SHAPING SMARTER GRIDS FOR YOUR FUTURE

## 2nd E.DSO Stakeholder and Innovation Council

# Conclusions

**February 2020**

**Introduction and general scope**

The energy system is undergoing fundamental changes. This is particularly true for Distribution System Operators (DSOs) confronted with an unprecedented growth of new loads, storage devices and distributed generation connecting to their networks. Fundamental changes require innovative ideas, fresh perspectives, and a mind shift in how we deal with new challenges and seize new opportunities.

E.DSO gathers leading European DSOs for electricity cooperating to ensure the reliability of Europe's electricity supply for customers and enabling their active participation into the energy system. To this end, E.DSO works on electricity distribution-related technologies, policies and projects. Connecting more than 350 million customers in Europe, E.DSO is the key interface between Europe's DSOs and the European institutions, promoting smart grid models and technologies in real-life, as well as new market designs.

E.DSO held the second edition of its Stakeholder and Innovation Council on November 13, 2019 in Paris. The Council was established in 2018 to provide advice and inspiration to E.DSO and its members, to introduce the DSO community to outside perspectives, sharing new visions on industry and technology in transition, and to design the evolution of DSO models that create value for citizens and society, industry and the economy.

The Council consists of a wide range of experts in digitalization and smart grids, representatives of EU institutions and international organizations as well as experts on customer behavior and trends. It is chaired by Livio Gallo, Head of Global Infrastructure and Networks at Enel, and composed of (as of November 2019):

- Ronnie Belmans (KU Leuven, Energyville)
- Dan Delurey (U.S. Association for Demand Response & Smart Grid)
- Patrice Geoffron (Université Paris Dauphine)
- Philip Lewis (VaasaETT)
- Simona Maschi (Copenhagen Institute of Interaction Design)
- Leonardo Meeus (Florence School of Regulation & Vlerick Business School)
- Anda Ray (EPRI – Electric Power Research Institute)
- Joisa Saraiva (Center for Regulation and Infrastructure, Fundação Getulio Vargas)
- Jorge Vasconcelos (NEWES – New Energy Solutions)
- Christof Wittwer (Fraunhofer Institute for Solar Energy Systems)

Together with these distinguished experts, the E.DSO chairmanship discussed on November 13 the following three distinct, yet interrelated topics of Grid Edge Transformation through Flexibility, Innovative Resilience and Customer Engagement by Design. The key messages from the evaluation and

experts' discussion of these topics held that day are useful guidelines for the following general objectives and potential ambitions:

1) Designing the evolution of DSO models to create value for citizens and society, industry, customers, and stakeholders.

2) Providing advice and inspiration to E.DSO.

3) Bringing views outside-in, sharing new visions on industry and technology in transition.

4) Reflecting on possible and forward-looking DSO and E.DSO strategies.

## 1) Grid edge transformation through Flexibility

The concept of flexibility will play an important part in the evolving path of the energy system: delivering on the challenges to meet emission targets, while providing a secure, reliable, resilient and affordable energy system. This will necessitate a strong cooperation between all relevant stakeholders, all playing a vital role in the transition towards clean energy. The transmission and distribution networks will be key to enable the integration of energy systems, power and electric mobility, providing their customers with the capabilities to play an active role in the energy transition.

The ongoing Grid Edge Transformation of electricity distribution networks will provide a future system facilitating a partnership between stakeholders by enabling the integration of decentralized potential actors and solutions at a local level. This customer-centered transformation shall be led by the creation of new business models to enhance and adapt both the physical grid and the utilization of flexibility for the benefit of energy communities, including the sectoral integration of energy sources and other industries. Within this transformation process, the DSO takes a key role of neutral facilitator and enabler of customer facing solutions to incentivize the optimal systemic outcome, driven by technological progress, which orientates regulation and, last but not least, sees public awareness evolve. Consequently, it is the DSO's crucial role to enhance interoperability at minimal cost, providing digitalized "grid smartness" interface solutions between the grid and the Citizen Energy Communities.

In order to allow and back such a transformational process, flexibility is essential, both in terms of regulation and services provided:

1. <u>Regulatory flexibility and responsiveness – dynamic regulation</u>

The regulatory framework itself must become more dynamic, conceding regulatory flexibility and responsiveness to the trial and progressive implementation of new business models. Flexible regulation for testing new solutions and approaches, such as Regulatory Sand Boxes (RSB), recently implemented by National Regulatory Authorities as a means of testing new technologies, services and business models in a real-world environment, will drive innovation. The RSB is a mechanism to experiment with new regulation providing a valuable learning experience to better grasp existing regulation or to identify potential regulatory barriers to innovation. Some examples of where RSBs are being used include the UK, the Netherlands, Germany, France and Italy: Regulatory exemptions for a limited period and within a predefined zone, to enable experiments with new technologies, procedures and business models. Lessons learned are documented and serve as input for future policy development.

Indeed, more Regulatory Sand Boxes should be envisaged, in order to establish a level playing field for large-scale demonstrators with flexible timeframes of up to several years, according to the

demonstrator's scale and ambition. In addition, the outcomes of such large-scale Sand Box demonstrators should be shared for review amongst a broad community of stakeholders, in order to ensure optimal and fair interoperability solutions for all actors concerned.

Furthermore, local grid regulation and operation schemes with their respective local tarification schemes should be foreseen in order to incentivize innovation at the Citizen Energy Community level.

Last but not least, the long-lasting experience of DSOs and their innovation potential should be triggered and built upon as much as possible by the dynamic regulatory approach, in strategic progress domains such as energy storage, to name but one.

2. Flexibility enabled through service provider incentive schemes

Another area for boosting the Grid Edge transformation is the involvement of service providers in flexibility enabling and incentivizing schemes, such as for home or car battery storage availability, or, in the past, for secondary circuits of cheaper power over night for water heating (boilers) as deployed in countries like Germany, Austria and New Zealand decades ago. Indeed, it becomes essential to develop stronger links among all participants of the value chain with the electricity system in the collective effort to decarbonize, such as in the previously mentioned examples of supplier incentives to final customers.

3. Price reflecting tarification schemes

The pricing mechanism also should gradually reflect liberalization, with prices composed of a global market price signal with an additional regional system charge. Hence, tariffs should tendentially align more and more to the global and regional price signals while taking also into consideration the individual household characteristics in terms of both consumption and generation.

4. DSO as integrated solution provider

Innovative solutions at individual or local level do not benefit from economies of scale that integrated solutions optimized and deployed through the cooperation of the grid operator and larger service providers might bring. Consequently, and because of its position as neutral market facilitator and to its larger-scale and long-lasting business experience, the DSO might result to be an adequate integrated solutions provider for the system and its stakeholders.

**2) Innovative Resilience**

Climate Change is ongoing and although tornadoes, floods and ice storms have always been part of the global climate as natural phenomena, now the frequency and intensity of these extreme weather events is increasing, posing direct physical risks for infrastructures, causing outages and power cuts, thus representing primary threats to the electric power system's reliability. Large-scale events and extraordinary demand peaks can amplify the consequences from a low-resilient answer by the system while the increase of distributed energy resources (DERs) and new market disruptive dynamics create a challenge for DSOs. Finally, increased 'digitalization' levels expose the networks to ever more cyber threats. All new challenges represent an opportunity to make the Distribution System Operators' infrastructure ever more flexible.

Any single one, or a combination of the previously mentioned challenges put at risk the reliability, adaptation and flexibility of power grids, causing less confidence or, at least, delays in decarbonization and electrification process of the heat and transportation sectors. Moreover, any effect on the grid has consequences on the supply of other essential services which increasingly rely on electricity (healthcare, telecom, water…).

The adoption of an integrated approach to prevent and manage risks is the key for a comprehensive power system concept that is '*resilient by design*', including technical, policy and regulatory dimensions. More specifically, this integrated approach should address the four elements listed below, and each of them needs to be analyzed and endorsed by relevant stakeholders, requiring specific guidelines and public and private partnership with the highest level of engagement from users and citizens, taking into account the diversity of geographical, cultural and institutional contexts.

1. <u>Stakeholder engagement, enhancing customer adaptability</u>

Planning for, and responding to, an event of high magnitude requires coordination and collaboration at the EU, national, regional and local levels to address the breadth and inter-related nature of potential impacts.

The ability to prevent or reduce the severity of such power outages and to expedite restoration when outages do occur is a "call to action" for all. Each day that a power outage is prevented or its duration reduced translates into substantial benefits across society and economy.

An effective approach to face "resilience enhancement" should consider four phases:

1. <u>Risk prevention</u>: actions and procedures to reduce the likelihood of any negative impact event and/or to minimize its collateral effects

2. Readiness: actions to increase the level of knowledge and the capability of forecasting and monitoring the grid in ordinary and extraordinary weather conditions, even in cooperation with other utilities and in conjunction with the appropriate local/state agencies. In this phase, it is important to assess the potential impact in advance including the collection of customer inputs on their level of awareness and adaptability.

3. Response: planning, execution and communication of on-field activities. Interaction with the citizens and, more in general, attention to the customer are crucial and make the difference in the reaction and effectiveness of the response phase.

4. Recovery: phase in which to bring back promptly the electricity system to an acceptable level of security. It includes ex-post event analysis in order to implement further improvement actions for the future.

For each of these phases it is required to identify relevant stakeholders and partners to create a common culture. With this purpose in mind, it is necessary to have an open and transparently shared information flow, also to allow the promotion and deployment of best practices within the sector as well as cross-sector regarding design, processes, emergency management also involving third party experts eventually.

## 2. Policies to promote resilience

DSOs should cooperate with stakeholders to develop resilience roadmaps to optimize deployment efforts, defining near, medium, and long-term strategic steps to adapt grid use and to incorporate regional and cross-sector planning efforts. With this aim, policy makers (from European to local authorities) and regulators should drive DSOs to develop climate-adaptation plans that protect and upgrade their extensive and capital intensive infrastructures through multi-year investment plans. Moreover, they should cooperate with utilities and help them to address cost-effective investments in resilience through adequate regulatory schemes and comprehensive cost-benefit analyses. Such analyses should include considerations of the potential impacts of any kind of extreme event or combination of events, as well as the ways in which such impacts could translate into potential costs to society, and should address all phases that can benefit from an increase in resilience, from risk prevention to response to the event.

Finally, it is worth to remind that regulators should take advantage of innovative mechanisms to encourage the transition of regulations to address transformations in the distribution systems, trough experimentation and forward thinking.

3. Implementation and management of cost-effective technology solutions

Technology and/or deployment options applied to networks, including changes in design, construction guidelines, maintenance, routines, inspection procedures, and recovery practices can significantly reduce the impacts from extreme events and reduce the costs to society from this type of events. These applications can be looked upon as simple and straightforward but can also be enhanced, reinforced and better addressed in many cases by the integration of innovative technologies. Some examples are the vegetation management and tree trimming, the installation of distribution lines underground, structural reinforcement, the overhaul of critical bare conductors in overhead cables using hydrophobic coatings, the change in design of poles and lines configuration, and the optimization of flexibility and redundancy of the network to allow new ways of reconnecting the customers affected by an outage.

Hardening the distribution system for resilience will include the use of innovative technologies such as Remote Monitoring & Control and Dynamic Circuit Reconfiguration that offer the opportunity to combine advances in information technology, communications, and sensors with innovations in restoration practices. Maintaining and managing a reliable and resilient grid distribution system requires the increase in Active Network Management based on smart grids, smart metering and taking into account the availability of new flexibility resources.

These technologies require an increasing number of smart sensors in the grid that allow for both improved flexibility and increased automation. Moreover, they are needed to deliver effective communication, to improve customer interface, to support information sharing and elaboration, ex-post analysis, data management process and procedures and to guarantee traceability of events, data and facts.

However, such an increase in levels of automation and of integration with the communication infrastructure can enhance the risk of cyberattacks, thus potentially leaving the grid more vulnerable. Therefore, more robust network system and security management protocols together with cybersecurity technologies and tools are necessary to identify the types of security faults and to meet the evolving threats from cyber actions against digitalized components of the system.

### 3) Customer Engagement by Design

*Centrality of customers in the energy transition has a relevant impact on the evolution of DSO models. DSOs shall be able to foster the energy transition, while tackling affordability, more flexibility and simplicity, and evolutionary customer behaviors and expectations.*

Full customer engagement is the key to fulfill the energy transition and realize its socio-economic value.

Customers' behavior and expectations are evolving, driven by new technologies, market, societal and environmental stimuli. Everyday life has moved from a state of stability to one of rapid change. Customers are increasingly used to real-time servicing and interactions, and become more demanding on quality, simplicity, transparency and choice.

Digitalization, decentralization and electrification – drivers of the energy transition – rely on the introduction of new technologies up to the edge of the network and at customers' premises, as in the case of smart meters. They also enable new services and business models where customers play an active role and engage more with energy, as in the case of flexibility services.

In this context, the relationship between DSOs and customers becomes closer, their interaction more frequent, and the need to develop broader awareness and take customers' priorities into account is compelling.

*Thus, the DSO model shall evolve from being an operator to acting as integrator: in this role, DSOs should promote the definition of a shared vision, and support its realization, through an early, inclusive and empathetic engagement of customers in the design, development and assessment of new initiatives.*

*The new "engagement by design" approach will pursue empathy with customers, citizens and communities, allow real experience of benefits beyond theory, and ensure excellence and evidence through the most advanced techniques in the field of design, data science, analysis and communication.*

When defining a shared vision, DSOs should pursue empathy, through design thinking and anthropological analysis: this will allow to include customers', citizens' and communities' inputs, and developing human-centered systems. Insights about people's perceptions and needs should differentiate between customers (those who pay), primary users (those who benefit and directly use electricity/new services), and secondary users (those who benefit indirectly, ex: neighbors, community, citizens).

When interacting with customers, DSOs should pursue excellence fully leveraging the variety of real-time digital channels available; sentiment analysis tools will allow capturing the underlying needs and sentiments of the communities where they operate; collaborative networks and open data platforms will support transparency and access to information.

When delivering the vision, DSOs should offer customers the possibility to experience and participate: hands-on prototyping directly with customers, users and stakeholders will make them realize visual and tangible manifestations of ideas. Prototyping can happen both through low-fidelity methods through workshops and expand to full living labs where a neighborhood or a city becomes an open platform for people to co-create, experiment and learn from each other.

When measuring impact, DSOs should be ready to use data science and artificial intelligence (AI) to measure KPIs and show evidence of the created societal value.

*This new approach will provide at least three key benefits related to understanding, acceptance and awareness.*

In terms of understanding, people understand value more concretely when they can directly experience it; as for acceptance, people will be more likely to adopt innovative products and services, when they feel ownership of the ideas and have been a part of the design process, thus their perspectives have been included. This will also mitigate the risk of disengagement and societal resistance, due to misalignment, either real or perceived, between the values carried by new technologies, systems, or services, and stakeholders' priorities. Finally, the approach will result in increased and broader awareness regarding electricity uses, efficiency and new opportunities arising from the energy transition, which in turn will boost the capability to unlock the value of the energy transition to society and industry.

**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 added value for the industry, for our customers, and for society altogether. 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.

*Grid Edge Transformation through Flexibility*

In order to enable the grid edge transformation, to facilitate the integration of decentralized actors and solutions at local level, regulatory flexibility and responsiveness (dynamic regulation) are needed. This includes regulatory sandboxes as a level-playing field for larger-scale pilots with flexible timeframes (2+ years) and an independent review of sandbox outcomes (broad stakeholder involvement).

Local grid regulation and operation schemes with local tarification are equally important. Moreover, flexibility is enabled through service provider incentivation schemes. The Stakeholder Council members provided several examples, among others from New Zealand, Germany and Austria. To achieve a well-functioning flexibility market, liberalized pricing is needed – consisting of a global market price signal, a regional system charge in combination with individual home automation. The role of DSOs was described by Stakeholder Council members to be that of integrated solution providers. Those solutions are optimized through the cooperation of grid operators with larger service providers.

*Innovative Resilience*

In order to cope with adverse weather events, that occur more frequently and more intensely, and with new, disruptive market dynamics and large-scale events, that can cause extraordinary demand peaks, thereby amplifying consequences in a low-resilient network, an integrated approach to resilience is needed. This integrated approach is key for a power system that is 'resilient by design' and includes four elements:

1) <u>Stakeholder engagement, enhancing customer adaptability:</u>

   Planning for and responding to adverse events requires coordination and collaboration at the EU, national, regional and local levels. Enhancing resilience considers four phases: a) risk prevention; b) readiness; c) response; and d) recovery.

2) Policies to promote resilience

DSOs should cooperate with stakeholders to develop resilience roadmaps that optimize deployment efforts, defining near-, medium-, and long-term strategic steps to adapt grid use and incorporate regional and cross-sector planning efforts. Regulators must drive DSOs to develop these climate adaptation plans through appropriate regulatory schemes and measures.

3) Implementation and management of cost-effective technology solutions

This includes changes in design, construction guidelines, maintenance, routines, inspection procedures and recovery practices for the networks. Hardening the distribution grid includes technologies such as dynamic circuit reconfiguration, remote monitoring and control.

Smart grids are key enablers of system resilience. Active network management must be promoted and appropriately remunerated. Effective communication and digitalization of the grid and customer interface are key.

*Customer Engagement by Design*

In order for DSOs to engage their customers, they need to define a shared vision, build this vision and deliver it. More concretely, defining a shared vision means that DSOs must focus on clean energy, affordability, universal access, reliability and understanding new customer needs.

To build the shared vision, understanding, communication and perception play a key role. Field experiments and living labs that allow customers to experiment and learn from different choices help in this regard. Moreover, open platforms to foster co-innovation and co-creation are needed while data science and AI measure the effectiveness of new actions. Also, the involvement of policy makers and influencers is needed in open ideation and prototyping processes. Furthermore, emotional analysis and information from social networks capture customers' feelings and perceptions which the DSO can learn from.

To deliver the shared vision, technology works as an enabler and DSOs work as custodians of data. Members of the Stakeholder and Innovation Council suggested that a long-term plan was needed that involves European DSOs, consumers and rule makers.

## Members of the E.DSO Stakeholder and Innovation Council

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|  | **Dan Delurey**: Founder of the US Association for Demand Response & Smart Grid. Accredited Delegation Head for the COP Series of UN Meetings on Climate Change. Helped develop much of the US policy regarding demand response and smart grid. Co-author of the blog "Update on DR, DER, and rid Developments" |
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|  | **Philip Lewis**: Expert in customer centric behavioral, competitive and smart issues. Former member of the WEF Global Agenda Council on the Future of Electricity. Co-founder and board member of the Smart Energy Demand Coalition. Named among top 40 most influential people in Smart Grid 2014. Author of the World Energy Retail Market Rankings |
|  | **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. |
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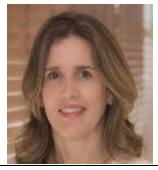
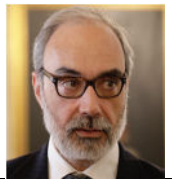
|  | **Joisa Saraiva:** Professor of economics, Director of the Center for Regulation and Infrastructure, Fundação Getulio Vargas. Formerly: Commissioner for the National Electricity Regulator in Brazil, ANEEL. Member of the Global Future Council on Energy of the World |
|  | **Jorge Vasconcelos:** Currently 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 |

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