (either conventional or new) can be deployed to accommodate the needs of a sustainable energy system. Below we set out a summary of the principles which CEER believes should set the trajectory of the future DSO-TSO relationship and related regulatory arrangements.

Overarching principles

The overarching principles set the framework within which the more specific principles and approaches on governance, network planning and system operation are developed. At the centre of this framework is the need for DSOs and TSOs to build a constructive and cooperative relationship, led by mutual respect. CEER believes that cooperation and coordination between network operators, effective unbundling and competitive retail and wholesale markets will support the delivery of optimal system outcomes.

Governance

The increased need for coordination should not create any confusion in allocating respective roles and responsibilities. Respective tasks should be carried out with appropriate consultation between DSOs and TSOs and with stakeholders. It is essential that controls on revenue recovery for DSOs and TSOs create incentives to optimise outcomes for the system as a whole, rather than focusing on minimising the DSO's and TSO's costs in isolation. The cross sectoral interactions between electricity, gas and heat should also be taken into account in the development and management of the networks.

Network planning

In a fast changing environment, transparency on network status and shared forecasts are crucial in allowing least cost solutions to be identified, and in creating the opportunity for innovative products and services to emerge. Importantly, there is a need to avoid under and over investment (i.e. stranded costs). Reinforced DSO-TSO cooperation on long-term scenarios and network development plans is needed to achieve this, alongside DSO-TSO cooperation with all stakeholders who may have a potential impact (e.g. urban planning bodies, and electric and gas vehicles development schemes).

System operation

The changing system is making the task of maintaining overall system security increasingly challenging. However, there are also significant opportunities for DSO-TSO cooperation to drive greater efficiencies in whole system operation. Greater information sharing is needed to help DSOs and TSOs to better predict and manage developments on their networks, and to identify where one party can and should take action to support the needs of the other and the system as a whole. Regulatory arrangements need to support effective coordination of actions and access to flexible resources, as well as creating the right signals and framework to allow the competitive market to address system needs and minimise the efforts needed by the DSO and TSO overall.

2 Introduction

Background

Europe's energy landscape is in a period of significant change.

Electricity is transitioning away from reliance on a small number of centralised fossil-fuel intensive generators towards low carbon generation. Low carbon generation is often more variable and generally has differing technical characteristics than traditional generation. It tends to be more spread out, with an expanding share of it connected at distribution level.

The way electricity is being consumed is changing too. Customers are using electricity for new things like transport and heating, and as retail markets develop, customers are approaching their energy use in new ways, becoming more actively engaged (e.g. as prosumers) and having greater access to new technology such as smart meters and smart appliances to help manage their consumption. New business models and market participants are also emerging, which have the potential to significantly change the products available and the way that current markets operate.

Whilst the changes taking place are predominantly in electricity, there are potential implications for the gas system. The increasing variability of electricity generation, driven by renewables, can lead to variable gas flows, to the extent that gas powered flexibility is used for electricity system balancing and network management. In some countries, gas is likely to act as a bridge technology for transition from coal intensive electricity generation to renewables. In the future, the gas sector could potentially see further changes, including growing injections of biogas into the distribution network. Although it is unlikely that the volume of produced biogas will be comparable to the penetration of renewable energy sources in the electricity sector, it could in some cases lead to decreased/reverse flows at transmission level. There could also be an uptake of compressed natural gas vehicles (GVs), accompanied by changes in refuelling infrastructure (mainly existing fuel stations upgraded with gas connections).

Interconnection in both gas and electricity transmission networks is also growing concurrently with the implementation of the 3rd Package. Network Codes and Guidelines introduce new roles and responsibilities for network operators, lay the foundations for maximising the efficient use of interconnection and facilitate greater cross-border energy trade across timeframes. Together with facilitating secure, affordable and low carbon energy for European customers, European market integration is expected to bring changes in the energy flows and capacity use within transmission and distribution networks.

The nature of the changes taking place has already been documented in a number of publications. This paper will focus on the impact of these changes on the relationship between European DSOs and TSOs, and how this relationship needs to evolve to meet the long-term needs of the wider system and deliver benefits for customers now and in the future.

Challenges for the DSO and TSO relationship

Electricity DSOs are facing new challenges in managing the impacts of increased generation connection at distribution level and changing consumer demand. At the same time, significant new opportunities are emerging for them in the form of new approaches, technologies and solutions to manage their networks. As noted in CEER's paper on the 'Future roles of DSOs' there is a need for DSOs to be increasingly innovative and explore smart and flexible solutions, including actively managing their networks. In a number of countries this transition is already underway,[1] and flexibility providers are gaining access to new DSO revenue streams.

Electricity TSOs are also facing new challenges in managing the transmission networks, and more specifically challenges related to balancing supply and demand to maintain system frequency. Changing demand and generation patterns mean changes in the way electricity flows through transmission networks, which in turn need to be managed. Local consumption of distributed generation can for instance lead to average flows on transmission networks decreasing. Equally more variable demand and generation means that there is a need for increasing volumes of flexibility – often found at distribution system level – to ensure system stability.

On the gas side, the variability of flows caused by gas powered flexibility for electricity system balancing and network management, can impact the way gas DSOs and TSOs develop and operate their networks. Furthermore, only a limited proportion of gas production is found within each country. Therefore cross-border trading and optimising the use of transport capacities have always been important issues for gas TSOs. Nowadays, it is becoming even more challenging due to the fact that more and more market participants are diversifying their trading portfolios. It is a change from just a few long-term trading contracts to a variety of different contracts (short-, medium- and long-term), which makes the management of the system increasingly challenging.

These developments may increase the complexity of the DSO-TSO relationship. Importantly, these changes mean that the interactions between energy transmission and distribution are growing.

It should be noted that whilst the patterns of change are common across many European countries, the extent of change varies from country to country, impacted by factors such as energy mix, dependence on certain gas producing countries, retail market development and rate of progress in 3rd Package implementation. Appropriate arrangements for the future DSO-TSO relationship are therefore likely to vary from country to country.

CEER believes that there is a growing and urgent need for regulators, DSOs and TSOs to take a whole system approach in the development and management of the electricity and gas systems. Developing regulatory frameworks and DSO-TSO operational frameworks which make best use of competitive markets can result in significant progress in addressing these challenges and opportunities.

[1] For instance please see https://www.ofgem.gov.uk/publications-and-updates/ea-technology-s-summary-low-carbon-network-fund-learning for developments in GB.

The need for greater coordination between DSOs and TSOs has been recognised in the ACER Conclusions Paper '*Energy Regulation: A Bridge to 2025*' and CEER's Conclusions Paper on '*The Future Role of DSOs'*. This paper builds on CEER's thinking on the issue. Stakeholders have also published a number of documents on this topic, including the joint paper published by ENTSO-E, CEDEC, EDSO, Eurelectric and GEODE: *'General guidelines for reinforcing the cooperation between TSOs and DSOs'.*

Objectives and purpose of the document

The objective of this paper is to explore how the relationship and regulatory arrangements between DSOs and TSOs may need to evolve to ensure efficient system solutions (either conventional or new) can be deployed to accommodate the needs of a sustainable energy system.

This paper covers both electricity and gas. It focuses on the high-level principles which CEER believes should set the trajectory of the future DSO-TSO relationship and related regulatory arrangements. These principles are set out in four areas; overarching principles, governance arrangements, network planning and system operation.

The paper does not go into the more detailed policy or technical solutions which may be appropriate, on the basis that no one-size-fits-all model exists, given the diversity of DSOs' profiles and national arrangements. The paper also seeks to build on, rather than replicate, the foundations for the DSO-TSO future relationship set out in the Network Codes and Guidelines. Network Codes are the building blocks of the Internal Energy Market. They will provide Europe with a coherent set of harmonised rules and requirements covering all important cross-border aspects of the electricity and gas sectors, including connection requirements, the coordination of system operations and the completion of pan-European energy markets. They also provide European standards for data formats and data exchange. These provisions are not exhaustive and should be considered as a basis on which future cooperation between TSOs and DSOs should be built.

3 Overarching principles

Below we set out overarching principles, which provides context and explains our approach to developing the range of more detailed principles set out in this paper.

Firstly, DSO unbundling is an important pre-requisite. Fair competition and the avoidance of undue market distortion are building blocks upon which further progress in developing the DSO-TSO relationship must be made.

a) *To avoid market distortion it remains essential that DSOs are neutral when performing their tasks and are sufficiently unbundled. CEER sees the effective implementation of the existing 3rd Package principles and obligations as the minimum necessary to achieve this.*

Secondly, the following overarching principles reflect the importance of a common approach, which also allows for the diversity of national arrangements across Europe.

The diversity of national arrangements (e.g. voltage levels for electricity or pressure levels for gas, roles and responsibilities, capabilities, interests, etc.) may preclude the development of one-size-fits-all solutions. However, NRAs, DSOs and TSOs across European countries should cooperate to agree common approaches, where these better facilitate the optimal operation of the system, i.e. in a secure, sustainable and cost-efficient manner.

b) *With regards to the future DSO and TSO relationship, CEER believes that general principles should be defined on European level, while more detailed regulation, for the implementation of common principles in the respective countries, should be developed at a national level.*

In implementing the principles set out in this paper, NRAs, DSOs and TSOs should ensure that detailed national regulatory arrangements are appropriate to the needs of their energy system. One major difference between many European countries is in the number and nature of DSOs.

c) *The type and nature of DSOs (e.g. size, DSO-connected or TSO-connected) should be taken into account when designing the instruments and requirements to deliver the wider objectives, in order to avoid disproportionate or negative cost/benefit impacts.*

In a number of cases this would be expected to mean that a DSO connected only to another DSO would cooperate with the connected DSO, instead of the TSO.

d) *For the future DSO-TSO relationship it is necessary to enhance a whole system approach at every level of responsibility i.e. NRAs, TSOs and DSOs. This includes cooperation in the efficient use of (and where appropriate, trialling of) innovative solutions and approaches for system operation and network planning.*

4 Governance

In the context of this paper, governance includes three different yet interlinked areas: (i) the allocation of roles and responsibilities between DSOs and TSOs, (ii) high-level principles on the regulatory framework for the delivery of these responsibilities (e.g. price controls) and (iii) the representation of network operators in the Internal Energy Market governance.

4.1 Current arrangements

Across most of Europe, electricity and gas TSOs own, develop, maintain and operate the respective transmission systems. Electricity TSOs are responsible for maintaining overall system security via frequency control, congestion management, voltage support in the transmission network, as well as being in charge of system restoration. Gas TSOs are responsible for overall gas system security, ensuring appropriate pressure levels via linepack management and checking the quality of any imported natural gas. They are also in charge of gas system restoration.

Similarly, electricity and gas DSOs generally develop, maintain and operate the distribution systems and have responsibility for system security and quality of service in the respective distribution networks. For electricity DSOs there is an increasing emphasis on distribution congestion and voltage management to support their networks. Gas DSOs use linepack to ensure appropriate pressure in their networks and to optimise the use of the respective systems, including the upstream systems of the TSOs.

NRAs currently tend to subject DSOs and TSOs to separate regulatory regimes, which may have differing incentives and timelines associated with them. Regulatory regimes for electricity and gas are also separate.

4.2 Emerging challenges

Current roles, responsibilities, and regulatory frameworks tend to set out clear divisions between the DSO and the TSO, the distribution and transmission networks more broadly, and between gas and electricity.

However, as we have seen, changes in the energy sector mean that interactions are growing between DSOs and TSOs and between electricity and gas. In electricity, the expanding share of production at distribution level is causing a higher demand for flexibility in system operation and the need for coordinated grid investment at DSO and TSO level. The high intermittency of this distributed electricity also leads to increasing changes in the way electricity flows through transmission networks. As mentioned earlier in the paper, where gas fired power plants are widely used to balance intermittency on the electricity side, this can also be challenging for the gas systems. There is the potential for more gas injections at distribution level, but, at the same time, we are likely to see more customers changing to other ways of heating (e.g. district heating, photovoltaic, heat pump, etc.) resulting in a decrease in demand.

It is important that roles and responsibilities, and regulatory regimes for revenue recovery, appropriately reflect these increased interactions and the increasing importance of the DSO-TSO relationship in electricity and gas.

4.3 Future principles

Roles and Responsibilities

In some areas, the Network Codes (and Guidelines where relevant) allocate specific roles and responsibilities to TSOs and DSOs. The principles below build upon these allocations to ensure that TSO/DSOs have clarity on their respective roles/responsibilities and effectively coordinate their activities where relevant. Nevertheless, it is important that the increased need for coordination does not lead to a reduction in clarity of respective roles.

a) *Roles and responsibilities should be clearly allocated to TSOs and DSOs. Where responsibility is shared between actors to allow for efficient whole system outcomes, a clear framework and processes should be in place to manage interactions.*

b) *DSOs and TSOs should build a common understanding of (i) which actions undertaken by one party could have an impact on the other; and (ii) which actions of one party could support the needs of the other.*

Clear working level processes need to be agreed between parties to avoid confusion at any stage of system operation, network planning and to clarify their access to market services.

It is clear that many of the changes we are seeing are not driven by DSOs and TSOs themselves, but instead by market participants. The market should also be relied upon as a central part of the solution.

c) *In delivering effective transmission and distribution systems, DSOs and TSOs should make best use of transparent market based procedures in a non-discriminatory way.*

It is logical also that in undertaking roles, DSOs and TSOs must not only share information and consult with one another, but that they must place an increased focus on consulting and sharing information with the market and with other parties such as local authorities. The exchange of data and consultation process must be meaningful and DSOs and TSOs must act on the information received to better manage their networks.

d) *Across all areas of responsibility there is a need for extensive yet proportionate consultation among DSOs, between DSOs and TSOs and with stakeholders, both to exchange information and take inputs into account.*

e) *Where it supports efficient operation of the system and can benefit customers, DSOs and TSOs should cooperate to efficiently provide appropriate data in proper time-bands related to their respective networks to other stakeholders in the energy market in a non-discriminatory manner.*

Regulatory arrangements

DSOs and TSOs have the potential to offer solutions to one another which could help address issues on their respective networks in a more cost-efficient way. A DSO for instance may be able to offer a solution to a problem on the transmission network, which is more cost-efficient than the transmission alternative.

f) *The regulatory arrangements, and in particular controls on revenue recovery, (sometimes called price controls) must support a competitive market and efficient whole system outcomes. Controls on revenue recovery for DSOs and TSOs should create incentives to optimise outcomes for the system as a whole, rather than focusing on minimising the DSOs' and TSOs' costs in isolation.*

g) *Remuneration arrangements for services provided between DSOs and TSOs should not unduly distort market mechanisms.*

There are a number of elements NRAs should consider in implementing these principles.

The first is appropriate alignment of incentives across regulatory boundaries. Without this, parties are unlikely to take the appropriate combination of actions to deliver optimal outcomes.

The second is in achieving a fair allocation of costs. Regulatory arrangements for the cooperation of DSOs and TSOs should allow cross network costs, driven by the actions of either the DSO or the TSO, to be fairly allocated between parties.

CEER is further developing its thinking in this area in its paper *'Guidelines of Good Practice on Incentive Schemes for DSOs'.*[2]

European Governance

On a European level ENTSO-E and ENTSO-G were established to give TSOs legal mandates under the 3rd Package. The changing energy sector is leading to greater responsibilities for DSOs and the need for their wider integration into legal processes.

h) *Due to the structural changes in the European energy system, CEER considers that the distribution level should be adequately represented in the Internal Energy Market governance scheme (i.e. discussions and negotiations on Network Codes and Guidelines, TYNDPs processes etc.).*

This includes ensuring the effective representation of DSOs in governance processes, and appropriate reflection of the needs of the distribution system in existing codes, guidelines and processes.

[2] Due in Q4 2016.

5 Network & System Planning

5.1 Current arrangements

In this document we focus on the most common legal provisions underpinning current arrangements, without prejudice to voluntary practices and other, less common, national or regional arrangements.

Roles and responsibilities for network planning differ among parties from country to country. However, there are common patterns of responsibility at each voltage or pressure level. Equally, a range of responsibilities applies across a large number of Member States, in particular those defined in (or derived from) the European regulatory framework for TSOs.

At their respective levels, TSOs and DSOs both have similar responsibilities in planning for outages, maintenance, construction and faults; for infrastructure development or operational alternatives necessary to meet connection requests; and to ensure system security and quality.

In terms of specific responsibilities, TSOs have common requirements set out as part of the European Ten Year Network Development plan (TYNDP). This includes adequacy forecasting and long-term considerations, but also the analysis of future potential transmission network planning needs (both new built and refurbishment, including interconnectors) that TSOs undertake for their own purposes on a rolling 10-year timeframe. Coherence between the two is an area under regulatory scrutiny.

More generally, there are also common patterns of information sharing between DSOs and TSOs on network planning, such as TSOs providing or publishing information on their network (e.g. outage or investment plans), and DSOs providing or publishing data on connections. However the amount of information shared varies between countries. It is also valuable to note that DSOs commonly have opportunities or obligations to feed information into TSO planning processes. Quite often however, with no obligation on the TSO to take DSO needs into account, nor justify if not.

5.2 Emerging challenges

The fast pace of system change, as described in the introduction, is making it increasingly important to develop detailed forecasting of demand and generation (injection, import and storage for gas). It is particularly important to understand patterns of reduced flow at transmission level, or even reverse flows where distributed electricity generation or green gas injection (methane from biogas and power to gas) exceeds demand on distribution networks. This information is crucial for TSOs in developing long-term analysis, forecasts and plans.

Equally, DSOs have an increasing need to improve visibility and forecasting at distribution level, both to share this information with TSOs, and to support distribution network planning.

For both DSOs and TSOs, insufficient visibility of local authority plans can inhibit efficient network planning, particularly with the rise of local energy schemes and interactions with developments such as heat networks. DSOs' and TSOs' ability to plan network build and connection/transport capacity efficiently can also be inhibited by lack of visibility of market players such as distributed generators, green gas producers, flexibility providers, aggregators, electric or gas mobility infrastructures and others.

Reciprocally, for connectees, insufficient information on the full range of connection options or network status, can hamper their ability to identify cost-efficient connection options, and can also lead to more work for DSOs and TSOs in dealing with prospective connection applications in constrained areas.

As well as the increasing importance of information sharing amongst parties, the growing influence of the distribution network on the transmission network, and the emergence of new technologies and solutions, mean that DSOs and TSOs have more opportunities than ever to offer solutions to one another in the network planning process, which can bring costs down overall and deliver benefits for customers.

Greater cooperation between DSOs and TSOs, and with other stakeholders, is therefore needed to ensure the most efficient solutions are found.

5.3 What do Network Codes and Guidelines already require?

Some of the aspects listed below in terms of data and/or information exchange are already covered by Network Codes or Guidelines.

Electricity

As far as electricity is concerned, the System Operation Guideline (SO GL), which has been adopted by all Member States, provides clear general rules on data exchange between DSOs and TSOs (Article 40). The SO GL also provides rules on more specific aspects, such as the integration of relevant distribution systems within a TSO observability area (Article 43), information for DSOs on transmission level projects which have the potential to impact distribution (Article 83), and on DSOs' involvement in regional year ahead availability plans and outage coordination regions (Articles 98, 100).

Gas

Relevant Network Codes and Guidelines concerning the DSO-TSO relationship include the Network Code on Gas Balancing of Transmission Networks (312/2014) and the Network Code on Interoperability and Data Exchange Rules (703/2015). Both of them have already become applicable, as well as the Security of Gas Supply Regulation (SoS) (994/2010)[3].

[3] The Regulation 994/2010 is currently being revised.

The Balancing Network Code is predominantly focused on rules for physical balancing, while the Interoperability Network Code determines rules for natural gas quality, odorisation and data exchange. Rules for preventative action plans and emergency plans are set in the SoS Regulation, including specifications on the kind of market based and non-market based measures that should be taken into account when developing such a plan. Infrastructure and supply standards detailed in the SoS Regulation have to be monitored by competent authorities.

In building on the provisions already set out in Network Codes and Guidelines, CEER believes that particular further focus should be given to optimising network investments between transmission and distribution. This is a particular theme that flows through the following future principles.

5.4 Future principles

In the specific case of network planning, a coordinated approach to system development by TSOs and DSOs can optimise network development costs. It could contribute to reducing losses and lead to economic optimisation of network reinforcement. It would also simplify access to the network for connectees and enable efficient long-term use of connected resources.

Transparency and forecasting

Transparency on network status between system operators, but also towards stakeholders, is crucial at a time when the number of interacting parties is growing rapidly, and with the general move towards distributed resources, market based services and flexibility.

From the DSOs' and TSOs' perspective, building a common understanding of the status of each other's network is a key facilitator to better managing the growing interactions between networks across all timeframes (including real time). On a more general level, transparency over available network capacity and network needs is necessary to enable market players to both connect, and to innovate and offer solutions which could be efficient alternatives to network build.

With the development of distributed resources and new uses of energy (e.g. electric or natural GVs), forecasting over short, medium and long-term timeframes becomes essential for TSOs and DSOs in order to achieve efficient planning. TSOs and DSOs need to share their views on perspectives and drivers for change in the years to come, as well as on their network status.

a) *There is a need for transparency on network status, as well as on forecast of future status. The instruments to achieve this should be adapted to the specific circumstances, which could include but not be limited to the following:*

- *Shared Network models between DSOs and TSOs, including assumptions underpinning these network models;*
- *Information on projected congestion;*
- *Connected capacity including distributed resources, both existing and planned;*

- *Information on connection or injection capacity available (for significant customers or producers) in order to indicate to connectees easier/cheaper locations to connect;*
- *Medium-term forecast of network needs/service requirements, such that market participants are able to react and offer solutions; and*
- *Plans for outage, maintenance, construction and faults.*

The implementation of the above principle needs to take into account that the need for constant information on network status differs between gas and electricity. Due to the ability of the gas networks to store energy through linepack, as well as a large swing between winter and summer due to heating purposes, constant exchange of information regarding the network status between network operators is of less value on gas than on the electricity side.

We note that the changing system is making the factors that need to be considered in predicting congestion more complex. In addition to considerations such as the number of connectees, peak load requirements and network capacity, congestion can also be impacted by new factors. These include: the influence of weather, not only on demand (e.g. heating and cooling), but also on generation; the patterns of demand side flexibility; storage and distributed generation/injection; as well as cross-border flows. The extent to which these factors need to be considered will inevitably vary between countries and over time. Nonetheless, greater sharing of assessments of congestion has the potential to bring customer benefits.

As well as sharing models and forecasts, agreeing common assumptions in developing them (based on a shared pool of knowledge) can also better support efficient planning.

b) *DSOs and TSOs shall cooperate to produce generation or injection forecasts, demand scenarios and models where they can better support efficient planning across the network.*

To fulfil this, DSOs and TSOs should in particular ensure that short-, medium- and long-term demand forecasting properly takes into account energy efficiency, new forms of flexibility and new uses, including electric vehicles (EVs) and GVs, biogas, power to gas, self-production etc.

<u>Planning and investments</u>

Transparency and shared views on network status and forecasts are intrinsically beneficial, but to reap the full rewards in terms of cost reductions and/or improvement in the quality of services, they have to be properly translated/integrated into planning and investment schemes.

Here, in a proportionate manner (see principle [c] in the overarching principles section), each network operator must fulfil the same minimum standards to make the whole system approach concrete and operational.

c) As already stated in the 2015 CEER Conclusions Paper*, DSOs should take action to develop and publish long-term plans for their networks.*

The aim of these plans is to provide greater transparency on anticipated network development, and the future demand, generation, and capacity forecasts underpinning it, to help inform ENTSOs' TYNDP, and better system planning. As for TSOs, rolling long-term plans are complementary to 3-4 year exercises, providing greater transparency on anticipated network development and offering the opportunity to identify no-regret investment options between contrasting scenarios.

d) *In developing efficient investment plans, the range of available alternative solutions that could lead to the reduction of reinforcement costs, as well as the reduction of gas or power losses, should be taken into account. This includes using innovative technologies, providers and solutions, where efficient, and considering build or non-build solutions which may be offered by other parties or at other voltage or pressure levels, to ensure that the most efficient investment option is taken forward across the system.*

Finally, as noted above, it is important that network plans are designed in a coherent way, taking into account relevant developments which have not traditionally been a significant feature of our energy system.

e) *When developing network plans, DSOs and TSOs should take into account the interactions between the electricity, gas, heating and cooling systems.*

f) *DSOs and TSOs should be interacting with each other, as well as with public authorities and other stakeholders on a local and regional level, in order to ensure full coherence between network planning exercises and other relevant developments including local and regional urban planning, climate plans, as well as infrastructure development schemes for electric and gas vehicles.*

6 System Operation

6.1 Current arrangements

Electricity

System operation is generally understood to be about securing a reliable flow of electricity through networks to customers. Each European country will differ in terms of: (i) topology of the networks and the consequent allocation of responsibilities across voltage levels, (ii) the size and number of TSOs and DSOs in a country, (iii) the level of unbundling and competition in the retail market and (iv) ownership of the networks. These differences explain variations in the way different electricity systems are operated. Currently the roles and responsibilities are strictly separated into operation of the distribution network and the transmission network/system.

There are only a few predefined rules for cross-network system operation responsibilities. For example, in some countries, DSOs and TSOs currently cooperate to ensure restoration from emergency or blackout system states. TSOs are responsible for restoring the system, but they have to consult with DSOs before assigning any responsibilities to them, aiming at an efficient process.

System operation can be distinguished from system planning in terms of the relevant tasks and the timeframes in which these tasks take place. System operation activities can be grouped into two categories: (i) medium-term and short-term operations and (ii) real-time operations.

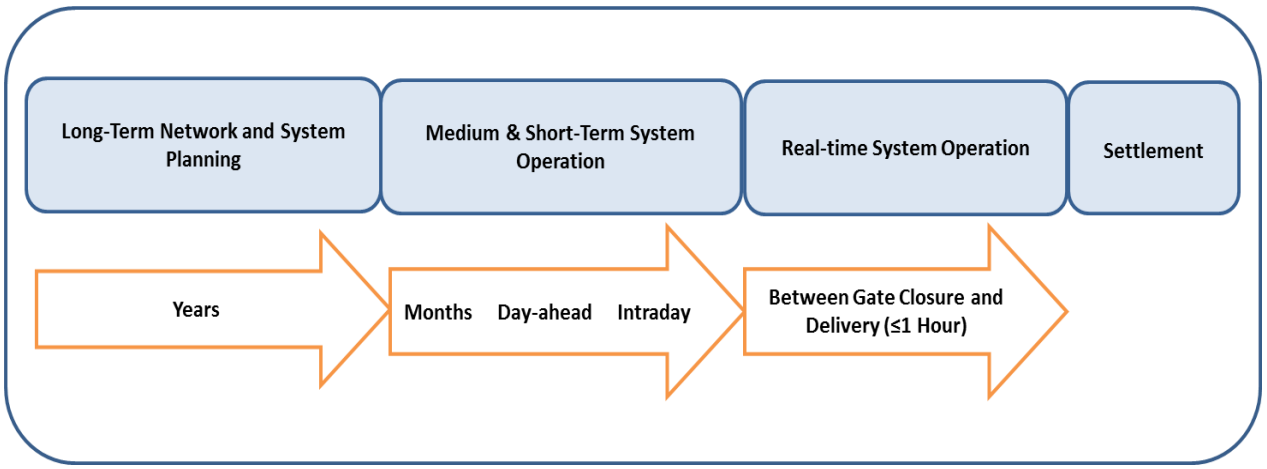

Figure 1: Different time-frames in network & system planning and system operation

Medium and short-term system operation covers a time period of 1 year to (less than) one hour before delivery, depending on the market gate closure time. The central mission in this timeframe is market facilitation, with the objective of maximising market efficiency, while maintaining operational security. A key aspect of market facilitation is European market integration, the implementation of which is established in the relevant European Network Codes and Guidelines. Medium-term and short-term system operation activities include:

- Capacity Calculation;
- Capacity Allocation and Congestion Management;
- Operational Security Analysis in the Time-Ahead time frame;
- Operational Security Coordination;
- Outage Management;
- Medium-Term and Short-Term Adequacy Assessment;
- Procurement and reservation of Ancillary Services, and
- Congestion Management.

Real-Time Operation covers the timeframe directly after national intraday market gate closure time. The main focus in real-time operations is on safeguarding the security of supply. When the transmission system is in a 'normal', secure state, the objective is to maximise market efficiency. The system operation functions during this period include:

- Operational security monitoring;
- Balancing (Frequency Control);
- Congestion Management;
- Voltage/reactive power control; and
- Switching/(De-)energising network components for security of supply/maintenance/ construction purposes.

When the transmission system is in state of emergency/blackout/restoration, the objective is to improve or restore security of supply in a rapid and efficient manner. The system operation functions during this state include:

- Emergency and Restoration;
- Dis-(connection);
- Re-synchronisation; and
- Frequency management.

Gas

System operation in gas is understood to be about securing a reliable flow of gas through networks to customers. European countries differ in terms of: (i) topology of the networks (e.g. mainly exporting, importing or transmission of gas), (ii) the size and number of TSOs and DSOs in a country, (iii) the level of unbundling and competition in the retail market, (iv) ownership of the networks, (v) number/volume of storage sites, (vi) usage of storage sites (e.g. strategic storage), (vii) calorific values, (viii) number of interconnection points and (ix) gas transmission via pipelines or liquefied natural gas (LNG). These differences explain variations in the way different gas systems are operated.

With regards to system operation on the transmission system, TSOs have responsibilities including but not limited to the following:

- Coordinating system operation and the use of linepack, as well as the use of physical balancing energy;
- Capacity Calculation;
- Capacity Allocation;
- Congestion Management;
- Coordinating the nomination procedure for the transmission system; and
- Organising the establishment and operation of the online platform for offering transport capacity at the entry/exit points of the transmission network.

Current DSOs' responsibilities concerning system operation on the distribution system include but are not limited to the following:

- Booking and managing capacities at the internal interconnection points from the transmission into the distribution network, respectively and vice versa;
- Handling nominations at the internal interconnection points into the distribution network;
- Providing the system service (load/pressure control and pressure maintenance, metering service);
- Preparing total load forecasts for the early detection of imbalances;
- Staying informed of the system utilisation status at any time, including but not limited to flows and pressure levels;
- Initiating and taking congestion management measures; and
- Managing schedules.

6.2 What do Network Codes and Guidelines already require?

Electricity

The System Operation Guideline (for electricity), contains several provisions requiring cooperation and coordination between TSOs and DSOs. It gives a general obligation to consult DSOs and take into account impacts on their system and, in particular, it addresses the following areas:

- Data exchange: obligation for TSOs and DSOs to agree on the scope, processes, formats etc.;
- Coordination in preparation and activation of remedial actions;
- Coordination in prequalification and activation of reserves from units connected to the DSO grid; and
- Exchange of information related to infrastructure projects, and coordination planning for outages.

The Guideline on Electricity Balancing, entering Comitology in 2016, lays down detailed Guidelines on common rules for electricity balancing. These include: the establishment of common principles for procurement and settlement of frequency containment reserves; frequency restoration reserves and replacement reserves; and a common methodology for the activation of frequency restoration reserves and replacement reserves. The Guideline requires DSOs, TSOs, balancing service providers and balance responsible parties to cooperate to ensure efficient and effective balancing.

The Guideline on Emergency and Restoration, expected to enter Comitology in 2016, determines common requirements and principles to manage Emergency, Blackout and Restoration System States. It aims to:

- Prevent the propagation or deterioration of an incident, in order to avoid a widespread disturbance and Blackout State;
- Ensure efficient and rapid restoration from Emergency or Blackout System States; and

- Coordinate system operation in Emergency, Blackout and Restoration System States in a common and coherent way throughout the EU and in 3rd countries where applicable.

When applying this Guideline, Member States, regulatory authorities, competent entities and system operators are required consult with relevant DSOs and take account of potential impacts on their system. The Regulation also states that each TSO should design the respective system defence plan in consultation with the relevant DSOs. Furthermore, it requires TSOs to activate the procedures of its system defence plan in coordination with DSOs and significant grid users[4] and with defence service providers.

Gas

The European Network Code on Gas Balancing covers the operational and commercial balancing rules for managing the gas network, and specifies how DSOs, TSOs and forecasting parties should cooperate. DSOs have information obligations towards TSOs regarding information on intraday and daily metered inputs and off-takes on the distribution system. Forecasting parties have to provide forecasts of network users' non-daily metered off-takes and subsequent allocations. DSOs and TSOs must cooperate to provide network users with forecast, near real-time and allocation data on their gas portfolios. This allows Network Users to take responsibility to balance their portfolios, meaning the balancing activities of the network operators is minimised. The Code also prioritises market based balancing using short-term products over the use of long-term balancing contracts.

In addition, the Interoperability and Data Exchange Network Code ensures that the physical and technical rules are harmonised to the extent needed to ensure the unrestricted flow of gas across networks. It covers technical rules as to how the TSO, DSO and other parties communicate to each other, like data format and data exchange, and also the physical attributes of the gas itself (e.g. pressure, odorisation).

The Regulation on Security of Gas Supply (SoS) stipulates what kind of information has to be exchanged between natural gas undertakings and the competent authority during an emergency.

In several sections of the Balancing and Interoperability Network Code, as well as in the Security of Gas Supply Regulation, it is stipulated that TSOs and DSOs have to consult each other when fulfilling their responsibilities.

6.3 Emerging Challenges for System Operation

The task of maintaining overall stability of the electricity system is becoming increasingly challenging. Centralised large synchronous generation is being replaced with variable non-synchronous generation connected at the distribution level. This is causing system inertia to reduce and new constraints to emerge at transmission and distribution level (including reverse flows). Simultaneously, the load curve/demand profile is becoming less predictable.

[4] Identified pursuant to Article 11(4)(c) of the Guideline on Emergency and Restoration

In order to maintain system stability at efficient cost, electricity DSOs and TSOs will need to increasingly rely upon access to distribution level supply and demand side resources to manage their respective networks. Without some form of coordination over access to common resources, there is a risk that inefficient system outcomes result.

Furthermore, limited visibility of distributed resources, such as distributed generation, demand-side response, EVs and storage results in difficulties in suboptimal dispatch/inefficient curtailment of resource.

As noted in the introduction, even though the changes taking place are predominantly in electricity, there can be potential effects for the gas system to the extent gas powered flexibility is used for electricity system balancing and network management.

In order to operate the system in a secure and cost-efficient manner, and thus deliver the best whole system outcome for customers, DSOs and TSOs need to significantly increase engagement with one another. As regulators, we have a key role to ensure that regulatory arrangements facilitate an efficient current and future energy system.

6.4 Future principles

Ensuring visibility of cross-system impacts

Data exchange plays a central role in effective system operation, both to address issues of resource visibility, and to help anticipate system operation needs on respective networks. Whilst the focus to date has been on DSOs connected to TSOs, distributed flexibility resources can be connected anywhere on the system, and their impact cannot be fully understood unless data exchange processes are extended to smaller DSOs and small distributed generation.

a) *DSOs and TSOs should cooperate to ensure appropriate exchange of relevant operational data and visibility of each other's network status, in order to better support optimal operation of the system. For electricity, data exchange between DSOs and TSOs should be achieved by implementation of the System Operation Guideline, while further focus should be given to data exchange – including in emergency state – from small, non-transmission connected DSOs, distributed generation and aggregators. For gas, this shall be achieved by full implementation of the Network Code on Gas Balancing and the Network Code on Interoperability and Data Exchange Rule.*

The need for constant information on network status differs considerably between gas and electricity. Due to the ability of the gas networks to store energy through linepack and the large swing between winter and summer, data provision on the status of the distribution network is of less value than it is on the electricity side, where the system is balanced on a second by second basis.

As well as sharing information on operational data and network status, it is critical that DSOs and TSOs develop a constructive ongoing dialogue (see principle [d] in overarching principles), which enables them to understand which system operation actions could have cross network impacts (see principle [b] in governance).

Some actions can have a negative cross-network effect. For instance, TSO use of distributed resources for balancing purposes has the potential to exacerbate DSO constraints. Equally, whilst DSO use of innovative solutions, such as active network management, can deliver benefits to customers, if not managed properly they may in some cases counteract actions taken by the TSO.

There will also be a range of actions that could offer cross-network solutions. For instance, a DSO may be able to reconfigure their network in a particular area to ease a TSO constraint. DSOs and TSOs should build a common understanding of (i) which actions undertaken by one party could have an impact on the other; and (ii) which actions of one party could support the needs of the other.

Coordinating actions to maximise whole system efficiency

This exchange of information must in turn facilitate more informed decisions about what actions each party should (or should not) take to secure the best overall outcome for customers.[5]

b) *NRAs should ensure that DSOs and TSOs work together to optimise actions they take across the system to deliver optimal outcomes for customers. DSOs and TSOs should define processes when cross-system impacts are anticipated and subsequently take appropriate actions, including actions that the DSOs and TSOs may need to take to support system operation.*

Where risks are identified with a prospective action, careful consideration needs to be given to ensure that any measures chosen to prevent these risks are in the best interests of customers.

c) *No party should be unnecessarily restricted from taking an action which contributes to whole system efficiency, unless operation of the transmission or distribution system is at considerable risk. There should be processes in place to ensure appropriate justification and transparency around restrictive actions taken by the DSO or TSO.*

NRAs too, have a role in ensuring effective coordination of actions taken for the purposes of system operation.

d) *NRAs should ensure that the regulatory framework does not pose a barrier to, and should facilitate wherever possible, coordinated access to flexible resources, such that resources can be used optimally in customers' benefit across the system.*

As noted in principle [g] in the governance section, this also includes ensuring DSOs and TSOs are subject to appropriate incentives to support optimal whole system outcomes.

Incentives must be appropriate not only for DSOs and TSOs, but for all market participants. The more that all parties are exposed to signals about the true system costs/benefits associated with their actions, the smaller the challenge will be for DSOs and TSOs in addressing residual balancing needs.

[5] The requirement for DSOs to act as neutral market facilitators should not prohibit DSOs (and TSOs) from taking, and being remunerated for actions which can create benefits elsewhere on the system, where doing so does not unduly distort market mechanisms.

e) *Where in customers' benefit, regulatory arrangements should ensure that all market participants are exposed to appropriate signals/incentives reflecting the costs and benefits their actions may have on the wider system.*

Exposure to true system benefits includes enabling flexible resources to access a range of revenue streams. For instance, a battery may be able to offer benefits to both the DSO and the TSO, and it should not be arbitrarily restricted from offering services to both.

We note, however, that in some cases there may be justification for restrictions. For instance, where the operation of the transmission and/or distribution system is at considerable risk, or where regulations around market access can better support coordinated use of resources on a long-term basis.

f) *Resources should not be unreasonably restricted from accessing a range of revenue streams and valuing their potential where it is most efficient to do so. When assessing the associated costs and benefits, long-term impacts should also be taken into account.*

The need for increased use of cross-network solutions is particularly relevant when the system is in emergency state. CEER believes that there is a potential for enhanced cooperation between DSOs and TSOs to support more robust emergency and restoration arrangements.

<u>Use of resources and innovative technologies for Emergency and Restoration arrangements</u>

In view of the rising number of energy resources connected to distribution networks – particularly in the electricity sector – close coordination between TSOs and DSOs becomes indispensable. This implies clear rules for DSO involvement in preparing and executing emergency and restoration plans. Action plans and emergency plans are also required by the Security of Gas Supply Regulation, which gives a non-exhaustive list of market based and non-market based measures (also cross commodity) for ensuring security of gas supply.

g) *DSOs and TSOs should work together to ensure that emergency and restoration arrangements make efficient use of resources and of innovative technologies across the distribution and transmission networks to enhance the resiliency of the system. In particular there is a need to give greater consideration to the contribution that DSOs can provide to emergency and restoration arrangements, when it is cost-efficient and secure to do so.*

7 Conclusions

Europe's energy landscape is in a period of significant change. It is critical that DSOs and TSOs work together constructively and cooperatively to address the needs of their mutual customers. Below we set out a summary of the principles we believe should underpin the relationship.

3.Overarching principles	a) *To avoid market distortion it remains essential that DSOs are neutral when performing their tasks and are sufficiently unbundled. CEER sees the effective implementation of the existing 3rd Package principles and obligations as the minimum necessary to achieve this.*
	b) *With regards to the future DSO and TSO relationship, CEER believes that general principles should be defined on European level, while more detailed regulation, for the implementation of common principles in the respective countries, should be developed at a national level.*
	c) *The type and nature of DSOs (e.g. size, DSO-connected or TSO-connected) should be taken into account when designing the instruments and requirements to deliver the wider objectives, in order to avoid disproportional or negative cost/benefit impacts.*
	d) *For the future DSO-TSO relationship it is necessary to enhance a whole system approach at every level of responsibility i.e. NRAs, TSOs and DSOs. This includes cooperation in the efficient use of (and where appropriate, trialling of) innovative solutions and approaches for system operation and network planning.*
4. Governance	a) *Roles and responsibilities should be clearly allocated to TSOs and DSOs. Where responsibility is shared between actors to allow for efficient whole system outcomes, a clear framework and processes should be in place to manage interactions.*
	b) *DSOs and TSOs should build a common understanding of (i) which actions undertaken by one party could have an impact on the other; and (ii) which actions of one party could support the needs of the other.*
	c) *In delivering effective transmission and distribution systems, DSOs and TSOs should make best use of transparent market based procedures in a non-discriminatory way.*
	d) *Across all areas of responsibility there is a need for extensive yet proportionate consultation among DSOs, between DSOs and TSOs and with stakeholders, both to exchange information and take inputs into account.*
	e) *Where it supports efficient operation of the system and can benefit customers, DSOs and TSOs should cooperate to efficiently provide appropriate data in proper time-slices related to their*

	respective networks to other stakeholders in the energy market in a non-discriminatory manner.
	f) The regulatory arrangements, and in particular controls on revenue recovery (sometimes called price controls), must support a competitive market and efficient whole system outcomes. Controls on revenue recovery for DSOs and TSOs should create incentives to optimise outcomes for the system as a whole, rather than focusing on minimising the DSO's and TSO's costs in isolation.
	g) Remuneration arrangements for services provided between DSOs and TSOs should not unduly distort market mechanisms.
	h) Due to the structural changes in the European energy system, CEER considers that the distribution level should be adequately represented in the Internal Energy Market governance scheme (i.e. discussions and negotiations on Network Codes and Guidelines, TYNDPs processes etc.).
5. Network and System Planning	*a) There is a need for transparency on network status, as well as on forecast of future status. The instruments to achieve this should be adapted to the specific circumstances, which could include but not be limited to the following:* *- Shared Network models between DSOs and TSOs, including assumptions underpinning these network models;* *- Information on projected congestion;* *- Connected capacity including distributed resources, both existing and planned;* *- Information on connection or injection capacity available (for significant customers or producers) in order to indicate to connectees easier/cheaper locations to connect;* *- Medium-term forecast of network needs/service requirements, such that market participants are able to react and offer solutions; and* *- Plans for outage, maintenance, construction and faults.*
	b) DSOs and TSOs shall cooperate to produce generation or injection forecasts, demand scenarios and models where they can better support efficient planning across the network.
	c) As already stated in the 2015 CEER Conclusions Paper, DSOs should take action to develop and publish long-term plans for their networks.
	d) In developing efficient investment plans, the range of available alternative solutions that could lead to the reduction of reinforcement costs, as well as the reduction of gas or power losses, should be taken into account. This includes using innovative technologies, providers and solutions, where efficient,

	and considering build or non-build solutions which may be offered by other parties or at other voltage or pressure levels, to ensure that the most efficient investment option is taken forward across the system.
	e) When developing network plans, DSOs and TSOs should take into account the interactions between the electricity, gas, heating and cooling systems.
	f) DSOs and TSOs should be interacting with each other, as well as with public authorities and other stakeholders on a local and regional level, in order to ensure full coherence between network planning exercises and other relevant developments including local and regional urban planning, climate plans, as well as infrastructure development schemes for electric and gas vehicles.
6. System operation	*a) DSOs and TSOs should cooperate to ensure appropriate exchange of relevant operational data and visibility of each other's network status, in order to better support optimal operation of the system. For electricity, data exchange between DSOs and TSOs should be achieved by implementation of the System Operation Guideline, while further focus should be given to data exchange – including in emergency state – from small, non-transmission connected DSOs, distributed generation and aggregators. For Gas this shall be achieved by full implementation of the Network Code on Gas Balancing and the Network Code on Interoperability and Data Exchange Rule.*
	b) NRAs should ensure that DSOs and TSOs work together to optimise actions they take across the system to deliver optimal outcomes for customers. DSOs and TSOs should define processes when cross-system impacts are anticipated and subsequently take appropriate actions, including actions that the DSOs and TSOs may need to take to support system operation.
	c) No party should be unnecessarily restricted from taking an action which contributes to whole system efficiency, unless operation of the transmission or distribution system is at considerable risk. There should be processes in place to ensure appropriate justification and transparency around restrictive actions taken by the DSO or TSO.
	d) NRAs should ensure that the regulatory framework does not pose a barrier to, and should facilitate wherever possible, coordinated access to flexible resources, such that resources can be used optimally in customers' benefit across the system.
	e) Where in customers' benefit, regulatory arrangements should ensure that all market participants are exposed to appropriate signals/incentives reflecting the costs and benefits their actions may have on the wider system.
	f) Resources should not be unreasonably restricted from accessing a range of revenue streams and valuing their potential where it is most efficient to do so. When assessing the associated costs and

	benefits, long-term impacts should also be taken into account.
	g) DSOs and TSOs should work together to ensure that emergency and restoration arrangements make efficient use of resources and of innovative technologies across the distribution and transmission networks to enhance the resiliency of the system. In particular there is a need to give greater consideration to the contribution that DSOs can provide to emergency and restoration arrangements, when cost-efficient and secure to do so.

The next step will be for NRAs, DSOs and TSOs to consider how these principles may best be applied in the context of their own countries, in order to deliver maximum benefit to customers.

About CEER

The Council of European Energy Regulators (CEER) is the voice of Europe's national regulators of electricity and gas at EU and international level. CEER's members and observers (from 33 European countries) are the statutory bodies responsible for energy regulation at national level.

One of CEER's key objectives is to facilitate the creation of a single, competitive, efficient and sustainable EU internal energy market that works in the public interest. CEER actively promotes an investment-friendly and harmonised regulatory environment, and consistent application of existing EU legislation. Moreover, CEER champions customer issues in our belief that a competitive and secure EU single energy market is not a goal in itself, but should deliver benefits for energy customers.

CEER, based in Brussels, deals with a broad range of energy issues including retail markets and customers; distribution networks; smart grids; flexibility; sustainability; and international cooperation. European energy regulators are committed to a holistic approach to energy regulation in Europe. Through CEER, NRAs cooperate and develop common position papers, advice and forward-thinking recommendations to improve the electricity and gas markets for the benefit of customers and businesses.

The work of CEER is structured according to a number of working groups and task forces, composed of staff members of the national energy regulatory authorities, and supported by the CEER Secretariat. This report was prepared by the DSO Working Group.

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More information at www.ceer.eu.