

## The EU Electricity Policy Outlook for the Smart Grid Roll-Out

Aurélie Faure-Schuyer

The energy transition from a socio-economic system based on fossil fuels to a sustainable low-carbon system is a multi-faceted process. This “transformation” of the energy system, more specifically of the power system, creates several challenges. These concern in particular the connections with the existing electricity infrastructure of new renewable power sources and the distribution of generating systems, together with automated grid assets and smart meters. The European energy transition is based on two different revolutions: i) the “post-World War II” industrial investment recovery, when electricity systems were built; and ii) the “Information Technology” revolution that is bringing new communication and connection modes to the grid.

There is no unique path towards a decarbonised electricity system. The implementation of this development depends on the current local configuration of electricity grids, the interaction between grid operators, the generation mix, the availability of backup generation capacities and the level of cross-border interconnections. Moreover, this evolution impacts the roles of all actors of the energy system, in particular those of Transmission System Operators (TSOs), of Distribution System operators (DSOs) and of National Regulatory Authorities (NRAs).

Besides the technical challenge, the Energy transition requires the transformation of business models designed as platforms, which are able to integrate different levels of stakeholders, whereas in the past, utilities were based on vertical, public monopoly structures that were often paid based on cost-of-service rules. The traditional utility models were characterised by centralised governance but as a result of technological changes, this system

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is making way for a more horizontal and multilateral governance. The role of consumers is also changing, with new attributes in particular with regards to demand-response measures.

The purpose of this paper is to analyse the key structural developments behind the European energy transition, as well as the main regulatory and policy challenges linked to the transformation of the system.

## 1. Energy Transition within the EU Context

### Milestones of European liberalisation policies and new governance

Since the end of the 1990s, different waves of market reforms have taken place in the European energy sector, leading to various degrees of markets' opening to competition. In the electricity sector, key reforms were initiated with the restructuring of networks and the development of renewable-**based** electricity generation, the latter gathering political momentum in 2009 with the 2020 Climate and Energy Package.<sup>1</sup>

The Second Electricity Directive, adopted in June 2003, reinforced procedures whereby energy transmission networks had to be run independently from the production and supply sides. Throughout this package of legislation, where unbundling took different forms,<sup>2</sup> the European Commission wanted to limit risks of systemic conflict of interest that were deemed inherent in the vertical integration of production networks and supply activities. As a direct consequence, unbundling rules made a clear separation between network operators' responsibilities and electricity generators' scope of action and responsibilities.

While EU legislation painted a new operating landscape for networks, assets in use today have been inherited from former integrated utility companies. European legislation, however, was not passed without some form of cultural and political resistance in the creation of unbundled operating models, in which networks began their "own lives" within separate entities.

The integration of the electricity and gas markets progressed further with the Third Energy Package, namely Directive 72/2009/EC and Regulation (EC) 714/2009 for electricity. It currently forms the legal basis of the electricity market, in detailing the role of transmission and distribution system operators, and the separation requirements of generation and supply. Regulation (EC) 714/2009 (Article 8) created the Agency for Cooperation of Energy Regulators (ACER), and the European Network of Transmission System Operators for Electricity (ENTSOe).<sup>3</sup> These have acted together in the creation and adoption of framework guidelines and the

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<sup>1</sup> The Climate and Energy package includes the following texts: Regulation (EC) No 443/2009 - Reduction of CO2 emissions from Light Duty Vehicles / Directive 2009/28/EC – Renewable Energy Sources / Directive 2009/29/EC – Emission Trading Scheme / Directive 2009/30/EC – Fuel Quality Directive / Directive 2009/31/EC – Carbon Capture and Storage / Decision No 406/2009/EC – “effort sharing”.

<sup>2</sup> Full ownership, legal, management (or “functional”) unbundling.

<sup>3</sup> The ENTSOe covers 41 Transmission System Operators from 34 countries.

definition of network codes. The adoption of framework guidelines and network codes has been planned according to a specific timeline, agreed between the European Commission, ACER and ENTSOe in a 3-year working plan. ACER issues framework guidelines, while the ENTSOe develops network codes based on these guidelines which will be legally binding after the comitology legislative procedure, reserved for highly technical legislation. Through these new governance roles, transmission network operators regained some form of political foothold in energy policy.

As part of the Climate and Energy Package, the 2009 Renewable Energy Sources (RES) Directive (2009/28/CE) reinforced the concept of priority dispatch for renewable-based electricity. Following the entry into force of the Directive 2009/28, RES have received guaranteed access to networks with priority dispatching, subject to secure network operation. From an economic point of view, priority dispatching ensures a level playing field for small units compared to larger conventional units with longer operating hours and broader economies of scales. However, this has raised new concerns from a grid stability point of view.

### **European renewable policy targets: a reality check**

The 2020 European energy policy comprises a three-pillar target approach:<sup>4</sup> a renewable-based energy source target of 20% in 2020, expressed as a percentage of renewable energy sources in gross final energy consumption, together with a greenhouse gas (GHG) reduction target (20% cuts by 2020 compared to 1990), and an energy efficiency target (20% savings compared to projections of primary energy consumption for 2020).

In a recent Communication, the European Commission (EC) presented its 2030 framework with a proposal for a binding target equivalent to a 40% reduction in GHG and a non-binding target for renewable based generation of 27%<sup>5</sup>. According to the EC, this 2030 renewable based target would imply a 45% share of renewable sources in electricity generation, assuming that the share of renewable energy in the transport sector remains at 10%. This proposal will be on the discussion agenda at the 23-24 October 2014 European Heads of State or Government Council. However, the European Council is more certain to debate the necessity of balancing costs with environmental targets, as well as security of supply objectives, given that the deployment of renewable energy needs to be considered from a secure and system-wide perspective (including grid costs and stability). As an illustration, the Council of European Energy Regulators (CEER) estimated that the support for electricity from renewable sources produced in 18 European countries in 2011 was the equivalent of €7 per MWh of total, final electricity consumption.<sup>6</sup>

Moving towards 2050, decarbonisation scenarios with an equivalent GHG emission

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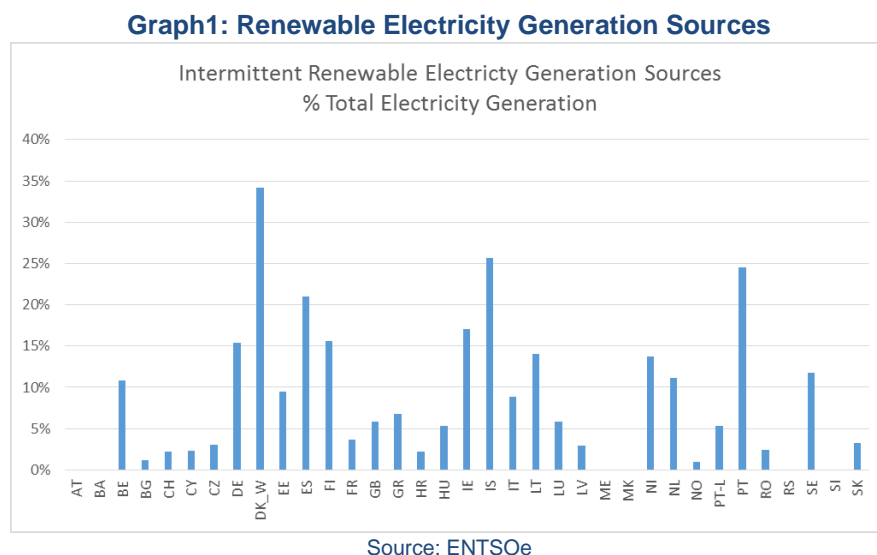
<sup>4</sup> Communication, “Energy 2020 A Strategy for competitive, sustainable and secure energy”, COM(2010/639).

<sup>5</sup> EC Communication, “A policy framework for climate and energy in the period from 2020 to 2030”, COM(2014), 22/01/2014.

<sup>6</sup> [http://www.ceer.eu/portal/page/portal/EER\\_HOME/EER\\_WORKSHOP/CEER-RGEG%20EVENTS/CROSS-SECTORAL/EU\\_SEW\\_2013/Tab/250613EU%20SEW\\_CEER\\_RES.pdf](http://www.ceer.eu/portal/page/portal/EER_HOME/EER_WORKSHOP/CEER-RGEG%20EVENTS/CROSS-SECTORAL/EU_SEW_2013/Tab/250613EU%20SEW_CEER_RES.pdf)

reduction of 85-90% below the 1990 baseline remain a prominent political goal. In this scenario, detailed in the 2050 roadmap,<sup>7</sup> the EU needs to generate 55% of the Union's gross final consumption from renewable sources by 2050. In two of the low carbon scenarios (High Efficiency and High Renewables) of the roadmap, renewable electricity generation reaches a share of 65% and of 86% respectively in 2050, raising once again both costs and technical concerns.

The European electricity system (as reported by ENTSOe) transmitted 3,300 terawatt-hours (tWh) of electricity in 2013, of which renewable-based power accounted for 13% of total electricity generation.<sup>8</sup> Denmark, Finland, Germany, Spain and Portugal reported renewables having a share of 15% or more in their electricity mix. Together with hydroelectric power, renewable-based electricity within the ENTSOe system (an enlarged EU system of 34 countries) accounted for 30% of total generation, up from 28% in 2012 and 25% in 2011. This rate is still far off the political goals currently discussed of 45% for 2030 or 65-86% for 2050 for the 28 EU Member States.



## 2. The Electricity Market's Transition to a Smart Grid

The energy transition builds on the historic development of the energy system as well as the expansion of technologies. This section addresses the context of the energy transition, notably the issue of ageing infrastructures and new smart grid developments. The recognition of the demand response is also an important aspect that will need to be clarified, before the full smart grid developments can take off.

### Adaptation of infrastructure to a new source of electricity generation

Mature countries like the United States (US) and in Europe have a high concentration of electrical assets which are 45-50 years old, including transformers,

<sup>7</sup> Communication, "Energy Roadmap 2050", COM(2011/885).

<sup>8</sup> Excluding hydroelectric power.

switchgears, overhead lines and cables that have extended their asset amortisation lives and that need to be replaced.<sup>9</sup> In its 2013 World Energy Investment Outlook Report, the International Energy Agency (IEA) pointed out that, in Europe, 67% of grid investments will remain allocated to the refurbishment and replacement of existing assets. This is a comparable situation to the US where 61% of grid investments are driven by ageing factors. The energy transition starts from assets that were built during post-World War II industrial investment recovery, using fossil fuels or nuclear (in some countries) as the main source of industrial development.

Renewables-based electricity generation has created a breakthrough, mainly away from fossil fuel power generation that runs according to the management of the availability of commodity fuels and efficiency factors.<sup>10</sup> Electricity generation based on renewable energy sources features high primary energy efficiency but also variable and intermittent profiles. For instance, photovoltaic generation (PV) is directly influenced by solar radiation levels, with intermittencies occurring both intra-daily and daily, while wind generation is directly influenced by wind speed propelling rotor machines. Other technologies like combined heat power, heat pumps, electric vehicles need also to be considered in the wider context of emission reductions and energy supply security. Altogether they form distributed energy resources, including plug-in electric vehicles (PEV) which store electricity, and can potentially act as batteries.

### **Smart grids connections and challenges**

Empirical experience shows that the geographic location of renewable energy, where primary energy sources (wind, sun, waves, etc.) are concentrated, can lead to network congestions and induce costs. These occur when load centres are far from generation sources, without any backup availability or cross border interconnections. In particular, large wind farms connected to the transmission grids create needs to improve wind generation forecasting, to strengthen interconnections and improve transmission. High Voltage Direct Current (HVDC) cable technology for long cables, or Flexible Alternating Current Transmission Systems (FACTS), which constitute an alternative to building a new transmission line, are being considered.

The energy transition implies not only large scale generation connected to the transmission grid, but more importantly, means that the distribution grid has to accommodate distributed sources of generation. Solar cells on a homeowner's roof or smaller wind mills connected to the distribution grid create new flexibility requirements, non-schedulable and sometimes bi-directional flows requesting active involvement from the DSOs. Three countries in Europe – Belgium, Germany and Italy – now account for more than 10% of photovoltaic penetration in the generation system as measured by installed capacity while, in Germany, more than 90% of PV systems are connected to the Medium and Low Voltage distribution grids. From a wider perspective and depending on voltage definition, 60% to 90% of European renewable-based electricity generation is being connected to Medium and Low

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<sup>9</sup> CIRED, Conference on Electricity Distribution, "Replacement of the ageing asset base – The challenge to regulators", John Douglas, May 2007.

<sup>10</sup> Final energy content relative to fuel energy content.

Voltage (MV-LV) networks.<sup>11</sup>

Both from a large and small scale development perspective, energy transition involves a new generation of automated products (smart meters, sensors, actuators, and control systems). Member States are required to roll-out smart meters, providing that this is validated by a Cost Benchmark Analysis.<sup>12</sup> The EC estimates that the deployment of smart meters in the EU will need to rise from some 45 million in 2011 to at least 240 million by 2020,<sup>13</sup> with the necessary annual investment spending increasing from just over €1 billion to €4-5 billion by 2015.

However, the anticipated market quick-off with the roll-out of smart meters has not occurred yet. Bloomberg News Energy Finance estimates that only \$1.4 billion was invested in smart grid systems across Europe in 2012, representing 10% of overall smart grid investments.

### **Demand response impacts physical grid flow patterns**

Since the introduction of smart meters, the concept of demand response has emerged as a new and strategic element of the energy system. It consists in an aggregation of demand-driven fluctuations, i.e. the sum of the behaviours by individual entities like households, small and medium-sized enterprises, large industries or network operators. It also involves new entities, called aggregators, operating on behalf of network users to provide an aggregated demand response to meet network requirements.

The demand response occurs under specific circumstances like the request from a supplier, an aggregator, or a network operator for system reliability purposes, or, possibly for commercial reasons: an electricity power price change.<sup>14</sup> In Europe, the demand response is already provided for by large and energy-intensive consumers connected to the distribution network. Initiatives are being developed in some Member States, where the demand response is activated to balance the transmission network, in view of maintaining a stable frequency on the transmission network (see example below).

#### **Examples taken from the EvolvDSO project:<sup>15</sup>**

In Belgium, several commercial demand response products are already in place and being applied: Frequency containment reserves for loads, Frequency replacement reserves (FRR) Interruptible Contract Holders, FRR Aggregated Power Plants and FRR R3 Dynamic Profile, are all open for aggregation. The latter two can be activated on the distribution grid as well.

<sup>11</sup> CENELEC (European Committee for Electrotechnical Standardization)'s definition of HV-MV-LV is usually used: LV is under 1kv, MV is 1kv to <35kv, HV is above 35kv.

<sup>12</sup> Directive 2009/72/EC – annex 1.2.

<sup>13</sup> Communication from the Commission, "Making the Internal Energy Market work", COM(2012) 663 final.

<sup>14</sup> Time-of-Use tariffs with different prices for peak and off-peak network use.

<sup>15</sup> EvolvDSO ("Development of methodologies and tools for new and evolving DSO roles for efficient DRES integration in distribution networks") is a collaborative project funded by the European Commission.



In the long term, the roll-out of smart grids and demand-side participation will have major advantages. It will reduce the need to call on emergency back-up generation, while postponing network capacity investments. It will in some cases lead to peak-shaving, whereby load curves will be flattened and load differences between days and nights will be reduced.

The value of demand response lies in the capacity to reduce system peak, to ensure system services, and to integrate additional low emitting generation, including potentially electric vehicles plug-in.<sup>16</sup> From this perspective, the demand response leads to a high economic and environmental footprint, also including benefits for supply security and price affordability. However, these benefits will only materialise over time, depending also on how national electricity network regulation and energy policy prioritise and promote these developments.

The main challenge will be for legislators to ensure that the role of network operators in procuring system services through demand response does not create any market distortion for other demand response providers.<sup>17</sup>

In any case, the obligations of the TSOs and DSOs will be adapted to move away from the traditional vertically integrated model, in which the consumer used to be a price-taker, with behaviour and consumption patterns not varying according to contractual estimations. In a recent communication on demand side-flexibility, the EC considers that this evolution “requires removing, where it exists, discriminatory treatment”,<sup>18</sup> pointing to situations in which market access for consumers or aggregators is hindered by an inefficient tariff structure.

Understanding how consumers will react to these changes is important for utilities, NRAs and policy makers. Different areas of social sciences help understanding the interface between technology and human behaviour. The findings are useful to understand consumers’ reaction as “prosumers”, to tariff incentives. These key issues will help in determining the impact on the end-customer market and in assessing the risk of customer defection.

### **3. An Extended Role for the Distribution System Operators (DSOs)**

#### **The current role**

DSOs act on the basis of local natural monopolies and in safeguarding the public interest in general (security and affordability).<sup>19</sup> Their responsibilities lie both in the operation and management of networks and concerning customer data.

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<sup>16</sup> The impact of electric vehicles lies in an increase of the load during off-peak hours.

<sup>17</sup> Think Project: “From Distribution Network to Smart Distribution Systems: Rethinking the Regulation of European Electricity DSOs”, Topic 12, June 2013.

<sup>18</sup> EC Staff Document, “Incorporating demand side flexibility, in particular demand response, in electricity Markets”, Accompanying the document communication from the commission swd(2013) 442 final.

<sup>19</sup> Art 2.6 Directive 72/2009/EC

This role is reflected in Directive 2009/72/EC's article 25 § 1: *"The distribution system operator shall be responsible for ensuring the long-term ability of the system to meet reasonable demands for the distribution of electricity, for operating, maintaining and developing under economic conditions a secure, reliable and efficient electricity distribution system in its area with due regard for the environment and energy efficiency"*.

In most Member States, DSOs are in charge of the roll-out of smart meters under the supervision of NRAs. NRAs' general responsibilities are in line with energy efficiency policies, including the objective of a smooth integration of large and small scale renewable production and distributed energy sources.<sup>20</sup>

DSOs are also involved in gathering highly important metering data, including meter point reference numbers, which are required by electricity suppliers when a customer wants to switch supplier, a key driver of the electricity retail market competition.

In ensuring the connection to the final customer point and the management of data, distribution networks play a central role in the transformation of the energy system.

### **Towards new roles**

As the existing distribution grid is designed for mono-directional flows, distributed generation introduces the issue of reverse power flows. However, the connection of high numbers of distributed energy resources might cause lower power quality, imbalances between load and generation, protection problems and congestion in the medium voltage network.

DSOs' new role will feature local system optimisation allowing the implementation of demand response for small customers, therefore increasing system efficiency by reducing energy distance paths at lower voltage levels, thus minimising energy losses.<sup>21</sup> This evolution will entail new roles in forecasting, local dispatching (the allocation of distributed generation in the network) and local balancing (in ensuring that generation and load are adequately balanced).

The increase of the share of renewable energy generation raises concerns over networks' operational security and stability. Grid support services then become essential elements of the energy transition. Ancillary services cover grid support services required by the transmission or distribution system operator to maintain the integrity and stability of the system, as well as the quality of power. These services remunerate providers for load and voltage control, frequency control, grid stabilization and system restarting. As they are procured by DSOs,<sup>22</sup> they could in the future also be performed by decentralised energy resources, network devices (battery storage), demand response participators, as well as conventional generators.

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<sup>20</sup> Art. 36 Directive 72/2009/EC

<sup>21</sup> Eurelectric Paper: Network tariff structure for a smart energy system Countries where responsibility for electricity losses entails to the grids (TSO/DSO): AT, BE, CH, CZ, DE, DK, EE, FI, FR, LT, NO, PL, SE – May 2013.

<sup>22</sup> Eurelectric, "Flexibility and Aggregation Requirements for their interaction in the market", January 2014.



The impact of renewable energy on the management of distribution grids has led to strongly diverging academic analyses. Some studies (Dena, 2005)<sup>23</sup> have pointed out that reactive power<sup>24</sup> requirements may increase with growing variable, renewable electricity-based installations, calling for higher investment in ancillary devices such as capacitors, inductors and converters. However, distributed generation (i.e., generation connected to the distribution network, e.g., localised wind farms or solar PV) may be able to provide these services at lower cost than conventional generators (Passera, 2014).<sup>25</sup>

### **The energy transition leads to new forward thinking**

The traditional planning approach for electricity infrastructure guarantees that all generated electricity is transported to the consumer at all times, based on the allocation of optimal costs, while ensuring security of supply. The primary task of TSOs is to avoid system-wide imbalances (including the N-1 criterion),<sup>26</sup> while the primary issue for DSOs is to relieve power congestion and control voltage in local networks.

For a renewables-based system, the maximum power output or designed capacity needs to take into account the fact that generation is only provided for a few hours each year: 15-25% of the time for onshore wind and 35% for North Sea offshore wind.<sup>27</sup> Conventional fossil-based power generation has different operating characteristics with minimum operating load factors of 40% of yearly operating hours. Renewables-based generation, therefore, introduces a new dynamic in the electricity system as the system needs to evolve from an “energy” or kilowatt hour (kWh) mind set and needs to introduce a “capacity” management – kilowatt (kW) – culture and reasoning, in order to be able to factor in the necessary grid investments costs.

Back in 2011, Eurelectric acknowledged that “out of the impressive 305 GW of solar and wind parks believed to be installed in the EU in 2020, either 30.5 GW (10%) or 61 GW (20%) can be considered firm capacity. The remaining capacity will either produce electricity or sit idle depending on weather conditions”.<sup>28</sup> In some cases, wind curtailment could become a structural issue to avoid network cost increases. To this extent, capacity markets designed to offer remuneration for capacity, which have already been introduced in Belgium, France and the UK and discussed at European level, would provide a temporary fix rather than a long term solution for the whole European energy system, including grid integration challenges.<sup>29</sup> In this respect, ACER recommended reviewing existing market capacity, in light of common European generation adequacy and a security of supply approach.<sup>30</sup>

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<sup>23</sup> Dena (German Energy Agency), Dena Grid Study I – Planning of the grid integration of wind energy in German onshore and offshore up to the year 2020. German Energy Agency, 15<sup>th</sup> March 2005.

<sup>24</sup> 'Reactive power' is the rate at which energy is stored in an electric or magnetic field, and returned to the supply.

<sup>25</sup> Passera, L., “Meet solar’s imaginary friend, reactive power”, 12<sup>th</sup> March 2014.

<sup>26</sup> IFRI Note, “The European Power System Decarbonization and Cost Reduction: Lost in Transmissions?”, Maïté Jauréguy-Naudin, January 2012

<sup>27</sup> RE-Shaping: “Shaping an effective and efficient European renewable energy market”, D23-Final Report, February 2012.

<sup>28</sup> Eurelectric, “Flexible Generation: Backing up Renewables”, October 2011.

<sup>29</sup> Ifri Actuelle, “Capacity mechanisms: EU or National Issue? Are capacity remuneration mechanisms helping to build the market or just a symptom of what does not work?”, Laura Parmigiani, October 2012.

<sup>30</sup> ACER, “Capacity remuneration mechanisms and the internal market for electricity”, 30 July 2013.

## A European market for decentralised renewable energy resources

The energy transition depends on the level of interaction between grid operators – mainly TSOs and DSOs – in grid management and planning, the generation mix and the availability of backup generation capacities. The pathway to the energy transition depends on the local configuration of grids, in which the spatial distribution of connection points and assets is very important when making investment decisions that involve large amounts of capital expenditure per km of network length.

At the end of the 19th century, electricity supply was provided by local municipalities and local authorities. Since the mid-20th century, most European countries have moved to regional or national systems: France and the United Kingdom opted for integrated national publicly-owned monopolies, while Germany, the Netherlands and Sweden relied on local and regional cooperation.

The graph below sets out different scenarios for distributed electricity generation compared to peak electricity power. It shows the clear distinction between countries with a history of decentralisation, and where renewable energy is allowed to penetrate at a much higher rate. These considerations are also important drivers towards a pan-European electricity market and governance.

**Graph2: Distributed Renewable Energy Sources**

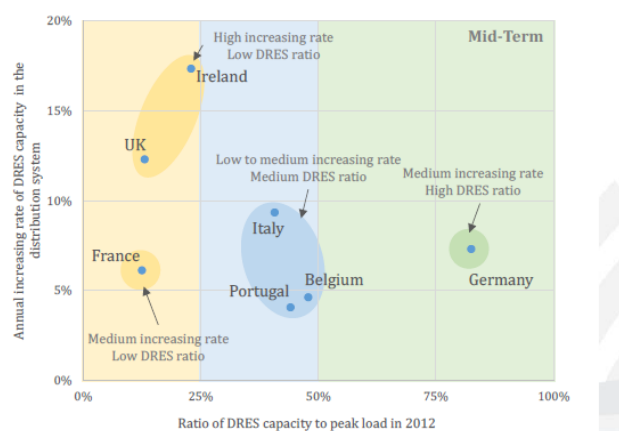


Figure 40: Increasing rate of DRES in the distribution system over RES capacity ratio. Scenario: mid-term, most-likely

Source : EvolvDSO ("Development of methodologies and tools for new and evolving DSO roles for efficient DRES integration in distribution networks")

## Conclusions

Both from a large and small-scale development perspectives, the energy transition requires a new generation of automated products (smart meters, sensors, actuators, control systems) compensating for the variability of renewable generation sources, to be connected to the electricity grid. However, many technical and regulatory challenges result from the connection of distributed generation sources in the European electricity grid system. These challenges are all the more complex as Member States have been building their electricity industries on a more or less decentralised approach.

With a large majority of distributed energy sources being connected at the distribution level, DSOs are in a central position in the transition of electricity markets, although acting at local levels. DSOs' primary role lies in local system optimisation allowing for demand response implementation for small customers, in order to reduce congestions and minimise energy losses. **The clarification of the role of DSOs in relation to demand response measures** is crucial before demand response can potentially develop in a liberalised market, outside of networks' regulated responsibilities.

**As far as future electricity market designs are concerned**, the role of **smaller players** and their ability to participate in the market should also be considered, by allowing for pooling of various small actors and their representation via an intermediate actor (demand aggregators), creating "negative load", and providing ancillary services to network operators. These developments should be followed closely by NRAs in order to make sure they do not undermine DSOs' role in reducing peak power consumption and secure optimum capital efficiency. The role of DSOs should also be clarified, notably in local dispatching and local balancing, in coordination with the TSOs, who have a central role in ensuring system wide security and stability.

Infrastructure planning is a central point of transition, as it supports the identification of assets that need to be replaced from a cost-optimum and system security point of view. The ENTSOe's network code on demand connection<sup>31</sup> should take into account DSOs' recommendations<sup>32</sup> in order to help overcome the barriers linked to the nature of this fragmented industry and the various ownership and unbundling situations in the different Member States. The ENTSOe's proposed Demand Connection Code (DCC) already sets out a range of network code parameters at TSO level, but the definition of demand side response raises issues on how demand simulation modelling should be exchanged between the different parties. At TSO level, the demand side response should be clarified to ensure that it can participate in system services. At a broad level, this degree of participation should not jeopardise systems' security and should not create undue transmission tariff distortions. To this extent, the role of demand aggregators in European legislation

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<sup>31</sup> ENTSOe, Implementation Guideline for Network Code, Demand Connection, October 2013.

<sup>32</sup> European Distribution System Operators for Smart Grids: Response to ACER public consultation on energy regulation: a bridge to 2025, June 2014.

still remains unclear.

From a wider energy policy perspective, questions arise as to the necessity of clarifying the role of DSOs, and demand response, in particular, in light of the Electricity **Directive 72/2009**, in which energy efficiency and demand response concepts are not clearly drawn. As far as DSOs are concerned, according to Article 27 of the Directive, “Member States should encourage the modernisation of distribution networks such as through the introduction of smart grids, which should be built in a way that encourages decentralised generation and energy efficiency”. Demand response should be clearly stated as a specific policy tool, being part of energy efficiency policy measures.

The transposition of the **Energy efficiency Directive** (Directive 2012/27/UE) into national law in June 2014 still creates opportunities for Member States to support **the role of DSOs in the use of system services** when operating the grid. The Directive mandates NRAs to encourage demand response measures and requires non-discriminatory practices (including tariffs) from network operators – both for transmission and distribution grid operators. According to Article 15 of the Directive, Member States will have to provide to NRAs with the potential of energy efficiency of their infrastructure and identify concrete measures of energy efficiency by 30th June 2015.

Finally, market designs (regulated as well as liberalised) for the ownership and management of **metering equipment, data handling and the definition of electric vehicle charging infrastructure** should be compatible with the aforementioned European legislation. Some key aspects related to customer data confidentiality will have to be preserved when being shared between grid operators and market operators, in order to avoid systemic conflicts of interest.

All these developments will ultimately provide a new cohesion and definition of the role of DSOs. It will improve clarity and cohesion of this fragmented segment of the electricity industry in which currently around 2400 companies operate in the European Union.<sup>33</sup>

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<sup>33</sup> Council of European Energy Regulators (CEER).

# Annexes

## Definitions

Variable generation: Wind and solar power generation.

Distributed generation includes distributed wind, distributed solar, pumped hydro, combined heat power, heat pumps, smaller traditional fossil-fuel based power plants.

Distributed Energy Resources (DERs) include distributed generation (DG),<sup>34</sup> energy storage including Plug-In Electric Vehicles (PEV), demand response and electric heating and transportation.

Distributed Renewable Energy Sources (DRES) include distributed wind and solar power, either connected behind the meter on customers' premises, or on the distribution grid. Electricity storage can, in some cases, be classified as a DRES.

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<sup>34</sup> Typically in the range from 3Kw to 10Mw.