3rd E.DSO Stakeholder and Innovation Council

The Path forward to the New System Operator Model

Customers inspire DSOs

Conclusions

February 2021

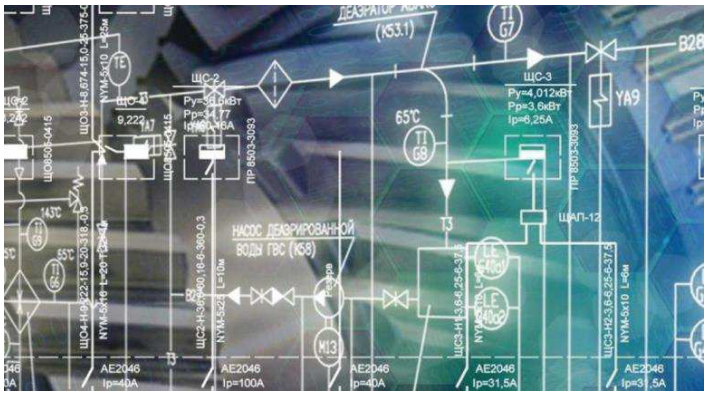
Introduction

The energy transition is shaping the future of electricity systems. **Fundamental changes of the energy system affect Distribution System Operators (DSOs) and require innovative ideas, fresh perspectives and a mind shift in how to deal with new challenges and seize new opportunities**.

DSOs are in the position to drastically adapt their crucial future role as System Operator through smart grids, implementing the distributed and renewable energy transition, while maintaining the security of supply and meeting and anticipating customer expectations.

The electricity distribution network is the direct link between energy consumers on the one hand and electricity generation and transmission on the other. It is the 'backbone' of our energy system. European DSOs connect 260 million connected customers of which the vast majority are residential households and small enterprises. DSOs shall therefore have to play a new role in the energy and digital transition – being a platform that brings together (active) consumers, suppliers, and energy service providers, creating value for all.

Having this commitment in mind, **E.DSO held virtually the third edition of its Stakeholder and Innovation Council on 12 October 2020**. Starting from the highly relevant issue of TSO-DSO cooperative interaction, the design, visibility, and control rules of network digitalization were considered as being crucial to achieve a maximum systemic benefit. Clear principles for data access/processing, objectives for increasingly complex technology deployment at the grid edge and security criteria were addressed to come up with best options for policy makers and to simplify prosumer involvement.



Great attention was paid to mitigate conflicting incentives between different levels of system customers, to allocate and communicate achieved benefits amongst consumers, DER owners and service providers.

The Integration of Electrical Vehicle (EV) 'smart charging' points, smart meters and distributed behind-the-meter storage facilities were considered as new elements that will trigger and increase citizen's involvement.

DSOs have the crucial responsibility to inform their customers about possibilities to become more active in the energy system, how they can use the network more efficiently, and reap their own benefits of this transition.

The experts participating to the third edition of the Stakeholder and Innovation Council addressed the topic of how customers can and shall inspire DSOs tackling the following three underlying issues:

1) **Societal values to be embedded in the New System Operator Model**
2) **Current market model and regulatory barriers to customers**
3) **Innovative tools/instruments to implement the New System Operator Model**

1. Societal values to be embedded in the New System Operator Model

The energy transition will put the system operators in a key position as enablers for their customers, serving many new players of which the most important ones are the grid users themselves. This means that in the future the focus must be on societal optimization of the entire energy system. Some of the most generic societal values include contrasting climate change and mitigating its effects, ensuring highest comfort standards to all citizens, while maintaining environmental impacts at a minimum level.

While decarbonisation and the energy transition are to large extent mainstream societal values, delivering on these may be perceived as interfering with other values important to the consumer, such as wildlife conservation, local environmental challenges (e.g., noise and visual pollution) and comfort.

To promote a more flexible use of the existing grid, all actors in the energy system must help each party in the system to achieve the societal optimum, including innovative and necessary properties of a resilient system. **System operators will have to take a leading role in the development of a framework in which both existing and new players receive the appropriate price signals.**

The price signals constitute an effective means to connect different markets and to promote the effective participation of the existing as well as the new players to their own as well as systemic benefits. **The ultimate success thereof is however dependent on sound communication action and simplified information exchange targeted for each specific customer profile**.

Looking at flexibility beyond day and week balancing, obtaining flexibility for the seasonal balances can also bring notable societal value. *How can DSOs design a system in which commercial energy suppliers, aggregators, energy cooperation and grid companies work together to serve the customer and to solve the unbalance issues in a societal optimal way*? One way can be by developing a system of markets and prices that value energy at different times, so that storage, over different time horizons, can receive the right signals about its value and investors can decide accordingly, thus responding to the system needs and maximizing social welfare outputs.

One of the most central innovations in the modern energy system are the smart meters, which with their gathering of crucial data also form the basis for fostering and enabling increased customer engagement. Digitalization and common use of data and information are becoming increasingly important in the energy system.

TO ENSURE THE SUCCESSFUL FACILITATION OF THE ENERGY TRANSITION, THE SYSTEM OPERATORS MUST VERIFY THAT THEIR PROJECTS CONTRIBUTE POSITIVELY TO SOCIETAL VALUES AND THAT THIS CONTRIBUTION IS CONVEYED TO SOCIETY

The data obtained through smart meters coupled with client portals and apps provide the system operators with new tools and enhance the central role of the DSO. **Open data will be ever more crucial to increase efficiency and transparency in the system, and thus it is very important that system operators develop the capacities needed for a sustainable management thereof**

respecting the rights of the customers. Sharing data, information and platforms by all actors shall contribute to an affordable and socially desired optimum and should be stimulated by Regulation by addressing the flexibility challenges of grid companies. To this end, we need a future oriented common 'mindset' to share and to work together in the energy chain.

2. Current market model and regulatory barriers to customers

The Energy Transition is both a great opportunity and challenge. It can only succeed when there is a clear regulatory framework and a consensual understanding among all relevant parties, ranging from regulated players such as the TSOs and DSOs to market parties (e.g., suppliers and aggregators) and consumers (that become ever more active).

Moreover, the COVID-19 pandemic has shown that the grid edge is becoming more relevant and that DSOs need to be prepared for changes on the consumer's side. More remote working has led to increasingly dispersed consumption and shifted the load curve. Investments in (demand side) flexibility and new technologies (at home or on the road) are important to address emerging challenges. This requires stronger motivators than just relatively minor savings on the consumer's final energy bill.

Consumers need to have a clear understanding of what they must do to reduce their carbon footprint, what they can concretely do and how much impact their change will have. To this end, reliable and non-conflicting information is essential – not only on how to alter their consumption, but also on when this change in consumption will most effectively reduce their carbon footprint - depending for instance on the energy mix in the system at any given time. At the same time, this should not imply higher costs or inconvenience.

On the contrary, flexibility should rather be seen by consumers as an enabler of future lifestyle (e.g., through managing the duck curve more people in communities can have by EVs). Bundling of benefits / motivations will help to activate customers rather than only financial incentives.

ENABLING CUSTOMERS AND UNLOCKING THE VALUE OF FLEXIBILITY THEREFORE REQUIRES TIMELINESS AND A FAST DATA FLOW BETWEEN ALL ENERGY MARKET PARTICIPANTS, AS CLOSE TO REAL-TIME AS POSSIBLE

The value of flexibility is not merely determined by its availability – but rather availability at the right time and location. In this context, we should also look at EV's for their potential as 'movable storage'. **We need to change our understanding of technologies as only serving one purpose**. For example, while most people think of EV merely as a means of transport, their storage function can also help alleviate grid constraints and reduce environmental impact. There could be storage signals other than time-based pricing.

Moreover, clear principles for data access and processing must be determined – that allow easy and direct data exchanges between system operators and third parties, to the benefit of customer and with their consent.

But customers do not easily understand their own impact on the grid. This awareness must be created. Their emission impact should be measurable and enable a better understanding and dialogue between consumers and grid operators.

In Europe, Demand Response from residential customers does not benefit from support schemes and is further hindered by

lack of data availability. Incentives currently focus on storage (*e.g., in the TEN-E Regulation there is a dedicated category for transmission and storage projects but not for demand side flexibility*) and the market alone may not achieve the implementation of all required flexibility solutions. New energy uses should come along with flexibility provision standards, based on new/different network tariff systems, with good information access to all parties and based on common societal goals.

Clear rules and defining exactly the roles of all market players are important. When setting up new rules and defining roles, a climate mainstreaming perspective must necessarily be adopted so that the market model and regulation follow the same logic. **All actors must achieve a consensual understanding of common societal goals to pave the way for critical investments in both the energy infrastructure and flexibility.**

As a conclusion note, the trade-off between flexibility measures and structural grid investment must be made under consideration of the societal goals and benefits to all parties. Regulation, investment and incentivisation should be goal-oriented and those societal goals need to first be agreed and then a holistic, coordinated and non-partisan approach agreed, without delay.

3. Innovative tools to implement the New System Operator Model

The global energy landscape is undergoing an extraordinary wave of changes and modernisation. The future energy system needs to be more reliable and resilient, integrate widespread distributed resources in a seamless way and make customers and communities' part of energy optimization.

At EU level, the EU Clean Energy package and the Green Deal aim to transform Europe's energy system by decarbonization, empowering consumers and deploying smarter technology.

The EU Digital Strategy identifies strategic priorities and actions needed to accelerate the EU energy system transformation.

The way the distribution grid is designed, planned, and operated is going to change. New technologies are going to support this change, besides smart metering and smart grid systems: smart home appliances, smart charging solutions for EVs, smart city solutions, Distributed Energy Resources Management Systems (DERMS), Network sensors, IoT, Network Digital Twins and Artificial Intelligence.

In this digital journey, stakeholders, and DSOs themselves need to re-consider their future roles and contractual interactions. The sooner society and regulation agree on the DSOs role in the future digital energy system, the faster can the required digital capabilities be used and grown.

What is the 'core' role of DSOs in this NEW digitalized energy system?

In current energy transformation, DSOs are facing increasing levels of decentralization, with the need to integrate highly volatile and dispersed distributed generation and increased load with a high-power rating (charging of EV and heat pumps), as well as digitalisation, which all together are changing customers' behavior, expectations and needs.

In this context, DSOs have a key role to play and must adapt promptly to manage:

- Vastly *more connection requests* that need to be assessed and implemented;
- More *renewable generation*, as well as *electrification* of transport and heating loads
- Additional *diversity of technologies* requiring access to the network;
- *Customers using the network* in new and less predictable ways;

- *Flexibility* from distributed energy resources, and *up to real time interaction with flexibility markets* and local energy communities;
- More need for *real-time network visibility*, and analytics
- Demands to make that network *data consistent, transparent and accessible* to third parties;
- Increased coordination with the TSO.

The nature of customer service by the DSO are also changing – those connecting customers of DER cannot be considered on a "connect and forget" basis. Customers will have ongoing commercial relationships with the DSOs, and new third parties (e.g., aggregators, charge point operators and Electricity System Operators/ESOs).

DSOs must understand their customers in a way they never experienced before. That is in itself a challenge requiring detailed understanding of segmentation, as well as the characteristics of each customer(s) technologies.

The urgency for entering this new dimension is also brought about by the rise of the need for enabling up to real time interaction with flexibility markets and "energy communities"[1]. Flexibility to manage the system will be realised in a wider geographical and longer time dimension (long-distance transport in real-time and precursor/delay demand). Therefore, there is need for a model with flexible demand, DER management, local markets and ultimately cooperation with TSOs.

Digitalised energy systems in the future must identify customers' energy needs and deliver at the right time, in the right place and at the lowest cost. Connected everything has raised the threshold, with costumers who now expect choice, control, and convenience. This includes new features to be implemented, such as displaying information about outages and scheduled maintenance works but also information on new services and ways for the customers to become more actively involved in the energy system.

Far from being a potential barrier to digital technologies, DSOs should be able to facilitate and indeed to drive the change needed to empower consumers.

Finally, yet importantly, innovation should be accelerated to enable more granular-scale energy monitoring and management, including generation and load forecasting. DSOs will have to continuously develop and operate the network in a reliable, affordable, and sustainable way, while building a grid that is fit for the future.

TSO-DSO interface

In the context of the evolution to the new role of DSO, the interaction with the TSO will need to be developed on the following main aspects:

***Flexibility*:** DSOs need to manage the network more dynamically and this includes interaction between DSOs-TSOs, related to coordination and accountability on the use of flexibility services from DER, flexibility markets, and network observability.

***Novel connections*:** Active System Management (ASM) is a key set of strategies and tools performed by DSOs and TSOs for the cost-efficient and secure management of the electricity system and grid. The

[1] https://publications.jrc.ec.europa.eu/repository/bitstream/JRC119433/energy_communities_report_final.pdf

integrated electricity system approach recognises and respects the roles and responsibilities of TSOs and DSOs as system operators and neutral market facilitators. It seems necessary for TSOs and DSOs to agree on mutual processes and data exchanges to guarantee the reliable, efficient, and affordable operation of the electricity system and grid, and to secure non-discriminatory and efficient markets.

4. Conclusions and final recommendations

DSOs will face several challenges in the coming years but there are also clear opportunities to transform the DSO model and to create benefit for the industry, for our customers, and for society at large.

The E.DSO Stakeholder and Innovation Council discussed three distinct, yet interrelated topics and gave recommendations that should inspire the DSO community to adopt best practices and go new ways, where this is necessary or desirable. **One of the key messages is that cooperation among a variety of stakeholders is needed to decarbonize our energy system and to meet new customer expectations. DSOs are in a crucial position, being the direct link between the customers and the wider energy system.**

Societal values

Delivering on these societal values should be based on the deployment of a new energy system with smooth user interfaces. DSOs should develop a framework in which all existing and new players receive appropriate price signals to align their actions with these societal values and exploit their potential. More importantly, enabling flexibility over different time horizons (minutes, hours, days, seasons) using distributed resources along central ones to contribute in a notable way to these societal values.

Widespread deployment, inter alia, of data capturing from Smart meters is a pre-requisite for the DSO to act as a neutral market facilitator. It poses the responsibility to safeguard the grid users' privacy in line with society interest. The co-creation of common standards and open source are essential. Furthermore, serving the exponential growth of electric mobility in all its aspects can become a groundbreaking example of future – and grid user-oriented standardized services.

Market model

The Energy Transition is both a great opportunity and challenge. It can only succeed when there is a clear framework and common understanding among all relevant parties, ranging from regulated players such as the TSOs and DSOs to market players including suppliers and aggregators, and consumers.

The market model should be based on a detailed understanding of society's goals. These goals are changing, and regulation needs to change with it. Dynamic regulation is needed to foster innovation and investment:

Re-think. Minor incremental changes will not bring the necessary framework. e.g. need to overhaul tariff regimes.

Discussion is needed among regulators, system operators, generators, suppliers, technology and solutions providers, and consumer (including low-income and underserved communities) representatives etc.

Financial incentives alone (minor savings on energy bills) do not stimulate sufficient behavioral change and we cannot have a future based only on punitive measures. Through timely actionable information (provided to consumers and other actors) relating to the impact of consumption behavior on emissions, along with an easy way to respond, we can avoid unnecessary restriction or financial burden to consumers. The distribution system will increasingly become an essential co-provider/gateway of information critical to timely emissions reducing behavior by consumers and other system stakeholders.

The market model should be sufficiently integrated to enable the pass through of information. The market model needs to evolve to enable changing trends such as: uncompromising emissions reduction objectives (including replacement of gas); increasingly distributed and potentially volatile load dynamics (including electrification and relocation of demand due to the pandemic); competition between storage and demand response.

Other trends and observations:

- Dynamic relocation of demand due to pandemic driven lockdowns;
- Storage as a competitor to demand response; Moveable storage effect of EVs;
- Electrification via reduction of natural gas
- Environmental justice
- Resiliency of the grid and personal resiliency actions

Innovative tools/instruments

The future power distribution system needs to be more reliable, resilient, and flexible, integrating widespread distributed energy resources in a seamless way and making customers and communities part of energy optimization.

Digitalisation and new technologies will ensure DSOs can support this transformation and reach out to the entire energy ecosystem, including new players.

Technological tools for DSOs to become agile, digital system operators through:

Dynamic real-time grid management and observability: widespread sensors for real-time situational awareness, state estimation, configuration management, data leaks. Asset monitoring and diagnostics for improved reliability and efficient operation.

Flexibility from all levels: DERMS technology to plan and manage the network more dynamically, including integration of distributed energy resources, platforms for integration of customer flexibility (for instance EV charging management, distributed generation active and reactive power management), TSO-DSO coordination and integration of a wide range of stakeholders.

Network modernisation and digitalisation: low latency communication networks including 5G, smart grids, IoT platforms, digital twin technologies, data analytics, cybersecurity, and artificial intelligence.

Integrated and Smart Ecosystem: The electricity grid as the platform to connect broader techno-socio-economic systems with multiple physical, cyber, social, policy, and decision-making layers (with cyber security and data privacy concerns addressed) to free up broad innovation opportunities across the ecosystem.

The future digital energy system involves many challenges, but also opportunities. DSOs can help make this broad ecosystem transition a reality by taking a central role in the coordination, namely through:

- Digital strategies enable *true customer-centricity* and the ability to adapt to each segment of customers' changing needs in a tailored way
- *Digitalisation of DSOs' processes* moves them from disconnected activities to an integrated data rich environment providing value to all stakeholders
- *Re-thinking and adopting agile work management* operating models, embedding AI and optionality into asset management strategy, and embracing automation and flexibility from all sources
- *Deep understanding of customers*, driven by data and analytics as a core competency.

Finally, yet importantly, DSOs shall pursue technologies to achieve an integrated, balanced, and sustainable smart ecosystem through regular investments in the transformation of the networks and by partnering at different levels with all Users. This will enable a participatory, responsible, and effective approach to the overall energy transition process.

Members of the Innovation and Stakeholder Council

	**Alberto Pototschnig:** Executive Deputy Director of Florence School of Regulation (FSR). Between 2010 and 2019 Alberto served as the first Director of the European Union Agency for the Cooperation of Energy Regulators (ACER). From 2006 to 2010 he was a Partner in Mercados EMI, an international consultancy specialised in energy markets design and regulation.
	**Christof Wittwer**: Head of Department "Smart Grids" at Fraunhofer Institute for Solar Energy Systems. Honorary Professor University of Freiburg, Master's degree program Renewable Energy Engineering and Management. Involved in national research programms BMWI-SINTEG and BMBF-Kopernikus regarding Smart Grids Technology.
	**Dan Delurey**: Senior Fellow for Energy & Climate, Vermont Law School. Founder of the US Association for Demand Response & Smart Grid. UN-Accredited Delegation Head for technology companies for the UN COP Process. Helped develop initial US Federal and State policy regarding grid modernization and distributed energy. Founder of National Summit on Smart Grid and Climate Change.
	**Joisa Saraiva:** Professor of economics, Director of the Center for Regulation and Infrastructure, Fundação Getulio Vargas. Formerly: Commissioner for the National Electricity Regulator in Brazil, ANEEL. Member of the Global Future Council on Energy of the World
	**Jorge Vasconcelos:** Currently Chairman of NEWES, New Energy Solutions and first chairman of the Portuguese Energy Regulatory Authority, ERSE. Founder and first chairman of the Council of European Energy Regulators, was founder and member of the Executive Committee of the Florence School of Regulation
	**Leonardo Meeus**: Professor of the Florence School of Regulation at the European University Institute. Strategy and Corporate Affairs Professor at Vlerick Business School in Brussels. Director of the Vlerick Energy Centre.
	**Mark McGranaghan:** Vice President of Innovation at the Electric Power Research Institute (EPRI). He is a member of the executive committee of the CIGRE U.S. National Committee and Vice Chairman of the CIRED U.S. National Committee. Mark has been with EPRI since 2003. He led EPRI research in the smart grid area and coordinated closely with government smart grid demonstrations and other efforts around the world.
	**Philip Lewis**: CEO of VaasaETT and co-founder of the SEDC (smartEn). Expert in energy market competition, customer behaviour and disruptive change. Former member of the WEF Global Agenda Council on the Future of Electricity and named among 11 Global Smart Energy Elites by Metering and Smart Energy. Author of the World Energy Retail Market Rankings.
	**Ronnie Belmans**: Full professor of the KULeuven. CEO of Energyville, joint venture research centre for sustainable energy supply of cities with VITO, imec, UHasselt and KULeuven. Honorary Chairman of the board of directors of ELIA. Chairman of the board of director of the Flemish Electricity and Gas regulator.
	**Simona Maschi**: co-founder and director of the Copenhagen Institute of Interaction Design. Formerly: over 15 years teaching experience at various institutions including Denmark's Design School (DKDS) and the IT University in Copenhagen.
E.DSO Representatives: Christian Buchel (Enedis), Livio Gallo (Enel Global Infrastructure and Networks), Armando Martínez Martínez (i-DE), Joachim Schneider (innogy), Franz Strempfl (Energienetze Steiermark), João Torres (EDP Distribuição), Jan Peters (Enexis), Roberto Zangrandi (E.DSO)	

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