EDSO for Smart Grids' response to CEER public consultation on Regulatory and Market Aspects of Demand-side flexibility

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Introduction

EDSO for Smart Grids welcomes this public consultation organised by the Council of European Energy Regulators to gather stakeholder feedback on the market aspects of demand-side flexibility.

The European Energy policies aiming at liberalising, integrating, and decarbonising the energy markets have forced our energy systems to undergo dramatic changes, where the more static and centrally focused system is changing into a more dynamic, less predictable distributed system, with a strong focus on the customer and the retail market. Distribution System operators (DSO) are on the forefront of the electricity market evolution, experiencing fundamental changes, such as legal and functional unbundling, huge amounts of distributed and renewable energy resources to connect and integrate to the grid, deployment of smart meters. New commercial players are entering the electricity market (ESCOs, energy managers, aggregators, etc.) and new technologies are expected to take off (heat pumps, electric vehicles) or being researched, developed and in some cases, demonstrated (energy storage).

The role and the responsibilities of the DSO thus need to evolve into an active system operator and a neutral market facilitator while maintaining security of energy supply and a stable network. To keep a high quality of service for all, their role has to evolve and include local congestion management, data management, and coordination of demand-side flexibility, electric vehicles, and storage.

Over the last decade, DSOs have invested significantly in innovation and demonstration for smarter grids. This is highlighted by the European Commission's Joint Research Centre (JRC) survey on "Smart Grid projects in Europe: Lessons learned and current developments". DSOs are involved in, or leading, 80 percent of the projects and are the source of half of the European investments. In order for the DSOs to be able to deploy these smarter, cost-efficient solutions and technologies, there is a great need to change the regulatory frameworks and incentivise investments in smart solutions beyond the traditional "investment in copper".

In the following pages, EDSO describes the challenges DSOs are facing when trying to make the most of demand-side flexibility.

- **What do you see as the main opportunities and benefits for demand-side flexibility in existing/futures markets and networks arrangements?**

Demand-side flexibility is crucial in order to maintain security of energy supply and a stable network in light of the massive development of variable and renewable distributed generation and the expected growth of the electric vehicles charging, and can be used by the DSO for grid planning, connection/access and operation.

In the planning phase, demand side flexibility can help to delay investments when the grid capacity is close to reaching its limit, using flexibility from the demand-side thus avoiding or delaying an extension of the physical distribution grid can lead to significant savings for the DSO, for consumers and for society. It can also give the DSO time to assess new options to ensure grid stability.

In the connection phase, a reduction of charges could be offered as an option in return for defined demand reduction a few hours per year, in cases where connection charges are covered by the costumer.

In the operational phase, it can be a useful way to solve local congestion by influencing the consumption patterns of consumers, the charging patterns of electric vehicles and other appliances that are consuming significant amounts of electricity. Demand-side flexibility can be developed together with well-identified large users (using an important transport capacity in the course of their business), and with residential users equipped with for example electrical boilers/electrical heating/ovens, which also represent an important electricity use when aggregated. Demand-side flexibility can also be a tool to bring additional balancing capabilities.

In order to reap these benefits, DSOs should become the neutral market facilitator: gathering, managing and sharing data with retailers, aggregators and other authorised third-parties, easing entrance of new players in the market, measuring and validating the use of demand-side resources connected to the distribution grid.

- **What do you see as the main barriers (e.g. legislative/market/regulatory) to the emergence / functioning of demand-side flexibility?**

  - Clarifying the role and responsibilities of all players
  - Developing monitoring and control tools to manage demand-side flexibility
  - Engaging consumers successfully

Clarifying responsibilities for all players

DSOs see a clear potential for using demand-side flexibility but lack visibility on the role they will be allowed to play in this new field. Clearly defining responsibilities and aligning interests between all the electricity players is necessary.

Customers start using energy when they come back from work in the evening, when the electricity price is high and the distribution network is used to a high degree. In order to lower costs for society and the customer DSOs would like the customer to decrease the usage during the evening peak (when the network is closer to its maximum capacity) and move this consumption to the “early

morning valley", when the distribution network is under-used. This would not only create savings for the customer regarding their network tariffs, it would also create savings on their electricity supply since electricity prices normally are lower at night than during daytime.

Appropriate incentives should be set up in order for the customer to reap benefits. For instance, some DSOs are currently using and investigating solutions like dynamic network tariffs (the tariff is higher when the overall grid use is increased and goes down when the network is used less) or incentive-based demand response (reduced tariffs or lump-sum payments that provide the DSO with limited, but clearly defined access to demand-side flexibility) which enable consumers to make savings by voluntarily adapting their electricity consumption to grid constrains.

Developing monitoring and control tools to manage demand-side flexibility

Demand-side flexibility will involve all electricity players: DSOs, TSOs, retailers, aggregators, consumers, etc. Monitoring network use and the actions of each player (who needs to influence consumption or generation, where, when, from whom?), will be necessary to manage the system effectively, keeping it stable and delivering power to the best quality. All players will have to coordinate through appropriate communication tools and be able to exchange data on their respective actions. Because the DSOs' core mission is to guarantee the security of supply and a stable distribution network, they should be fully involved in the design of Demand-Side Flexibility markets and the definition of technical conditions for activating flexibilities.

One solution could be the German "traffic light system", where the situation in the grid has been separated into three categories:

- Green light means that the are no specific congestions in the grid and market players are free to act without restrictions
- When the light turns yellow it means that there is a risk for network congestions, negotiations starts between market players and network operators in order to maintain system stability and solve congestions
- Red light means network congestions, and that TSOs and DSOs have to decide on the best course of actions for the system, without regards for markets.

As neutral market facilitators, DSOs should also be involved in the measurement and verification process to assess if market participants fulfil their balancing responsibilities.

Engaging consumers successfully

Demand-side flexibility is based on the assumption that consumers are willing to engage in demand-response activities. Engaging consumers will require incentives and technologies for demand-side flexibility to work and deliver its full benefits. Incentives could be for example based on price signals, dynamic tariffs or incentive based demand response in order for the consumer to making savings by offering controllable loads to market and network operators.

- **In what way will the implementation of the energy efficiency directive affect your organisation / involvement with demand-side flexibility arrangements?**

The implementation of the energy efficiency directive will impact DSOs in different ways. Firstly, the directive is expected to affect future network tariffs, as stated in article 15.4: "*Member States shall ensure the removal of those incentives in transmission and distribution tariffs that are detrimental to the overall efficiency (including energy efficiency) of the generation, transmission, distribution and supply of electricity*".

In Annex XI, the directive further states that: *"Network or retail tariffs may support dynamic pricing for demand response measures by final customers, such as:*

(a) time-of-use tariffs;
(b) critical peak pricing;
(c) real time pricing; and
(d) peak time rebates"

These requirements are not a based on current practices but rather set new objectives for NRAs. Today, volumetric tariffs (the more electricity that flows through the network, the higher the revenue for the DSO), and the interdiction to use dynamic tariffs, are common in national regulations. The implementation of the directive means that NRAs and DSOs may have to work together to develop new tariffs structure, in line with the EU sustainability objectives.

Secondly, the article 7(1) states that, "*Member States shall set up an energy efficiency obligation scheme. That scheme shall ensure that energy distributors and/or retail energy sales companies that are designated as obligated parties […] achieve a cumulative end-use energy savings target by 31 December 2020, without prejudice to paragraph 2.*

That target shall be at least equivalent to achieving new savings each year from 1 January 2014 to 31 December 2020 of 1,5 % of the annual energy sales to final customers of all energy distributors or all retail energy sales companies by volume, averaged over the most recent three-year period prior to 1 January 2013. "

Member States are given the choice to implement the directive "as it is" or to choose any other policy measures that would lead to reach the same amount of savings by 2020. According to the action plans published by Member States, distribution networks are not the main targets of national policies related to energy efficiency.

Last but not least, the directive also requires NRAs to design operational and participation rules to enable the procurement of flexibility from the market. DSOs see themselves as neutral market facilitators, monitoring the grid, assessing the impact of the market decisions on the physical infrastructure and taking action when the physical infrastructure is reaching its limit not being able to cope with the market (i.e. excessive electricity flow creating local congestion). Implementing the directive can positively spark a constructive discussions on how the role of the DSO should evolve.

- **Have you undertaken / are you aware of studies examining the cost-benefits of demand-side flexibility measures (for your country or for your organisation), and/or their cost-effectiveness relative to other measures? What were the results?**

DSOs have been actively investigating the potential of demand-side flexibility over the past few years, testing different technical solutions and market arrangements. The projects listed in Annex offer an overview of DSOs initiatives related to demand-side flexibility.

ANNEX

Please find below a non-exhaustive list of projects related to demand-side flexibility having been, or being run by DSOs.

Address (http://www.addressfp7.org)

ADDRESS is a large-scale Integrated Project, co-founded by the European Commission under the 7th Framework Programme. The goal is to enable Active Demand through the active participation of small and commercial consumers in power system markets and the provision of services. The objectives of the project were to:

- Enhance consumer flexibility and adaptability to enable active demand
- Provide real-time optimisation of energy flows at local and global level
- Develop technologies for distributed control and real time network management
- Exploit load flexibility to achieve the safer operation of the network and increase power system efficiency
- Propose solutions to remove commercial and regulatory barriers against active demand and the full integration of DG (Distributed Generation) and RES (Renewable Energy Resources)
- Enable profitable participation in the power economy by all market actors to provide local and global savings and increase the competitiveness in the energy market that will imply reductions in energy bills s
- Combine active demand with DG and RES to allow sustainable growth and energy consumption

ADVANCED (http://www.advancedfp7.eu)

ADVANCED aims to develop frameworks that enable residential and commercial/industrial consumers to participate in Active Demand (AD), thus contributing to the mass deployment of AD in Europe. Additionally, the benefits of AD for key stakeholders and its inherent impacts on the electricity systems, like the potential contribution to system stability and efficiency, will be quantified according to different regulatory scenarios. This will be achieved by comparing different AD solutions based on data from four AD pilots involving approximately 9,500 residential and some commercial/industrial consumers and matched with a database of 100 AD pilots and including the the experience of a Demand Response (DR) aggregators and data on further AD initiatives.

Main objectives:

1) Development of an action plan to implement Active Demand in Europe
2) Leveraging on the experience gained in the ADDRESS Project
3) Exploiting data and results obtained from ongoing demonstration projects

evolvDSO (website under construction)

Due to the growing number of distributed renewable energy sources (DRES) connected to the distribution network and the increasing participation of demand customers in the electricity system, power systems and their operation need to be evolved to address the manifold challenges. To do so, and to seize opportunities, evolvDSO will attempt to define the future roles of DSOs on the basis of a set of different future scenarios. Selected tools and methods to enable these changing DSO responsibilities will be developed and validated through computer simulations based on real grid data

and existing real life test beds. The new tools and methods will enable DSOs, in collaboration with transmission system operators (TSOs) and other market players, to support the transition of the distribution networks towards a smart system that supports a successful integration of DRES. To facilitate the uptake of the new tools and methods, evolvDSO will put forward recommendations for the regulatory framework.

GRID4EU (www.grid4eu.eu)

The project Grid4EU is an innovative 4-year Smart Grid project, started in November 2011 and co-funded by the European Union under the 7th Framework Program. It has been proposed by a group of six DSOs (ČEZ Distribuce from the Czech Republic, Enel Distribuzione from Italy, ERDF from France, Iberdrola from Spain, RWE from Germany and Vattenfall from Sweden) in close partnership with a set of electricity retailers, manufacturers and research organisations. ERDF is the project Coordinator, with Enel Distribuzione as Technical Director and Iberdrola chairing the General Assembly. The core of Grid4EU is the implementation of six, strongly integrated, large scale demonstration projects in the abovementioned EU Countries, to test innovative system concepts and technologies, highlighting and helping to remove some of the most important barriers to Smart Grid deployment. The main issues addressed are:

1. Maximizing the integration of small and medium-size distributed energy resources
2. Increasing energy efficiency
3. Enabling and integrating Active Demand
4. Enabling and developing new electric energy usages (e.g. electric vehicles, heat pumps, etc.)

The demonstration sites in Castellon (Spain), Nice (France), and Uppsala (Sweden) all cover some aspects of demand-side flexibility.

IGREENGrid (www.igreengrid-fp7.eu)

IGREENGrid (IntegratinG Renewables in the EuropEaN Electricity Grid) project focuses on increasing the hosting capacity for Distributed Renewable Energy Sources (DRES) in power distribution grids, without compromising the reliability, or jeopardising the quality, of supply.

The core objective of IGREENGrid is to share knowledge and promote best practices, identifying potential solutions for the effective integration of DRES in the six existing demonstration projects in low voltage (LV) and medium voltage (MV) grids participating in the project. These are then validated through simulation in other environments to assess the scalability and replicability at EU level. However, one of the demonstrators (Isernia,Italy) is also looking at the active participation of customers.

Improgress (http://www.improgres.org/)

Improgress stands for Improvement of the Social Optimal Outcome of Market Integration of DG/RES in European Electricity Markets. This project [32] compares the impact in overall system costs when implementing active network management tools, specifically advanced generation control and demand side management. Three real network scenarios were compared:

1. A rural area with wind power plants and CHP in the Netherlands (HV, MV and LV);
2. A residential area with PV penetration and micro CHP in Germany (MV and LV);

3. A semi-urban industrial and residential area with wind, PV, CHP and a high peak demand in Spain (HV, MV and LV).

A cost-benefit analysis was performed for these scenarios considering the 'classical' network and back-up plants investments avoided and the implementation of the control costs, which vary widely depending on the ICT techniques considered as most optimal in each case. In both cases, operation and maintenance costs are considered as well as losses. Redispatch and balancing costs are also taken into account. The active management options analyzed were demand side management and advanced generation control (via bilateral contracts between agents and DSOs or economic incentives (prices with some locational/temporal differentiation).

The advanced response resulted in a great impact on distribution costs due to the lowering of the maximum net generation and/or demand. Generation costs also dropped as less generation capacity as well as less peak generation was needed. External costs and balancing costs also decreased.

The study concluded that investments in the abovementioned solutions were cost-effective on the overall account, even though a cost-benefit analysis should be made to evaluate on a region specific basis.

Jouw Energie Moment (www.jouwenergiemoment.nl)

In cooperation with several partners, the DSO Enexis has launched two pilot projects on smart grids in the 'Meulenspie' and 'Easy Street' neighbourhoods in Breda and the 'Muziekwijk' in Zwolle. The results of these pilot projects will help guide the development of future local energy systems in the Netherlands. Residents produce their own energy using photovoltaic panels, and participants in the pilot projects received a smart meter, an energy computer and a smart washing machine which communicates with the energy computer. These smart appliances allow participants to make rational decisions based on actual energy use, increasing energy efficiency. This reduces costs and benefits the environment by empowering energy consumers.

Promoting energy efficiency in households by using smart technologies

(www.latvenergo.lv/lat/viedie_skaititaji/viedie_skaititaji --- only in Latvian)

The project is designed to research, implement and assess the technological advantages provided by smart technologies. This includes smart metering, data analysis, client awareness, the reduction of household CO_2 emissions and the promotion of energy efficiency in households. For this purpose, based on yearly electrical energy consumption, 500 project participants were selected and divided into various groups. Smart meters were installed for all of the project participants in order to provide them with detailed information about their electrical energy consumption. In addition, 35 households were provided with advanced in-home display kits for monitoring and managing individual appliance consumption.

The project's main goal is to achieve a reduction in household electrical energy consumption in order to reduce household CO_2 emissions by 10%. The additional objectives are to investigate the influence of detailed consumption information on client behaviour and habit change in direction of efficient energy usage.

Smart Domo Grid (no website)

Smart Domo Grid is a project managed by A2A Reti Elettriche aiming at:

1. Allowing the Active Demand Response interaction between a DSO and domestic “prosumer” through a service provider
2. Enhancing the power quality and the controllability of the grid.

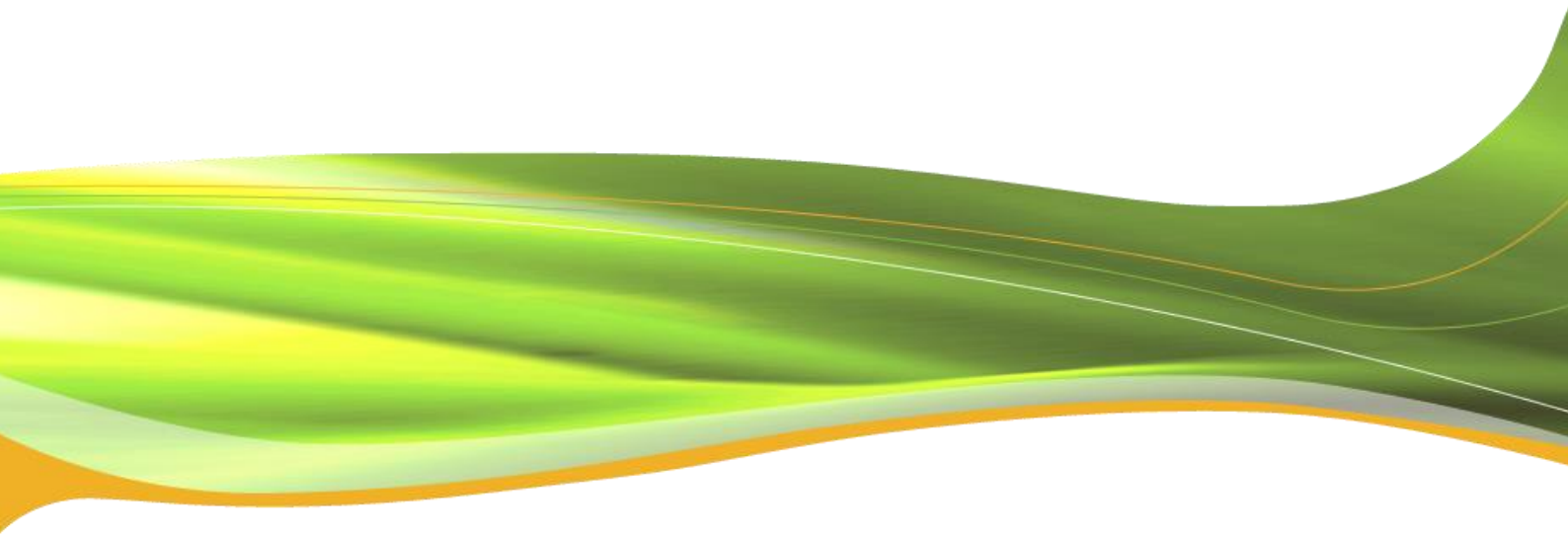
Each actor considered in the project has enhanced its functionality and tools:

- Twenty-two prosumers are equipped with three Smart Appliances, controllable storage, domestic photovoltaic panels and second generation smart meters.
- The service provider has developed a Domestic Energy Management System. The software is able to optimise the planning of Smart Appliances in respect of the prosumers’ constraints and DSO's necessity.
- The DSO has developed algorithms to forecast the condition of the load on the LV grid and to manage the power flows using the Demand Response approach. The DSO is equipped with a piece of equipment called Open Unified Power Quality Conditioner (O-UPQC) and a decentralised intelligence both installed in a MV/LV substation.

ZEM2ALL (www.zem2all.com --- In Spanish only)

The project ZEM2ALL (Zero Emissions mobility to all) aims to integrate the solution of mass recharging of electric vehicles together with control and management centres and management systems, in order to simulate this solution and the development of future technologies that are more respectful of the environment. The project activities are developed in the city of Malaga.

Endesa Distribución Eléctrica is involved in various parts of the project, notably the infrastructure deployment and the development of an advanced Service Management System that enables smart charging of electric vehicles.



EDSO
for smart grids

EDSO for Smart Grids is gathering leading Distribution System Operators, cooperating to bring Smart Grids from vision to reality.

www.edsoforsmartgrids.eu