Fostering energy markets, empowering **consumers**.

CEER Paper on DSO Procedures of Procurement of Flexibility

Distribution Systems Working Group

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INFORMATION PAGE

Abstract

This document (C19-DS-55-05), the CEER Paper on DSO Procedures of Procurement of Flexibility, provides insights on what the implications are for incentives, prerequisites and interactions among the involved parties with DSO access to and use of flexibility. The aim of the paper is to elaborate how flexibility can be made available and how market-based procurement procedures could be arranged at the distribution level, focusing on necessary preconditions and different methods giving an overview of most of the aspects to contemplate on a European level, taking into account the room for adaptation to national circumstances.

Target audience

European Commission, energy suppliers, traders, gas/electricity customers, gas/electricity industry, Distribution System Operators (DSOs), consumer representative groups, Transmission System Operators (TSOs), Member States, academics and other interested parties.

Keywords

Flexibility, Clean Energy Package, distribution networks, DSOs, procurement of flexibility, network development plans, efficient network development, active system management.

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Related documents

CEER documents

- CEER Paper on Electricity Distribution Tariffs Supporting the Energy Transition, Ref: C19-DS-55-04, 20 April 2020
- CEER Recommendations on Dynamic Price Implementation, Ref: C19-IRM-020-03-14, 3 March 2020
- CEER Conclusions Paper on New Services and DSO Involvement, Ref: C18-DS-46-08, 22 March 2019
- CEER Conclusions Paper on Flexibility Use at Distribution Level, Ref: C18-DS-42-04, 17 July 2018
- CEER Conclusions Paper on Incentives Schemes for Regulating Distribution System Operators (DSOs), including for innovation, Ref. C17-DS-37-05, 19 February 2018
- Distribution and Transmission Network Tariffs and Incentives, CEER White Paper series on the European Commission's Clean Energy Proposals, paper # I, 11 May 2017
- CEER Guidelines of Good Practice for Electricity Distribution Network Tariffs, Ref. C16-DS-27-03, 23 January 2017
- European Energy Regulators (ACER-CEER) White Paper #3 Facilitating Flexibility, 22 May 2017
- CEER Position Paper on Renewable Energy Self-Generation, Ref: C16-SDE-55-03, September 2016
- CEER Position Paper on Principles for Valuation of Flexibility, Ref. C16-FTF-09-03, 12 July 2016
- CEER Discussion Paper on Scoping of Flexible Response, Ref. C16-FTF-08-04, 3 May 2016

EU Legislation

- Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L0944
- Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R0943
- Regulation (EU) 838/2010 of the European Commission of 23 September 2010 on laying down guidelines relating to the inter-transmission system operator compensation mechanism and a common regulatory approach to transmission charging, https://eur-lex.europa.eu/eli/reg/2010/838/oj
- Regulation (EC) 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity, https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32009R0714
- Directive (EC) 2009/72 of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity, https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32009L0072

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EXECUTIVE SUMMARY

Background
The topic of flexibility is of increasing interest and importance across the entire energy value chain and CEER has published a number of papers relating to flexibility over the past years. In the distribution system, procurement of flexibility by DSOs could lead to a better utilisation and development of network capacity and thereby defer or be an alternative to traditional reinforcement, where it is a cost-efficient alternative.

With this paper, CEER aims to facilitate a holistic approach and discussion on DSO access to and use of flexibility at the distribution level, focusing on the market-based option. As flexibility can be accessed through rules-based approaches, connection agreements, tariff structures and market-based procurement in combination or separately, the categories are not necessarily mutually exclusive and the inherent regulatory incentives and implemented measures may overlap. Member States and national regulatory authorities (NRAs) should therefore, carefully evaluate the interactions when implementing new forms of access to flexibilities or when enhancing existing ones. As system operation, especially congestion management, are monopolistic activities, there should always be some form of regulatory involvement. There should be regulatory guidelines and measures within all of the categories, taking into account that the relation between them might differ substantially depending on the national context.

The Clean Energy Package
Article 32 of the Directive (2019/944) on common rules for the internal market of electricity sets new requirements on the use of flexibility in distribution networks. The content of the article is presented and discussed in this paper, especially focusing on the regulatory involvement, which sets the conditions of the procurement procedure. The article also contains requirements for network development plans in distribution systems, which aims to provide adequate information regarding the anticipated expansions or upgrades of the system. Topics ranging from hosting capacity for decentralised generation and growing demand from appliances such as electro-mobility charging to network users and relevant authorities are also covered. Finally, the report highlights the need to ensure transparency on the medium- and long-term flexibility services needed to be an alternative to, or reducing the size of, these expansions.

DSO specification of needs
For the procurement of flexibility services, the way that the DSOs describe their needs and how this is signalled to relevant market parties and other actors are of particular importance because this has a significant influence on the market outcome. The specifications of network needs might differ substantially depending on grid topology, customer basis and locational cause of congestions. The different needs in the grid could require different solutions and various types of access to and use of flexibility.

NRA involvement and assessment of efficiency
The market-based approach, meaning DSO procurement of explicit flexibility, is a relatively new field despite regulations in many Member States neither disincentivising nor explicitly forbidding such access. In the report, CEER gives an overview of the most fundamental preconditions needed before being able to procure flexibility and manage congestions in system operation. It also discusses the main elements and potential content of market-based procedures of procurement of flexibility.

The NRA involvement in and assessment of the market-based alternative, as defined in Article 32, is emphasised as a key procedure to make necessary adjustments to increase the efficiency of procurement and facilitate a beneficial use of flexibility for the system-as-a-whole. Assessments of the related processes could be performed on a conceptual basis, along with specific use cases or a combination of the two. The different options to access the market-based procurement are, to repeat, the procurement procedure (e.g. periodically and/or by changing the parameters), to restart the assessment (meaning different methods could be applied or return to conventional grid reinforcement) or to alter the framework, all of which are described in detail in the paper.

Recommended principles

On a European level, CEER recommends the following principles for all kinds of market-based flexibility procurement by DSOs: balanced incentives, adequate neutrality, technical prerequisites and an overall framework for procurement. The framework needs to clearly allocate rights, duties and responsibilities for the participating actors alongside securing availability of flexibility, while giving room for development.

Outline of elements of a framework

Potential elements and methods of procedures of procurement of flexibility in a market-based approach are described in this paper; the procurement procedure is the key process to appropriately signal the need for flexibility and acquire the necessary resources in a cost-efficient manner. The concrete implementation remains to be decided on the national level. The paper gives an overview, highlights important topics, describes potential assessments and further areas to develop within the components of a market-based procedure. A framework should, at least, consist of descriptions regarding product design, technical rules, a method to cope with imbalances caused by activations, tendering procedures, market model design and coordination schemes between system operators. Procedures of procurement of flexibility could follow the principles outlined in this paper with implementations adapted to national circumstances. This includes potential content and regulatory assessments of relevant aspects regarding the aforementioned topics. NRAs have an important task of making the terms and conditions for different stakeholders as clear as possible in the development, monitoring and potential intervention of such a framework, minimising the opportunities for distortions, resource lock-in, cross subsidisation and undue investments.

Market design and interaction

DSO congestion management can take place long before, prior to, during or after existing wholesale market clearing and as far as just before the (gate) closure of the balancing market. Flexibility markets could thus represent a variety of auction and trading platforms. There are many different approaches to the design and setup, keeping flexibility markets separate and somewhat independent on one side, or integrating them partially or fully with existing markets on the other. With the combination and potential integration of different platforms, it could be challenging to determine the borderline between the regulated and non-regulated domain. Especially with a potential interaction and overlap the frontiers of the domains should be properly defined. CEER finds it important to raise awareness of these situations and NRAs should assess the pros and cons of the different possibilities. The market design should facilitate an optimal valuation of flexibility from a system point of view, established through free price formation, free choice to participate where it creates the highest benefit, not to unduly blocking or hindering access, etc. Independent of the setup, the establishment of baselines and coordination schemes are a crucial aspect of products and their design and availability to other system operators and market parties.

1 Introduction

Significant changes in the European energy system over the last decade have been driven by an increased deployment of intermittent renewable generation, decarbonisation and digitalisation.[1] One way of managing these changes and ensuring secure system operation is through improving system flexibility.

The topic of flexibility is of increasing interest and importance across the entire energy value chain and a holistic view is necessary. European regulators have published a number of papers relating to flexibility over the past four years. In the spring of 2017, CEER consulted on the distribution system component with the *Public Consultation on Guidelines of Good Practice for Flexibility Use at Distribution Level*. In the resulting conclusions paper CEER[2] set out views on:

- The Distribution System Operators (DSOs) role in accessing flexibility services and enabling an environment for the provision of flexibility; and
- The regulatory framework, including tools and principles to enable flexibility use at the distribution level.

CEER divided the models enabling DSOs to access flexibility into four categories:

- Rules-Based Approaches;
- Connection Agreements;
- Network Tariffs; and
- Market-Based Procurement.

Another CEER paper relating to flexibility is the *Consultation on Dynamic Regulation to Enable Digitalisation of the Energy System* that was published in October 2019[3]. While the DSOs' use of flexibility services may not be directly comparable to developing new assets, flexibility services can serve to enhance distribution grid operation and the grid's hosting capability for decentralised generation and storage at the same time as we observe an increase of ordinary and new types of demand and supply. Flexibility could also aid management of short-term power system issues in the form of congestion management and lower overall network costs.

Although network users' potential flexibility cannot completely replace investments in traditional infrastructure, procurement of flexibility for congestion management could lead to a better utilisation of network capacity and thereby defer or be an alternative to traditional reinforcement, where it is a cost-efficient alternative. In this context, it is important to highlight that DSO access to and use of flexibility, could vary significantly between Member States due to the diversity in their situations, especially in relation to size, local conditions, national regulations and the tasks that they perform.

Taking up on this process, CEER in this document focuses on the DSO procedures of procurement of flexibility. The report provides further insights on what the implications are for incentives, prerequisites and interactions among the involved parties with DSO access to and use of flexibility. The goal of the report is to elaborate how flexibility can be made available and how market-based procurement procedures could be arranged at the distribution level. It focuses on necessary preconditions and different methods, giving an overview of most of the aspects to contemplate on a European level and taking into account room for adaptation to

[1] These last two are part of CEER's current 3D strategy: CEER's 3D Strategy (2019-2021), Ref. C18-BM-124-04, 9 January 2019.
[2] Flexibility Use at Distribution Level A CEER Conclusions Paper, Ref: C18-DS-42-04 17 July 2018.
[3] CEER Consultation on Dynamic Regulation to Enable Digitalisation of the Energy System, Ref: C19-DSG-09-03 10 October 2019.

national circumstances. Linked topics, such as units connected to the DSO grid used for balancing purposes, are only mentioned where it is necessary to understand the full picture.

The report is written on the basis that DSOs are able to procure flexibility in a market-based manner and has an emphasis on this base-case. However, there could be cases where the National Regulatory Authority (NRA) has decided that the market-based approach would not be efficient; that it could lead to severe market distortions or higher congestion. These cases are not included with detailed considerations or in comparison to the base-case.

The report starts by presenting the European legal basis (chapter 2), primarily describing the content of Article 32 in the Electricity Directive (2019/944) and the DSO's needs in terms of congestion management and voltage control (chapter 3). The succeeding chapter has a wider scope, discussing all the different ways of DSO access to flexibility (chapter 4) and the impact of interaction between the categories. Further on, the report continues to focus on the procedure of procurement following the established market-based principles with description of necessary preconditions before being able to procure and utilise flexibility (chapter 5). Further details for assessment and implementation will be introduced and discussed at the end (chapter 6) before concluding the report (chapter 7).

2 European legal basis

Article 32[4] of the Directive (2019/944) on common rules for the internal market of electricity sets new requirements on the use of flexibility in distribution networks. Member States must bring into force the laws, regulations and administrative provisions necessary to comply with Article 32 of the Directive by 31 December 2020.

Article 32 of the Directive is divided into two parts:

- Paragraphs 1 and 2 stipulate that Member states shall provide the necessary regulatory framework to allow and provide incentives to distribution system operators to procure flexibility services, including congestion management in their areas, in order to improve efficiencies in the operation and development of the distribution system. Exceptions to this principle are included as well.
- Paragraphs 3-5 focus on network development plans (NDPs) of DSOs, prescribing, inter alia, transparency in regard to the medium and long-term flexibility services required in the network.

The following section provides more detailed insights on the regulatory contents of Article 32, while the general the focus of this paper lies on the paragraphs dedicated to the flexibility procurement.

2.1 Flexibility procurement - Article 32 (1), (2)

The recitals of the Electricity Directive state inter alia that all customer groups should have access to electricity markets to trade their flexibility and self-generated electricity. Furthermore, consumers should be able to consume, store and sell self-generated electricity and to participate in all electricity markets. This can be realised by providing flexibility to the system, for instance, through energy storage (such as storage using electricity vehicles), through demand response or through energy efficiency schemes. These flexibility options can also be beneficial for the network. Article 32 paves the way for the implementation of incentives for the use of flexibility in distribution networks as stipulated in paragraphs 1 and 2.

Paragraph 1 aims to *improve efficiencies* in the operation and development of the distribution system by providing incentives for DSOs to procure flexibility services. The paragraph sets out what sort of actors can provide flexibility services in particular (distributed generation, demand response or energy storage) and how the procurement procedures must be established in a transparent, non-discriminatory and market-based manner. An exemption from the market-based procurement shall be made if the regulatory authorities have established that a market-based procurement for flexibility is not economically efficient, would lead to severe market distortion or higher congestion. In other words, the legislator states with an "*argumentum e contrario*" that the flexibility procurement has to be economically efficient and must not lead to severe market distortions or to higher congestion. Consequently, this inverse conclusion (the establishment of the presence of one of the above-mentioned cases) shows that market-based flexibility procurement presents the base-case to be implemented, but also must not come at any price, e.g. if congestions are increased as a result. Thus, there may be cases where it is decided at national level to not implement the market-based approach.

While paragraph 1 sets the conditions of the procurement procedure and potential exemptions, **paragraph 2** focuses on the operational design of the procurement process. Thus, the involved

[4] Complete wording of Article 32 is to be found in Annex 2 – Article 32 of the Electricity Directive (2019/944).

parties shall establish the specifications for the flexibility services procured and, where appropriate, standardise market products for such services, at least at a national level. The paragraph foresees an adequate remuneration and a cost recovery for the procurement of flexibility services. These specifications are subject to the approval by the regulatory authority or can be established by the regulatory authority itself.

The legal basis as described in the previous sections allows considerable room for national interpretation. The main NRA task is the assessment of the flexibility procurement's efficiency, which is a rather complex question. Therefore, this paper aims to discuss several aspects of that question in more detail. Article 32 must be implemented into national law by the Member States by 31 December 2020.

2.2 DSO Network Development Plans - Article 32 (3), (4), (5)

The recitals of the Directive indicate, moreover, that Member States should also introduce network development plans for distribution systems in order to support the integration of installations generating electricity from renewable energy sources, facilitate the development of energy storage facilities and the electrification of the transport sector. Member States should also provide adequate information on anticipated expansions or upgrades of the network to system users as currently such procedures do not exist for the majority of Member States. An important role of the NRA in the process of DSO network development plans is the possibility to ensure that the right balance is kept between the development of flexibility and investments in the infrastructure of the network. The detailed legal provisions are described within the next subsections.

Paragraph 3 states that DSOs shall draw up and publish a transparent network development plan at least every two years and submit it to the regulatory authority. The plan should provide transparency on the medium- and long-term flexibility services needed and set out the planned investments for the next five-to-ten years. Particular emphasis should be given to the main distribution infrastructure which is required to connect new generation capacity and new loads, including recharging points for electric vehicles. Demand response, energy efficiency, energy storage facilities or other resources that the DSO plans to use as an alternative to system expansion should be included as well.

As in all network development plans, the scenarios are fundamental to the result and CEER proposes that they should at least cover a broad range of assumptions, including a scenario with the highest degree of probability, based on available information, and that these scenarios should coincide with other scenarios (e.g. ten-year network development plan – TYNDP). This coinciding should be to the greatest extent possible, although the focus of scenarios might differ due to local considerations which needs to be reflected more precisely. They can also differ from large-scale scenarios because there might be additional drivers like the existence of a local gas or district heating grid, official regional or municipal planning requirements, etc.

In a network development plan, it is challenging to define the scope and breadth of how the DSOs should signal their medium- and long-term flexibility needs according to the national implementation, while providing information on foreseeable capacity issues and estimates of how much flexible capacity they might need in order to avoid grid expansion. In CEER's view, the signalling could be very broad, covering characteristic grids, if not the entire DSO network. As a result, the DSO would need and expect a certain number of MW of flexible assets within the five-to-ten-year horizon to be a viable solution within the defined area. If there are not enough flexible assets available currently or in the future, the DSO may need to make an investment decision at a given date upfront or potentially rely on other measures such as curtailment. However, signalling the need goes beyond network development plans but this

will be one way of doing it. The most important part is that network users and flexibility service providers (FSPs) know that the need is there in order for them to anticipate providing the flexibility, hence, seeing the opportunity for business and potential profits in the long run.

Paragraph 4 stipulates the obligation of DSOs to consult all relevant system users and relevant Transmission System Operators (TSOs) on the network development plan. The consultation results and the plan must be submitted to the regulatory authority, which may request amendments.

While, as a matter of principle, every DSO is obligated to fulfil the obligations of developing a network development plan, **paragraph 5** states that Member States may decide not to apply them to integrated electricity undertakings which serve less than 100,000 connected customers or which serve small isolated islands.

The extensive information that is required shows, in CEER´s view, that network development plans have a "stand-alone importance" which goes beyond the use of flexibility. Descriptions of already-existing network development plans in national regulations are listed in Annex 3 – Examples of network development plans in national regulations. These plans will still have to be adjusted to take into account the aim of integrating the use of flexibility services as an alternative to grid reinforcements.

Network development plans are an important tool to inform potentially interested parties where a demand of flexibility is or will be needed. The obligation and process to create the D-NDP is described in Article 32 (3), (4) and (5) and, as mentioned, leaves considerable room for interpretation when implementing the rules on a national level.

A summary of the mandated content in a network development plan are listed in **Error! R eference source not found.**.

Network Development Plans in a nutshell
Obligation for all DSOs (Member States can decide about exceptions for DSOs < 100,000 connected customers)
Time horizon: At least every two years, looking to next five-to-ten years
Process: DSO to consult, publish and submit plan to NRA. NRA may request amendments
Aim: Transparency on medium and long-term flexibility services, as an alternative to system expansion, including demand response, energy efficiency, energy storage or other resources
Content: emphasis on main distribution infrastructure required to connect new generation/ loads, including recharging points for electric vehicles.

Table 1: Overview of legal requirements for Distribution System Network Development Plans (D-NDP)

The national implementation along this legal requirement should be well designed to provide for a good compromise between effort and benefit. As the D-NDP also facilitates other aspects besides flexibility like efficient network planning and operation, especially in the case of existing D-NDP, these effects should also be taken into account.

Key points to consider are the size of DSOs, the input of the stakeholders and publishing the result in an efficient manner. This could be done by national guidelines of content, format and structure to allow interested stakeholders to get information from different DSOs with minimal effort. Furthermore, the current national regulatory scheme and the requirements of cost recovery should be considered. Finally, amendments requested by NRA can be used to keep the right balance between the development of flexibility and investments in the infrastructure of the network.

2.3 Competition law and REMIT

The Regulation 1227/2011 on wholesale market integrity and transparency (REMIT) covers all trade on the use of transportation capacity as well as the commodity itself. Contracts for the supply of final customers (except those which consume more than 600 GWh per year) are excluded.

As stated in its 5th Guidance on the application of Regulation (EU) Nr. 1227/2011[5], the EU Agency for Cooperation of Energy Regulators (ACER) considers capacity mechanisms to be wholesale energy products. As a consequence, markets where the flexibility contracts between DSOs and flexibility providers are concluded may be subsumed under the term of wholesale energy markets insofar as wholesale energy products are traded on such markets (markets where the flexibility contracts are concluded).

Local provision of flexibility almost by itself generates issues of dominance, low liquidity etc. REMIT and competition law can help tackle these issues ex post, though this is not a new issue. Load pockets on the TSO level have also in the past induced challenges in terms of potential gaming issues, whereby generators were and are able to increase the demand for their capacity by withholding production in the “normal” markets. As a result, a TSO may have to dispatch their production where competitive pressure on their ask prices is dramatically reduced or even non-existent.

[5] https://www.acer.europa.eu/Official_documents/Other%20documents/5th%20Edition%20ACER%20REMIT%20Guidance.pdf

3 DSO flexibility needs

An increase in the share of renewables has created and will continue to create challenges for the energy system. These challenges include frequency variation, insufficient transfer capacity in the networks, excessive voltage swells/drops, overloading of network equipment, outages and inefficient resource handling. Increasing and promoting flexibility in the grid could be a cost-effective way to minimise the challenges that come with renewable energy production and new forms of consumption.

On the supply side, there has been an increase of renewable intermittent electricity production such as windfarms and photovoltaics which is forecasted to continue. On the demand side, there has been an increase in the number of electrical vehicles and an electrification of heating and cooling sources.

When it comes to heating, cooling and transport, it is important to consider the load curves to understand the impact that the consumption growth will have on the network. More congestion could arise if the increased charging of electrical vehicles and use of heat pumps coincide with existing peaks. Another change to the power system is the increase in data centres of different scales as they might have a considerable impact on certain parts of the grid if concentrated in specific areas. There is also a trend towards other electrical equipment requiring more power, e.g. fast chargers for an array of electric vehicles or larger battery factories. Furthermore, the continued trend of urbanisation changes consumption patterns at the household level. The changes in consumption and production could result in simultaneous demand or supply exceeding different networks' capacities, thereby causing congestions in the distribution system. These trends mean that there may be a need for more flexibility to cope with these rapid developments and maintain reliability at all voltage levels.

The specifications of network needs might differ substantially depending on grid topology, customer basis and locational cause of congestions. The different needs in the grid could require different solutions and various types of access to and use of flexibility. The main aim of DSOs and NRAs is to maximise the efficiency of the distribution network, by utilising the existing and future infrastructure to its full capacity. The use of flexibility to maximise the efficiency of the grid could provide socio-economic benefits by utilising existing resources that could decrease or defer the need for new investments in grid infrastructure and power plants. It also has the potential to decrease short term electricity production from polluting resources.

Flexibility is of particular importance to the DSOs because the majority of distributed variable generation and new loads are connected directly at the distribution level. In essence, if the DSO use of flexibility would make the current grid last longer by requiring less infrastructure upgrades or reinforcements, while at the same time achieving better voltage quality and continuity of supply, there is the potential to better utilise and efficiently develop the distribution system. More specifically, the utilisation of flexibility in the distribution system can fulfil several purposes, such as:

- The alleviation of insufficient (transfer) capacity by means of active congestion management, allowing alternatives to curtailment;
- The reduction or shifting of demand to smoothen the load shape; and
- Managing power quality issues, such as those relating to voltage swells/drops, harmonics, flicker, and asymmetry.

3.1 Definitions

The focus of this paper is the procurement of flexibility services, including congestion management, in order to improve efficiencies in the operation and development of the distribution system. Some descriptions of relevant definitions are included below. For the sake of completeness, controlled islanding and redundancy support (n-1)[6] are also mentioned, although they are not within the scope of this paper as they are not within the scope of application of Article 32 of the Electricity Directive[7] and Member States may have differing obligations. Nevertheless, it must be clear that different legal frames could be applicable for other uses than congestion management and some solutions may overlap in contributing to improvements in overall efficiency.

Grid capacity management involves a system operator performing the planning and realisation of network transfer capacity according to predefined criteria and the respective regulatory framework. Capacity constraints can result in incidental or frequent temporary overload or congestion, but in contradistinction to congestion management (which usually provides temporarily solutions), it should in the future be considered business as usual. DSOs may use the explicit, or even some forms implicit, demand-side flexibility to increase their operational efficiency without any impact on the freedom of dispatch, trade and connections (copper plate principle). The main purposes are deferral of grid reinforcements[8], optimisation of operational performance of assets (e.g. extending the lifetime of the component) and reducing grid losses by influencing the peak load or generation. Moreover, by influencing the peak load or generation, the capacity management can be used during planned maintenance to preserve possible operational obligations (e.g. n-1), to enhance reliability or to avoid the need to perform congestion management.

Congestion[9] management refers to avoiding the overload of system components by reducing peak loads to avoid failure situations or outages. This process addresses, contrary to capacity management, the overload situations that have not been anticipated during the long-term grid planning process, or situations where grid reinforcements cannot cope with the load/ generation increase. Such measures provide a temporary solution, where the long-term solution (in general) is grid reinforcement. In the future, in order to fully harness the potential of flexibility, grid capacity management should be considered as business as usual for the DSO, contrary to congestion management. Both services, when designed as an explicit, market-oriented mechanism, could have different tailored products (short term – energy products or long term – capacity products that may be combined with energy products), but are aimed at solving or preventing active power overloads.

Voltage control[10] addresses problems with power quality, e.g. occurring when production (mostly generated by distributed RES) significantly exceeds the demand in the observed time interval with the result of an increased voltage level in the (local) grid. Using demand-side flexibility to impact the load/generation can avoid exceeding any voltage limits and

[6] Such obligations do not exist in all but in some Member States (e.g. Slovenia).
[7] Pursuant to Art. 2 No. 49 non-frequency ancillary services means: "a service used by a transmission system operator or distribution system operator for steady state voltage control, fast reactive current injections, inertia for local grid stability, short-circuit current, black start capability and island operation capability". The procurement of non-frequency ancillary services is stipulated in Art. 31 paragraph 7 of the Electricity Directive.
[8] Especially relevant for (but not limited to) grid areas where n-1 obligations apply.
[9] The term congestion refers to overload of grid components, over- and under voltage and/or forced usage of the local fail-over capacity in the distribution system. The overload deteriorates network performance, power quality and, left unaddressed, would lead to a shutdown by the automatic safety systems installed to prevent a total system collapse (USEF definition).
[10] Mostly depending on active power in lower voltage levels.

consequently reduce the need for grid investment (such as automatic tap changers) or prevent generation curtailment.

3.2 Grid operation with own assets vs. procuring flexibility

The increase of variable energy sources and consumption growth can cause congestion in different parts of the grid depending on the existing infrastructure and consumption patterns. The challenges regarding capacity could also vary significantly between the networks, based on the different DSO grid structures. Additionally, the foreseen increase of DER penetration could lead to wider voltage variations, meaning that DSOs will most likely need to procure larger volumes of voltage control reserves.

As discussed, constraint management consists of several methods to handle challenging grid situations. As a starting point, DSOs can manage constraint issues with the activation of their own flexible grid assets[11]. Such actions are a default option and applied before or at the same time as considering market-based management. If a DSO cannot solve a problem with its own assets (e.g. topology changes, tap changers, voltage boosters, etc.) it may need to invest in new assets; the procurement and use of flexibility for congestion management could be the better solution economically.

According to the definition, congestion management is activating a remedial action to respect operational security limits[12]. Congestion is a condition where one or more constraints (thermal limits, voltage limits, stability limits) restrict the physical power flow through the network. Network congestion occurs because the hosting capacity of a given grid is limited by the inherent characteristics of physical assets (i.e. lines, cables, transformers). Congestion in the distribution network is caused by voltages exceeding the allowed limits[13] or overloading of the network components. Thus, congestion management is mitigated by voltage control or by load/generation control[14]. In the context of DSO congestion management, the focus of this report is on physical congestions. These are defined in TSO-DSO report[15] as “any network situation where the forecasted or realised power flows violate the thermal limits of the elements of the grid and voltage stability or the angle stability limits of the power system”[12].

Furthermore, there is a distinction between two types of physical congestion:

- *Structural congestion*, which is defined as congestion in the distribution or transmission system that can be unambiguously defined, is predictable, is geographically stable over time and is frequently reoccurring under normal power system conditions[12].
- *Sporadic congestion*, which can be defined as an unpredictable congestion that is not stable over time and can occur under any system condition.

[11] E.g. the reconfiguration of network parts (topology reconfiguration) or transformers with tap changers (OLTC).
[12] Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management. Link.
[13] The Smart Grid – Adapting the Power System to New Challenges, Math H.J. Bollen, 2011.
[14] Congestion Management in Distribution Networks. IDE4L project, deliverable 5.2/3. Link.
[15] An integrated approach to active system management with the focus on TSO-DSO coordination in congestion management and balancing Link.

4 DSO access to flexibility

The DSO's access to market-based procurement of flexibility is, generally speaking, a new phenomenon, thus there is a lack of empirical data and experiences in this context, even though regulations in many Member States neither disincentivise nor explicitly forbid such access. At this point, there are numerous pilots and demonstration projects being undertaken in order to get deeper insights into the subject and to explore the benefits of this access. These are mostly still in the starting phase and the scope of the projects seems to vary significantly. However, on one end of the spectrum is the UK, where all DSOs are tendering for flexibility as business as usual, inviting bids according to a (predefined) specification of needs.

4.1 Different ways of accessing flexibility

A classification of different forms of how DSOs can access flexibility is possible, and Member States already have experience with some of them. These forms vary depending on the DSO's flexibility needs and according to the regulatory coordination mechanism.

The CEER Conclusions Paper "Flexibility Use at Distribution Level"[16], CEER divides the coordination mechanisms enabling DSOs to access flexibility into four categories:

- **Rules-based Approach** – codes and rules, which impose detailed flexibility requirements.
- **Connection Agreements** – DSOs could reach arrangements with network users for the provision of flexibility where a Member State considers this an appropriate measure.
- **Network Tariffs** – tariff structures may be designed to encourage network users to alter their behaviour for a more efficient use of the distribution network.
- **Market-based Procurement** – DSOs can explicitly procure flexibility that benefits the grid services from the market(s). The flexibility could be procured via (bilateral) contracts or in a market, e.g. via a platform or other forms of interfaces, given there is enough liquidity and arrangements for the market-based procurement do not unduly distort markets and comply with unbundling rules.

Depending on the national context, the relation between the four categories might differ substantially. Some could have a gliding transition into others, especially to which extent the implicit[17] and explicit[18] flexibility mechanisms are merged, signalled and compensated. Set up in a somewhat chronological order, congestion could be managed by connection agreements, tariff structures and market-based procurement (with direct payments to alter a network user's behaviour) in combination or separately, with regulatory guidelines and measures in all the categories. In case of low efficiency or market failure, administrative approaches could be introduced if they are deemed more cost-effective (see section 6.6).

4.2 Rules-based Approach

The demand connection code imposes several technical requirements on new participants in demand response services organised by the system operator (TSO or DSO). The nature of

[16] Flexibility Use at Distribution Level A CEER Conclusions Paper, Ref: C18-DS-42-04, 17 July 2018.
[17] Fixed price signal actors respond to, e.g. by spot price in wholesale market or tariff set by DSO.
[18] The actors themselves bid in their price and actively contribute to the price formation.

such an approach is technical and the costs that the network user has to bear are normally related to necessary equipment and settings. From a flexibility point of view, the flexibility should not be blocked unduly and it should not create high running costs. If this approach is taken, the overall costs (network user, DSO, system as a whole) should be minimised compared to other solutions. It could also be used as a guaranteed last measure if other incentive-based methods do not deliver as expected. The negative effects for the network user should be monitored. An example would be to reduce infeed if voltage exceeds normal operation level via local measurement of voltage and automatic control of infeed.

4.3 Connection agreements

In many Member States, DSOs are mandated by law to always offer a firm connection to every network user without exception. The network users can, at least in theory, utilise 100% of its contracted volume or capacity whenever they want. However, low voltage distribution grids are usually dimensioned with a coincidence factor taken into account that not all network users withdraw or feed in the full amount of power possible at their individual connection points at the same time. This grid planning philosophy of *connect & forget* is challenged by new consumptions patterns due to greater power demanding equipment on one side and RES with simultaneous infeed on the other, which are expected to exceed the networks capacity in both directions. A network user's rights to utilise its contracted volume usually do not differentiate between the two. Consequently, connection agreements by themselves provide no incentives for existing network users to adapt to the capacity currently available from the grid.

Non-firm connections are a possible way to fit new customers into a network where there is not full capacity available at all times, or to allow existing customers to change their capacity if Member States consider this as an appropriate measure. A reduction in connection charges, also seen as a locational price signal, might be favourable to certain, larger types of network users. From the DSO's perspective, such solutions could be beneficial for allowing new connections without reinforcing the grid, but it is not applicable to already-existing network users changing their consumption or production patterns leading to capacity challenges, if the network users' changes are still within their contracted volumes. Discrimination between network users could arise (e.g. later connected network users) and has to be avoided, taking into account that the grid situation might have changed over time. In this regard, behavioural changes need to be accounted for and the issues that they raise solved by other means than investing in traditional infrastructure, given that more cost-efficient alternatives exist in utilising flexibility through network tariffs, market-based procurement and/or administrative measures.

4.4 Network tariffs

Network tariffs[19] can provide incentives for efficient usage of the grid to network users and contribute towards limiting or postponing network investments and solving or avoiding congestion situations. The network users should be exposed to price signals that reflect that changes in their utilisation of the grid affect future network costs. The tariff design should be targeted at reducing both the system peak and individual peaks. As an example, tariffs based on the peak capacity of the network user will lead to behaviour where the peak is reduced as much as possible. In this way, the tariffs structures affect the subsequent flexibility needed by the DSO. Advanced differentiation in time and location, for example through dynamic tariffs, may further incentivise network beneficial behaviour. It must be noted, however, that the effectiveness of dynamic tariffs firstly depends on the actual existence of customer flexibility

[19] For an extensive review on future tariff design, we refer to the CEER Paper on Electricity Distribution Tariffs Supporting the Energy Transition, C19-DS-55-04, 20 April 2020.

and, secondly, on the interaction between the network tariff signals and other behaviour-influencing factors. In particular, customers connected to the low voltage level may not be able to react to such signals.

There is an interaction between static and dynamic tariffs and flexibility procurement. Combined with static network tariffs, the impact of flexibility procurement should be easy to identify. Where static time signals do not prompt the desired demand response, the procurement of flexibility forms a beneficial additional instrument. Dynamic network tariffs and flexibility procurement differ in that under the procurement of flexibility, the DSO explicitly contracts for it with the customer or their intermediary. On the contrary, with dynamic tariffs the flexibility provided by customers is implicit. Introducing fully dynamic network tariffs in combination with flexibility procurement is more complex than in combination with static tariffs because the interaction between both instruments makes the effects of any behaviour change in response to tariffs harder to predict. Under a system of continuously changing tariffs and network load situations, it will be very difficult to effectively allocate and (subsequently) apply explicit flexibility. This again might lead to problems regarding location decisions for different network users. If applied at the same time, their interaction should be carefully considered. One approach to solve such issues would be information from the DSO about future tariff changes or activations of interruptible tariffs with appropriate time in advance so that other use of flexibility could be adapted.

4.5 Market-based procurement

The facilitation of, and the DSO access to, network user flexibility could be incentivised through market-based measures. In CEER's conclusion paper[20] based on a former consultation, CEER agreed with many respondents when examining these models that market-based procurement is the preferred option because the procurement of flexibility on a competitive basis would be efficient as long as markets are liquid, overall costs are lower than in alternative solutions, DSOs comply with unbundling rules and market distortion/misuse potential is acceptable (see examples in section 6.6 Administrative measures if the latter is not the case).

In a market-based setting, the DSO could negotiate bilaterally or participate in an organised marketplace with network users offering their flexibility, or interact with service providers acting on their behalf, defining and trading desired products. CEER further stated that clear contracts need to be defined to limit the potential for abuse by system operators. In any case, none of the models should unduly distort the markets. The legal provisions of Article 32 of the Electricity Directive (2019/944) now provide further clarity on a market-based procurement of flexibility.

Essential parts of a well-functioning market with free competition are:

- Full information;
- Rational actors;
- Standardised products;
- Liquidity;
- Low entry and exit costs; and
- Low transaction costs.

In essence, there must be a legal framework to allocate rights, duties and responsibilities for the actors engaging in the market, separating between commercial and monopoly regulated entities. It is necessary with a framework giving room for development and regulation of

[20] Flexibility Use at Distribution Level A CEER Conclusions Paper, Ref: C18-DS-42-04 17 July 2018.

essential parts of the aforementioned components, as flaws in one or several of these could lead to considerable distortions.

Article 32 provides for a situation where the market is restricted under certain conditions, stating that flexibility procurement has to be economically efficient and must not lead to severe market distortions or to higher congestion. As congestion management is a monopolistic activity, especially in case these impacts are identified and determined detrimental by the NRA, regulatory intervention could be necessary but the degree depends on the NRA's assessment. Administrative options exemplifying some of these are described in section 4.6. In short, the challenge related to cost-based mechanisms is that they require information on costs and available volumes, which may be private and sensitive information. These are especially difficult to assess in the case of demand, storage and renewable facilities.

However, under the right circumstances and with a number of different prerequisites and methods discussed throughout this draft, explicit procurement of flexibility through market-based mechanisms could be an efficient and reliable way to manage congestions in the grid both in a short and longer term. CEER would like to state that all NRAs have an important task of making the terms and conditions for different stakeholders as clear as possible in the development, monitoring and potential intervention contained in such a framework, minimising the opportunities for distortions, resource lock-in, cross subsidisation and undue investments.

CEER wants to better the conditions for competition (on equal terms) by removing distortions step by step and effectively improving DSO procedures of procurement of flexibility. The preconditions, principles and potential methods of procedures of procurement of flexibility in a market-based approach are thoroughly described in the subsequent chapters.

In this context, it is necessary to emphasise that there is usually never a first-best option. A framework needs time to be developed properly and there is always room for improvement. Regulatory assessment of the effectiveness of the different categories are critical, as there are various approaches to flexibility mechanisms that could reach a cost-efficient outcome. On this note, CEER would like to point out that NRAs should think carefully before implementing measures and intervening in the market(s). This is especially true in early stages of development, as regulations could contribute to reducing actors' chances of innovation and weaken competition. At the same time, it is important to highlight that congestion management is a monopolistic activity, meaning that there should always be some form of regulatory involvement, both in the developing and more established stages of procurement. Depending on the number and variety of emerging platforms and solutions, regulators should follow the development closely and impose overall guidelines or requirements, as the marketplaces may not self-organise in an appropriate manner for the system as a whole.

4.6 Interaction between the market-based approach and other categories

Due to the complexity of the descriptions and coordination mechanisms of DSO access to flexibility, it is important to carefully assess which model is appropriate in which context and what the impact of the combination of several categories can be. This can vary significantly among Member States, as already mentioned.

This section focuses on procurement of flexibility through market-based measures according to Article 32 (1) and (2). Figure 1 summarises CEER's initial understanding of DSO access to flexibility. The DSO has a set of options, including grid reinforcement (all kinds of investments to enhance grid capacity), and access to flexibility within the listed categories, or a combination of them, to solve an arising grid issue, depending on how the categories are implemented in

the national framework by the respective Member State (MS). This is included in the box "Relevant national Framework".

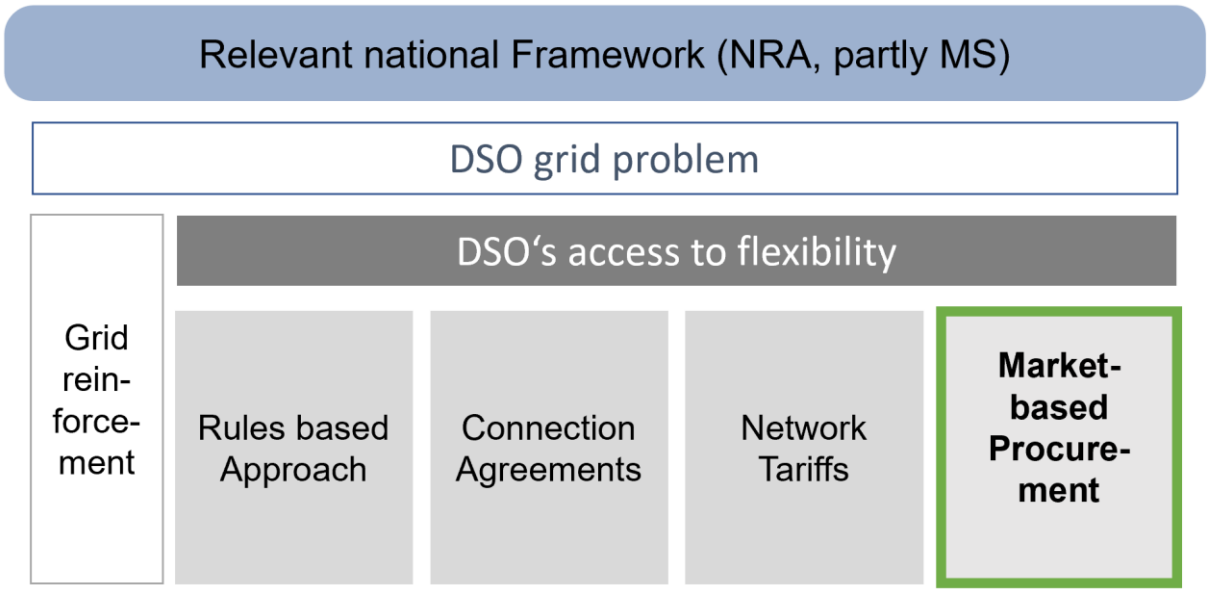

Figure 1: Options of DSO access to flexibility with an emphasis on market-based procurement.[21] [22]

The categories are not necessarily mutually exclusive and the inherent regulatory incentives may overlap. Therefore, Member States and NRAs should carefully evaluate the interactions when implementing new forms of access to flexibility or when enhancing existing ones. An NRA assessment in the market-based alternative is emphasised as a key procedure to make necessary adjustments, referring to the discussion in the previous sections. This is mandatory by Article 32 (1) as described in 2.1 Flexibility procurement - Article 32 (1), (2)**Error! Reference source not found.**. For the NRA assessment, at least the following approaches are possible[23] :

- Conceptual: the assessment is based on a conceptual analysis which could be done at different levels of granularity ranging from for all DSOs, to clusters of DSOs, to every individual DSO (or something between), or along other dimensions;
- Process based: a process is designed and executed for instances of market-based procurement, again at different levels of granularity ranging from once per type/cluster of market-based procurement, to every single case of market-based procurement or other variations; and
- Other forms, e.g. as a combination of the above-mentioned approaches.

Illustratively typical options for NRA assessment in the market-based alternative are described in the following list, but other options could be possible, depending on the national situation, and the initial implementation in a Member State may significantly change these options:

- Change framework: this may include an initial assessment based on the conceptual analysis, but could also be chosen by the NRA after having some experience with market-based procurement. It mainly involves the adaption (or initial design) of the national framework, e.g. to improve the efficiency of the procurement procedure,

[21] According to Article 32 (non-market-based approaches are not comprised).
[22] NRA involvement in other categories than market based is not plotted in the figure, e.g. in designing network tariffs or setting conditions for non-firm connection agreements.
[23] Implementations in Member States could also include assessments that are not explicitly listed here.

liquidity, incentives for the DSO to procure flexibility services via market-based procedures, or to introduce obligations regarding availability, accessibility or price;

- Restart analysis: If the DSO grid problem could not be efficiently solved by the market-based procurement, the DSO would return to the analysis of the problem with all the options open again, including infrastructure investment, delayed connection etc. (this is typically more for process-based); and
- Repeat procurement (after some time and/or adjustment of parameters): this is typically a process-based analysis, meaning that the market-based procurement is repeated after some time (if circumstances have changed, e.g. more liquidity, lower costs through innovation in technology etc.) or after changing parameters of the rules by the DSO (or other responsible party) with the aim of improving the result of the market-based procurement (e.g. through adjustments towards the capabilities of potential bidders).

The NRA assessment may be performed during the initial implementation. It could consider already-existing solutions or technical necessities, DSO overall costs, related risks, unsecure future predictions, long-term costs, comparison with grid reinforcement or other criteria and methods. A reassessment could be performed periodically or if the circumstances have changed significantly.

Table 2 is a starting point for further discussion of the categories and gives an overview of the framework. Other aspects in the categories also differ – e.g. financially: the cash flow to or from the DSO, the reduced or higher income for the DSO caused by grid tariff schemes in contrast to explicit flexibility procurement which normally leads to short-term expenses for the DSO. This would result in different incentives, but depends on the national regulatory schemes

Another aspect to consider when evaluating the categories is the type of congestion to solve, taking into account that a combination of the categories could be beneficial. For instance, that an incentive-based method like a capacity-based network tariff is complemented by explicit flexibility procurement or a rules-based approach like P(U) to prevent voltage violations. Market-based approaches may have advantages for more dynamic problems which occur for limited time periods, but are not generally limited to those kinds of problems. It is not always possible to clearly distinguish between the categories, especially if the categories are linked e.g. a connection agreement and network a tariff can be coupled in an interruptible connection which is priced with a (rebated) interruptible tariff.

Flex category	Frame	Financial	Time frame	Delivery
Rules based	EU network codes/ guidelines and/ or national rules	Possibly shift of costs from DSO to network user, typically no compensation	As in framework defined (usually continuously)	Binding
Connection agreement	National rules, contract may be individual	Possibly reduction of cash flow from network user to DSO, possibly higher/lower costs network user, initial or when change (e.g. capacity)	As in framework defined (usually continuously; could also be time-limited)	Usually binding

Network tariff	National rules, may include options for network users, may differ per region, DSO etc.	Reduced cash flow network user to DSO	As in framework defined, Periodically / (pre)determined periods (typically monthly with yearly changes)	Usually not binding; interruptible could be binding
Market based procurement	National rules (based on EU legislation)	Typically DSO to flexibility provider Reservation: initial / periodically /without Activation: per delivery; Freedom of design includes: Fixed prices/caps, obligations regarding availability, accessibility etc.	Agreed period Optional / As long as bid is available	Usually Binding

Table 2: Overview of categories of DSO's access to flexibility

5 DSO principles and preconditions to procure flexibility

In this chapter, CEER aims to give an overview of the most fundamental preconditions needed before being able to procure flexibility to improve efficiency in system operation. The chapter describes the need for equal incentives between capital and operational expenditure in DSO revenue regulation and mandatory legal aspects to ensure neutrality in addition to technical prerequisites in relation to operational principles. The principles in this chapter describe general concepts which should be followed for an efficient framework for flexibility procurement. More detailed and technical implementation options are described and discussed in chapter 6.

5.1 Incentives

The DSOs' decisions when planning, expanding and managing their networks are led by the incentives in the revenue / remuneration regime and direct regulatory requirements. To put it simply, DSOs may either opt for the use of greater network expansion with less need of flexibility or less network expansion with a greater need of flexibility. The details of the regulation and the lawmakers' provision to necessary grid expansions, including potential degrees of freedom for the DSO on network dimensioning, determine the direction of the system operator's behaviour.

If a DSO decides to design the network with scarce capacity, meaning lower capacity margins, there is a greater need to carry out congestion management procedures. In this case, the DSO incurs the cost of payments to third parties for their contribution to relieving congestion. Alternatively, other options could arise here, e.g. in the sense of contractual arrangements with other market players on the provision of grid flexibility. The level of security of supply must be guaranteed according to national obligations in all cases.

Congestion management costs are classified as operational expenditures (OPEX), whereas network expansion costs are classified as capital expenditures (CAPEX). Of relevance here is how these costs are treated and remunerated in the regulatory scheme, comprising the total cost of expenditures (TOTEX). Consequently, a DSO wishing to make improvements from an economic perspective would make the decision which is most attractive from the point of view of the revenue/remuneration regime. Some regulation schemes in Europe have a bias towards CAPEX solutions, e.g. due an attractive rate of return on equity or direct reflection of CAPEX in the price/revenue cap, whereas OPEX may occur in the revenue allowance with a certain lag, or even be treated separately in a variety of ways. Overall, a different regulatory treatment of OPEX and CAPEX leads to the lack of a level-playing-field in terms of the DSOs' choices of how to dimension their networks. CEER advocates for an equal regulatory treatment of equal technical solutions to enable DSOs to find the best solution in any situation.

To summarise, a fundamental prerequisite is the need for equal incentives between capital and operational expenditures in the DSO revenue regulation, which necessitates similar incentives when weighting between the levels of OPEX and CAPEX to handle a given network congestion over time. Subsequently, this determines their expected remuneration and the most cost-efficient choice of option is made based on the willingness to pay to either carry out, defer or avoid an investment in traditional grid reinforcement. Other aspects, e.g. different risks associated with the different solutions, may also be necessary to look into.

5.2 Neutrality and unbundling

As stated and elaborated in CEER's report on "New Services and DSO Involvement"[24], DSOs must act as neutral market facilitators in order to ensure a level playing field amongst different technologies and solutions when procuring flexible resources. In other words, they should be unbiased in their actions.

An important part of securing this aspect are the unbundling provisions requiring network operators to be separate from other areas of energy supply, generation and related services. The purpose of such provisions is not only to penalise specific breaches committed by individual operators. Rather, it is to prevent possibilities of discrimination towards other market actors. In terms of unbundling, a neutral relationship between DSOs and network users is of high importance. In accordance with the spirit and purpose of unbundling, it is essential for full transparency in the relationships between the system operators and the providers of flexibility and in the technical and economic conditions applicable to the use of the flexibility services. Contracts with these actors, their affiliates or through intermediaries for measures in the interest of the grid are mandatory. They must be non-discriminatory and must take account of the unbundling provisions of European law[25]. Associated business units may not be given preferential treatment. Contractual agreements concluded between DSOs and third parties are to serve the interests of a cost-efficient congestion management, conform to the unbundling provisions that should be concluded and worded in a non-discriminatory manner.

The question arises whether there may be scope for positive discrimination in favour of affiliated companies within the framework of active system management. For example, this concerns the availability and exchange of information about congestions in general and the potentially limited number of local flexibility providers, in addition to the award of contracts for provisions and deliveries. The same applies when system operators issue instructions to installations belonging to the same vertically integrated undertaking by way of administrative intervention in operational schedules. Active system management requires, at the least, effective unbundling of system operators from the purely competitive activities of their corporations. Summarised, equal treatment of all actors is essential to ensure the overall most viable/efficient solutions.

All DSOs must implement legal, informational and functional unbundling from affiliated companies to guarantee a minimum level of equal treatment when procuring flexibility from them. However, given the current statutory regulations, discrimination in this area – owing to complex rules of behaviour necessary for non-discriminatory flexibility management – cannot be completely ruled out; this can only be guaranteed through ownership unbundling. Member States have some discretion when it comes to DSOs with less than 100,000 customers. This point should be discussed further as Member States must provide incentives and prerequisites to procure and use flexibility regardless of the size of the DSOs. Those DSOs still have the obligation to operate their network in a non-discriminatory way and comply with the statutory provisions of accounting unbundling and informational unbundling. In case of vertically integrated DSOs, regulatory systems might include additional rules for procurement of in-house or from other parties, e.g. an obligation to procure standard products unless an in-house solution is more cost-effective.

[24] CEER Conclusions Paper on New Services and DSO Involvement, ref: C18-DS-46-08, 21 March 2019,
[25] Directive (EU) 2019/944.

5.3 Technical prerequisites and operational principles

Higher utilisation of the distribution grid increases the risk of more frequent congestion and leads to an overall system operation with lower capacity margins. This constitutes an increased need for local system services to handle constraints at specific locations in both meshed and radial networks. Key prerequisites are sufficient observability (meaning the DSO's information regarding the known and forecasted state of its own grid) and controllability (to assure correct activation of flexibility from network users). The former will be further elaborated throughout this section and in Annex 3, while a discussion around the latter can be found in section 6.2. Both observability and controllability vary greatly between different grid and voltage levels due to historically different operational principles, access to SCADA-systems and control centre functions.

In short, the term observability describes DSOs' abilities to determine the current and coming state of their networks through models comprised by static data on components and topology, planned changes, prognostics and real-time measurements. With a sufficient level of observability, DSOs can detect where congestions might occur in short or longer terms, based on calculations and observations. Hence, determining within a variable time frame where they need to reinforce the grid, how to set dynamic network tariffs in Member States where these are implemented and/or or explicitly procure flexibility.

For example, a thermal congestion occurs because of an excess amount of power flow. The grid component to firstly breach its technical constraints will be a congested node. In radial medium and low voltage networks, this is typically the sub-station or distribution transformers between the voltage levels. It could also be the first lines in the feeder or connected branches. The direction of the electrical current reveals whether the distribution system is a net producer or consumer of energy. If the former is the cause of a congestion, the DSO must either curtail production, increase the load or charge an energy storage system (ESS) by employing third parties, e.g. network users or their intermediaries, beneath the specific component. Vice versa, the DSO must increase production, reduce load or discharge an ESS if the congestion is caused by too much consumption. Voltage constraints can to some extent be solved by the same measures, or even on its own with functional requirements set when connecting (new) components to a network.

To have the ability to use flexibility in system operation, sufficient planning tools, procurement procedures and activation methods must be developed. From a technical perspective, this means more complex control centre action in order to maintain a secure and reliable supply of electricity. Moving away from the traditional "connect and forget" approach implies more forecasting, monitoring, control and automation as DSOs must predict possible congestions and their cause before they occur in real time, and then act accordingly. To facilitate this transition, CEER believes that it is vital that methods for forecasting production from renewables, in addition to consumption from both new and existing loads, are improved. This implies wide-spread use of systems for predictive and actual state estimation in lower voltage networks or other simplified algorithms. Adequate time resolution and availability of sensors are also important to determine because of the impact on ICT-costs and vulnerability of such systems.

Regarding requirements for observability, it could be determined on a national level with reference to the *System Operation Guideline*[26] and its implementation, but with the focus from

[26] Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (SOGL).

the DSO perspective and needs. In the guideline, observability is divided into structural, scheduled and real-time data. The relation between these are explained in Annex 3. CEER supports that content, direction of data flow, method of exchange and frequency of delivery is to be defined on a national level between system operators and network users, subject to NRA approval. Fundamental issues are the extent of TSO and DSO observability areas and extended coordination.

Issues regarding observability are the overlap into other system operators' interfaces requiring standardisation of common data, how data should be gathered from relevant actors (which implicates the direction of data flow) and all costs related to data transaction. Stakeholder access to relevant data and interoperability when communicating with commercial actors and market platforms to avoid proprietary solutions and the lock-in of local resources are also extremely important.

NRAs have an important task overseeing and potentially determining the responsibilities that go with different forms of data exchange[27], especially when evaluating pros and cons of centralised vs. decentralised solutions and models. As many decisions relating to data exchange aspects of system operation depend on national network structures and operational principles, NRAs and system operators should strive for a common ground of understanding, having area-based or national consultation and approval processes using existing standards to the extent possible. Throughout Europe, using standards defined in the Common Information Model (CIM[28]) for electricity seems to be the preferred option, and CEER would recommend continuing exploring the benefits of this approach.

These technical prerequisites and operational principles are a fundamental basis of the framework for procurement of flexibility and are summarised in Table 3.

Technical prerequisites		Operational principles	
Observability	DSO knows where the problems are, including actual state and forecasts of the network	**System operation**	Planning tools, integration in control centre operation, coordination SOs, etc.
Controllability	Activation and confirmation / verification of procured flexibility	**Data exchange**	Harmonised / standardised / interoperable: API, CIM etc.

Table 3: Technical prerequisites and operational principles for flexibility procurement

[27] Article 32 (2) … shall exchange all necessary information and shall coordinate with transmission system operators in order to ensure the optimal utilisation of resources, to ensure the secure and efficient operation of the system and to facilitate market development.
[28] https://en.wikipedia.org/wiki/Common_Information_Model_(electricity)

5.4 Framework for market-based procurement

To enable an efficient market-based procedure of procurement of flexibility by DSOs, a framework or regulatory guidelines should be introduced. In the following descriptions, CEER aims to facilitate a holistic approach and discussion on DSO procurement of explicit flexibility, focusing on the main elements of the procurement procedure. The objective is to give an overview of most of the aspects to generally consider, and this discussion is not meant to determine specific regulatory requirements, as the details of implementation are subject to national processes and approval. The evaluation consists of technical and economic components, which in combination, are fundamental to enable an efficient procurement procedure and a well-functioning market. A well-functioning market with free competition and adequate liquidity has at least the following building blocks: full information, rational actors, standardised products, low entry, exit and transaction costs – this is assumed embedded in the below described framework.

The framework should at least consist of descriptions regarding:

- Product design;
- Technical rules;
- A method to cope with imbalances caused by activations;
- Tendering procedures;
- Market model design; and
- Coordination schemes between system operators.

If deemed necessary, it can also include administrative measures in a restricted market-based approach.

The **product design** should fulfil the requirements of the DSO by FSPs having an actual sensitivity on the congestion, e.g. in terms of meeting the technical needs to solve the DSO issue, including locational information etc., but also facilitate liquidity (e.g. through aggregation), meaning that most market participants should be able to provide the products. Furthermore, it should only include necessary limitations and the designs should aim to be as standardised as possible.

The **technical rules** should allow for an efficient implementation. Standardised technical equipment or procurement via aggregators should be considered, but also other areas are possible to include.

A concept for **imbalances settlement** is necessary to avoid negative effect to other Balance Responsible Parties (BRPs) or suppliers as well as for the whole system. Different models exist and can be chosen to fit the national situation.

The **market model design** should allow for efficient participation. The coordination with or integration towards **existing market models** should help to not unduly hinder participation in existing markets, unwanted effects to other market parties, and make the roles and responsibilities clear to all actors.

The **procurement procedures** are also vital, both to allow market parties to efficiently participate and DSOs to fulfil their requirement, in addition to assuring regulatory overview and compliance. Direct tenders or procurement via platforms could both be efficient, as long as there is a clear separation between the regulated and market/commercial domain in all cases.

A procurement procedure must be carried out in accordance with the national legislation on public tendering if the legislation is applicable. The main purpose of a tendering procedure is to increase the efficiency and to enhance the competitiveness of a tender. The fundamental and important principles of a tendering procedure are:

- Equal and non-discriminatory treatment;
- Transparency and proportionality;
- Fair competition/fairness; and
- Appropriate rules with regard to the prevention of misuse and gaming potential.

Non-discrimination means that the DSO must ensure equal access to the contracts from all tenderers. Equal treatment means that comparable situations should not be treated differently, unless such treatment is objectively justified. In practice, equal treatment includes that the same information is provided to all tenderers and the same timelines are applied for all.

The principle of transparency requires an open tendering procedure with only narrow exceptions. Tender opportunities shall be announced widely enough and the decision-making process must be transparent. The DSO shall provide sufficient information before opening the tendering procedure as well as during the procedure. Transparency also requires that rejected tenders shall be objectively justified.

If DSOs decide to procure flexibility services, they must communicate this transparently in order to treat all potential providers equally. To limit discrimination, all potential market players must be informed transparently and in good time of the situation in all segments of the network. The framework could include obligations for active communication by DSOs to facilitate more participation. A transparent and non-discriminatory exchange of information should also include requirements for DSOs to publish information relating to contracted and activated capacities and the compensation/remuneration paid in return.

Proportionality means that measures adopted in the procurement process shall be appropriate to the service pursued and shall not go beyond what is necessary to achieve it.

The procurement procedure and parameters should be designed to allow for a maximal possible use of flexibility in other markets or flexibility evaluation methods (e.g. balancing reserves, ID, DA, portfolio optimisation etc.) and allow for an optimisation to benefit the whole system. This can be tackled via subsequent gate closure times or other parameters and methods in the market design by giving the right incentives for the market participants. There are also cases where activation of flexibility solves more than one problem, e.g. balancing activations by the TSO could in addition relieve congestion in the distribution grid. The flexibility should only be reserved by the DSO when needed and its utilisation of the contracted flexibility should be communicated by the DSO with enough time in advance to allow the flexibility provider to adapt its bids in other potential markets (e.g. balancing, ID/DA etc.).

In any case, it is important to highlight that the efficiency of market-based procurement can be significantly negatively affected by severe distortions and gaming[29] possibilities. When gaming and misuse cannot be efficiently prevented or excluded, the appropriate handling and legal consequences of the situation can be decided by the responsible national bodies.

More detailed descriptions of the elements of a flexibility procurement framework including areas to consider, options and consequences are to find in the subsequent chapter 6.

[29] For further details on gaming, see the excursus in section 6.6.

6 DSO flexibility procurement components and methods

With the necessary preconditions in order, referring to equal incentives, neutral behaviour and sufficient observability in chapter 5, DSOs should be able to pinpoint relevant locations in their grids to engage in congestion management. Summarised, this includes determining where congestions are expected to occur, their cause, size, duration and time frame. Depending on the granularity, this information could be very sensitive and if made completely public could be to the detriment of the market functioning. The DSOs should consider the relative sensitivity, and thereby only to a limited extent publish their needs for flexibility, signalling it in as broad a way as possible, whilst still providing enough information to support the market. When a potential congestion has been identified, and the expected size and duration are forecasted, important assessments include selecting one or several resources to relieve the congestion, the method of activation and how the activation should be validated. Accordingly, an appropriate procurement procedure needs to take place. Within this frame of considerations there are various approaches to flexibility mechanisms that could reach an efficient outcome.

6.1 Product design

A vital part of DSOs signalling their needs, is establishing the product specification. In the EBGL[30] (electricity balancing guideline) a list has been set up containing parameters that could be necessary to define. A description of all the attributes in such products and how they might look like in practice could be very comprehensive. For CEER, it is not a goal to parameterise everything, but in the long run, product specifications should primarily be set with reference to these key parameters. In the starting phase, through demonstrations and piloting, it might be a good idea to study and utilise the different characteristic of flexible resources, rather than defining specific products.

A big question is the coherence between the degrees of variation for different DSO needs compared to what FSPs in a congested area actually can deliver. Both could greatly depend on specific grid conditions and locations, often in combination. As there is a vast variety of FSP characteristics, and in theory also DSO needs, it is important to be technology-neutral when setting up the specifications. In other words, defining them in an agnostic way to ensure a level playing field. A customised approach may be better suited for the valuation of certain characteristics, but if they are too customised the products are harder to compare and it might be challenging to have a good price formation.

As an alternative to referring to the comprehensive list in the EBGL, another way of addressing the designs of products are that they mainly need to balance three considerations

1. As specific as necessary to solve the congestion;
2. As broad as possible to facilitate liquidity; and
3. Standardised (on a national or regional level), e.g. it could be a similar approach as for balancing products.

Taking the considerations into account, a set of specifications and characteristics must be set up in one way or another, regardless of the degree of freedom, if product prequalification can take place. Going back to the list, most of the remaining parameters are related to time, availability and bid size. DSOs and FSPs should aim to experiment with the different attributes to see which of the considerations are most relevant in their specific use cases.

[30] Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing.

As a step further, the April 2019 TSO-DSO report[31] introduced the concept of a flexibility resource register. In short, a flexibility resource register stores data related to bids' capabilities using the same resources for different purposes. A very specific need to solve a given congestion could, for instance, lower the value of a product, but in a register a bid could be differentiated containing several products prequalified for a variety of purposes, still based on the same structural information. This means that the combination of characteristics from numerous resources can constitute several uses available by default to all who are granted access thereby theoretically complying with all the numbered considerations above. A register would at the same time allow for value stacking, thus increasing the source of income for FSPs. Several H2020 projects and national initiatives are now planning to look more into and develop some of the concepts of such a register. These outcomes should be taken into account by NRAs in further design of the framework if they are deemed to be viable solutions to address or potentially implement at the national level.

A significant component of how flexibility needs are signalled are the definitions of congested points or congested areas, referring to (the term) observability described in section 5.3. Locational information is crucial, but if the geographic granularity is made available with too high resolution this could enable speculation and lead to gaming issues. To minimise such possibilities, it is a good argument that DSOs, when engaging in congestion management, should only publish the necessary level of detail of information regarding constraints within an area, especially if this is linked to known topology and transfer/capacity limits under certain grid conditions.

Even though the DSOs might refer to larger areas when defining congestions, it is essential that the bids for flexibility should include the exact location of the bids, or at least refer aggregated bids to the upmost point in the network they are present. Otherwise a bid itself, or substantial parts of it, could be useless. Summarised, this means that the DSOs should signal their needs as broadly as possible within the area they want to source flexibility, thereby allowing for maximum participation from and competition between FSPs to facilitate liquidity. At the same time, the bids themselves, should include the geographical location of the offered resource(s) at the necessary granularity so as to not unduly introduce barriers for aggregation.

CEER will also address the establishment of baselines as this is a crucial aspect of products and their design. In short, the offered flexibility for congestion management equals the deviation from a given baseline and baseline methodologies are in most cases/always based on historical data. As opposed to traditional production plans that are heavily regulated and based on strict time schedules, consumption plans within smaller areas have a more probabilistic nature. The same is true for RES production at lower voltage levels. Depending on the Member State, a retailer's consumption plan is based on a single price area, which could mean an entire country, while in the DSO networks, the expected production and consumption are often based on regional forecasting.

Baselines on the other hand, describe the load profiles of different network users at their respective connection points. These could be generalised to some extent categorising similar network users into groups or they could be set individually. Congestion management completely depends upon such a high granularity, but baselines based on individual load profiles and historical data are not legally binding at this point.

[31] TSO-DSO Report: An integrated approach to active system management, April 2019, https://www.edsoforsmartgrids.eu/wp-content/uploads/2019/04/TSO-DSO_ASM_2019_190304.pdf

In the establishment of baselines, it is important that all relevant actors are involved, preferably with regulatory overview, when categorising and agreeing on the different terms of such a framework. This is not straight forward and the actors' incentives could substantially deviate (e.g. if the baselines are set by the DSO, the FSP or the marketplace operator. NRAs have an important task of evaluating the pros and cons of the different approaches).

6.2 Controllability

Controllability refers to DSOs' ability to control their own and other assets remotely or manually, either individually or in combination with the actions of network users and system operators at their interface. This activation can be performed directly or through indirect (intermediary) measures. DSOs usually coordinate the operation of their networks from a control centre.

When a given resource has been selected, regardless of aggregation, the activation can either be made directly from a control centre or through intermediaries. The subject of controllability has many similarities between transmission and distribution system operation. The latter can introduce more challenges due to the intermittent and distributed nature of small-scale renewables or demand response, in addition to the potential quantity and variation of such resources. As opposed to TSOs that are used to interacting with larger power plants and industrial loads run by professional actors with long experience in the energy markets, DSOs must to a greater degree rely on new and smaller parties.

The vital part in real-time operation, after forecasting the capacity margin and setting the expected congestion size on particular nodes, is the actual activation of a given resource while ensuring that the delivery is sufficient to handle the congestion. It is important that the controllability of flexible resources is thoroughly tested going through an agreed product prequalification process. Control centres can thereby gain sufficient experience before wide-spread deployment.

To ease the transition towards more active system management, DSOs might, as a starting point, prefer the possibility to access and activate flexible resources directly from their control centres instead of being dependent on intermediaries in the last and most crucial steps of the procurement procedure. Controlling other devices is quite different from traditional grid operation. To make the steps towards a fully integrated grid operation, a hands-on approach by operators could support the change to perform such actions and reduce some of the possibly perceived uncertainties. Particularly with the initial emergence of bilateral contracts, direct controllability might be a reasonable step in relation to operative actions with inherent risk. A more advanced (and necessary) step would be activation through intermediaries, for instance flexibility market platforms and aggregators, which is for some DSOs is already business as usual and state of the art in TSO grids. Such measures should be coordinated with other relevant system operators and potentially be assessed by NRAs.

6.3 Imbalance settlement

To maintain the system frequency, supply and demand of electricity must constantly be balanced. Every Balance Responsible Party (BRP) has an obligation to achieve this for the market actors and network users they represent, but the TSO balancing method and the BRP model for imbalance settlement is country dependent.

Due to uncertainties in plans and forecasts for both producers and consumers, in addition to congestions or failures of grid components, power plants etc. and imbalances will occur on a regular basis in real time operation. BRPs need to settle their imbalances financially.

Regardless of the different market solutions and financial settlement models, balancing is of utmost importance to ensure system stability and a well-functioning commercial electricity market.

In most ongoing demos and pilot projects with procurement of flexibility for congestion management at lower voltage levels, the volumes are so small (< 5 MW) that it is typically not necessary to perform a re-dispatch in system operation and the BRPs' financial imbalances are usually low. However, System Operators and NRAs should be highly aware of the fact that solving local congestions on a large scale within the same time frame could influence the imbalance of a BRP to an undesirable degree if it is not accounted for in a proper manner. Rapid changes in power flow might occur regularly and could severely impact the financial liability of the involved market parties (and system frequency), if they are not accounted for in a proper manner.

The introduction of independent aggregators operating as balancing service providers and FSPs might be a challenge for current market participants because they, in principle, resell an amount of energy that a supplier has already paid for in the existing market(s), or refrain from using it. It is important to determine whether or not an FSP or an aggregator should be responsible for the costs of the unmatched positions they cause for balance responsible suppliers[32], meaning that the price risk remains on such actors. If the latter is the case, there could be a distortion between the FSP profiting on an activation while the risk of the financial imbalance is placed on another party, which might be unaware and even unable to influence its own settlement.

In this regard, it could be necessary to establish different forms of compensation mechanisms to ensure that other market parties are not significantly affected by their activity. In other words, being economically responsible for the imbalances they inflict on existing BRPs. In many Member States, this would imply becoming BRPs themselves, or to source the service to existing BRPs acting on their behalf, although there could be other methods that achieve the same purpose.

On the other hand, several Member States have, in accordance with legislation, allowed more than one BRP per connection point. The aim is to have a more orderly interaction between several actors offering different services to the same network user. With several BRPs complexity arises, both when trying to ensure system stability and in deciding which actor is responsible for an imbalance in the financial settlement. When implementing market (aggregation) models aimed to support such schemes, they could be applied by adding additional meters, either parallel at the connection or through sub-metering, or through some form of synthetic profiles coupled with actual metering or other solutions which ensure proper verification.

6.4 Procurement procedure

The procurement procedure is one of the key processes to appropriately signal the need for flexibility and procure the necessary resources to engage in congestion management in a cost-efficient manner. Within this section, CEER will present initial thoughts on what a procurement procedure may look like. The concrete approach and accompanying steps of the procedure remain to be decided at the national level.

[32] http://www.nordicenergyregulators.org/wp-content/uploads/2020/02/A-New-Regulatory-Framework_for_Independent_Aggregation_NordREG_recommendations_2020_02.pdf

Given a viable OPEX solution, DSOs should arrange open and transparent procurement processes, as e.g. tendering procedures, signalling their need for flexibility before contractual agreements on deliveries are set. NRA assessment might be essential in one or many of the involved steps of such processes. Regarding the tendering procedure, CEER proposes to set up a non-exhaustive list of elements following the process described below to act as a guideline for both System Operators and NRAs in order to have a unified way of referring to and assessing important components of a tender:

1. Flexibility demand: DSOs must signal and publish their need;
2. Request for tenders: should be as broad as possible;
3. Product requirements: must be properly defined and preferably based on standards;
4. Optional: ex-ante assessment performed by the NRA (of elements 1., 2. and 3.); and
5. Optional: ex-post review performed by the NRA on the tendering outcome and the DSO decision (fitted to national implementation; random tests may be sufficient).

1. Flexibility demand: DSOs must signal and publish their need

Before launching a procurement procedure, the DSO should consider conducting preliminary market consultations as a preparation for the procurement procedure where the services that relevant market participants are able to provide or the services required by the DSO are not yet clear. The preliminary market consultations and seeking of advice should not influence the competition in the procurement procedure and should not violate the principles of non-discrimination and transparency.

The content of a tendering procedure is defined by the DSO. The conditions should be reasonable, transparent and justified. The conditions are the minimum requirements that every tender should meet. The procedure should ensure observance of the principles of equal treatment and transparency. To ensure transparency and traceability, the tendering procedure should be documented, and the tenders should be submitted in writing.

The DSO should indicate in advance the minimum requirements for the procurement and they should not be changed during the procedure. Also, the criteria and possible weighting should remain stable during the entire procedure. The requirements and the criteria should provide measurable specifications against which each tender can be evaluated and could also include location if that is of significant influence for overall costs.

2. Request for tenders: should be as broad as possible

Following already existing national legislation of the area, at least the following information from the procedure should be published:

- The need for flexibility including congested area(s);
- The time frame for flexibility needs (seasonal, daily, acute situations, duration);
- The financial responsibilities of the involved actors;
- The technical specifications; and
- Information on reporting and monitoring.

The parameters for a tender procedure have significant influence on the outcome. In an open tendering procedure, a system operator may request a tender and any tenderer who meets the criteria will be eligible to have its tender assessed. A competitive procedure, including

negotiation and dialogue, can be used for purchases where innovations etc. exist and where there is a special need for flexibility in the procedure. This is different in platforms, where the products and processes are more defined, equal and transparent.

To ensure efficient competitiveness, the tendering procedure should not be restricted more than necessary. Unnecessary restrictions concerning providers, technical requirements etc. can lead to a discriminatory tender request. Restrictions could also lead to a situation where the interest from market actors unnecessarily decreases. The DSO should only set restrictions that are necessary in their control area.

The deadline for offering tenders should be reasonable and fair for all tenderers. The deadline for the tenders should be communicated in advance and the timeline should not be shortened during the process.

CEER would like to state that it is essential that the tender should be as broad as possible within the defined needs, meaning that the needs should be described as broad as possible. This would allow the market-based procedure to generate the best outcome through competition and avoid a potentially risky dependence on specific network users.

3. Product requirements: must be properly defined

In order to ensure an effective procurement procedure, there is a need to set certain requirements for the product. Product design is extensively dealt with in section 6.1. As mentioned there, the DSOs can specify the product to a certain degree to respond to the need considering the circumstances and specify the detailed standards and characteristics to define the product. The standards should satisfy the needs of DSOs and consider the available technical constraints etc. When defining the products, the DSOs should foster competition and efficiency.

The requested product could be standardised, at least to a certain degree. Standardised products aim to ensure a sufficient level of liquidity and allow for building up a merit order to organise competition. In this way, price transparency is promoted and comparison of the value of offers is easier. Nevertheless, it should be noticed that variants could be allowed if possible, to encourage tenders on innovative products and services. With standardised products it could, as already discussed, be challenging to meet very specific flexibility needs. Standardised products should not create unjustified obstacles to competition.

The provider should meet the requirements set in the terms and conditions adopted by the DSO, and the tender must be sent within the set timeline. It should also include all the necessary data and any other information needed to evaluate the provided service as well as a calculation of the overall costs.

4. Optional: ex-ante assessment of the tendering procedure performed by the NRA (element 1., 2. and 3.)

All tenderers must be treated equally. Especially in the starting phase, a careful ex-ante assessment could be performed by the NRA based on the planned tendering procedure and on a market analysis. If there is no interest in the tender, the NRA could review the outcome and see if changes in the tender are needed. The tender could be rejected if the tender is non-compliant or incomplete, unless these errors are correctable in a non-discriminatory manner.

5. **Optional: ex-post review performed by the NRA on the tendering outcome and the DSO decision**

The DSO should publish information on the procurement proceeding and report the outcome of the procedure to the NRA, containing sufficient information on costs, benefits and potential effects. The DSO should also provide information on how the common requirements on non-discrimination, fairness and transparency are met.

After an unsuccessful tender, a new and refined procedure could be started, or such a tender could after some time be successful (e.g. after improvement of technology or costs). A "market test" could be described as a tool to assess such situations. The roles and responsibilities would need to be defined and could involve both the NRA and the DSO. It could be a combination of or something between the ex-ante and ex-post analysis. Further assessment would also be needed on the relationship between the ownership of storage and the procedures of Article 36 of the Electricity Directive. If flexibility procurement is successful, it seems unlikely that a market test for storage is necessary, because an efficient solution was delivered by the market and it would be difficult to fulfil all conditions of Article 36 (2) to allow ownership of storage for DSOs.

Finally, the outcome could be part of the terms and conditions which could be subject to oversight by the NRA or be approved by the NRA following national rules.

6.5 Market model design and coordination mechanisms

Given the descriptions of preconditions and methods, referring to the content of previous sections of this chapter, a reasonable approach could be to split up the concept of DSO congestion management into different time frames, namely in a long, short and operational term. Hence, DSO congestion management can take place long before, prior to, during or after existing wholesale market clearing, as far as just before the (gate) closure of the balancing market moving towards real time. As mentioned, this can be done via bilateral contracts or by auctions with or without continuous trade. Bilateral agreements, contracted based on the previously described principles of a tendering procedure, will be a natural first step before having sufficient volume to establish a marketplace, potentially moving over to pay-as-bid. In the setting of continuous trade, placed orders in a market will be executed at the best price available without delay in the first dedicated time slot.

As flexibility markets could represent a variety of auction and trading platforms, there are many different approaches to the design and setup, keeping flexibility markets separate and somewhat independent on one side, or integrating them partially or fully with existing markets on the other. Products for congestion management can be capacity-based (reserved) or energy-based (non-reserved), addressing long- and short-term issues respectively or in combination, meaning that trades could be set up without interfering with the existing markets or the time frames could be linked to a certain or precise extent, although they do not necessarily need to align.

Both during the work of the SmartNet project and after the publication of the report on "Network and market models D2.2"[33], the project promoted and concretised the discussion on how flexibility markets might look like in practice. The project had quite wide descriptions introducing five potential market model setups and coordination schemes. The models were developed

[33] http://smartnet-project.eu/wp-content/uploads/2019/02/2019215113154_D2.2_20190215_V1.0.pdf

further and reduced in number in the TSO-DSO report. Under the topic of marketplaces for congestion management, three main options for market models were presented. Namely:

1. Separated TSO and DSO congestion management;
2. Combined TSO and DSO congestion management, with separated balancing; and
3. Combined balancing and congestion management for all system operators together.

The primary argument for separated TSO and DSO congestion management is mainly the need for special option schemes at the DSO level. As the DSO need could be quite specific in location and time only occurring with specific incidents and/or in a certain number of hours of the year, the DSO must ensure and completely rely upon that the relevant resources are there when they are needed. This could be more difficult compared to the TSO situation because the number of activations per year could be significantly lower while the locational range is smaller. Otherwise, it could increase the risk of engaging in congestion management, making investments in traditional infrastructure more favourable even if they turn out to be less cost-efficient in the long run.

To secure the availability of resources in longer terms, option schemes with a reservation and predetermined or variable activation cost could be beneficial. It is possible to determine and include the activation price upon entering the option, both to reduce the chance of market power as well as to increase the predictability for the DSO. The emergence of new actors and resources could, on the other hand, push the potential market price down. This consequently reduces the DSO's efficiency as it is unable to relieve congestions in the cheapest way possible.

As mentioned under product design, a fully separated marketplace could be better suited for DSO congestion management because of its easy applicability and the fact that it can easily be tailored to the DSOs needs. However, this could also be solved with the implementation of some form of a flexibility resource register, promoted both here in this paper and in the TSO-DSO report noted in footnote 31, allowing FSPs to participate in all of the market models presented above regardless of if they are separated or combined. Obligations in other markets should of course be fulfilled, referring to the discussion of physical and financial balance in the imbalance settlement subchapter.

In short, the same resources and actors could be present on both the existing and developing platforms with the inherent risk of exploiting that the market price signals in the commodity market does not reflect or embed the actual costs of congestions.

If an FSP participates in the balancing market, it should also undergo a pre-qualification process with the TSO for the volumes they wish to bid in. The resources could in this way firstly be available to the DSO, and if not used, be aggregated and bid into other markets. This implies that the DSO must verify that other DSO or TSO activations do not lead to or is blocked by congestions regardless of if they are used for other non-local system services or balancing purposes. Somewhat independent of the choice of market-based solution and coordination mechanism, activation should happen when constraints are quite well known and system operators have the most updated information concerning the state of their grids, but still in due time to check if other system operators might be influenced and to allow for participation in other markets in times without activation.

The process of system operator coordination obviously depends upon the national context/set up, but lay outs such as grid prequalification, a flexibility resource register and traffic light concept could be adapted to circumstance. The implementation of such concepts could be

helpful in increasing the efficiency of system operator coordination and cooperation as long as there is willingness and consensus among the involved parties, with regulatory overview or approval of the processes.

In this context, CEER wants to highlight that there is a vast number of relevant initiatives, funded both nationally and by the EC through H2020 (Bridge) on the topic of DSO procedures of procurement of flexibility addressing the characteristics of specific resources, market model design and coordination schemes. It is challenging to get an overview, keep updated and see coherence amongst so many projects/initiatives. Notwithstanding, if the projects and initiatives could pinpoint the planning and operational timeframe for which they are engaging in the market and how other system operators or actor are notified, it will be easier to compare, see similarities and clarify differences. CEER wants to state the importance of open exchange of experience and competence in this regard, making relevant information and knowledge available to other System Operators and NRAs.

Another important aspect of separate DSO and TSO congestion management is the role of the marketplace operator. As the balancing markets in most Member States are in the regulated domain, the developing markets at the DSO level are run by commercial entities, sometimes in the same corporation (but different legal entity) as the DSO. The role of the marketplace operators and the tasks that they perform need to be properly defined in order to avoid conflicts of interest and minimise the possibilities for cross subsidisation. In short, the marketplace could be:

- A broker who does not take physical positions, but only facilities financial deals;
- A trader who takes physical positions, e.g. by aggregating bids and forwarding them to the balancing market; or
- An organised marketplace or platform for the sale of electrical energy (with physical delivery) at the local level. This would require a concession.

With the combination and potential integration of different platforms, it could be challenging to determine the borderline between the regulated and non-regulated domain. Especially with a potential interaction and overlap the frontiers of the domains should be properly defined, even if there may be many variations and it is not always a clean cut. CEER finds it important to raise awareness of these situations and NRAs should assess the pros and cons of the different possibilities. The alternative to separate marketplaces is to further develop the current ones, but this is more demanding due to stricter and already established requirements in these markets.

As always, assessment of the different market models and coordination mechanisms might substantially deviate between Member States. The goal is to create the highest societal net benefit over time by encouraging and allowing participation in demand side response of market parties and system operators with no undue barriers. NRAs should aim to facilitate that flexibility is utilised for the purpose that creates the most value for the customer and the system as a whole within the four categories of DSO access at the distribution level. That is, to oversee and potentially implement how market-based procurement could be arranged and not prejudge the forms, accesses to and utilisation of flexibility in terms of efficiency because this is a moving target that can change over time. NRAs should carefully assess which model is appropriate in which context and what the impact, combination and interaction of other market designs and coordination mechanisms can be through concepts or firm rules of priority and control hierarchy.

Market development will take time, but participation, and hence, liquidity could increase as a consequence of the transition towards more production connected at the DSO level on one side, and more controllable consumption due to the electrification of relevant sectors on the other. Especially if such processes are mandated, the situation could develop rapidly.

CEER will encourage regulators to generate a market design within appropriate time. NRAs can to some extent discuss the pros and cons of the different approaches on a theoretical level, but it is challenging to state without practical examples and experience. The same is valid for the different coordination schemes and mechanisms.

6.6 Administrative measures

The Member State's choice of the DSO's access to flexibility and the suitability of market-based procurement may vary across Europe. If some or substantial parts of the preconditions and methods discussed throughout this report are not fulfilled, it may be assessed as preferable to introduce administrative measures, particularly if an administrative approach is shown to be more cost effective.

The key element of administrative measures is that the price for the provision of grid flexibility is not determined by the market participants or through a market-based procedure, e.g. at a trading platform or through an auction mechanism, but through a regulatory assumption regarding the opportunity costs that a provider of grid flexibility incurs. An administrative interaction could also imply that the DSO has direct operational control to change the behaviour of the entity causing the congestion. In some Member States, today's re-dispatch and curtailment regimes are designed this way.

Market-based interaction will be less efficient with the presence of distortions and lack of liquidity or under uncertainty regarding future network demand, long term costs or other criteria (see also section 4.6). If these preconditions are not fulfilled, administrative options can be considered. Administrative measures are considered a potential solution where gaming (see excursus in this section) is rife and risks increasing consumer costs at a greater rate than the efficiency losses of an administrative approach.

According to Article 32 paragraph 1 of the Electricity Directive (2019/944), an exemption from the market-based procurement shall be made if the regulatory authorities have established that a market-based procurement of flexibility is not economically efficient, would lead to severe market distortion or higher congestion. To establish that a market-based approach is not economically efficient, it must be compared to the base-case, as all markets have some inefficiencies. If the administrative approach could present greater long-run efficiencies due to severe weaknesses in the market-based approach, administrative options are possible. Hence, the due diligence to assess the market situation is on the NRA, and the national implementation depends on the respective national approach in the Member State.

Excursus: The Decrease-Increase Game (Dec-Inc-Game)

The Dec-Inc-Game describes a situation where actors take profit from the artificial creation of network congestions. This implies a setting where these actors first behave in such a way that congestions occur, e.g. due to their bidding behaviour in order to secondly relive this congestion by offering grid flexibility at a secondary market. The strategic behaviour leads to increased network costs, distorts investment signals and weakens the commodity markets as they are biased by the higher profits of the secondary markets for grid flexibility. Moreover, the behaviour creates situations where actors develop an interest in the persistence of network congestions.

Notably, several approaches to reduce the risk of Dec-Inc gaming might be explored, including dynamic network tariffs that respond to changes in marginal constraint costs. Thus, if a player tried to increase a constraint at the DA to benefit from selling to the DSO flexibility market, their actions in the DA market would result in a higher tariff cost for that imbalance settlement period, removing the gains they would make in the flexibility market (as theoretically, the costs for the constraint should be around the same). Thus, the Dec-Inc game is also a problem of market price signals, meaning that the commodity markets (DA or ID) may not reflect the costs of a network user causing a constraint.

Another option would be to remove the possibility of a flexibility market entirely and solely implement administrative measures. As indicated above, the key element of an administrative measure is that the price for the provision of grid flexibility is not determined by the market participants or through a market-based procedure (e.g. at a trading platform or through an auction mechanism), but through a regulatory assumption regarding the opportunity costs that an FSP incurs.

However, it is not always trivial to find the appropriate compensation for the providers of grid flexibility from a regulatory point of view. This is due to information asymmetries regarding the quantification of the actual opportunity costs the FSP experiences. Costs-based mechanisms require information on costs and available volumes, which is private and sensitive information. In addition, these types of information are difficult to assess in the case of demand, storage and renewable facilities. In the process, the NRA or DSO would have to estimate a regulated price without the benefit of having a market setting the actual price level for them.

The extent of the error in the regulated price setting could on one side discourage investment in flexible resources if it is set too low or over-compensate network users on the other. In the former case, the long-run distortions could be greater as DSOs would have lower levels of flexibility to rely on as investment shifts to other alternatives than flexibility. In other words, DSOs could have to pay more for managing their networks. In the latter case where DSOs over-compensate, the distortions would appear in the short run, as producers will be extracting the surplus from the additional payments over their opportunity costs.

An administrative system will also need to establish a merit order between the different sources based on the NRA or DSO's own guesswork on opportunity costs. When errors occur in the merit order, it could cause further inefficiencies and cost to consumers.

Even if there are few providers of flexibility in a local area demanding a higher price due to low liquidity, it does not necessarily mean that an administrative solution would be more economically efficient in the long run. If NRAs have ensured low regulatory barriers to entry, ideally new innovative actors would invest in the market causing prices to fall while facilitating a sufficient level of flexibility in the system.

7 Conclusions and outlook

This report builds upon previous work completed by CEER on the use of flexibility at the distribution level and elaborates on different aspects of DSO access to and procurement of flexibility. The different options (rules-based approach, connection agreements, network tariffs and market-based procurement) have differences in their characteristics (e.g. financial, time frame etc.) and should be assessed individually and in combination, choosing the most efficient alternative(s) for a given setting. It can be efficient to apply more than one as they can beneficially complement each other, but interactions should always be carefully considered.

CEER attempts to put these categories in context, with a focus on the market-based approach for this paper, describing preconditions to, components of and methods for the procedures of procurement of flexibility primarily seen from the DSO perspective. To enable an efficient market-based procurement, it is necessary to have a result-oriented procurement procedure where CEER recommends the following principles:

- Incentives: provide the basis for the DSOs to choose the most cost-efficient solution in consumers' interest, including market-based, with appropriate CAPEX/OPEX consideration;
- Neutrality and unbundling: DSOs must act as neutral market facilitators in order to ensure a level playing field amongst different technologies and solutions when procuring flexible resources;
- Technical prerequisites and operational principles: definition of the problem to solve and tools to solve the problem successfully and efficiently, including observability (actual and forecasted state of the grid), controllability (activation with verification) and system operation with extended System Operator coordination and harmonised data exchange; and
- Framework for procurement: can give room for development and regulation of essential parts of the aforementioned topics to fit to the national framework and situation. CEER would like to state that all NRAs have an important task in the assessment of the whole framework and especially the procurement procedure, which has to be transparent, non-discriminatory and market-based, e.g. through making the terms and conditions of the DSO as clear as possible for the stakeholders.

The suggested **framework for procurement** should address the principles needed to engage in flexibility procurement and potentially include a stepwise description of the procedure. Furthermore, the procurement procedure is the key process to appropriately signal the need for flexibility and acquire the necessary resources to engage in congestion management or voltage control in a cost-efficient manner.

Network development plans are an important tool to elaborate on the first step and aim to help improve liquidity by providing information to potentially interested parties where there is or could be a demand for flexibility in the medium and long-term. The obligation and process to create the network development plans should be well designed to meet a good compromise between effort and benefit. In addition, other effects should be taken into account as they also facilitate efficient network planning by seeing larger investments in infrastructure in context and coordinating these in areas with several System Operators and voltage levels.

If the market-based approach is deemed efficient by the NRA, it could follow the principles outlined in this report, with implementations adapted to national circumstances in the framework for procurement. This includes potential content and regulatory assessments of relevant aspects regarding product design, controllability, imbalance settlement and market

model and coordination scheme. In regard to the procurement procedure, CEER has identified the following important elements:

1. Flexibility demand: DSOs must signal and publish their need;
2. Request for tenders: should be as broad as possible; and
3. Product requirements: must be properly defined and preferably based on standards.

Around these market-based elements a "market test" could be developed to assess if the market is still able to deliver efficient solutions. In case not, the criteria could be adapted and the test is repeated, or the test is repeated after some time or other methods for flexibility could be used. Otherwise, grid reinforcement could be the most efficient solution. The costs of such an approach should be weighed against the benefits in a comparable way between the different options.

Within the product design, it is necessary to specify parameters or main characteristics correlating to the DSO's need. The granularity of locational information could be quite broad when DSO needs are signalled, but the geography-specific considerations should be very precise in the offered bids. As the offered flexibility for congestion management equals the deviation from a given baseline, they are critical to establish.

The controllability of flexible resources should be thoroughly tested to ensure a correct delivery, regardless of whether the activation is performed via intermediaries or directly by the DSO, preferably going through a specified prequalification process. Verification is also critical in the imbalance settlement that needs to have clearly defined financial responsibilities for the involved market parties and actors.

DSO congestion management can take place long before, prior to, during or towards existing market clearing. There are many different approaches to the design and setup, keeping flexibility markets separate and somewhat independent on one side, or integrating them partially or fully with existing markets on the other. In a separate market, the role of the marketplace operator must be defined. Coordination with other System Operator and market parties is essential, regardless of market model design, especially to ensure that the activation of a resource is not blocked by or could lead to a congestion elsewhere in the system.

At the same time, DSO utilisation of flexibility should not unduly obstruct any resources from participating in other markets. The topic of sector coupling and integration with multiple uses of flexibility in different systems has not been directly addressed. In any case, the market-based procurement should be based on a level playing field and open to all forms of flexibility, including assets from other sectors like heat and gas[34].

If the market-based method is deemed to not be efficient, other categories to access flexibility could be used or measures to improve the market-based approaches could be applied. Other alternatives are conventional grid reinforcement, extensions or other conventional measures in the national framework.

Recently, the European Commission had a public consultation to establish the priority list of network codes[35], one of the key areas of which was demand side flexibility. CEER stated in its response that "*Many Member States already have systems in place which enable or foster the participation of demand in existing (market) mechanisms. This needs to be kept in mind as a*

[34] Also see the CEER Paper on Whole System Approaches, Ref: C19-DS-58-03, 30 June 2020.
[35] See https://ec.europa.eu/energy/consultations/consultation-establish-priority-list-network-codes_en

starting point for the judgement on the necessity of a demand side flexibility Network Code. Moreover, existing Network Codes (in electricity such as Balancing and CACM) have a very strong emphasis on the provision of flexible resources including demand for system stability reasons. Any new legislation should not impede or hinder these already established processes, but rather build on them.

…It also remains to be seen to what extent the legislative and implementation work the Electricity Directive (2019/944) will help to utilise the demand response flexibility potential, including across borders. In other words, any further integration via a new Network Code should be postponed until Member States have had the chance to implement the aforementioned articles into their national legislation."

The national implementations of Article 32 should be observed and best practices should be shared, taking into account the national circumstances. To develop the system to an optimal point in terms of the utilisation of flexibility, more detailed analysis is needed, e.g. interactions between DA/ID or balancing, TSO/DSO cooperation in the planning and operational phase, in addition to other forms of flexibility use in related sectors. More detailed analysis on how these markets interact and how coordination schemes could be carried out in practice to gain experience and allow for optimisation in the interest of the end consumer. Future observations should also take into account the interaction with regulation such as the Electricity Regulation (2019/943) – especially Article 13 Redispatching, which is also applicable for DSOs.

CEER considers market-based procurement of flexibility as one very important option which could allow for a substantial benefit in the distribution grid, contributing to its further development to support as renewable, reliant and efficient an energy supply as possible. This is especially salient when considering the integration of fluctuating renewables, electrification of industry and the further growth of appliances that increase demand like e-mobility, heat pumps and home storage. A careful design and assessment of efficiency is critical, where all necessary prerequisites for a market-based approach must be respected, imposing regulatory measures if/when necessary.

The framework of procurement should be given time to develop properly and leave room for testing. It could also be beneficial to test some relevant aspects based on settings in regulatory sandboxes, where interactions between market functioning and scaling should be taken into account. Further points for analysis, after gaining experience and seeing some of the practical implications, are: the interaction between the different categories of DSO access to flexibility; the NRA assessment of the market-based procurement; and how to avoid higher costs through the inherent and perceived risks of DSO flexibility procurement. This is all in addition to the details of a network development plan in order to help to improve transparency of flexibility needs. This need for further analysis also goes for the interaction with other markets or flexibility valuation methods. Furthermore, the interaction with other new actors like aggregators or energy communities needs to be observed and analysed.

Especially in the area of market-based procurement procedures, CEER sees room for more research in details of the procurement framework, including definition of products; the establishment of baselines; concepts to develop the framework towards optimal system benefits; priorities; sequence of activations; and the like. In the area of developing a functioning market, e.g. via market tests, adding decisions and criteria for the different actors (NRA, DSO) would be beneficial, but this needs to be adjusted to the national implementation. Another area for more analysis is the issue of TSO-DSO coordination, as well as the introduction of platforms and their potential relation to the monopolistic activity.

Annex 1 – List of abbreviations

Term	Definition
ACER	EU Agency for the Cooperation Energy Regulators
BRP	Balancing Responsible Party
CAPEX	Capital Expenditure
CEER	Council of European Energy Regulators
DA	Day-Ahead
DER	Distributed energy resources
DSO	Distribution System Operator
EB GL	Electricity Balancing Guideline
EC	European Commission
ESS	Energy storage system
FSP	Flexibility Service Provider
H2020	Horizon 2020 [projects]
ID	Intra-Day
MS	Member State(s)
(D-)NDP	(Distribution) Network development plan
NRAs	National Regulatory Authorities
OPEX	Operational Expenditure
TOTEX	Total cost of expenditures
TSO	Transmission System Operator
TYNDP	Ten-year network development plan

Annex 2 – Article 32 of the Electricity Directive (2019/944)

1. Member States shall provide the necessary regulatory framework to allow and provide incentives to distribution system operators to procure flexibility services, including congestion management in their areas, in order to improve efficiencies in the operation and development of the distribution system. In particular, the regulatory framework shall ensure that distribution system operators are able to procure such services from providers of distributed generation, demand response or energy storage and shall promote the uptake of energy efficiency measures, where such services cost-effectively alleviate the need to upgrade or replace electricity capacity and support the efficient and secure operation of the distribution system. Distribution system operators shall procure such services in accordance with transparent, non-discriminatory and market-based procedures unless the regulatory authorities have established that the procurement of such services is not economically efficient or that such procurement would lead to severe market distortions or to higher congestion

2. Distribution system operators, subject to approval by the regulatory authority, or the regulatory authority itself, shall, in a transparent and participatory process that includes all relevant system users and transmission system operators, establish the specifications for the flexibility services procured and, where appropriate, standardised market products for such services at least at national level. The specifications shall ensure the effective and non-discriminatory participation of all market participants, including market participants offering energy from renewable sources, market participants engaged in demand response, operators of energy storage facilities and market participants engaged in aggregation. Distribution system operators shall exchange all necessary information and shall coordinate with transmission system operators in order to ensure the optimal utilisation of resources, to ensure the secure and efficient operation of the system and to facilitate market development. Distribution system operators shall be adequately remunerated for the procurement of such services to allow them to recover at least their reasonable corresponding costs, including the necessary information and communication technology expenses and infrastructure costs.

3. The development of a distribution system shall be based on a transparent network development plan that the distribution system operator shall publish at least every two years and shall submit to the regulatory authority. The network development plan shall provide transparency on the medium and long-term flexibility services needed, and shall set out the planned investments for the next five- to- ten years, with particular emphasis on the main distribution infrastructure which is required in order to connect new generation capacity and new loads, including recharging points for electric vehicles. The network development plan shall also include the use of demand response, energy efficiency, energy storage facilities or other resources that the distribution system operator is to use as an alternative to system expansion.

4. The distribution system operator shall consult all relevant system users and the relevant transmission system operators on the network development plan. The distribution system operator shall publish the results of the consultation process along with the network development plan, and submit the results of the consultation and the network development plan to the regulatory authority. The regulatory authority may request amendments to the plan.

5. Member States may decide not to apply the obligation set out in paragraph 3 integrated electricity undertakings which serve less than 100 000 connected customers or which serve small isolated systems.

Annex 3 – Examples of network development plans in national regulations

Germany

The German legislation already provides rules concerning the obligation for DSOs to provide network development plans. Pursuant to §14 Ib EnWG (German Energy Act), DSOs – only operators of high voltage/110 KV – are obligated to develop network development plans, submit them to the NRA and publish them on an annual basis. The plan has to include "congestion-maps" of the grid and the basis planning with regard to feed-in and off taken electricity within the next ten years. In detail, the plan has to include information on specifically planned grid-optimisation, grid-reinforcement and grid-expansion measures within the next five years and on intended measures for a further five years. The NRA can specify and extend the required information within an administrative decision.

In addition to the obligation for operators of high voltage grids, the NRA has, pursuant to § 14 Ia EnWG, the possibility to demand further network development plans from all DSOs with the exception of DSOs with less than 10,000 directly connected customers. The requested plan has to be submitted to the NRA within two months. The NRA can specify and extend the required information within an administrative decision.

Norway

In general, the network development plan (NDP) contain a description of the existing power system with actual and potential developments within the next 20 years. Important elements are an overview of the areas' consumption and generation and national and regional energy and power balance, in addition to an assessment of the security of supply with an overview of weak areas. The development plans contain scenarios for future consumption, production and grid investments coupled with a socio-economic evaluation.

The HV networks (33-132 kV) in Norway are divided into 17 different specific geographical planning areas. All 17 areas have individual NDPs with a 20-year horizon. In each planning area one DSO is appointed to put together the NDP while other DSOs within each area and the TSO collaborate to provide necessary data. An updated NDP is published every second year. The NDP should be a planning tool for grid investments in HV networks and give important information about the power system to stakeholders and authorities.

The TSO is similarly obligated to publish a NDP for the transmission network every second year. In addition, an update of investment plans, expected commissioning and consequences of any delays shall be sent yearly. Both the 17 planning areas and TSO must produce a detailed report with confidential information about the power system that is submitted to the responsible authority. A public version, that is mainly a summary and censored version of the detailed report, is published.

The TSO and each of the 17 planning areas must hold meetings every second year where the NDP is presented. These meetings are meant to inform stakeholders of the development of the HV networks and transmission network. The 17 planning areas and the TSO are also obligated to issue a statement on all grid development that affects them. In addition, all DSOs are obligated to continuously provide updated structural data to the TSO. All plans or modifications that affect the HV networks or the transmission network must be approved by the TSO. Furthermore, other required information can be specified and extended within the NDP by the responsible authority.

Portugal

According to Portuguese law (Decree-Law n.º 29/2006, in the current wording), concerning the High and Medium Voltage levels, the DSO shall submit until the end of April of each even year a D-NDP proposal, both to General-Directorate of Energy and Geology (DGEG) and to the Portuguese regulator ERSE, the latter of which holds a public consultation for at least 30 working days, and issues a report on the results of the public consultation, attaching all received contributions. This report is sent to the DSO, the TSO and DGEG.

ERSE, DGEG and TSO shall then prepare and issue their own individual Opinions and send them to each other and to the DSO. These Opinions may determine necessary changes to the D-NDP's proposal. The ERSE Opinion shall cover all investment needs identified during public consultation, and those necessary to promote competition, in full cooperation with the TSO in its National Development Plan. The DGEG Opinion shall focus on security of supply and compliance with energy policy targets.

Taking into consideration each Opinion, the DSO shall amend and send the final D-NDP proposal to DGEG, who shall then forward it to the Government body responsible for the energy sector. This body will then submit it to the Portuguese Parliament for discussion. Finally, following Parliament Opinion, the Energy Minister will decide on the approval of the D-NDP.

Once the D-NDP Plan is approved, and according to the same Decree-Law, ERSE shall carry out the monitoring of D-NDP implementation (schedule and budget). If necessary, ERSE may issue a binding Opinion on any of the projects included in the Plan.

In the new context of the energy transition, D-NDP will play a bigger role regarding identification of investment needs for new connections, which must be carefully planned to meet new challenges regarding the penetration of distributed renewable generation. We emphasise the uncertainty of the future use of the electrical networks at different voltage levels, due to the expected decoupling from final electricity consumption.

Annex 4 – Network models and observability

In short, structural data refer to all relevant (electric) components in a specified system with their technical specification, location and relation to other components. When assembled, these form a static network model. Put together with scheduled data on the actual breaker and switch positions, it shows the topology of the network. Topology and transfer capacity at a given time set grid constraints and potential network user restrictions. Certain control centre or network user action might also be unavailable. Combined with production schedules for larger plants, in addition to forecasts for demand and smaller production units, system operators can calculate the expected power flow of their networks through complex or more simplified state estimation methods. Real-time data, primarily meaning sensor measurements, reveal the actual state of the network and deviation between expected and realised power flow. Put together, structural, scheduled and real-time data constitute a dynamic network model.

The size and complexity of such a model depend on the number of performed calculations and obtained real-time measurements, their granularity and the type of control systems used. In essence, dynamic network models make DSOs capable of continuously analysing their networks and monitoring grid behaviour with a new level of quality. Regarding the latter, various network-monitoring technologies are available today, mostly at a reasonable cost. With the roll-out and implementation of smart metering, DSOs could also have the possibility to remotely check relevant voltage parameters at every connection point in their networks, given sufficient functionality in the meters themselves, the communication infrastructure and the control centre systems.

Summarised, a dynamic network model could be fundamental for DSOs to efficiently describe their needs for flexibility and source services from relevant providers, in addition to facilitating TSO-DSO coordination in general and when utilising distribution connected resources. CEER believes that it is beneficial for system operators to strive for harmonisation when exchanging all forms of common data in such models, whether structural, scheduled or real-time, to the extent possible. Harmonisation of data made available to or collected from market participants and other third parties are also vital to secure interoperability between different control centre systems, individual actors and platform solutions.

Annex 5 – About CEER

The Council of European Energy Regulators (CEER) is the voice of Europe's national energy regulators. CEER's members and observers comprise 39 national energy regulatory authorities (NRAs) from across Europe.

CEER is legally established as a not-for-profit association under Belgian law, with a small Secretariat based in Brussels to assist the organisation.

CEER supports its NRA members/observers in their responsibilities, sharing experience and developing regulatory capacity and best practices. It does so by facilitating expert working group meetings, hosting workshops and events, supporting the development and publication of regulatory papers, and through an in-house Training Academy. Through CEER, European NRAs cooperate and develop common position papers, advice and forward-thinking recommendations to improve the electricity and gas markets for the benefit of consumers and businesses.

In terms of policy, CEER actively promotes an investment friendly, harmonised regulatory environment and the consistent application of existing EU legislation. A key objective of CEER is to facilitate the creation of a single, competitive, efficient and sustainable Internal Energy Market in Europe that works in the consumer interest.

Specifically, CEER deals with a range of energy regulatory issues including wholesale and retail markets; consumer issues; distribution networks; smart grids; flexibility; sustainability; and international cooperation.

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More information is available at www.ceer.eu.