International Conference on Electricity Distribution

CIRED Working Group 2018-2

Final Report

# DIGITAL DSO

**NEW OPPORTUNITIES AND CHALLENGES TO IMPROVE CUSTOMERS RELATIONSHIP AND TO INCREASE THEIR PARTICIPATION THE DISTRIBUTION SYSTEM**

**CIRED Working Group**

**March, 2020**


**Working Group**

# Final Report

# Digital DSO:

# NEW OPPORTUNITIES AND CHALLENGES TO IMPROVE CUSTOMERS RELATIONSHIP AND TO INCREASE THEIR PARTICIPATION IN THE DISTRIBUTION SYSTEM



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# EXECUTIVE SUMMARY

For the CIRED 2020 Workshop, a work group was commissioned to ascertain what topology of challenges the DSOs are facing on the topic of data management and engagement with the constituting Stakeholders that belong to the numerous existing services within the Grid.

As a central figure in the energy value chain the Consumer holds an important role, but with the access to energy being seen as a basic commodity among many of the energy *players* a direct relationship with the consumer isn't a focal point for the interactions that belonged to a typical DSO. But with advent of the digital revolution and with services being ever more pressured to respond in a timely manner DSOs have recently adapted to this new environment by generating a more customer-centric strategy.

This report presents some detail for how the framework of a Digital DSO can be described: In chapter 2, the challenge of new energy trends as decentralization and digitalization are presented; in chapter 3 the regulatory and legal framework that impact the DSOs business model are characterized; in chapter 4 information management layers are the focus point; and in chapter 5 technology as an enabler for new services.

As in any market the underlying challenges that are present can be seen as new opportunities to be tackled giving way to new solutions, services and new means of operating the system. This paves the way for new market roles to take a foot in the existing system and drive new market opportunities that can push the boundaries of services and system capabilities.

Chapter 6 presents examples of new solutions that are currently being explored by DSOs to overcome or bridge the gap for new market services or energy needs to be viable, these use-cases enable the reader to better grasp what is currently the status quo of the DSOs roadmap:

Table 1 – Use-cases

| Use Case Number | Name | Responsibility |
|---|---|---|
| UC01 | Third Parties Open Platform | Enedis |
| UC02 | Smart Charging Initiative | Enedis |
| UC03 | Flexibility Coordination in Active Distribution Grid Cells | Netze BW GmbH / University of Stuttgart |
| UC04 | Open Data Platform | EDP Distribuição |
| UC05 | EDP Distribuição Digital | EDP Distribuição |
| UC06 | Smart Grid Infrastructure Information | Enedis |
| UC07 | Renewable Energy Generation Signal | Enedis |
| UC08 | Grid & Market Hub | EDP Distribuição |
| UC09 | Digitalization of connection process - e-forms | Elektro Ljubljana |
| UC10 | Common energy data hub | Elektro Ljubljana |
| UC11 | Client Account Chatbot | Enedis |
| UC12 | Grid Observability to enable Flexibility | Iberdola |
| UC13 | Digital Project Management | e-distribuizione |

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# ACRONYMS

| | |
|---|---|
| AI | Artificial Intelligence |
| AR | Augmented Reality |
| B2B | Business to Business |
| B2C | Business to Consumer |
| CX | Customer Experience |
| CSIRT | Computer Security Incident Response Team |
| CEP | Clean Energy Package |
| DER | Distributed Energy Resources |
| DSO | Distribution System Operator(s) |
| DTC | Distribution Transformer Controller |
| EED | Energy Efficiency Directive |
| ESCO | Energy Service Company(s) |
| EV | Electric Vehicle(s) |
| FCR | Frequency Containment Reserve |
| GDPR | General Data Protection Regulation |
| HV | High Voltage |
| IoT | Internet of Things |
| IT | Information Technology |
| LV | Low Voltage |
| NIS | Network and Information Security |
| MV | Medium Voltage |
| OLTC | On-Load Tap Changer |
| OT | Operational Technology |
| PV | Photovoltaic |
| PQ | Power Quality |
| QoS | Quality of Service |
| RES | Renewable Energy Sources |
| SG | Smart Grid |
| TSO | Transmission System Operator |
| UC | Use Cases |
| VR | Virtual Reality |
| WG | Working Group |

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# 1. OBJECTIVES

To meet the Clean Energy Package (CEP) objectives and the society desire for clean energy and more sustainability, the use of Renewable Energy Sources (RES) is expected to strongly increase in the coming years. Nowadays, these renewable resources are mainly Distributed Energy Resources (DER) whose production is hard to predict (mainly wind and solar power).

The integration of these resources, at a cost deemed reasonable by all parties involved, will raise questions pertaining to grid topology and planning methodologies. Finding a good answer to these questions is the key to reduce investments, to replace by other type of assets (e.g. ICT) and lower the cost of the Energy Transition for all stakeholders: producers, network operators and customers.

The Tallinn e-Energy declaration[1] issued on 20th of September 2017 emphasizes the need to "[recognizing] the vast potential of digital solutions in the energy sector and the need for better cooperation across all sectors for delivering on our common energy and environmental objectives".

Smart Grids (SG) will then play a key role in this new paradigm enhancing the integration of renewable resources and giving Distribution system operators (DSOs) a better observability of their networks, particularly at LV level while challenging DSO to evolve the way they manage their network.

To get this necessary network observability, DSOs are rolling out Smart Meters and deploying sensors at different voltage levels. This will give DSOs access to an unmatched wealth of information on their grid, which will in turn enable them to provide more gradual information to their customers and to market players, and to better integrate flexibilities into their networks.

This network digitalisation will increase the capability to respond to emerging challenges of the energy sector (DER integration, increase of energy efficiency , higher regulatory pressure – CAPEX and OPEX optimization, higher expected quality of service, new ways of stakeholders' participation, etc.) and foster a higher level of engagement of customers.

Hence DSOs roles are evolving: besides being a market facilitator ensuring an efficient integration of distributed resources, DSOs are becoming data managers by collecting and providing data to 3rd party entities in a transparent and non-discriminatory way, fostering the emergence of new products and services by market players. As data managers DSOs will help customers to better manage their energy consumption ("neutral energy adviser"). Additionally, DSOs are evolving to a more proactive

[1] Signed among others by EDSO, Eurelectric and CEDEC, reflecting a common DSO stance on the digitalisation of the network.

management approach by validating the flexibility provided by distributed resources contributing to lower system costs and higher levels of network reliability.

Furthermore, customers are becoming increasingly digital and have higher expectations regarding to the quality of digital interactions, looking forward to interact digitally, in a simple and transparent way, as well as to receive valuable information through new, or improved, digital channels or to interact digitally.

To meet the expectations of customers, many use-cases are being considered, some that will only be possible when the smart grid vision is fully deployed, such as the provision of new and updated information between DSOs and their customers, regarding proactive notifications of network incidents.

This digitalisation of the network will impact, now and for the years to come, all market stakeholders, namely DSOs, customers and market agents such as Suppliers, Balancing Responsible Parties, Energy Service Companies (ESCO), etc.

With the purpose of creating a consistent vision for all participants in the electricity sector and to reap full benefits of a digital SG, the present working group was created to investigate:

- How to improve customers' experience with DSOs by providing new information and developing new digital channels for interacting with them directly or through third party stakeholders?
- Which kind of information may be provided and which kind of technologies and interfaces between DSO and its stakeholders are more suitable to reap the full benefits of a digital smart grid from all participants in the power sector?
- How can emerging technologies deployed by the DSO provide new services and enhance customer engagement? Which kind of use-cases are being implemented by DSOs regarding the provision of new, transparent and valuable information to Customers?

# 2. VISION AND TRENDS FOR ELECTRICITY

Technology and innovations are disrupting forces that challenge the way traditional models of consumption and generation are seen, bringing new services (e.g. beyond the meter) that are being reshaped by three trends of our society: Decarbonisation, Decentralization and Digitalization.

The European Clean Energy Package, explained in more detail in section 3, has provided an ambitious policy framework in terms of decarbonisation targets. These efforts are the accelerators for the decentralization and digitalization of the electric power system, which will be at the heart of this transformation.

The combination of these three major trends and their simultaneity in time has fostered and accelerated the developments that each trend could trigger individually. Decarbonization brings the need for electrification and leads to increasing renewable generation, which is critical for long-term carbon reduction. On the other hand, the increase of energy decentralization, DERs and client sophistication implies an increased complexity and a significant coordination between the several stakeholders of the energy sector.

Digitalization represents the support for this increased complexity by enabling more control, automation, real-time optimization of consumption, generation and client engagement by provision of new kind of information, valued by Customers.

Distribution System Operators are at the epicentre of this digital transformation (Figure 1) that directly impacts their networks, where SG, Smart Homes, Smart Charging and Storage are key enablers for the evolution of the sector.

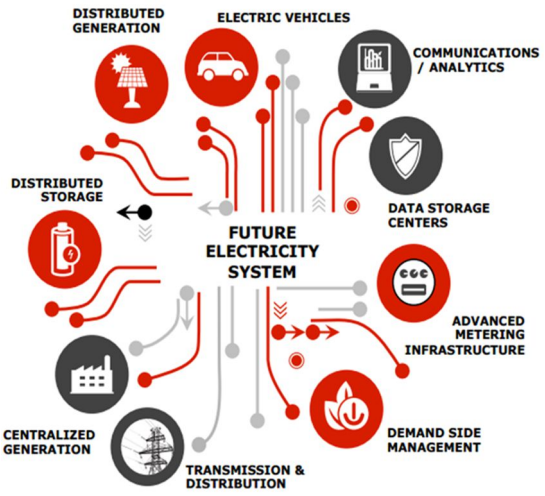



Figure 1 - The variables of the future electricity system *(Source: World Economic Forum - The Future of Electricity)*

## 2.1. DECENTRALISATION AND DIGITALISATION

The electric system value chain is evolving to a more decentralized and diversified model that will not only have an impact on networks but also on generation and downstream levels, allowing new business models to emerge and to bring new opportunities. Under this perspective, it is critical that the DSOs ensure an efficient orchestration between a more decentralized generation and a growing demand for electrical power (e.g. in a scenario of transport electrification).

In order to be prepared to address this challenge, DSOs are relying on the digitalization of Low Voltage (LV) and Medium Voltage (MV) networks. This approach gives the DSOs a higher observability of their grids, providing the necessary tools and information to optimize investment planning and grid operation.

Smart Meters are an essential component of the digitalization process for the DSOs, making it possible to access consumption data of each individual supply point, enabling a more precise and accurate management of the grid and giving valuable information for understanding more localized consumption patterns. For customers, Smart Meters represent a major shift in managing consumption patterns and tendencies, by enabling an accurate depiction of the consumption profile and therefore providing a framework to leverage new services which enable energy saving and trading. Generation and consumption forecasts constitute one of the greatest challenges for DSOs. Especially in LV networks, where the level of aggregation is the lowest, Smart Meters data will be essential to improve forecasting accuracy.

The role of the DSOs is changing. The advent of grid digitalization empowers the DSOs to not only be an asset-centric company, but through the usage of digital technologies to optimize asset management, integrate RES and improve grid efficiency. Also new devices such as Smart Meters, provide an opportunity for DSOs to be neutral facilitators among market players and reinforce the relationship with stakeholders along the value chain.

At the *Eurelectric* conference “Moving from pipes to platforms”, the digital transformation was mentioned with high expectations, expressing the emergence of the DSOs position as the contact point between the grid vision and the stakeholders: DSOs are the entity responsible for providing safe, reliable energy and data systems for the customers, with a highlight on the need to adopt an agile and proactive stance to enforce digitalization and innovation in collaboration with the regulators to build a forward-looking regulatory framework that enables investments in innovation, and consequently in the grids evolution and maintenance strategy [ENEL]. Besides, DSO are evolving towards a more customer-centric companies, with success dependent on the strategies enforced as well as an objective and well-planned solution to bring the best value for the customers [ORSTED].

With the purpose of extracting value from this needed digital transformation, it is indispensable to have an enabling infrastructure that supports the improvement of four key pillars:

1. **Observability**. Increasing the knowledge depth of all network components and the visibility at all voltage levels, especially at the LV;
2. **Connectivity**. Provided by a flexible, secure and scalable communications network to ensure that all network devices are more connected, intelligent and automated, increasing SGs ability to self-adjust to new variables at all times;
3. **Controllability**. Enabling a secure, more flexible and coordinated operation of the network based on the implementation of advanced tools and automation and considering the integration of new DERs and other emerging technologies;
4. **Resilience**. With improved self-healing capabilities and increased capacity to deal with adverse operating conditions, provided by improved monitoring, decision aid tools and integrated solutions for Work Force Management systems and control centres.

The DSOs of the future need to extend the implementation of the intelligence and control layers in an integrated and transversal way, to ensure an adequate response on these pillars, where digital platforms will empower utilities to improve reliability, availability and efficiency of the grid.

A digital grid platform acts as a facilitator for the advanced operation of SG and is typically formed by three essential layers (Figure 2):

1. **Devices**. The devices layer composed by all types of equipment, from the traditional network assets, through the distributed sensors and actuators, to the Smart Meters;
2. **Communications**. The communications layer, which, based on the various available technologies, aims to support bi-directional communication between the DSO, the network and the customers, leveraging a set of critical business solutions;
3. **Systems**. The applications layer that represent the tools that support operational and business processes, whether they are more focused on asset management, network operation or other types of services.

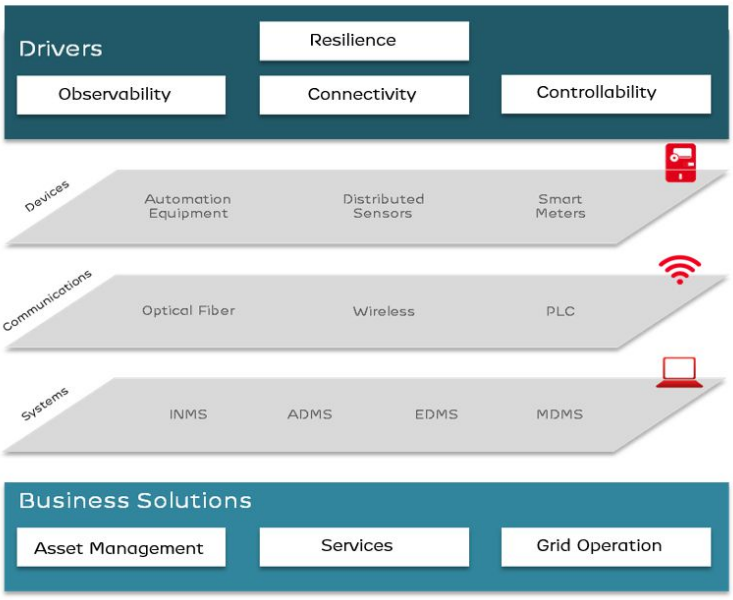



*Figure 2 - Digital grid infrastructure as an enabler for relevant business solutions*

A key aspect of the communications layer is the interoperability between different (sub-)systems, digital platforms and manufacturers, which is independent of the communication technology itself. International standards will need to be developed and adhered to, in order to achieve plug and play solutions.

All new digital grid platforms will require an IT/OT infrastructure that can support a broad set of business solutions that will be critical to the activity of DSOs. In this context, solutions such as advanced distribution management to supervise and control, and flexibility management to monitor and control of DER, will play a major role for grid operation purposes. Asset monitoring applications for optimized asset management and workforce management are some of the solutions enhanced by this infrastructure. Other solutions that enable new services and optimize interaction between utilities and its clients, by improving customer portals to provide in-depth account details or billing and settlement functionalities among others, are also becoming even more relevant in the light of an increasingly customer-centric approach.

Additionally, data management applications are becoming increasingly important, and will rely heavily on the analysis of huge volumes of data to extract value from the millions of endpoints connected to the networks. Thus, big data could become an advantage, allowing a better understanding of the grid, prosumers and business, while analytics will play a major role transforming the existent data into information for its end users. Despite all the potential that data management has for energy utilities, data-driven businesses are also exposed to new risks that must be addressed to ensure the resilient and sustainable outcome, where cybersecurity and data protection are critical areas.

Furthermore, the increase in inverter-based system components, like EV infrastructure, energy storage and solar photovoltaic, raises concerns regarding Power Quality (PQ). Monitoring systems for PQ will become more attractive for DSOs, due to decreasing hardware costs and higher performance of measurement devices. These meters produce large amounts of data, which require new data processing and management concepts. The digitalisation of the electric power system and especially the operators' backends is a mandatory requirement, to face the mentioned challenges that come along with big data.

## 2.2. NEW PRODUCTS AND SERVICES

The digitalization of the electric power system boosts the introduction of new services/products and facilitates the integration of distributed resources in the grid. Therefore, digitalization promotes a wide range of new trends, such as:

1. **Distributed micro-generation**. Installation and operation of distributed generation systems (e.g. solar Photovoltaic (PV));
2. **Energy Storage**. Installation and operation of batteries for grid services (e.g. Frequency Containment Reserve -FCR, Reserves with Automatic Activation - aFRR, balancing market or TSO/DSO congestion management[2]) at the local distribution level;
3. **Electric vehicles (EV) and infrastructure**. EV adoption and (smart)-charging infrastructure development;
4. **New products and services**. Offer of products aimed at promoting greater energy efficiency and client comfort;
5. **Demand-side management**. Promoting flexibility in resource management with increased demand response to valorise it through suppliers or third parties, on the energy market, on TSO balancing mechanisms and ancillary services, TSO congestion management mechanisms but also down the road on DSOs local congestion management mechanisms;
6. **Power Quality monitoring.** In order to guarantee PQ within normative limits and develop suitable mitigation methods, PQ monitoring will become a vital component of future power systems.

Distribution networks will be in the centre of this transformation and SGs will be connecting the future electricity system, improving reliability of supply and enhancing new products and services. These intelligent grids enable communications and bi-directional flow of energy and data between utilities and customers, working through a set of controls, automatisms and interconnected intelligent equipment, to respond rapidly to demand and generation needs.

The DSOs core duty of ensuring an efficient and reliable operation and maintenance of the system is gaining in complexity due to an increased share of renewables in the energy generation, coupled with growing numbers of EV on the road and the shifting role of consumers.

[2] Each service alone may not be enough to justify the investment but once their value is stacked, the ROI may become attractive (even though the market depth is limited).

Electrification is key to decarbonizing our economies and DSOs are central to this transition. However, DSOs must remain neutral market facilitators, and specific rules are defined to that end for DSOs involvement in storage and EV infrastructure in the CEP Electricity Directive and Regulation. Data management rules are also laid out in the Directive enforcing among others a free access for the end customers to their consumption data.

# 3. REGULATORY AND LEGAL FRAMEWORK

The European Commission has a favorable view on the contributions granted by the SG to deal with the energetic change[3]. SG allow for the development of new energy services that further develop the energy mix of European countries. Thanks to the new layers of information obtained from the SG infrastructure, DSOs will be able to extend their range of remote grid operations and will use or offer new energy services (non-firm contracts for RES integration, flexibility to defer investment or operate the network, *etc.*). These services will contribute to the reduction of greenhouse gas emissions thanks to the increase of grid efficiency, in a context of a forecasted tense (already tense for some countries) electrical resources management with an increasing number of DERs, RESs, and EVs.

The ambitious decarbonisation goals and energy security concerns are driving the adoption of new energy policies. The Clean Energy for all Europeans[4] published in 2016 by the European Commission pave the way towards carbonic neutrality of the EU in 2050 and the new directives are now being transposed into national law, by each Member State. The EU energy policy is focused on the following pillars:

- **Energy efficiency**, the new Energy performance of buildings directive (EU 2018/844) maximizes the energy saving potential of smarter and greener buildings;
- **Increasing the share of renewables to** at least 32% in 2030;
- **More rights for consumers**, with new rules facilitating the right of individuals to produce, store or sell their own energy, with more transparency on bills, and greater choice flexibility;
- **A smarter and more efficient electricity market**, promoting more flexibility, cross-border trade and regional cooperation and ensuring consumer protection, information and empowerment.

The directives from the CEP sets out general rules to facilitate consumer participation and sustain investments in flexible energy resources. The EU legislation also acknowledges the concept of renewable and citizens energy communities, providing definitions for their implementation in the EU countries. These directives are aimed to empower customers, particularly customers that are more conscious of environmental causes and have a propensity to value sustainable actions or/and that are more engaged in digital platforms and have a higher level of participation and interaction with their surroundings. Therefore, these customers are to be the main drivers in this energetic transition, turning into active players in the market with the capacity to be self-governed agents.

[3] European Commission: https://ec.europa.eu/energy/topics/markets-and-consumers/smart-grids-and-meters/overview_pt

[4] Clean energy for all Europeans, Directorate-General for Energy (European Commission), 2019.

The DSO acting as a neutral market agent has the responsibility of guaranteeing access to data/information on an easy-to-access way to customers and market players (e.g. suppliers), such as load diagrams, peak loads. This enables the consumers to engage, directly or indirectly through third parties, in new energy services, by making decisions on their consumption profiles. These decisions may also serve the purpose of being a flexibility agent that supply a service to the grid and allow the DSO to optimize the operational efficiency of managing the grid. The CEP explicitly empowers customers and third parties to develop demand side response in the Electricity Market Directive[5].

Smart Meter is a key piece of hardware for the implementation of the proposed business cases and to fulfill the directives present in the CEP, that is necessary to be installed in the customers' household. When the customer is not part of a defined rollout plan for the installation of Smart Meter then it is necessary to guarantee channels that allow the customer to request the installation of a Smart Meter from the DSO.[6]

In addition to CEP, the Energy Efficiency Directive (EED) was established to ensure the grid efficiency and flexibility. EED presents two relevant articles addressing energy digitalization and efficiency. In article 15.2 the member states are required to devise a common methodology in order to encourage network operators to reduce losses, implement cost-efficient and energy-efficient infrastructure investment programs and properly account for the energy efficiency and flexibility of the grid. Article 59.1 sets out the regulatory authority duties: monitoring and assessing the performance of the transmission system operators and distribution system operators in relation to the development of a smart grid that promotes energy efficiency and the integration of energy from renewable sources based on a limited set of indicators, and to publish a national report every two years, including some recommendations.[7]

Some countries have already started issuing legislative changes that aim to enhance Smart Grids and consequently to foster new information that customers will receive. One example is Portuguese Decree-law 610/2019[8] set by Portuguese regulator. This regulation approves the technical and functional requirements of the Smart Meters and the rules for the information and billing provision to customers and market agents.
In this context, the Portuguese DSO, EDP Distribuição, is implementing the requirements that will allow to provide a wide set of information to customers and market players.

[5] Article 15 and Article 17 of the Electricity Market Directive - DIRECTIVE (EU) 2019/944
[6] Distribuition System Operators Observatory 2018 – Overview of the electricity distribution in Europe, 2019, JRC SCIENCE FOR POLICY REPORT, Prettico, G., Flammini, M. G., Andreadou, N., Vitiello, S., Fulli, G., Masera, M.
[7] Article 59 (1)(l) of the Electricity Market Directive - DIRECTIVE (EU) 2019/944
[8] Decree-law 610/2019 published in 02th of August 2019, approves the new regulation for Smart Meter Services in Portugal

For Customers, these will bring more information by providing detailed information about consumption profiles, peak load or even information about quality of service, among others. For market players, this information will provide the opportunity to create new services for customers allowing for a more proactive engagement.

# 4. INFORMATION MANAGEMENT

Information Management plays a fundamental role in the transition which relies evermore on the implemented systems and the data generated.

Data Protection is essential and a big concern when looking at the specter of digital services that can be enabled with technological advancement, particularly since companies can be liable for the way data are used, as well as how data can be explored by external entities. To regulate this environment the Europe Union issued a regulation called General Data Protection Regulation (GDPR) that instates the rules and regulations that companies need to abide by when hosting and governing data respective to customers and sensitive commercial data. One key aspect regulated by GDPR is how important it is to correctly declare a Data Governance model, meaning that the access to data should be controlled and justified in terms of (i) party that has access, (ii) data that is accessible and (iii) period of access to the information.

As a strategic standpoint, in the next few years, the prioritization on developments of information management systems is crucial as it is the pillar that enables all other services platforms to work correctly in the digital age.

## 4.1. DSO AS A DATA MANAGER

Presently there is still a gap between the digital level adoption of DSOs and Customers. DSOs historically were more focused on operational efficiency and quality of service and are now assuming new roles such as market facilitator and data managers, fostering the promotion of new customer services provided by market players, the provision of new valuable information to customer and creating new digital channels that will simplify the relation with customers.

With the Smart Meters roll-out and the digitalisation of the network, DSOs have access to increasing volumes of data that will create value in different stakeholders. DSOs are evermore entwined in an evolving and complex ecosystem of stakeholders:

- Local authorities need energy data at a local scale to implement energy planning or accompany the energy transition. In some countries, e.g. France, concession agreements may lead to supplying specific data to local authorities;
- Suppliers, Producers, Balance Responsible Parties, Flexibility Services Providers, may use the information to optimise their participation in the energy markets;
- End consumers are keen on getting information so as to manage their energy consumptions;
- Start-ups or ESCOs will build new products or services based on their customers' data.

Consequently, DSOs are going through a necessary transition on their data policies: a shift from a "Protect data by default" approach, where the DSOs share information on

an exceptional basis, to a "Data sharing by vocation", where the DSOs shares as much as allowed by regulation to authorised stakeholders. In this spirit, Enedis was the first European DSO to open energy data in 2015 and many followed since then. To respect GDPR the shared data should be presented in an aggregated format as to avoid the identification of a an individual's behaviours.[9]

Open Data Platforms promote a transparent hub in which consumers, prosumers and any permitted stakeholder can interact, offering personalized and dedicated views for the different needs.

Sharing data with customers and third parties will lead to three gains for the ecosystem:

- Full information of data and all interactions between Customers and DSO: e.g. through DSO website, APPs or even SMS, in which Customers can visualise his load curve, his daily consumption, to ask for a service, to check the status of a complaint or to be advised that an outage is occurring at his premise;
- Higher customer empowerment: for instance by showing a consumption comparison between similar households to stimulate more sustainable behaviours;
- Enabling innovation while respecting GDPR – e.g. sharing a customer data with his consent to a third party promoting a new service. For this purpose, for instance, Enedis developed a sharing data platform (DataConnect) on which a customer validates the third parties with which he shares his data and where he can revoke his consents anytime.

DSOs need to foster this stakeholder participation by providing valuable information and positioning themselves as market facilitators but at the same time still need to adapt to increasing regulatory pressure, connect new kind of distributed resources, improve QoS achieving high standards of continuity among others.

To ensure that the stakeholders have a full grasp of the functionalities and data they have access to, DSOs must involve third parties when developing data access platform. These platforms may be specific to each type of stakeholders (third parties, suppliers, local communities, and so forth).

In this sense, DSOs have a responsibility in data management process:

1. Being an independent player must share data in a transparent and non-discriminatory way;
2. Maintaining a central position while "feeding" the ecosystem with its data;

[7]Aggregated data is a cluster of individual data, where the number of individual sites is large enough to anonymise each site. For instance, aggregated data can cover the consumption of a full community or an administrative region. Clusters are usually composed of the same customers profile (I&C, residential customers) so as to facilitate data use by third parties.

3. Value creation for the ecosystem through co-innovation.

However, it should be brought to attention that sharing data does not mean sharing all DSO data: sensitive data must be protected (privacy, commercial secret) and core-activity related data should only be shared under strictly controlled conditions.

To boost and ease the access to open data from DSOs, a platform shared by all DSOs of a same country can be implemented. Such a platform has been implemented in France: market players have a single platform that centralizes all French DSOs open data.

EDP Distribuição is also implementing an open data platform to share a set of information with different stakeholders.

Many digital technologies are available in the market but there is a need to know which of them should be used to create value not only for DSOs but also for stakeholders, providing valuable information for them and fulfilling customer expectations regarding the experience that they are demanding.

New systems and platforms, advanced models of analytics, Artificial Intelligence (AI), flexibility and advanced distribution management mechanisms, smart devices and communications or even new realities like AR/VR are only some examples of this digital wave that DSOs can embrace to reduce the gap with its stakeholders and to convert todays challenges into opportunities.

More details on the topic of data governance can be found at annex 1.

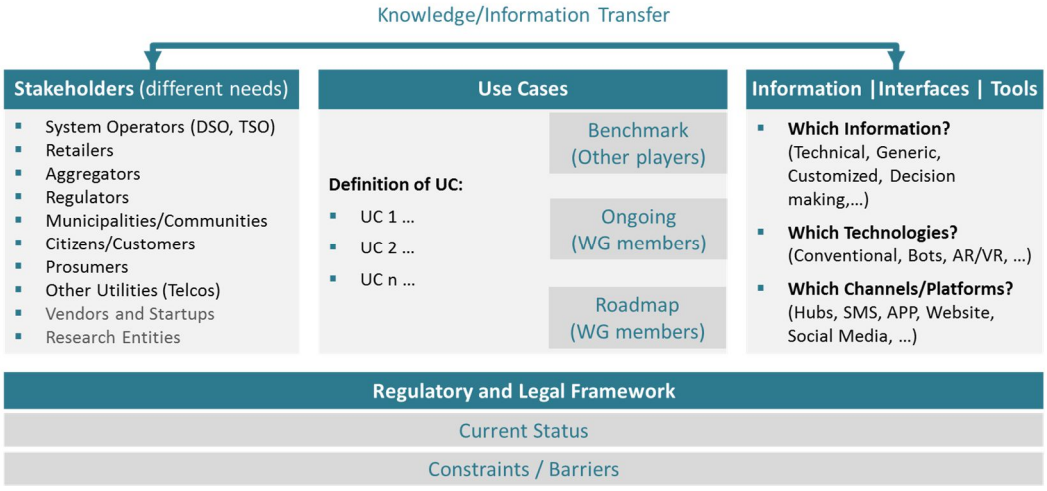



*Figure 3 - Knowledge and information transfer model*

# 5. TECHNOLOGY AS AN ENABLER

At the present the spectrum of digital technologies employed by the DSOs is already quite extensive, seeing as the assets of the grid range from High Voltage (HV) to LV and it is essential to monitor grid behaviour to guarantee the supply of energy to the customers of the grid as well as monitoring the correct functioning of the grid within the nominal parameters. This means that the DSOs manage large volumes of data. This tendency is only going to increase at it is necessary to prepare the infrastructure to process and analyse larger volumes of data with higher speeds and precision.

The future of the DSOs and the grid is digital with the advent of Prosumers, Cyber Security and distributed resource management: these disruptions require a digital transition, creating a holistic environment for all stakeholders of the grid to interact with the various services (Figure 4).

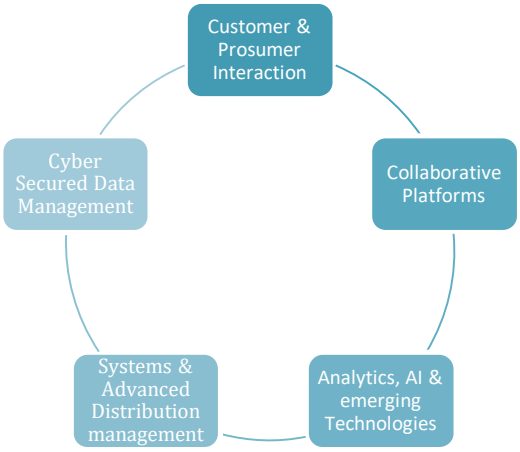



*Figure 4 - Drivers for a Digital transformation*

## 5.1. CUSTOMER & PROSUMER INTERACTION

The Smart Metering infrastructure is one of the main pillars when it comes to enabling new services for customers. The infrastructure itself is under the DSOs responsibility as in most EU countries.

With the information of Smart Meters and other DSOs sources it is possible to provide new kind of information to customers through different technologies such as as in-home display, social networks, DSOs managed apps or internet-site, regarding different use-cases such as load usage data, benchmarking of consumption with peers, high consumption alert, trouble shooting, safety tips or outage restoration data.

Additionally, many third parties need to access data for billing, for network management or to provide new services: suppliers, ESCOs, communities, aggregators and in some cases TSOs, which leads to the need of meter data orchestration via secure data platform(s).

New digital platform enables prosumers and flexibility aggregators to register available load for the DSOs to manage through local flexibility markets. This is also important to manage EV Smart Charging by optimizing charge times and flexibility.

## 5.2. COLLABORATIVE PLATFORMS

Digital platforms are key for the deployment of new energy management systems and new flexibility markets, where flexibility can be traded in a reliable way between Transmission and Distribution System Operators (TSOs and DSOs), suppliers and aggregators or in peer-to-peer schemes. These new platforms can aggregate and support the automatic negotiation of new energy flexibility services.

DSOs will have necessarily to interact or even operate some of these new platforms, considering their multiple roles in the operation of distribution systems and interaction with new actors. The following roles have been identified in [evolvDSO final report], namely:

- Customer and other third Relationship Manager, providing regulated services based on data management and provision;
- Smart Meter Operator, responsible for the roll-out, operation and maintenance of the infrastructure;
- Data Manager, responsible for collecting, storing and processing metering and network data;
- Distribution System optimizer, maximizing the efficiency of the network through proper investment and asset management and operation;
- Neutral Market Facilitator/Enabler that supports market participation of resources connected to the distribution grid. This can be done through pre-qualification and by implementing a transparent instrument to assess the grid status in concert with potential market actions;
- Flexibility Market participant, being able to mobilize flexibility resources based on the grid needs.

As neutral market facilitator, the DSO can exchange data and related services through new digital platforms. In addition of consumption and production data, the platform(s) can provide different services to consumers namely technical support related to consumption patterns and contracted power. It can also include services from third parties, such as ESCOs or data science companies for services such as self-consumption solution sizing or even consumption or production forecasts.

As market facilitator, DSO can also provide technical network data regarding flexibility needs, based on traffic light concepts or others similar information.

Regarding the implementation of flexibility services for energy and grid services, according to [USEF white paper – Flexibility Platforms] and [Ofgem's Future Insights Series Flexibility Platforms in electricity markets] different types are emerging, namely:

- Peer-to-peer platforms, which facilitate transactions between two or more parties without the need for centralised coordination or intermediary. This type of platforms will include mainly virtual energy trading, which means that it is not dependent on the electricity network infrastructure restrictions, not being able to ensure actual energy exchange between participants. However, it is unquestionable the need of network operators to validate such bids or at least to impose limits to the transactions. This type of platforms are emerging for community and microgrid services, in order to optimize self-consumption within the community and meet individual customer objectives;
- Grid service flexibility platforms, which are more complex than peer-to-peer platforms requiring robust monitoring, control and transparency. Figure 5 shows the tasks that can be integrated in this type of platforms, which include coordination of platform tasks and data flow, flexibility procurement, dispatch and control, transaction settlement, pre-qualification and payment services and finally analytics and feedback. However, they have an important role in tasks such as coordination, procurement and on pre-qualification of resources;
- Technology platform for the monitoring, control and energy management of energy systems such as Virtual Power Plants, microgrids or communities;
- TSO or DSO coordination platform, in order to coordinate the tendering, trading, activation and/or settlement of flexibility for their own purposes.


*Figure 5 - Flexibility Platforms Tasks [Ofgem].*

## 5.3. ANALYTICS, AI & EMERGING TECHNOLOGIES

The SG is composed of smart devices that provide telemetry data on the grid and the customers. This data provides relevant insights that guide day to day operations through near real-time actionable information which optimize field operations and ensure resources are correctly allocated. That way, it is possible to create new services/products that improve the stakeholders' experience.

Digital technologies such as advanced analytics, Internet of Things (IoT), augmented reality, mobile apps, distributed computing and blockchain have the potential to improve customer interface and technical support as well as network monitoring, control and operation.

Regarding customer interface, AI can help improve day to day communication for technical support, for example through chatbots. Similarly, augmented/Virtual Reality could also provide new tools for residential customer support services.

These new technologies, particularly advanced analytics (e.g. AI) provide key tools to improve the DSOs efficiency and network quality management with more effective processes for handling grid needs, and optimising action workflows. Advanced analytics has the potential to:

- Improve forecasting tools to identify generation and consumption from different technologies;
- Apply predictive maintenance for better asset management;
- Use predictive grid fault management;
- Develop fault-tolerant systems that can provide continuous and correct performance of their specified tasks in presence of failures (e.g. severe weather phenomena's).

Additionally, all of these new sources have information that can help the DSOs to understand how the customers are dealing with the services and assets provided, as well as identifying the pain points present in the customer journey to redesign and improve services.

## 5.4. SYSTEMS AND ADVANCED DISTRIBUTION MANAGEMENT

The increased uncertainty in load profiles and high number of interactions with TSOs, market platforms, communities and generation plants increase the complexity of network operation.

A new generation of distribution management tools is required in order to incorporate flexibility and resilience in network operation and planning tools. DSOs will need to improve their short-term operation planning, being able to effectively control new assets such as distributed storage, together with conventional assets such as OLTCs (On-Load Tap Charger) and capacitor banks and at the same time mobilize new flexibility services for grid support. Together with accurate forecast tools, a new generation of predictive control tools will enable a more efficient and effective control of the network.

Also, the increased complexity also requires improved observability and controllability particularly at the MV and LV networks. The large-scale integration of DERs in non-dedicated MV feeders and LV networks imposes new monitoring, protection and control strategies to maintain normal operation and ensure an effective isolation and service restoration. Together with new IoT monitoring solutions, decentralized self-healing and automatic control strategies can become more effective and benefit from data driven algorithms that can extract knowledge from the local monitoring devices.

This means the deployment of distributed intelligence downstream from the HV/MV substations to the LV consumer premises. HV/MV and MV/LV substations become intelligent nodes of distributed management and control architecture capable of

processing and integrating automatic control tools and interfacing with central control systems.

These systems benefit from new product sensors and analytics, enabling the mitigation of different constrains due to climate, unforeseen customer behaviour (PV, EV, cyber risks) or external grid events. With the evolution of the SG and an ever-connected layer the operating factor of the system will benefit greatly. This means, new functionalities, and new operation & activation, will be key criteria to empower a "real-time solution" for the grid.

## 5.5. CYBER SECURED DATA MANAGEMENT

When establishing the main pillars for a digital DSOs three critical aspects need to be taken into account:

1. Cyber Security**;**
2. Data Architecture;
3. Data openness & availability.

Cyber Security is essential, because it is important to enforce a strict policy and guidelines to protect the infrastructure from external attacks or malicious interference which can have serious consequences if breached such as a full system blackout.

In 2017, GDPR was enforced and has had a part to play in energy utilities, giving special emphasis on cybersecurity. On that same year WannaCry, a ransomware, was launched into the world affecting organizations across the EU that weren't prepared for this type of eventuality. NotPetya was a virus that affected an Ukranian nuclear plant and created a very sensitive situation for the country and government. These events raised a global awareness to how important cybersecurity is for critical infrastructures and how non-critical infrastructures can be exploited to gain access to sensitive systems.

To lessen the risks of cybersecurity failures, in 2018 the Network and Information Security (NIS) directive was sanctioned and provides a directive that represents one of the first pieces of EU-wide legislation on cybersecurity with guidelines that each individual EU country should follow:

- Each country should have a national CSIRT (Computer Security Incident Response Team), perform cyber exercises, test systems for possible weaknesses, guarantee extra protection layers on sensitive infrastructures, etc…
- Participate in cross-border collaborative exercises with other EU countries such as the EU CSIRT network, the strategic NIS cooperation group, etc…
- An oversight of critical sectors from a national standpoint.

NIS represents an opportunity for DSOs to create more resilient defences by following the framework and best practices to develop solid cybersecurity strategies provided by the NIS directive.

This way it is guaranteed that if all critical systems follow this norm the country as a whole is more robust in its defence of nationwide systems.

Grid modernization can be seen as the perfect time for energy utilities to begin designing and integrating digital security solutions into the core of their systems as well as enforcing the new framework by adapting existing mechanisms and processes from the crucial OT systems that currently exist.

# 6. USE CASES AND ROADMAP

DSOs have multiple stakeholders with different profiles, making it critical to know their needs in order to design solutions that meet their expectations.

Throughout this section real use-cases will be presented that are already in place or will be implemented by WG member entities to gather various perspectives of the electricity sector (e.g. utilities, vendors, universities, research institutes).

Main questions such as which types of information or services DSOs should provide to each stakeholder, which systems or platforms should be used as communication channels and which technologies can enable this information transfer are some of the topics that will be addressed in this chapter. To achieve that a list of use-cases, grouped in three main areas, was identified:

The Use Case areas are:

- ⇨ “Grid management” (DSO oriented);
- ⇨ “Technical-commercial information” (Customer oriented);
- ⇨ “Emerging technology” integration by DSO (several stakeholders oriented).

## 6.1. GRID MANAGEMENT

| UC01. Third Parties Open Platform (Enedis) | On-going |
|---|---|

**Scope / Description**

While working on smart grids demonstrators, it became clear that the flexibilities for the DSO uses were too intermittent and wouldn't be enough to sustain a local market by themselves. More stakeholders would be needed to develop the local flexibilities and ensure offers for the DSO when needed.

Consequently, the Third Parties (TP) Open Platform was created in order to:

- Enable stakeholders to submit flexibility offers and register flexibility needs
- Register customers that would like to offer a new flexibility (as a first step, only industrial customers are concerned by the platform)
- Display the DSO flexibility opportunities

However, this platform is **not a market place** and no exchange takes place between stakeholders. It only **works as a linking** of suppliers and customers.

The platform is being tested on Nice Metropolis area.

**Information / Functionalities**

- The embedded functionalities are all linked to the procurement of flexibilities either by a market player or a DSO (submit flexibility offers, register flexibility needs, display where the flexibility opportunities are, etc.).
- There is no commercial information on this platform since it is not a market place: the only commercial information available would the contact details in case some market players would be interested in a flexibility offer.

**Channels / Platforms / Technology**

- Open Website – generic information for the general public and opportunity to submit an unsolicited flexibility offer
- Reserved Area – specific to market players and collectivities

**Use Case Diagram**

## UC02. Smart Charging Initiative (Enedis) — On-going

### Scope / Description

This project is part of SO MEL So Connected initiative (started in January 2017). A charging station with 12 charging spots has been installed on a parking lot equipped with solar panels and a 60kWh battery. The project aims are to dynamically adjust the available capacity for a EV charging station so as to:

- Primarily avoid or lift grid constraints due to EV charging.
- Coincidentally, it may also limit connection costs by optimizing the connection capacity.

The station has then a connected capacity of 119kVA while it should have been over 250kVA in case of a full capacity connection.

The automation aggregates 5 different instructions (solar panels production, battery charging status, grid limitations, needed power input based on customers' charging choice, flexibility order transmitted by a FSP) in order to determine the power input needed for the distribution grid.

- Enedis sends a day-ahead authorized power load curve to the automation.
- In return, Enedis gets an identical or modified curve based on the automation intraday estimates.
- The next step is to get a dynamic flow to the automation with an intraday update by Enedis.

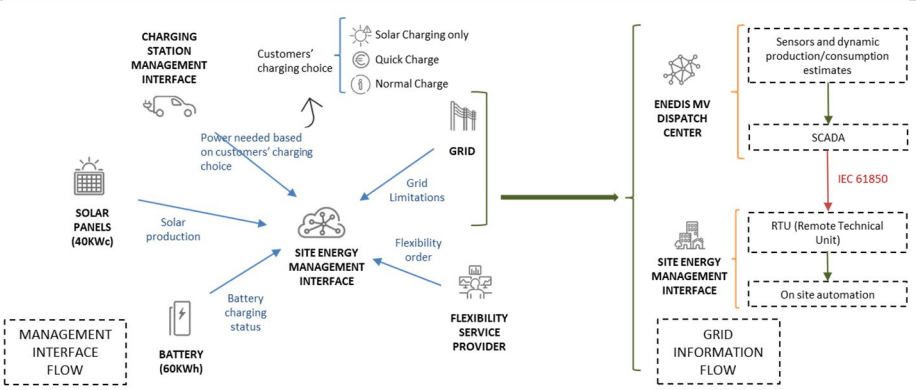
### Information / Functionalities

- Technical Information: Enedis sends a day ahead load curve that is computed based on weather forecasts and satellite imaging.

### Channels / Platforms / Technology

- The information is sent from Enedis SCADA (MV dispatch center) to the customer's RTU (Site Energy Management Interface) in accordance with IEC 61850 standard.

### Use Case Diagram



| UC03. Flexibility Coordination in Active Distribution Grid Cells (Netze BW GmbH / University of Stuttgart) | On going |
|---|---|

## Scope / Description

This cooperative research project between the German DSO Netze BW and the Institute of Power Transmission and High Voltage Technology (IEH) at the University of Stuttgart aims at estimating the current system state of a German low voltage distribution system in real time, based on measurements and historic data. Additionally, an intraday system state prediction, based on weather reports and historic data, is performed hourly. This enables an optimised operation of flexible system components (e.g. adjustable transformers, PV inverters, batteries…) regarding system stability, by providing power schedules to the distributed flexibilities.

In this project LTE and PLC are used in parallel as the communications platform. The two technologies are compared to each other regarding their usability and reliability. Measurements and calculation results are visualized on a website, where the local DSO can coordinate the usage of flexibilities and gain access to information about the current, past and future system state and power consumption/production. This platform can also be used for public relations purposes.

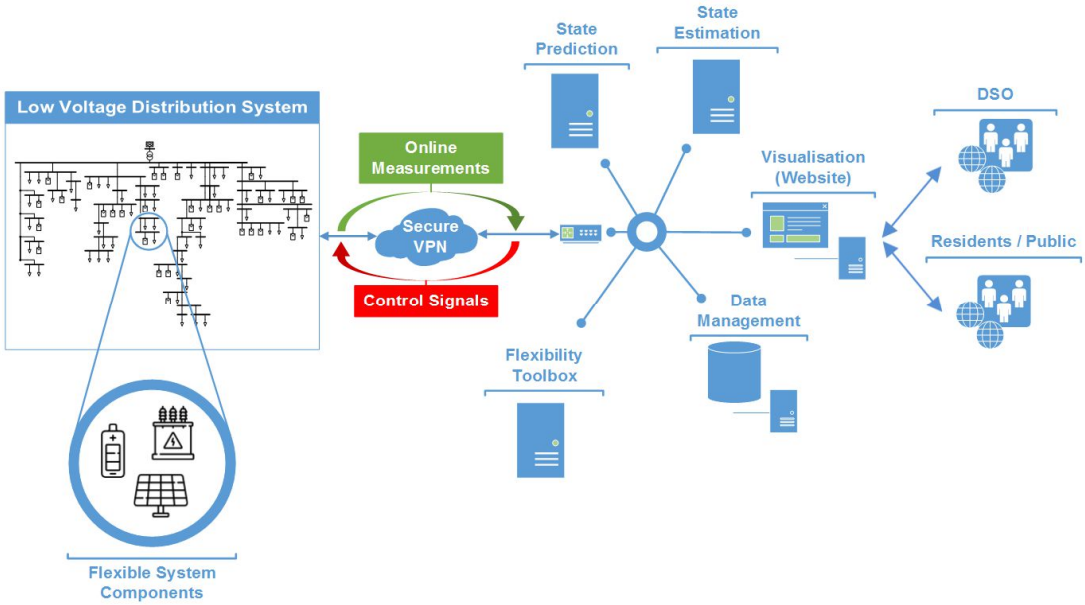
## Information / Functionalities

- High resolution measurements (1s)
- State Estimation (every 10s)
- State Prediction (15 minutes time resolution, hourly)
- Optimal operation of flexibilities regarding system stability

## Channels / Platforms / Technology

- LTE
- PLC
- Open Website for public relations
- Restricted Website for coordination of flexibilities by the DSO

## Use Case Diagram



## 6.2. TECHNICAL-COMMERCIAL INFO

| UC04. Open Data Platform (EDP Distribuição) | On-going |
|---|---|

**Scope / Description**

A digital DSO should implement a clear, simple and transparent relationship with its multiple stakeholders, providing to them the valuable data they need.

The advent of the digital DSO provides an opportunity to enable the exchange of information and data which can provide new experiences for consumers as well as fostering the creation of new services that can modernize and create value in the energy value chain. EDP Distribuição is therefore committed to creating an Open Data Platform (ODP) with the goal of providing digital services to the grid and its stakeholders.

The ODP is a platform with a well-defined governance policy (each stakeholder has a defined user policy which ensures that they only access data and information that is assigned to their role), guaranteeing this way transparency and accountability of the data usage, as stipulated in GDPR. This platform can then be made available to each stakeholder using different interfaces such as a Web Browser, a specifically defined web portal (e.g. Autarchies Portal), API's or other available protocols. This solution is made possible through a Data Lake which hold the necessary information and data for the various stakeholders:

- A Public area which holds public information about distribution network infrastructure such as technical grid quality;
- A Stakeholder area which holds stakeholder specific information and data which is stored separately, providing only information according to a previously signed declaration giving authorizing for the access and usage of the data.

This solution employs some functionalities that enable new kind of information, such as:

- Service orders' schedule
- Request for grid connections
- Outages and grid issue report

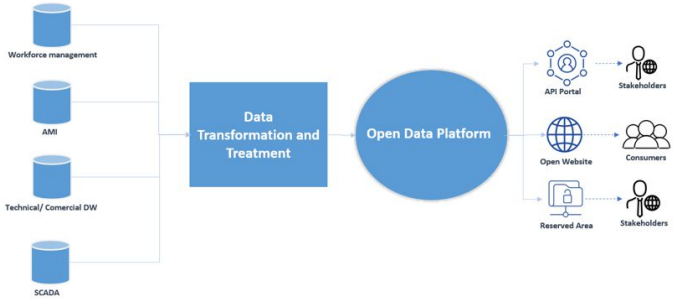
**Information / Functionalities**

- Infrastructure; Energy; Grid; Electric mobility;

**Channels / Platforms / Technology**

- Open Website
- API portal
- Reserved areas for specific stakeholders

**Use Case Diagram**




| UC05. EDP Distribuição Digital (EDP Distribuição) | On-going |
|---|---|

## Scope / Description

EDP Distribuição Digital initiative aims to ensure greater simplification, agility and speed in the organization's processes. This program includes the development of new services and functionalities that respond to the real needs of its stakeholders.

This program comprises a multi-channel approach (website, App, SMS, …) creating a digital ecosystem of interaction platforms focused on customer digital experience:

- Mobile App for Citizens, Residential customers and Municipalities with functionalities such as: report of a network anomaly (street lighting, illegal schemes, unsafe situations, …), power cut management, meter readings, field services notifications among others
- Website renewal with new forms fostering self-service (e.g. full-online network connection request)
- Creation of new reserved areas for Residential customers, Industry customers, Producers, Municipalities, Retailers and Technicians

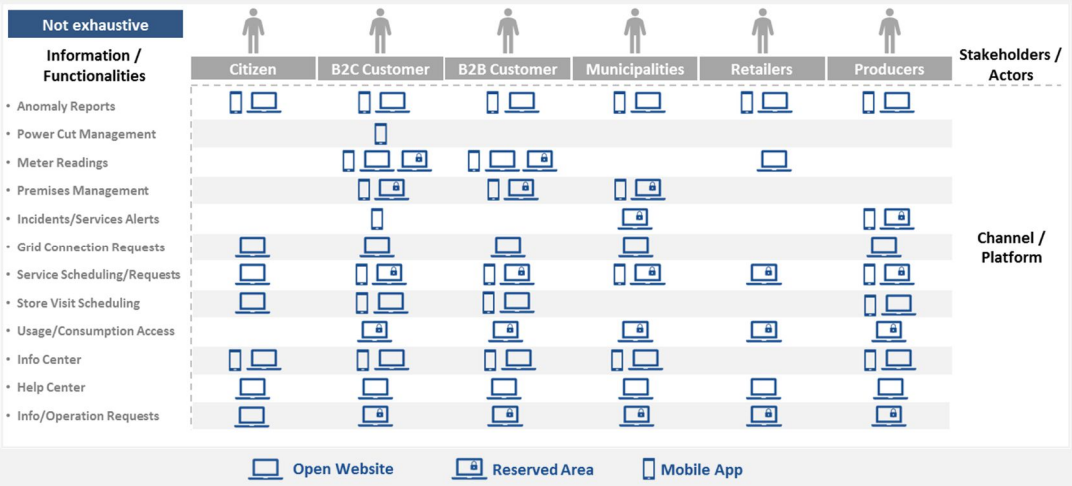
## Information / Functionalities (not exhaustive)

- Technical Information: Anomaly reports; Outage management; Incident / Services Alerts; Grid connection requests; Service orders scheduling
- Commercial Information: Meter readings; Premises management; Requests management; Store visit scheduling; Usage/consumption usage; Info center; Help center

## Channels / Platforms / Technology

- Website (open area) - providing generic information and services
- Reserved Areas – customized areas to address the specific needs of each stakeholder and to provide a full view information of all interactions with DSO
- Mobile App - designed to share transactional information (bidirectional) with residential customers, citizens and municipalities

## Use Case Diagram (not exhaustive)



## UC06. Smart Grid infrastructure information (EDP Distribuição) — On going

### Scope / Description

Under the terms of the SG regulation present in chapter 3, the Portuguese DSO has the responsibility to provide customer with a set of data/information derived from the SG infrastructure.

As such, EDP Distribuição, is implementing solutions that ensure that information is provided with quality and in an understandable and valuable way to customers, using the digital platforms (e.g. reserved areas).

For instance, consumption data, load curves and load peaks, when compared with the historical data can create consumption alerts based on the absolute difference between equivalent periods. This data can be analyzed periodically, resulting in effective information to understand the periods where it is more favorable to change behaviors. This set of new information empowers the customer to manage more efficiently their energy consumption.

Smart Meters also allows remote operations that benefit the customer (e.g. contract power change, remote activation or deactivation of energy supply). These new services make the interaction of the customer with the DSO more agile and efficient.

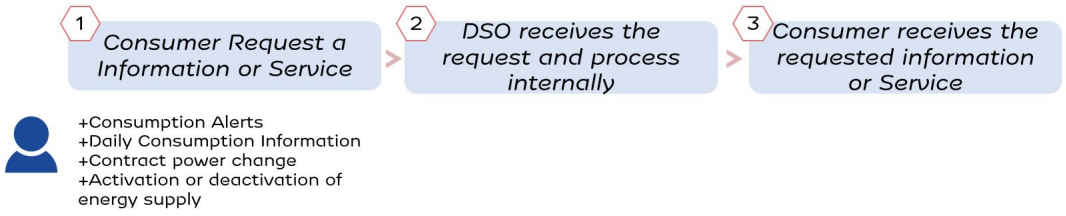
### Information / Functionalities (not exhaustive)

- Load Curve and peak load information
- Consumption alerts: comparisons with homologous period and with the previous month
- Request for temporary power reduction

### Channels / Platforms / Technology

The regulation gives several suggestions to support channels such as: meter display, digital channels (e.g. reserved areas in website), SMS or other channels that guarantee the effectiveness of the communication. EDP Distribuição will prevail digital channels with customers.

### Use Case Diagram



| UC07. RE Generation Signal (Enedis) | Under Assessment |
|---|---|

## Scope / Description

To improve its environmental policy, an industrial site in the Champagne region decided to charge its EV fleet only when local ER production is on.

The project consortium is then composed of:

- Enedis (grid signal and forecast)
- Local Industry (EV fleet and Environmental policy)
- EV management firm

Enedis objective is to send a day-ahead preemptive signal to EV management automation in case of forecasted wind turbine production. Enedis simulation cores and weather forecast data computes it with enough precision to give it with a day ahead warning.

The simulation is reenacted several times intraday to give an updated signal to the EV management automation.

The project also aims to test a V2G flexibility solution in case of grid constraints.

The project has been positively assessed by Enedis but is on hold waiting for Regional Council funds.

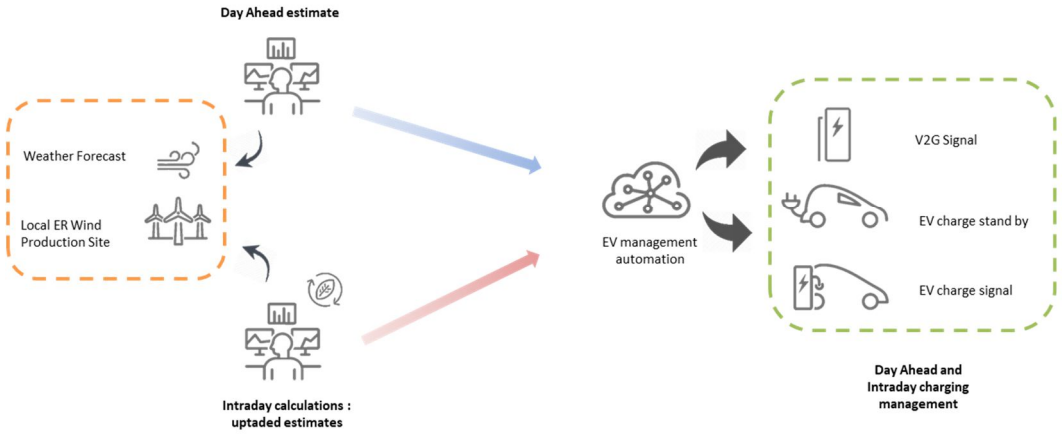
## Information / Functionalities

- Technical Information: day-ahead and intraday signals in case of forecasted wind turbine generation.

## Channels / Platforms / Technology

- The channel and technology for the signal are not yet defined (work on technical specificities still ongoing)

## Use Case Diagram



| UC08. Grid & Market Hub (EDP Distribuição) | On-going |
|---|---|

**Scope / Description**

A cloud-based grid and market hub (gm-hub) is being developed and demonstrated in the context of H2020 European project InteGrid, whose main objective is to facilitate market access allowing new business models and services while ensuring efficient and secure network operation as well as the highest standards of data security.

The solution supports the provision of services in a neutral and standardized way between customer relationship manager/neutral market facilitator (primary roles of this central platform) and stakeholders like electricity retailers, transmission system operator (TSO), aggregators, group of consumers and energy services providers (e.g., Energy Services Company - ESCo, data analytics companies).

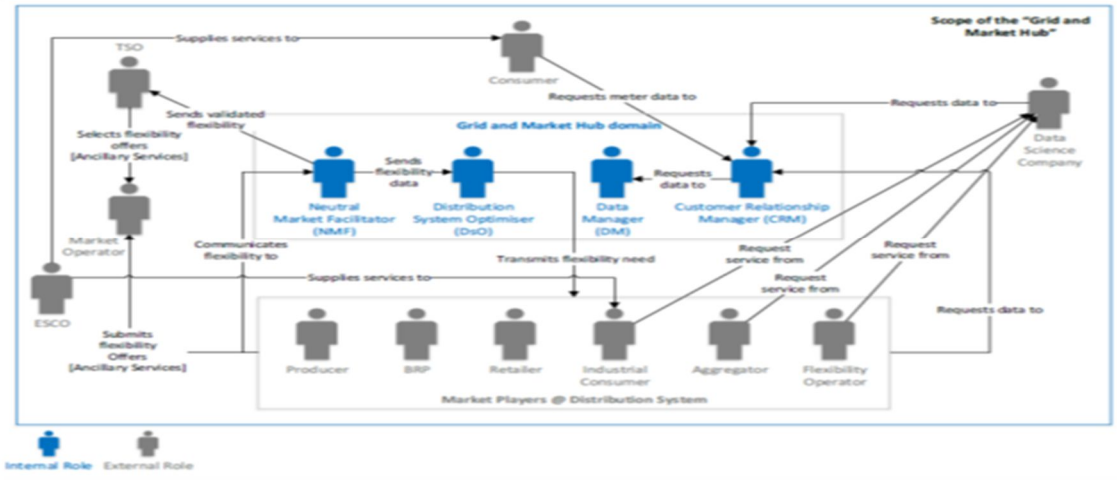
**Information / Functionalities**

- Basic functionalities are associated to the management, processing and publishing of smart meter data, concerning the different actors (see diagram).
- gm-hub provides a set of advanced services for different actors: Traffic light concept; Flexibility exchange to support grid operation; Information feedback about contracted power; Alarms about high consumption patterns; Gather consumption profile; Residential Energy Resources Sizing.

**Channels / Platforms / Technology**

- The gm-hub consists in a centralized cloud-based platform with decentralized data storage that provides the integration link between the stakeholders of the project (e.g., service providers, service users) to build an integrated environment, enabling demand response, smart grid functions and storage
- The gm-hub services could either be deployed directly into the gm-hub or forwarded to third-party systems through custom REST APIs

**Use Case Diagram**



| *UC09. Digitalization of connection process - e-forms (ELEKTRO LJUBLJANA)* | On-going |
|---|---|

**Scope / Description**

Elektro Ljubljana starts to prepare and digitalize one of the main processes in life cycle of the end user. The connection process is a process which is started from the end user with the fulfilled form, send it to the Elektro Ljubljana whose connection referents evaluate the info, calculate the possibility to connect to the distribution grid and issue a connection agreement.

Elektro Ljubljana's aims are to enable the end user to fill in and send the form independently from the companies office hours, to prepare the known data for the user and to visualize the connection process for easier understanding for end user. Second aim is to collect the metadata from the e-form and prepare them to directly integrate the data in the backend system.

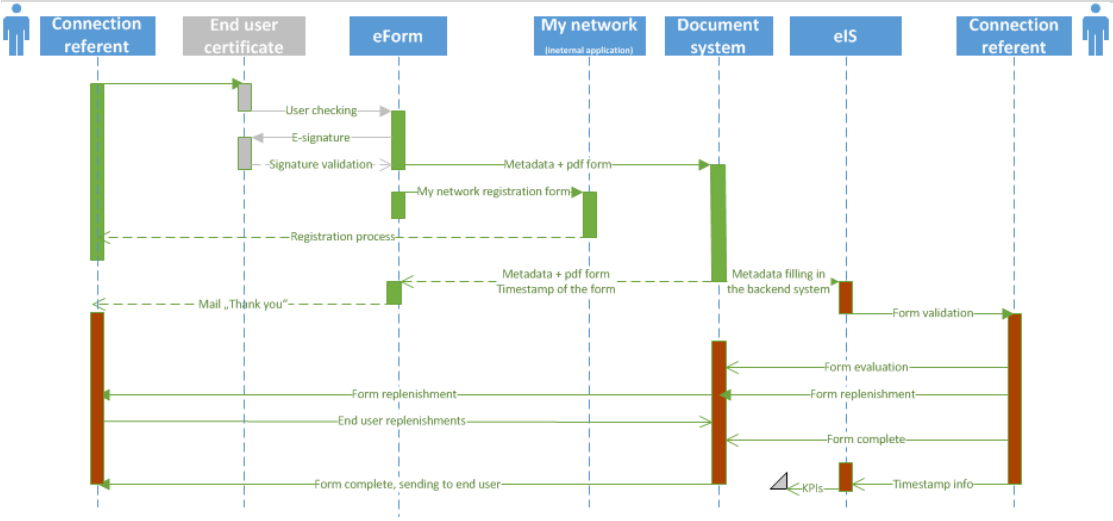
**Information / Functionalities**

- e-form will be filled with known data
- e-form could be prepared and send independently from the companies office hours
- end- user will know which step of the process is concluded in which is the next step
- Benefits for the company:
- Metadata will be collected from end user and integrated directly to backend system
- Faster issuing the connection agreements
- Less mistakes or process correction due to the form cannot be sent if all data are not fulfilled.

**Channels / Platforms / Technology**

- eFrom
- My network (internal application)

**Use Case Diagram**



| *UC10. Common energy data hub (ELEKTRO LJUBLJANA)* | **On-going** |
|---|---|

**Scope / Description**

Slovenian‘s five distribution companies established common platform for metering data exchange. Metering data are collected in five distribution metering centers which are integrated in common energy data hub. Data are visualized for end users (B2C segment) and available for exchange for distribution companies, regulatory purposes, energy service providers etc. A mobile App for end users is already established.

Slovenia currently has more than 60% of metering points equipped with smart meters (different generation), which allows remote data collection and at least other basic functionalities. Common energy data hub was also obligated by national decree. Energy hub gives end users opportunity to observe the energy usage or production from their own metering points, independently from which metering center the data collection was made.

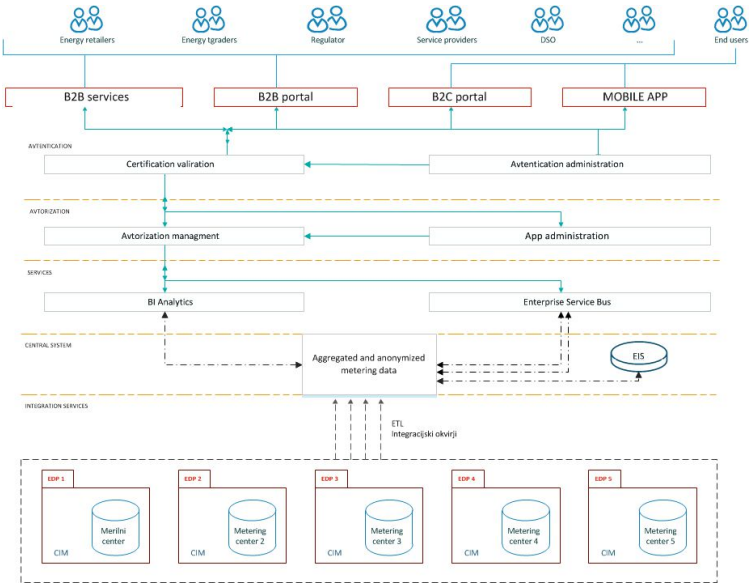
**Information / Functionalities**

- Energy data hub
- Visualization and access of SM data (B2C portal and B2C portal)

**Channels / Platforms / Technology**

- Mobile App
- B2B portal
- B2C portal
- B2B services

**Use Case Diagram**



## 6.3. EMERGING TECHNOLOGY INTEGRATION

| UC11. Client Account Chatbot (Enedis) | On going |
|---|---|

### Scope / Description

Enedis is experimenting two different chatbots on its website. The first one is used to alleviate the load of help centers for everyday needs while the second is specialized on the client account creation process.

These chatbots are not used as standalone solution as they cannot handle complex situations/questions and don't have access to specific information. They're used as a first level help platform. In both cases, it is possible for the customer to escalate to an available client adviser.

The experiments are s till ongoing and shows some promising results:

- 44% rate of "once and done answers"
- Only 14% of failed conversations with no answers (relevant or not) given to the customers.

The continuous update of the chatbots databases improves both the answers relevance and the client satisfaction.

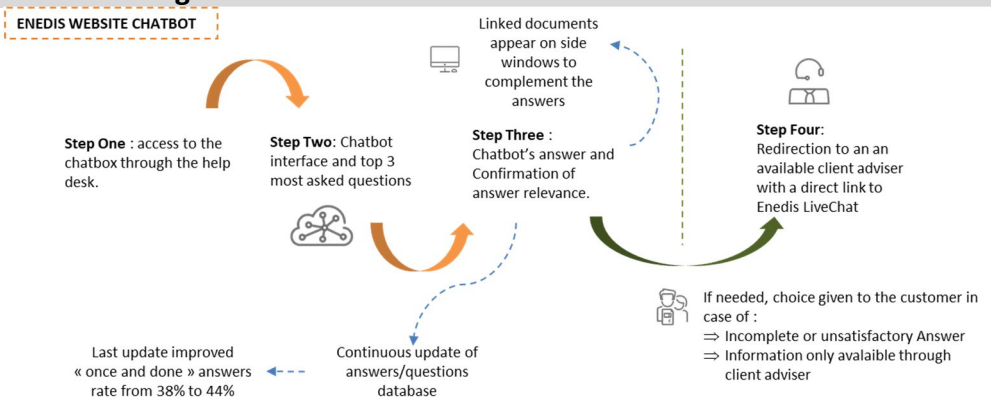
### Information / Functionalities

- The chatbot provide general information on themes usually covered by client advisers: how to react to an outage, grid connection process, etc.
- The provided answers can either be a text, a picture, a link to a relevant website or even a video.

### Channels / Platforms / Technology

- Both chatbots will be open to the general public on Enedis websites.
- Work is in progress to make the chatbots available through Enedis Facebook and Twitter accounts.

### Use Case Diagram



| UC12. Grid Observability to enable Flexibility (*IBERDROLA DISTRIBUCIÓN ELÉCTRICA S.A)* | Benchmark |
|---|---|

## Scope / Description

The UPGRID project has developed and validated solutions to enable the implementation of advanced functionalities over existing technology, to form a truly integrated intelligent system, through 4 demonstrators (Spain, Portugal, Sweden and Poland). The project has improved the observability of LV & MV grids, to anticipate technical problems associated with large scale integration of DER, bringing also end users closer to system operation and planning.

The use case focuses on the Swedish demonstrator, that makes use of data provided by both smart meters at customer premises as well as RTU at secondary substations to analyse the LV grid and raise awareness of grid status, building the basis for the future required flexibility to manage renewable generation, EVs, batteries, complex DR strategies and so on. Different data analytic strategies have been carried out to detect power quality issues in the grid, identify losses, assess the stress of transformers, monitor the unbalances or detect precisely the LV topology. Moreover, in order to be as flexible as possible, analysis have been adapted to existing infrastructure available at each segment of the grid (either meters, RTU or both of them at the same time). It's important to highlight the analysis carried out analyzing meter events, as a way of pinpointing areas of the LV grid suffering from power quality issues, that could then enable precise and detailed additional investigation activities over the affected areas.

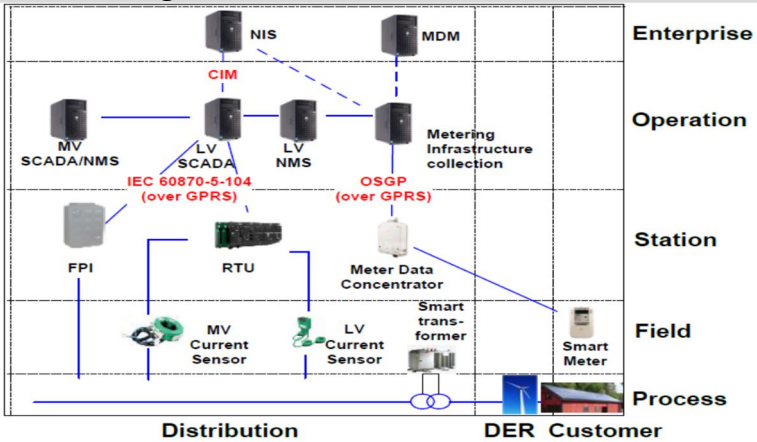
## Information / Functionalities

- Pinpointing LV grid power quality issue

## Channels / Platforms / Technology

- SCADA
- Smart meters
- RTU

## Use Case Diagram



| UC13. Digital Project Management (Support PMO e-distribuzione) | On going |
|---|---|

**Scope / Description**

CESI S.P.A have been engaged by e-distribuzione to carry out the PMO support and technical assistance in configuration, testing and delivery of the OEM module.

CESI S.P.A in order to provide support to the project management of e-distribution monitoring of **trouble-ticketing activities** (for the identification of critical issues of the devices Smart Info and MOME **), device deliveries** etc., calculates several project KPIs using a Business Intelligence tool.

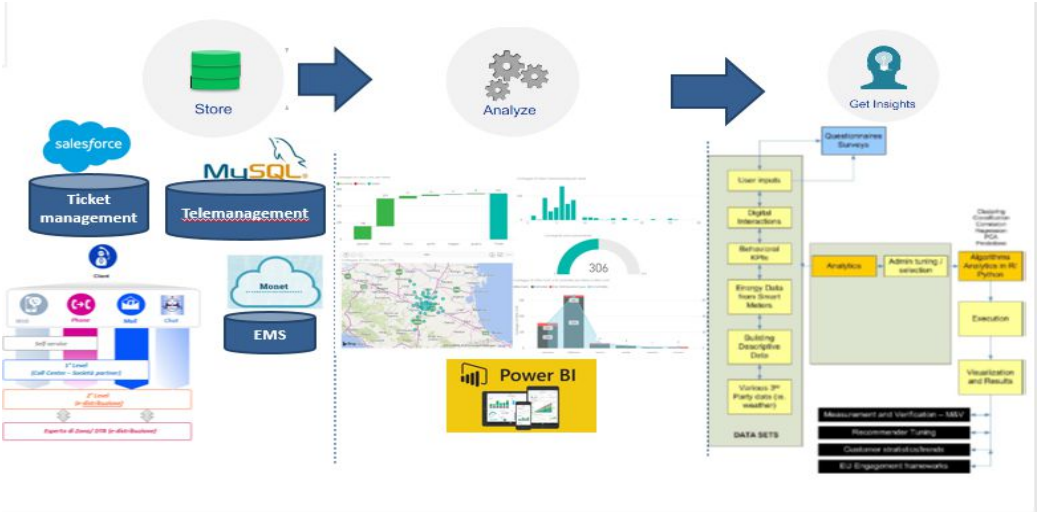
**Information / Functionalities**

- CE interface via PLC Band A on electrical socket
- Real-time diagnostics on communication with CE
- The Smart Info (not for System integrator) module provides consumption and production data via USB or WiFi (via WiFiDrive dongle device), which can be consulted by the end customer on a touchscreen display or on the **EMS (Energy Management System)** via the web/app.

**Channels / Platforms / Technology**

- Device **plug&play**
- **MOME:** module is developed and put on sale to the system integrator, companies interested in offering submetering services to end users.

**Use Case Diagram**



# 7. OUTLOOK AND FINAL REMARKS

As stated in this report, digitalisation is a necessary step to meet decarbonised and decentralised production objectives, while answering to a deep longing of customers to become more active towards energy system (self-consumption, flexibility, *etc.*). Additionally, DSO must transform themselves and interact with its customers digitally like others business do for a long time. Smart Grids are a pillar to support new challenges and enablement for a Digital DSO. As stated in chapter 6, DSOs, investigation centres and universities are focused on working on use-cases that fosters this digital transformation using new technologies and providing new products and services. Th e use-cases aspire to disrupt the status quo as we know it by:

- Integrating new technological solutions in operational processes;
- Creating new services that allow stakeholders to have a higher autonomy to integrate solutions in the market;
- Facilitating access to new pathways of energy consumption services;
- Engaging with the customers and creating a space for a more proactive interaction with the grid and household management;
- Promoting the emergence of new digital channels to foster a simpler, transparent and value-added relation with customers;
- Promoting a smart management of both DERs and RESs while keeping grid optimization in mind.

All of these use-cases show the willingness of DSOs to go further and their appetite for implementing new digital solutions able to build a more energy-efficient society for all stakeholders: from consumers' data access and provision to consumers to interaction with different stakeholders (e.g. market players, retailers, prosumers, TSO, BRP).

In terms of regulation, Europe is launching new laws that follow new energy and society trends and further establish ever more ambitious goals to ensure a focus on sustainability and on increasing the integration of more RES. One example is the CEP that sets up the new roles for the digital DSO, through its Electricity Market Regulation and Directive, by providing higher accessibility to information for consumers, prosumers and authorized third parties. By working closely with the National Regulatory Authorities (NRAs), through NRA resolutions or the CEP transposition, DSOs will ensure that all the stakeholders are given access to relevant and independent data to their roles.

In this new context, DSOs will take a central role in sharing data as a neutral market player. DSOs are indeed a trusted third party: they already warrant cyber-secured data feeds and already interact with all customers while respecting GDPR. DSOs must be agile and proactive to fulfil this new role since it is guaranteed to evolve with the new services and markets that are currently being developed.

# 8. REFERENCES ("FOOD FOR THOUGHT")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# ANNEX 1: DATA GOVERNANCE

DSOs are getting more requests from external stakeholders while coping with an increasing pressure from legal framework evolutions and regulation. Besides, as regulated entities, they are obliged to guarantee an unbiased, transparent, and rigorous treatment of each stakeholder. Creating the adequate internal procedures that ensure the information pipeline respects quality, usability and is delivered in timely manner.

To ensure a coherent answer to the stakeholders without giving away personal or sensitive information, DSOs must implement a data governance model, considering a:

- Efficiently master data management – as such minimising the risk of multiple standard or data repository within the company and ensure the data quality;
- Align data initiative with DSOs' strategy – open data set or specific information must be issued or disclosed in a coherent framework and strategy;
- Balance resources and benefits.

To be balanced and effective, this governance is based on four key pillars:

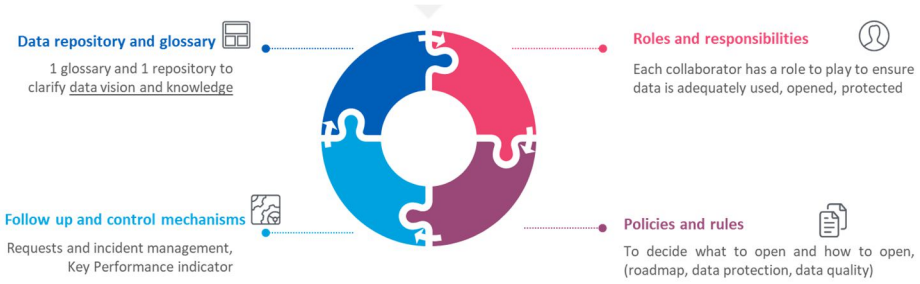


*Figure 6 - Data governance four key pillars*

## 1. Data repository and glossary

DSO is responsible for managing the grid assets and guaranteeing the normal functions of the grid and as such has an extended portfolio of Systems and Tools generating large volumes of information, which in turn are a powerful asset to DSO. To manage this information, it is important to create a data repository and glossary, with the purpose of organizing the data and normalizing it independently of the source from which it originates, e.g. SCADA, workorder management, commercial information, making it easier to access and use the information for several key use-cases.

Each domain data has an owner (cf. infra) whose consent is compulsory to publish or use the data outside the boundaries set by the internal policies and rules.

## 2. Roles and responsibilities

In the capacity of data management, it is the responsibility of the DSO to define the data governance in terms of a responsibility hierarchy, making it clear that the usage of data occurs through clearly defined guidelines and to ensure data protection:

- Who can use which data?
- Who has the authority to let people have access to which data?
- Who can decide what can be done with it (within the boundaries of the company's data policies)?

As said above, having a data domain owner makes it easier to have a coherent data use and publication.

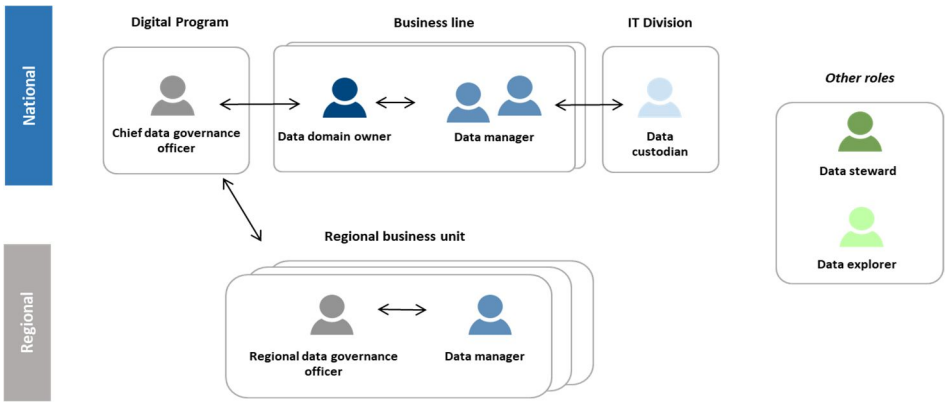


*Figure 7 - Data governance roles and responsibilities*

The different roles can be defined as follow:

- Chief data governance officer is the main facilitator of the data governance policies and is in charge to implement the needed mechanisms;
- The Data domain owner is responsible for the alignment of strategies and policies of the data of his domain;
- The Data manager has the same responsibility as the data domain owner but limited to a few data;
- The Data custodian has a "meta"-role to ensure that the IS managing the data are well defined, functional and improved when needed;
- The Data steward supports the data domain owners on their missions by taking care of the operation aspect;
- The Data Explorer tries to find new ways to valorise the data and to foster innovation using this data.

Some roles can be devolved at a regional level to give more flexibility to the local entities while ensuring that they respect the global policies.

## 3. Policies and rules

Policies and rules are keys to ensure a coherent decision making within the DSOs. It is of the utmost importance that the data domain owners are perfectly familiar with these. The main achievements of policies and rules are:

- Data provision for external needs: open data, rules to manage external requests, data sharing contract model;
- Data protection: data security rules for cloud services, critical assets identification, work on data aggregation and anonymisation;
- Data quality and internal use: data quality governance, rules to open data internally.

It also includes data risk assessment. Each data criticality must be assessed to adapt the DSOs policies about use and publishing. The assessment matrix can be specific to each DSO and the following example is the one used by Enedis (Figure 8), based on a criticality level and 9 parameters.

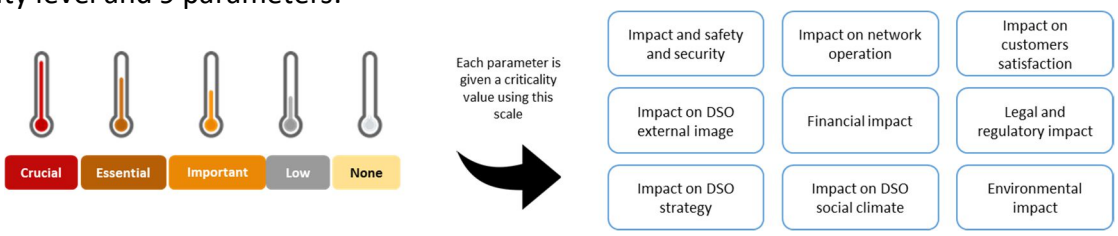


*Figure 8 - Data Risk Assessment*

## 4. Follow up and control mechanisms

Punctual controls and a latent follow up mechanism are needed to ensure that the policies are still kept up with the years.
DSOs strive to give access to the ecosystem to the full value of the DSOs data while respecting the European GDPR. DSOs must then have the following ambitions for their data:

- Data transparency as a public service and data protection – bringing DSO data to a reference level, ensuring data is published and protected and keeping on publishing open data;
- More efficiency for the distribution system to the benefit of Energy Transition – Improving network operation and maintenance, investing more efficiently, facilitating the economic development of all energy transition stakeholders and promoting clients empowerment and energy data acculturation;
- Reach efficiency, deliver time-to-market projects, offer cutting edge digital technology – valorising Smart Meters data, choosing "market standard" solutions for data processing/analysing and for data sharing.