WindEurope views on the TSO-DSO coordination- *Enabling flexibility from distributed wind power*

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MAIN MESSAGES

- Europe's power system is undergoing a profound change. Most of the new generation capacity is being connected to distribution networks. Distributed generation could provide valuable services today to the system but some market design features impede the delivery of these services to the market.

- Utilising the services from distributed generation would lead to lower system costs (i.e. through higher competition). Additionally, optimising the use of flexibility resources could reduce the amount of curtailed wind and solar power, saving tax-payers money and maximising the use of carbon-free sources.

- Today, in most countries, Distribution System Operators (DSOs) are not encouraged (under the current regulatory schemes for the calculation of their remuneration) to resort on innovative solutions to system operation. Moreover, Transmission System Operators (TSOs) may not be able yet to access flexibility resources available in the distribution grid due to a still ongoing process of enhancing DSO-TSO coordination.

- TSOs and DSOs need to team up to maximise the flexibility resources in distributed generation, demand side management solutions and storage providers. Market players should be able to offer these resources also in aggregated form.

- A common centralised market place for the use of ancillary services from all resources would lead to the most efficient outcome. System operators should procure services in a technology neutral way, ensuring network and system needs are fulfilled (including local/regional requirements), regardless of the technology use. In that sense, contracting those services from the market (e.g. through a tender) is the preferred way.

- There is a need to explore new models of connection arrangements. Network buildout to evacuate up to the last kWh might not be economical, nor practical. Options such as flexible connections should be further explored. Curtailment might be the best solution in particular cases, however, the full range of options should be available to the system operator (storage, demand side management, more flexible thermal generators and grid expansion).

- The decision to work on a European network code on flexibility (beyond the scope of the European Energy Balancing Guideline) should be preceded by a comprehensive discussion on the definition of flexibility and objectives and benefits of such a new code.

- We welcome the proposal to establish an EU-wide body for electricity DSOs, with legal power and responsibilities. The new body should engage in a formal, transparent and inclusive way with the users of the grid, including power plants owners and technology providers, who will bring a significant amount of expertise.

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1. INCREASING ROLE OF DISTRIBUTED GENERATION

Context

Europe's power system is undergoing a profound change as increasing amounts of renewable energy sources (RES) displace conventional forms of generation. Renewable energy sources are developing in different locations, with different type of system configurations and technologies; however, an increasing amount of this new power generation is connected to the distribution network[1]. In addition, consumers are increasingly interested to take part in the market, be it through self-production and consumption (prosumers), or by providing demand side response services.

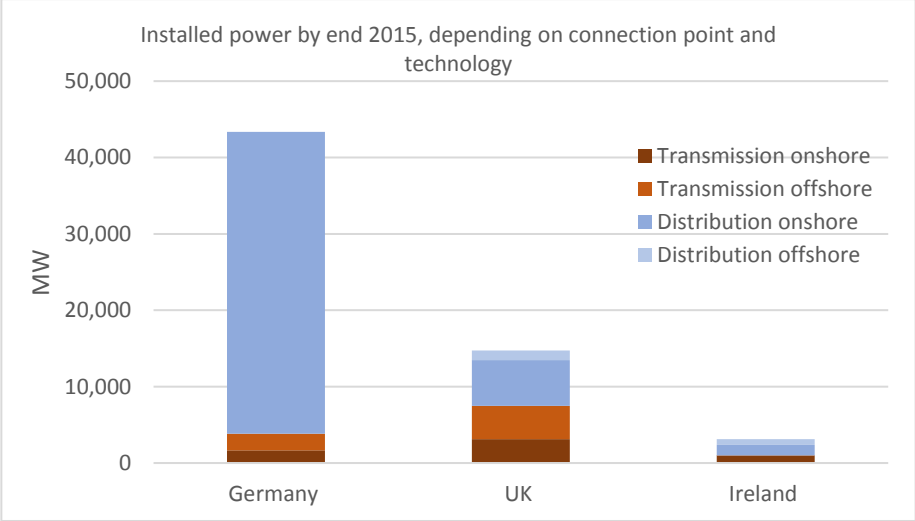

Figure 1. Wind plant connection points in selected countries. Source: WindEurope. Note: Transmission Networks refer to networks with high voltage levels >110KV

Current planning and operational practices are historically designed for the traditional power system where generation is centralised, connected to the transmission grid and then distributed one direction towards consumers (from high-voltage to low-voltage networks). Today, TSOs rely heavily on synchronous generators to provide system services (in particular thermal generation for providing inertia, but also for other types of frequency response and voltage control). Renewable energy technologies are on the contrary, mostly based on converter (asynchronous) technology. As they displace the conventional fleet, the growing scarcity of system services from these synchronous resources will become more acute. Thus, the system needs new planning and operational arrangements between TSOs and DSOs to unlock the capabilities of distributed generation, demand side management and storage facilities to plug the shortfall in the services from synchronous generators.

All these trends are expected to continue, forcing to review planning and operation practices of both TSOs and DSOs, clearly defining their roles and improving their interaction.

[1] Distribution networks are considered those networks with operating voltage below or equal to 110KV

Benefits of increasing TSO-DSO cooperation

More concretely, an improved cooperation between TSO and DSO is important to:

- **Create an efficient, open and centralised platform for flexibility** where all market parties can offer their flexibility in a competitive, market-based and fair fashion, increasing contribution to system security and reducing overall system costs;
- **Allow aggregation of resources;**
- **Enhance visibility of the distributed generation connected to the distribution networks**, as well as deployment of storage facilities, electrical vehicles charging points and related new flexibility services such Vehicle-to-Grid. This can ensure the TSOs maintain system security (balancing, frequency control and system restoration);
- Solve congestions in both transmission and distribution grids through a coordinated **active power/network management of distributed generators and demand.**

2. DESIGNING, PROCURING AND OPERATING FLEXIBILITY FROM DISTRIBUTED GENERATION

2.1 MARKET DESIGN ASPECTS

Access to the ancillary services market

The ancillary Service market is usually run by the TSO. Therefore, those connected to the transmission grid are naturally more accessible than those connected to the distribution grid (pre-qualification, metering and communication etc.). In many cases, the TSO have not shown much interest in procuring certain services from the distributed connected generator by specifying somehow "discriminatory" requirements such as minimum size, etc.

However, wind power producers (mostly connected to distribution networks) should be able to sell their services where it is the most profitable for them (e.g. balancing, system services, valuation in the energy market, contracts with DSOs or TSOs as an alternative to grid reinforcement, etc.). For that to happen, wind power producers should have non-discriminatory access to balancing and ancillary services markets, where product allow a level playing field among all resources[2], and where the services are properly remunerated. For instance, frequency reserves should distinguish between upwards and downwards reserves, with different activation and price formation. Products should be short and granular (e.g. 10-15 minutes) and should be bought near time of delivery to allow good adaptability of a variable resources

[2] For instance, frequency reserves should distinguish between upwards and downwards reserves, with different activation and price formation. Products should be short and granular (e.g. 10-15 minutes) to allow good adaptability of a variable resources and reduced forecast errors. For more recommendation on balancing markets see: https://windeurope.org/wp-content/uploads/files/policy/position-papers/WindEurope-Ten-Commandments-of-the-Wind-Industry-on-Balancing-Markets.pdf

and reduced forecast errors. For more recommendation on balancing markets see dedicated WindEurope paper[3].

It is also very important that the system operator communicates to the market what are the exact system needs (calibrated to a minimum level that is sufficient to meet the system requirements). This need to be done by specifying clear products that are technology neutral and can be guaranteed by the market participants. The system needs (product) must come with comprehensive justification, based on system analysis and studies, avoiding unnecessary costs for consumers, and long-lasting dependency to specific technologies.

Procurement of services

TSOs and DSOs should cooperate and share information among themselves in order to enable flexibility and balancing where wind power producers offer their services in an efficient way. Such cooperation should have a unique set of market rules to allow TSOs to balance the system and ensure system security (through active power management to maintain frequency stability), and DSOs to resolve congestions at the local level (e.g. through voltage control).

Such coordination scheme should be based in the following principles:

- **Distributed energy resources connected to distribution networks should have equal rights and opportunities than those connected to transmission networks**. The procurement of ancillary services from the distribution grid should be clear, easy to understand, reliable, cost-efficient and fast. In case interaction models are too complex, the value for smaller flexibility providers of distributed energy resources might be heavily reduced;
- **The TSO should be responsible for balancing the system**, doing it at national and cross-border level. Balancing at the distribution grid separately will be inefficient and will not exploit the complementary of wind resource across larger geographical areas. Small and fragmented flexibility markets will be less liquid and will provide fewer opportunities to market players;
- **DSOs should be enabled to solve local congestions at distribution level by procuring and activating eligible resources to participate to the markets**. To this end, DSOs should be able to procure services they can activate also close to real-time as the local congestions may occur close to real time;
- **DSOs should perform a systematic validation activity of the TSO's dispatching orders** on distributed energy resources connected at distribution level, aimed at ensuring the coherence between such dispatching orders and the operational constraints on the distribution grid;
- **The procurement of ancillary services from the distribution grid, should be transparent, non-discriminatory and neutral**. This is in particular relevant for small DSOs, procuring flexibility, in case they are vertically integrated with a non-regulated energy player.

[3] https://windeurope.org/wp-content/uploads/files/policy/position-papers/WindEurope-Ten-Commandments-of-the-Wind-Industry-on-Balancing-Markets.pdf

The EU funded project Smartnet[4] is exploring various schemes for the procurement of services from distributed resources (see figure 2). The recommended scheme should be based on the abovementioned principles. Those will maximise the participation of wind energy producers in ancillary services and would lead to efficient market outcomes

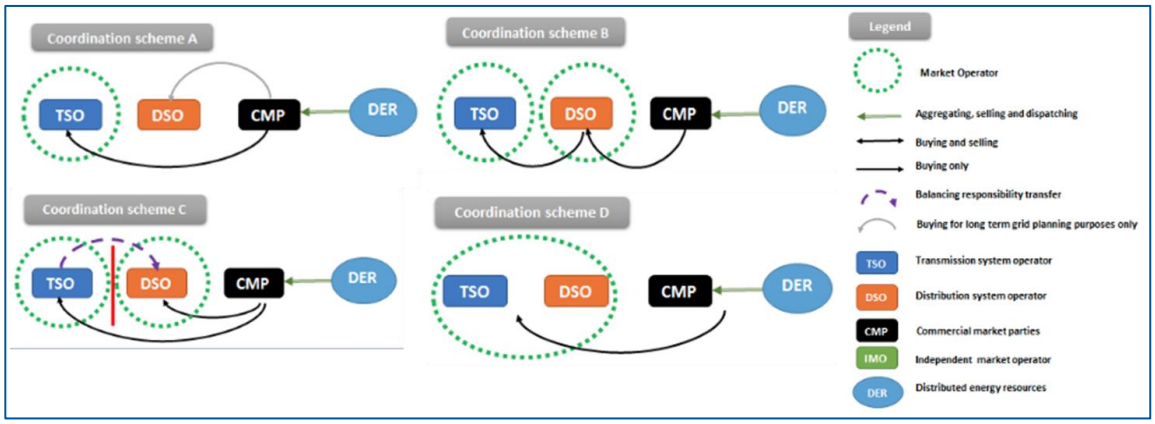

Figure 2. Selected proposed coordination schemes under consultation. Smartnet project

Role of system operators with regards to flexibility

System operators (DSOs and TSOs), as neutral market facilitators need to enable the development and the operation of flexibility services to resolve congestions and maintain system security in an efficient way. Those flexibility services (including storage) must be contracted through market based mechanism to ensure competition and access of new players. As previously explained, it is very important that the system needs are clear and transparent to market parties, to make the best use of flexibility resources.

In some cases, TSOs procure (through tenders) flexibility products that are best suited for storage services (see National Grid Enhanced Frequency Response (EFR) tender[5]) in order to ensure system stability. This type of market mechanism fosters competition and innovation. In some other cases, system operators have decided to own and operate their own (battery) storage facilities to provide balancing services[6], trying to influence balancing prices resulting in the balancing market from not being disproportionally high (due to a lack of flexibility in the market). While Terna does not generate any profit from this operation (all revenues from the balancing markets are regulated and used for regulated operations), it does impact price formation in the balancing market, potentially dissuading new market players to offer their services. In addition, this approach may prevent more cost-efficient solutions from being used. A good example is the German control power market, where overall cost (not only prices) have continuously decreased , since it has been opened to new players, including pools of distributed units (without requiring

4 Basic schemes for TSO-DSO coordination and ancillary services provision, Smartnet project, December 2016, http://smartnet-project.eu/wp-content/uploads/2016/12/D1.3_20161202_V1.0.pdf

5 http://www2.nationalgrid.com/uk/services/balancing-services/reactive-power-services/reactive-market-tender/ & http://www.energy-storage.news/news/battery-storage-dominates-national-grid-efr-tender-results

6 See Terna storage project https://www.terna.it/en-gb/azienda/chisiamo/ternastorage.aspx

investments in storage)[7,8] and where trading in the intra-day market has been enhanced. It is thus important that the flexibility market is open to all market players and that participating rules do not discriminate any player, to avoid that players with a dominant market position keep prices artificially high.[9]

Similarly, DSOs could procure (in a market based competitive process) storage services for grid management to prevent potential network bottlenecks and to ensure adequate service levels. In addition, storage system could be coupled with renewable plants (i.e. Wind plants) in order to lower the imbalances and to provide and enhanced number of ancillary services.

2.2 OPERATIONAL ISSUES

Coordinating the activation of flexibility

Active power management (dispatch downward or upwards) in real time can contribute to system balancing and frequency stability. However, this will also have an impact on local congestions. On the contrary, planned active power management (e.g. curtailment) and voltage control to solve local congestions might have impacts on system balancing and stability, if not properly coordinated between TSO and DSO. An efficient exchange of data is critical to minimize curtailment of distributed generation and to minimize redispatching costs. As trading moves closer to real time, the need for this coordination becomes imperative (as active power management will have also implication on local network congestions). The exchange and use of data between TSO and DSO should not create additional burdens to generators, unnecessary administrative work and double communications.

Active power management can be done by the generators (by following a signal from the market and/or the system operator) or directly activated by the system operator. Today, wind power plants come with all capabilities and functionalities to contribute actively to system balancing and frequency response. However, in some instances these capabilities are not utilised because the TSO has no visibility on the generation fleet connected at the distribution network or simply because the market is not design for the wind farm operators to offer the flexibility in the market (see section 2.1).

Curtailment in distribution networks

When distribution system operator use curtailment to manage local network constrains, they tend to use practices that are not very efficient. Either they share the reduced output equally amongst all constrained parties (a so-called “pro rata” approach) or impose more heavy restrictions on the latest connected generators (so-called “Last In First Off”).

Introducing price signals for curtailment could be a much better solution because it would:

[7] Balancing Power and Variable Renewables: Three Links, Lion Hirth & Inka Ziegenhagen, Neon Energie, 2015
[8] Angus Media, February 2016 https://www.argusmedia.com/News/Article/?id=1190650
[9] See footnote 2

- Find the most economical way of using the available flexibility to manage a given network constraint, whether that involves curtailment, DSR, storage or network reinforcement;
- Provide the longer-term signals to all new customers to connect to parts of the network where they impose the lowest cost or have the highest potential benefit;
- Provide consistency with the approach already taken on the transmission network, thereby allowing flexibility to be used with maximum efficiency for the network as a whole, and providing appropriate reinforcement signals.

We recognize however that creating a market (introducing price signals) at the local level can be very challenging (e.g. lack of enough players and thus competition). Therefore, there should be market based remuneration to asset owners offering a solution for system needs and congestion management on the local level.

2.3 SMART INVESTMENT IN DISTRIBUTION NETWORKS AND CONNECTION ARRANGEMENTS

Incentivising innovation in distribution network operation

It is important that distribution tariffs evolve in order for DSO to be able to make smart investment decisions, moving away from the only network expansion to smart development. In that sense, DSO should be exposed to financial incentives in order to invest on innovative technologies. Two major barriers to the deployment of smart and active distribution systems were identified by CEER back in 2011[10] namely first, to encourage network operators to choose the most cost-efficient investment solutions, and second, to encourage network operators to choose innovative solutions.

A good national example of innovation incentives through the regulatory scheme (network tariff) can be found in the UK. The regulator, Ofgem, implements a performance based model that regulates the DSO revenues base on 3 elements (Revenue=Incentives+ Innovation+Outputs).[11] It is known as the RIIO model and offers DSO greater certainty of rewards for successful innovation. This might lead a DSO to procure flexibility from e.g. storage provides or generators, instead of deciding to upgrade grid capacity.

[10] Pag. 38, Study on tariff design for distribution systems, Final Report, Commission by DG Ener to Mercados, Indra and Ref(e), January 2015.
[11] https://www.ofgem.gov.uk/network-regulation-riio-model

Flexible connections

Connections of generators and demand parties are generally "firm" connections. This type of connection means that as long as the network is operating normally, customers would get access to a fixed network capacity all year round. A number of countries are introducing **flexible connections**, under which, if the network is constrained, the DSO can use Active Network Management (ANM) to curtail generators. This proactive DSO approach allows generators to connect to a constrained part of the network without needing first to reinforce it, making the process faster and (potentially) cheaper[12].

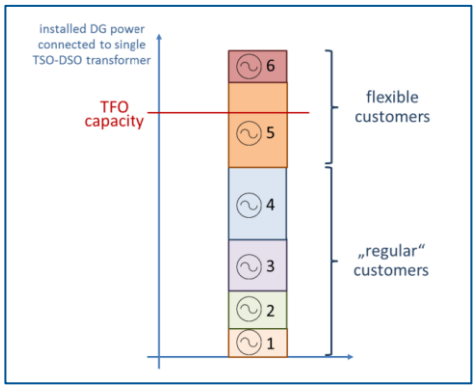

Figure 3. Illustration of regular and flexible customers. TFO stands for Transformer. Source: ISGAN, 2014

With an increasing share of distributed generation, flexible connection could lead to economic efficient situation since renewable source have low load factors and not all generators' outputs are peaking simultaneously. However, the risk of curtailments impose great investment uncertainty, leading to high financing costs and increasing overall the cost of renewables. A number of options could mitigate those risks, as presented already in WindEurope's paper on curtailment[13]. A summary of the options is presented hereafter:

- **Introduce market mechanisms to reduce the cost of curtailment**, allowing DSM and storage to participate in a level-playing field with all other generators (including renewable source);
- **Introduce caps to limit curtailment risk**. Under flexible connection contracts, a maximum level of curtailment should be agreed beyond which generators would need to be compensated;
- **Curtailments would be compensated for the lost revenue** (including the market price and possible premium);

[12] The perceived cost will depend on who has the ultimate responsibility for reinforcing the grid between the existing infrastructure the wind farm. Costs are classify as shallow, *shallowish* and deep for the various arrangement. See WindEurope paper on Network tariffs for a comprehensive overview, February 2016: http://www.ewea.org/fileadmin/files/library/publications/position-papers/EWEA-position-paper-on-harmonised-transmission-tariffs-and-grid-connection-regimes.pdf

[13] WindEurope views on curtailment, June 2016 https://windeurope.org/wp-content/uploads/files/policy/position-papers/WindEurope-Priority-Dispatch-and-Curtailment.pdf

- There should be much **more transparent and accessible data** regarding operational procedures of system operators with regard to curtailment and redispatch actions (for instance, due to operation reserves for frequency stability). This would help developer to better assess curtailment risks.

3. VIEWS ON A FUTURE EU NETWORK CODE ON DISTRIBUTED FLEXIBILITY

The future role of network system operators is likely to be driven by a combination of technical innovation and market forces. The future system will be supported by a combination of better capabilities in connected units (e.g. requirements in European network connection codes) and flexibility brought through market instruments.

Trends have emerged in countries such as UK, Germany, Spain, Denmark and Sweden where the DSO today is already playing an increasing role as market facilitator. These developments are being accelerated through the roll-out of smart meters, better capacity of data analysis, increasing impact of distributed generation on system security and the introduction of dynamic tariffs (time of use tariffs) that encourage consumers to invest on small scale generation, storage and demand response systems.

Because of the levels of coordination involved, there is an important role for system operators and regulators in ensuring that an efficient solution emerges. A number of standards are emerging to define the precise roles and relationship of TSO and DSO. It is early to say what should be the most effective regulatory framework, as the system is undergoing a rapid transformation. Thus, it might seem premature to propose a European Network code for flexibility at this stage. The recently published package of legislative proposals "Clean Energy for All Europeans"[14], along with the implementation of the existing connection, market and operational network codes will aim to tackle some of the issues presented in this paper.

Whichever form it takes, high-level principles that allow continuous innovation and wider market participation should be pursued. The term of "flexibility" should be better defined[15] and best practices for the operation of the system which make use of all available resources should be encouraged across borders. Among other topics, regulation should be more coherent regarding energy storage and its potential benefits for network development and operation (e.g. avoiding storage facilities face network charges twice, as consumers and generators).

It is important for all parties to maintain a close dialogue in order to better understand the challenges faced by the other stakeholders, being system operators of the transmission and distribution networks and all network users, including generators and consumers.

[14] https://ec.europa.eu/energy/en/news/commission-proposes-new-rules-consumer-centred-clean-energy-transition
[15] See for instance, Flexibility report from the EC Task Force on Smart grids, Expert group 3.

4. VIEWS ON A EUROPEAN DSO ORGANISATION

WindEurope welcomes the European Commission's proposal to form an EU-wide DSO body with a legal role. As such, the DSOs should be further involved in network planning and network operation, to ensure an optimal operation of the system.

It is important that this new body engages in a formal, transparent and inclusive way with the users of the grid, including power plants owners and technology providers, who will bring a significant amount of expertise.

This new body should build on the experience gathered by ENTSO-e throughout the years. In particular, all the improvements with regards to stakeholder engagement and transparency should be implemented from the very beginning.

The creation of a new body should not lead to additional burden to stakeholders (e.g. wind industry). Topics should be addressed once, avoiding overlapping stakeholder groups on the same issues (e.g. possible stakeholder group on network code implementation).

ACER should oversee the formation and operational tasks of this new entity.

The basic statutes of this new entity should be spelled out in the legislation, as well as transparency requirements.

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