Digitalisation in the Energy Sector - Questionnaire

CONTEXT

Within the Energy Union, three key targets and policy objectives have been established in light of the 2030 climate and energy framework of the EC: 40% cut in greenhouse gas emissions, 32% share for renewable energy and 32.5% improvement in energy efficiency.

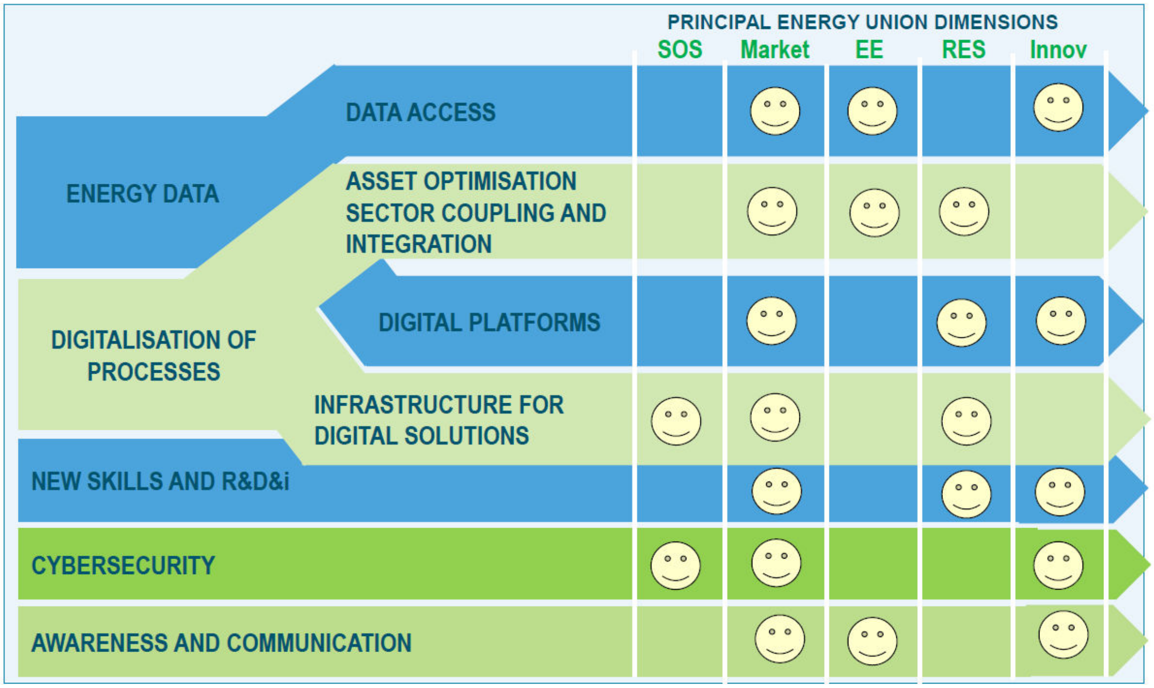
To achieve these objectives, five mutually reinforcing dimensions work together to balance the overarching energy triangle (energy security, sustainability, competitiveness) and enable the achievement of the **2030 climate and energy framework**. These dimensions are: (1) Energy security; (2) Internal energy market; (3) Energy efficiency, (4) Decarbonisation, (5) Research, innovation and competitiveness**.** The Energy Union Strategy also recognises that an innovation-driven transition to a low-carbon economy offers great opportunities for growth and jobs. This would lead to the increasing flexibility in the electricity sector, emergence of new business sectors, new business models and new job profiles. Nevertheless, the transition will also imply adjustments in some sectors, business models or job profiles.

On the other hand, the data-driven nature of the transformation of the energy sector requires understanding the interdependence with the **Digital Single Market**, to ensure access to online activities for individuals and businesses under conditions of fair competition. The relevant areas include: (1) Interoperability and related standards; (2) Horizontal legislation on data: the General Data Protection Regulation (GDPR), free flow of non-personal data (FFD), e-Privacy Regulation; and (3) Cybersecurity.

The legal basis for bridging the objectives of the Energy Union and the digital transformation of the energy sector is already present in the **Clean Energy for All Europeans package**. The Market Design Initiative introduces new provisions closely related to the digitalisation of the electricity sector. In particular, the provisions within the newly adopted Electricity Directive on demand response, dynamic prices, flexibility procurement, access to data, interoperability and data management. The Energy Performance of Buildings Directive promotes digitalisation of buildings through the establishment of a smart readiness indicator for buildings and through the introduction of requirements for the deployment of recharging infrastructure for electric vehicles. For heating and cooling, the revised Energy Efficiency Directive requires a transition to remote readable metering devices in district heat and cooling networks and in sub-metering systems within multi-apartment and multi-purpose buildings.

QUESTIONNAIRE

The figure below summarises a possible mapping of the different clusters on the digitalisation of the energy sector and the impact into the principal Energy Union dimensions.



The paragraphs below describe each of these clusters and propose relevant questions to understand better their status and impacts. Please, insert your answers under each question in the boxes below and send your contribution back to **ENER-DIGITALISATION-TASK-FORCE@ec.europa.eu** **before 15 September**. Please indicate whether you reply as individual expert or as an organisation/association; in the last case, please provide the full name and coordinates of the organisation as well as your position in such organisation.

1. Data Access

Data Access refers to the rules ensuring that data should be sourced easily, while its flows should be constrained to the lowest possible extent. Through this area, the Commission should aim at achieving a fair usage of energy data and boost innovative markets and services by ensuring competitiveness, accessibility and consumer engagement.

Questions

1. **How could the access to non-sensitive energy data be improved in order to increase the accessibility and eliminate market barriers?**

Some of the data collected and processed by DSOs in the context of their regulated activities can bring many benefits when made publicly available. As a matter of fact, not all data is

suitable for this purpose as there are important tradeoffs involved, for example data that can harm critical infrastructure or essential services, personal data or privacy-sensitive data.
Open data, which by definition should be non-sensitive, can contribute to better decision making, to sparking innovation and services and to increasing transparency across society.

The combination of private and open data delivery through standard and interoperable interfaces is providing a sound basis to increase accessibility and to eliminate market barriers alongside with open access platforms which will eliminate the cost barrier to interested parties who would have to cover large uprate costs in order to connect in areas of diminished capacity.

In any case, sensitive or not, it is important that consumers have full access and control of their energy data. The owner of the (source of the) data, e.g. smart meters, must be able to check consents before sharing the data with a third party. Therefore, consent must be given to the owner of the data source (for sharing the data) as well as to the third party (for processing the data). This way consent can be checked before sharing the data with a third party.

Because there are multiple data sources and parties involved, a set of rules and guidelines must be established to ensure that consumers can control their consent of different data sources at a single point of choice. This can be enabled by providing consent APIs and data access regulation, not only for data that grid operators have to share with the markets, but also vice versa, as data from some assets (such as storage, PV inverters, EV charging points) which is relevant from an energy system perspective need also be accessed by grid operators, in order to ensure system stability and security of supply.

2. **How could existing initiatives on interoperability standardisation [e.g. for smart appliances] be used to further data access and consumer engagement?**

The optimal level of functionality of smart meters must be the result of a thorough cost benefit analysis, bearing in mind that:
- It would be very expensive if smart meters are forced to be a hub for all electric appliances downstream. Not all customers would benefit from such a complex device.
- Cybersecurity issues arise if smart meters are forced to connect to the customer's home area network.
- Most customer data needs can be obtained from the central database where readings are stored. i.e. not optimal to use smart meter as a data server.
- Forcing customers to use smart meters as the smart home hub could be interpreted as a monopoly situation in favour of electricity companies.
- Open standards, such as PRIME, should be required in order to ensure interoperability and lower cost.

Furthermore, standardised, open and enabling interfaces, play a fundamental role in empowering consumers' participation in the electricity market, namely through better access to data and the possibility of making their flexibility available to system operators in a much more complex and multiparty environment.

Customer engagement work is also key to foster data access, especially if the customer can easily interact with his or her peers for e.g. energy trading in the meaning of having the neighbour participating in his or her own generation (as a prosumer).
Consequently, DSOs are furthering the efforts and working together with TSOs, market players and other stakeholders, as well as the industry, to come up with open, standard and future-proof interfaces that, on top of data sharing, are also contributing to the development of best practices around flexibility.

Currently the IEC are undertaking a project, TC57, to prepare international standards for power systems control equipment and systems including EMS (Energy Management Systems), SCADA (Supervisory Control And Data Acquisition), distribution automation, tele protection, and associated information exchange for real-time and non-real-time information, used in the planning, operation and maintenance of power systems.
As another example, InterConnect is a H2020 project in which the interaction between grid, users and the market is going to be enhanced.

3. **What data-driven services and related new business models can help the energy transition (e.g. combining health, mobility and energy data to trigger smart home services)?**

Generally, offering products or services that combine benefits for private customers with help to the energy transition are very desirable.
For instance, smart solutions based on digitalization such as mobility, self-consumption, home devices, green energy certificates or efficiency will help not only for economical savings and carbon emissions reduction but also for digitalisation of customers and adoption of digital channels, and finally engagement with their energy through insights.

Some products and services that will facilitate the electrification and decarbonization of the economy through digitalisation are:

- Hosting capacity: making available to users the capacity that they need to generate or consume;
- Electric vehicles: smart and flexible recharging possibilities;
- Flexible use of the heat pump;
- Battery storage;
- Demand response: to price signals as a possible source of flexibility;
- Financial sector willing to provide mortgage loans for isolating homes, but requesting energy usage data in order to verify that homes have been properly isolated (increasing the value of the real estate as well);
- Building cooperations hiring contractors for isolating real estate, also with a need to verify the results via energy usage data;
- Municipalities and the national bureau of statistics, to define and monitor KPIs related to municipalities and national tasks with respect to energy efficiency.

4. **How can fair access to data contribute to energy efficiency in buildings and consumer engagement in demand response schemes?**

Fair access provides the means for a better analysis of buildings' behaviour in several scenarios. As regards energy efficiency in buildings, the use of the heat pump will not only bring the benefit of heat decarbonization by the use of electricity, but, thanks to the remarkable energy efficiency of this technology, the global energy efficiency objectives will be more easily achieved.
Fair access will also help better forecast and assess performance when participating in flexibility services provision in demand response schemes. Price signals are needed to create the potential for increased efficiency, and better information is enabled by the deployment of smart meters.
To fulfil such activities, a wider availability of reliable information, access to private data, combined with open data are necessary to enable better knowledge and to change the customers' behaviour as well as decision-making towards more efficiency, while consumer consent is crucial when allowing third party access to personal / consumption data

However, the information for the customer is currently not there to make an informed decision. Fair access to their energy consumption / pricing in real time would allow for opportunities for them to better save money, reduce consumption and also contribute to a demand response scheme. When high usage is clearly laid out to an individual it may also prompt the desire to improve home efficiency.

5. **How can open data on meteorological conditions be used to help integration and forecasting of variable renewable energy into the electricity system?**

Open data on meteorological conditions is currently used by network operators to increase the input for renewable energy production forecast, which are subsequently used to identify possible congestion points in the grid, to make generators' bids into the market.
Open data managed by the forecast models and together with machine learning techniques will extract the maximum information from models and convert them into asset power forecast allowing an important reduction of forecast deviation, facilitating greater penetration of renewables. The next step would be to use this model at a micro generation level in order to give small scale owners the same benefits while TSOs and DSOs should use the same data sets from WSPs, only differentiating the data for geographical areas. This would enhance forecasting of the system as a whole.

However, enforcing open data access could eliminate commercial advantages that companies currently possess.

2. Digital Platforms

Digital platforms are data-driven solutions that have the potential to create new markets and services throughout the whole energy chain. Through this area, the Commission should strive to achieve (1) open markets through fair competition and market access, (2) interoperability to boost technological change and (3) consumer choice to strengthen consumer participation in the energy transition.

Questions

1. **Which digital platforms already exist in the energy sector for (i) flexibility markets (congestion management) and (ii) trading day ahead, intraday and balancing? Can they be used for selling electricity and demand side flexibility products?**

There are several platform solutions being addressed both at national and European level, some of them already in operation, but with most of them still under development in so called state-of-the-art projects, notably those under the scope of H2020 projects which are specifically addressing flexibility and the new interfaces (e.g. Integrid, Interconnect, amongst others).
While there are markets and platforms for trading and balancing, markets and platforms for congestion exist as pilots. These platforms can be used for selling electricity and demand side flexibility.

An example for digital platforms is Enerchain, a permissioned Blockchain energy trading platform used for wholesale products and for those who create new decentralised markets for highly innovative products – be it other commodities like coal and oil, PPAs, PoAs, or even other industrial products.

Also GOPACS is a Dutch pilot which could become the national flexibility aggregation platform for both Dutch distribution and transmission network operators.
There are the regular wholesale electricity markets (EPEX SPOT, ETPA, etc.) where electricity can be traded DA and ID.

Coordination and proper alignment between system operation and market functions, at different levels, will be at the core of the energy transition, thus shifting the discussion away from the platforms themselves and focusing on the interfaces between existing and future solutions. Consequently, following on from the work done together with TSOs (for example the Active System Management Report) and other stakeholders at European level, DSOs are furthering work on the subject and contributing to the development of the interoperability requirements that will be needed for the digital platforms to coexist and to contribute to the cost-effective provision of flexibility. E.DSO has established its own Task Force working on flexibility coordination mechanisms, investigating existing data and flexibility projects, TSO/DSO cooperation and the interface between the regulated and market domains. Platforms will require IT/OT infrastructures that can support a broad set of business solutions that will be critical to the activity of DSO and market entities.

2. **In order to create fair competition and access to new markets and services, how should the role of existing and new digital platforms be developed? What should be the criteria to harmonise or not those digital platforms?**

The rise of market platforms, e.g. for flexibility is a necessary step to support the energy transition by ensuring grid stability and efficiency in grid operation and create many opportunities, of commercial and public nature. To achieve this goal, DSOs are currently working on building and operating new platforms on which new markets are developed and access to information required by different players is managed, following the privacy and security practices that are established by regulation.

For any of these platforms, non-discriminatory access, interoperability, use cases, regulated and market functions, and governance models, are key factors, all together ensuring a transparent level playing field and the proper coordination mechanisms. They should contain elements of open data where security regulation allows but can go beyond this for internal use such as data-insights for asset management.

Digital platforms should be developed to avail of the same benefits seen at grid scale with a strong focus on a joint TSO/DSO coordination platform in the regulated domain interacting with platforms in the commercial domain, as TSO-DSO cooperation on system level is crucial for the energy transition and because developing individual TSO and DSO platforms will be costly, complex and event might introduce system stability risks (EG3 report chapter 8). It is also crucial to provide clarity on what functions reside in the TSO-DSO coordination platform/ regulated domain and what functions could/ should be left to the commercial domain.
Without this clarity the fundamentals of unbundling may be jeopardized, leading to a situation where TSOs and DSOs are not in control anymore of system operations (as explained in chapter 8 of the aforementioned TSO-DSO Active System Management report).

The extent to which such platforms can be used across market players or should even be harmonised should be left to the market itself. As the relevant data for such platforms is proprietary knowledge of each DSO, it is a question of trust and/or commercial terms, if DSOs are willing to share them.

The overall aim should be to stimulate their development as much as possible, but to avoid possible lock-ins for customers. It is therefore necessary to investigate some form of interoperability and compatibility standards to ensure that the potential benefits they bring are maximised on a system-wide level.

The criteria to harmonise would depend on the structure currently in place within each Member State of the EU but it would need to be underpinned by an EU standards- and legislation-based approach. However, it is less the harmonisation of the platforms than the

standardisation of their usage, which will give a significant push to access new markets. To fulfil distinct aims across Europe, the goal should not be to harmonise at the platform level, but rather to standardise the interaction between and the access to those platforms.
The key issues are around interoperability, use cases, regulated and market functions, and governance models, all together ensuring a transparent level playing field and the proper coordination mechanisms. This way, the means and rules to grant access to any platform will be public and easily available to any interested party.
As for the platforms, they should comply with these requirements and be designed to minimise entry barriers.

3. **How should we ensure that the governance of platforms facilitates data access, exchange, interoperability and ensures data sovereignty (i.e. no lock-in) for those who supply data to the platform?**

This can be achieved by ensuring good data architecture from the beginning and by making sure it aligns with ICT best practice standards.
Also technologies like blockchain can provide a solution for security, data sovereignty and protection. Through the use of cryptography (digital signatures, encryption, time-stamping), blockchain provides a fairly secure way of storing and managing information, including personal data. The element of anonymity is also added to further protect the blockchain.
Since the information should be accessible to all interested parties, the entities responsible to provide these universal services should be subject to regulations that enforce non-discriminatory behaviours and interoperability for the sake of both market development, system operation and consumers benefits.
Therefore, it is crucial that the owner/operator of platforms in the regulated domain is a party free from commercial interests which could create lock-ins for customers. His/her role will be to facilitate the digital energy market in a neutral way.

Furthermore, data platforms should be accompanied by a (continuously developing) set of rules and guidelines with the parties involved. This includes among other things agreements on:

- Standards for data exchange protocols
- Identification and authorisation requirements
- Governance
- Cost model

4. **What are the data-driven service models of the future? In order to stimulate the creation of new data-driven services, could technological innovations [such as Big Data, AI, Blockchain, Service Platform Architectures] be used to (i) manage how electricity flows, (ii) perform energy forecasting, (iii) create new remuneration/financing mechanisms, and (iv) create new ways of managing transactions (smart contracts, Blockchain)?**

All services and technology innovation mentioned below will be key in unlocking potential renewable energy solutions. But one of the biggest data-driven service models is the development of DER management systems which can be used to manage the flow of electricity.

They are in fact closely related, for example: with better energy forecasting (ii), we will be better able to manage how electricity flows (i), which can lead to new forms of remuneration (iii) for, in this case, flexibility. These services could be financially settled through new ways of managing transactions, for example a blockchain (iv).

Technological innovations will, undoubtedly, facilitate the adoption of future use cases in a more complex environment. Nevertheless, the proper rules and interfaces to provide the basis for coordination between parties are still work in progress and subject of growing interest and development.

It is advised to closely monitor the development of such technologies and incentivise their use in the R&D context. It is foreseeable that, provided the right conditions exist, DSOs will be able to utilize these technologies both for reaching their regulatory efficiency targets and for creating new benefits and offerings to their customers.
It should be assumed that the service model based on future data will first use Big Data possibilities and closely related machine learning mechanisms. Blockchain is at the end of this chain as a support for the automation of contract performance as well as ensuring security and certainty of contract performance.

5. **Which digital platforms are being developed to support sharing energy within energy communities, including for allowing them to be open to cross-border participation)?**

ENTRNCE is a platform that takes care of the administrative part of peer2peer transitions, which could form the basis of a (virtual) energy community. By using the ENTRNCE platform, customers can freely exchange energy without needing to have a contract with the same electricity supplier.

SERVO is also a platform currently being developed which among many other services will support energy sharing within communities. One of its modules will act as a DERMs system that can optimise local renewable generation and demand. In the future, the platform will be able to assist communities with trading in I-SEM that already works for cross-border participation.

However, such platforms are usually at a conceptual and design stage. In the context of energy communities, blockchain is seen as a support.
It should be remembered that blockchain technology cannot function in itself, because it is not a database with the ability to store a large amount of various data and quickly perform complex calculations.

3. Asset optimisation, sector coupling and integration

The Commission aims to establish to what extent digitalisation can accelerate to the optimisation of processes and infrastructure to further decarbonise the energy sector and integrate renewables into the energy network. This are will assess whether ICT can be of use to link energy carriers, integrate the energy sector with other sectors and/or optimise assets such as buildings and wind turbines.

Questions

1. **How can digitalisation facilitate sector coupling and sector integration? What are the existing use cases? Which digital technologies applicable to sector coupling exist in the market?**

Digitalisation is already today one of the main contributors to the decarbonisation of the energy system. Without digitalisation it would have been impossible to integrate the large amounts of wind energy and PV generation already feeding into the electricity system. The same technology which enables renewable energy integration (sensors, actors, remote access) is already available to sector coupling as well. The main barrier to sector coupling is the missing business case, not insufficient digitalisation nor other technological issues.

Therefore, DSOs believe that priority must be given to electrification as a pathway towards decarbonisation by introducing for instance (Energy) Data Exchange Framework(s) which requires standardization of relevant data and a a way of authentication, which enables combining of data from different sectors, owned by the same customer. National Government should initiate the development of national data exchange frameworks, while at the same time the focus on EU level may lay on interoperability of these frameworks, enabling a single digital EU market.

It is also important to underline that sector coupling can reduce the economic cost of the energy transition. Indeed, gas, as an example, can be an important flexibility solution for electricity. Besides the technical grid solutions, flexibility is needed both on the generation and on the demand side. In order to benefit from the storage capabilities of natural and renewable gas it is important that both sectors cooperate in order to develop integrated solutions, such as power-to-gas.

As regards existing use cases, sub-metering of appliances will allow coupling of appliances and energy services. E.g. heating services that consist of leasing a heat pump including the electricity usage. There are examples in the health industry using real time metering of energy to monitor the behaviour of clients, in order to send help in case of deviation of normal patterns.

An example of integration of different sectors is Alastria, a non-profit association that promotes the digital economy through the development of decentralised ledger technologies/blockchain.
Another existing use case may be the herd numbers info stored for dairy farms and electricity usage on the milking units. Having both at hand would allow for a better model on sizing connections and allowing farmers to see more clearly expected profits in increasing numbers based on increased variable costs.

2. **How to speed up the investment in digitalised (remotely monitored and controlled) assets, in particular in areas/sectors where this is not the priority (e.g. buildings, electricity or district heating grids in Southwest and Central Europe)?**

To speed up the investment in digitalised assets, a wise incentive or regulation scheme respectively is key to establish necessary measures in order to incentivize DSOs to make the grids more digitalized.
Also the regulatory frameworks at Member State level should be reviewed in order to enable a better framework for research and innovation at the system level and to acknowledge technical and financial efforts, required from DSOs to proactively address the challenges ahead.

A complementary driver in increasing investment is by raising awareness of projects of this nature and highlighting their results. If an asset owner becomes aware of how digitisation can result in maximising profits or performance for them, it will pique interest and potentially result in their own investment in digitalising. Asset management is a long existing function within a company or for an individual, this can result in tunnelled vision on how to best go about it. By showcasing the benefits of digitalisation, it could work towards widening the possibilities for existing assets.

It is finally essential to ensure that these drivers make economic sense; to use historical cases from other countries to verify whether it is justified. The imposition of costly measures which lead to higher consumers costs without any reward should be avoided. A secure and reliable wireless communication infrastructure is crucial in allowing assets to be remotely monitored and controlled.

One of the key developments that could be carried out in this regard is the complete secondary substation automation (up to each low voltage feeder) to get the most out of:

- Distributed solar connected to low voltage: minimize curtailments
- Charging of electric vehicles: apply smart charging measures only when really needed. (EV charging only produces issues at distribution grid level, never in transmission)
- Maximize access to the grid up to the actual maximum capacity.
- Minimize distribution company restrictions to the use of flexibility by customers (if ‘blind’, distribution companies would operate on the safe side).

3. **What are the socio-economic and regulatory preconditions for enhancing the use of digital technologies that facilitate sector coupling? For example, how could digitalisation facilitate the deployment of power-to-gas?**

A major precondition in enhancing the use of digital technologies would be the assurance of the quality of work / implementation. As these are a relatively new skillset / area for many companies there may be a level of fear of the unknown in introducing new digital technologies into the business. To alleviate some of these concerns a level of non-affiliated auditing could be introduced for companies to avail of, thus ensuring they are investing in quality work/ technology when they lack the ability to perform this themselves.

The benefits of digitalization do not have to be altered by the consideration of a whole energy system, because the difference in efficiency that has electrification versus gas-based technologies is very large.

The flexibility option brought by the coupling of the distribution grid with heat and cooling networks is increasingly dependent on digital technologies. The same applies to the coupling of the distribution grid with the gas grid which is still in an early phase of development. There is, therefore, the need for more involvement on the side of network operators and the implementation of sandboxes to study, demonstrate and evaluate the flexibility potential that can be brought by coupling the electricity distribution grids with more local energy networks.

To conclude, it should be recognised that the energy transition equals also a business transformation. As existing markets do not transform by themselves, the regulatory incentive for creating change should be significant.

4. **In order to integrate renewable and low-carbon gas into the gas network, how would connectivity and data analytics contribute to measuring and metering?**

Since the electricity sector is at a more advanced stage of development concerning the adoption of digital technologies and metering solutions, other sectors such as gas, might benefit from the good practices which have been adopted in the electricity sector.

Due to the increasing diversity of renewable gas sources, we expect an increased necessity to monitor and control gas composition and specific gas features. On the other hand, we do not expect an extremely large variation in gas composition at end consumers. Gas applications usually need a certain range of gas composition to operate reliably and safely. But, gas distribution system operators might be capable to allow a higher variation of gas infeed if equipped with monitoring capabilities in combination with installation to gas treatment to supply end consumers with a certain sort of gas.

The same overall connectivity and metering infrastructure could exist for a gas network running on low carbon or renewable gas.

5. **In order to improve consumer's energy consumption awareness, how would smart meters measuring calorific value, in addition to gas volume, contribute to more accurate billing?**

Smart meters measuring calorific value is seen as a way to prepare the gas system for the integration of new types of gases such as biogas, green gas and hydrogen. Gas systems have different calorific values and using just gas volume will not be sufficient to bill consumers accurately.

At the same time, it should be taken in account whether measuring calorific values is beneficial considering that the bandwidth of calorific value is set separately for each country. Appliances are set to these conditions and cannot handle a large variation in calorific values. It should thus be defined from which amount of consumption a variation within the calorific value bandwidth really makes a difference.

If in a future environment, gas composition at end consumers remains stable, there is no need to measure gas as calorific value, as there is a constant factor to transform a volumetric value to a calorific one.
If a future system allows higher variation of gas composition at end consumers, metering service companies would need to exchange metering devices anyway. Using this switch to new metering systems to change to calorific value in one and the same step would only cause minor costs.

Referring especially to the EG3 report chapter 8 recommendations, the architecture of the grid edge should be revised allowing smart meters, submeters, smart inverters, EV charging points, home energy management systems to be positioned in an overall architecture.

6. **How can policy instruments support the deployment of a critical mass of energy-smart appliances?**

To support deployment of energy smart devices, policy would need to ensure that poor quality products do not discourage buyers from making the investment. Banded VAT on such appliances based on the quality (energy efficiency etc.) would support the market's desire in weeding out inferior products. Standards (for instance, standard connection agreement to be enhanced with a requirement on standard ICT interface for interworking with the market and grid operators) could demand newer appliances to have some degree of smart functionality via a centralised policy approach which would allow for greater level of controllability of load for the DSO and price for the consumer.
For instance, digitalised home appliances or home energy management systems (home assistants) are already being developed by another type of industry different from the energy sector and at very competitive prices (with economies of scale).

Regulators have a role in setting or approving the charges incurred by network operators. It will be important to ensure that investments are made to maximise efficiency from a whole-system perspective, as any cost savings from the efficiencies in the current system will lower bills for consumers if they are passed on and make it attractive for businesses.

Therefore, interoperability, compatibility standards and massive deployment of smart meters across Europe for the electricity sector amongst others, is fundamental to:
- Enhance the access to data (locally and remotely) and to promote the automatic operation of the smart appliances;
- Ensure one digital network is created to increase overall system efficiencies and better information that avoid lock-ins for customers;
- Foster market parties and solution vendors to work on the development of apps and platforms which will create value on top of the information made available and to implement the services that will reward consumers for the smart and flexible use of their appliances.

As for upskilling of the workforce, it is important to keep enhancing the traditional energy and electrical engineering background with new digital skills that span across a myriad of areas such as computer and data sciences, artificial intelligence and advanced analytics, telecommunications and cybersecurity, developed and agile methodologies, etc. Those, amongst others, are of utmost importance for the research, development, integration and operation of digital services, technologies and platforms.

7. **How can smart buildings and energy-smart appliances contribute to a broader integration of RES, optimise local consumption and improve energy efficiency?**

Smart buildings and energy-smart appliances might help to integrate more distributed generation and to address local energy balancing issues.
For this to happen, coordination and interoperability is essential and system operators need to observe energy flows in their grids and interact with the flexible resources, either by technical means or through market interaction. Therefore, smart appliances shall communicate with each other, and the data they collect, both real time and historic, can be translated into (price) signals and general information to their owners.
However, if these connected smart devices are not part of the overall solution it would be impossible for anyone to match demand with renewables when available and demand response schemes could not exist at scale.

For example, smart home devices such as thermostats, lights, consumption monitoring, air conditioning controllers and plugs provide user engagement with their energy through insights, relevant information and continuous interaction. This engagement makes the users more conscious about their energy usage, helps themto reduce it, and helps them to understand the origin of the power generation (certified green energy).

Furthermore, optimisation of local consumption can also be achieved by self-consuming energy and avoiding net metering, by changing loads in accordance with system needs and by aligning the use of energy with network tariffs.
As for the efficient use of energy, it can be achieved by making extensive use of the data provided by the smart meters and by relying on new digital solutions to optimise the use of electricity and avoid wasting it.

Intelligent buildings in which smart devices are installed, i.e. those that have the ability to run programs optimizing energy consumption (also home energy storage) and acting automatically, they contribute to the optimization of consumption but also to improve energy efficiency. In terms of renewable energy integration, it can be assumed that with consumption management mechanisms supported by appropriate incentives and appropriate regulatory and legal conditions, the use of such buildings as a source of flexibility is possible. Such solutions do not have a special impact on connecting more renewable energy sources to the network.

8. **What digital solutions are available to allow for differentiation of electricity sources at charging stations for electric vehicles?**

DSOs can contribute to the deployment of sufficient public recharge infrastructure in situations where market solutions are not feasible. For this reason, DSOs should be in charge of designing and managing the smart recharging systems of electric vehicles, with the participation of other market agents that add value to the customer in this new business model and where different suppliers of energy (sources) can provide energy at one charging point at the same time (requiring clearing & settlement).

The electricity source for a charger is determined by each local network topology. If you are free to choose your own supplier at a charging station, this allows you to differentiate between electricity sources.

There are, at least, some third-party innovative solutions that are under development and test to provide blockchain-based digital green energy certificates, although not necessarily for the sourcing of electric vehicles.

4. Infrastructure for digital solutions

Digital infrastructure enables decarbonisation and further decentralisation, which can lead to more flexibility in the energy sector. Through this area, the EC should assess whether legislative action is needed to support the development of IT infrastructure for digital assets and services in the energy sector.

Questions

1. **What opportunities would a digitalised energy network bring to decentralised and/or energy communities models?**

Digitalisation is providing communities with further opportunities to engage in the energy transition by focusing themselves on energy management activities whilst contributing to the integrity of the energy system, while at the same time DSOs are working on innovative cooperation methods to address the needs of local energy communities, as they have been doing with other stakeholders.
It can allow for an optimisation of the physical assets within the community itself and then let this community exchange any possible remaining production and/or consumption needs with the rest of the energy system. This could provide more independence for them, with or without a central backbone with the rest of the energy system.

A decentralised network and energy communities would provide the opportunity to have peer-to-peer trading of energy, a reduction in network losses if generation is used locally and possible transmission constraint alleviation with less large-scale generators having to flow through it. Furthermore, with real-time data exchange of the measurements at the connection point from grid to community, each partner can control the generation/consumption contribution. This might help to prevent e.g. congestion.

On top of a digitalised energy network, collaboration will pave the way for better integration of self-consumption and exchange of energy among the members, easy access to information and more means for the communities to successfully contribute to the system as a whole.

If DSOs had a fully digitized, observable and intelligent network, this means that communities would benefit directly from energy without having to engage in the digitization process to optimize network processes. In addition, local balancing understood as balancing community needs would be possible to implement quickly and securely, with maintaining the required network parameters at the highest level.

It should also be noted that real-time energy supply, grid analysis and planning, data management and market facilitation are all functions that can be 100% digitalised, and in this way become available as a service. In that respect, grid maintenance and enhanced processes have a strong level of digitalisation.

2. **In order to enable the decarbonisation of the energy sector, how would digitalisation contribute to system/grid management assets and services?**

To enable decarbonisation with a greater penetration of RES, an improved level of vision and controllability is necessary. This can only be achieved through further digital concepts, such as virtual power plants and storage.

Also demand response services allow not only a better integration of RES but also a proper sizing and use of the network infrastructure. These services can be offered thanks to the digitalization of energy.

Thus, the availability of more and better data can be used by regulators and TSOs/DSOs to make better informed decisions which improve the efficiency and productivity of the grid assets and procedures and, at the same time, reduce risks. These are some of the key factors:

- Sensorisation: the intelligent network now can provide more data to optimize the operation and reduce risks;
- Reduction of losses (technical and non-technical) with the deployment of smart grids, where data on network flows and voltage can be analysed;
- Resilience and system reliability with the help of real-time information;
- Optimal planning and operation (demand forecast);
- Resilience against cyber-attacks;
- Good observability of the LV grid, providing clear legislative guidance on how smart meter data could be used.

However, more digitalisation in the network requires an additional investment effort, as well as maintenance, to entirely cover the networks and to ensure proper coordination with external actions so the network must be conveniently considered sustainable.

3. How to ensure that the future telecommunication infrastructure provides the type and quality of services (at a competitive/reasonable cost) that the energy transition requires?

The business model of commercial telecommunication providers (consumer and bandwidth focussed) does not match the needs of grid operators (high reliability, low/moderate bandwidth needs). A separate telecom infrastructure should support the energy system. It should be noted that a separate telecom infrastructure for the energy system does not imply that DSOs are becoming telecom providers.
One of the most effective method of quality service at low prices is best achieved via an open market where competition thrives. This will fuel innovation in order to give the customer the best experience. Another means is to ensure dedicated broadband width which is reserved for the communication of vital infrastructures such as the energy sector and its assets. This could increase security as this broadband width would be solely used by these (public) sectors. Security is crucial already and will become even more so as the energy system digitalises even further.

Simultaneously, ‘edge computing’ could contribute to the solution. Monitoring and local optimisation can be done at application level. This minimises the need to share data to central (cloud) systems and thus the required telecom capacity.

However, the main challenge is the governance and assurance model, namely taking into consideration the need for greater interdependency of telecom and energy which is crucial for the future of the energy sector, possible regulatory advances that can give support to energy backup capacity on telecoms infrastructure, fixed and wireless private networks which have an important role as the backbone for essential services, and the definition and enforcement of suitable accountability models.

4. **Given the development of new technologies such as 5G, IoT, blockchain and AI, how can consumer’s connectivity and security be ensured?**

The consumer’s connectivity and security can be protected by ensuring that each technology is properly tested, scrutinised and held to a high standard via proper security controls and standards. This would also include protection against the formation of a monopoly in which the consumer could suffer.

When it comes to connectivity of consumers, it is crucial to ensure that fast digital infrastructure is in place which guarantees access for everyone at a reasonable price and with the highest security standards possible.

Furthermore, appliances with a lifespan longer than the average lifespan of a telecom technology, e.g. smart metering, should be flexible to use different communication technologies or should have the opportunity to easily replace communication modules. Otherwise, assets become obsolete due to the fast development in the telecom industry.

5. **What digital solutions are available to allow remote management of isolated electricity systems in rural areas and/or islands?**

- Historical and real-time data can also help in the dimensioning of assets, for example storage.
- Monitoring of the functioning of the assets (and plan maintenance schedules) and their day-to-day operations and dispatch.
- Managing network islands in physical islands or remote rural areas requires balancing between load and generation and resilience to faults while respecting the network’s limitations regarding power flows. For instance, SCADA is implementing solutions based on “off-the-shelf” which has sight to an MV level of rural areas and islands. SCADA systems already exist and can be used from large networks to small ones.
- Every telecommunication technology in general.

Several European projects under the scope of the H2020 programme are contributing to the development of innovative digitalised solutions to better integrate the management of islands in the overall operation of the electric system.

5. Cybersecurity

Given that energy services are essential to the economy, and that these services are progressively subject to data-driven transformation, their cybersecurity should be ensured. Hence stressing the interaction and interdependence between energy and digital infrastructure. Through this area, the Commission should therefore ensure the security of the digitalised energy services and infrastructure, in order for consumers to make digital choices.

Questions

1. **To what extent is the Commission Recommendation on Cybersecurity1 implemented? What needs to be further considered to address the particularities of the energy sector in terms of cybersecurity, namely real-time requirements, cascading effects and the mix of technologies?**

The Commission's Recommendation on Cybersecurity has been already implemented at national level with several ongoing initiatives seeking to address the outstanding items. However, common standards for the connection and integration of DERs into the system need to be further considered to address the particularities of the energy sector.

The NIS Directive also defines and specifies requirements for the secure operation of IT, OT and SCADA systems of energy grids.

The correct and up-to-date implementation is assessed regularly (at least on a yearly base) by extensive, external audits. The comparable security level is ensured by a clear definition of requirements and a uniform certification based on the international standard ISO/IEC 27001 and ISO/IEC 27019. Constantly performed sisk analysis ensure that the current implementation is sufficient, also under consideration of often changing threats or new technologies and changing circumstances.

[1] Commission Recommendation of 3.4.2019 on cybersecurity in the energy sector, C(2019) 2400 final, https://ec.europa.eu/energy/sites/ener/files/commission_recommendation_on_cybersecurity_in_the_energy_sector_c2019_2400_final.pdf

Diverse digital assets (DERs, prosumers, smart devices and appliances, EVs, etc.) are becoming increasingly integrated with the energy system and utilities OT. Therefore, new standards of cybersecurity requirements should be established for (i) devices and systems, and ii) an adequate interconnection with the utilities' mission critical systems.
Different security requirements of OT and IT systems should lead to dedicated approaches and increased logical segmentation between both domains.

2. **How would you estimate the costs of addressing the particularities? Can you provide examples?**

Security is not a "one-off" cost but a continuous investment.
To be able to assess the costs of addressing the particularities, utilities have to perform a gap analysis, followed by a risk assessment to validate the relevance of implementing the listed measures, and only then proceed with a market analysis to establish a strategy and roadmap.
Furthermore, it shall also consider the non-negligible recurring operational costs associated with the measures, such as licensing, support and service fees.
The financial and human resources costs of addressing the particularities will always vary according to each specific measure, its application to each organizational context and dimension, and the existing combination of legacy and state-of-the-art technology.

Additionally, the costs and complexity of retrofitting cybersecurity into legacy systems can justify the investment in its replacement. For example, to fulfil the strict requirements, new employees had to be hired, existing processes had to be reconfigured, new, more secure technologies had to be implemented and the security awareness of all employees had to be raised significantly.

Given the fast-evolving threat landscape and the unpredictable, ever-increasing attack surface, it is essential that utilities carry out year-round cybersecurity risk assessments, driving dynamically the investment priorities and operational costs.

3. **How can digitalised distributed renewable power generation contribute to the resilience of the EU electricity system?**

Digitalisation of distributed renewable power generation is crucial for DSOs to better predict and manage constraints at a more distributed level and offer better solutions for DSOs to remotely and locally interact with DER. Therefore, digitalised distributed renewable power generation is necessary in order to increase their controllability against a generally unpredictable energy source. Without this they could greatly harm the electrical system's resilience.

Digitalised distributed renewable power generation thus contributes to the resilience of the EU electricity system if the DSOs implement edge computing solutions. Such solutions could support decentralised SCADA functionality which should be able to run in island mode in case of a large IT failure.

On a system level, better insights into renewable production data can lead to a more efficient use of balancing resources.

The availability of more and better data from these distributed renewable power generators (forecast and real-time) can be used by DSOs to make better-informed decisions which improve the resilience of the electricity system.

Moreover, since DSOs increasingly need to perform energy balance in real time, it is essential for them to continuously monitor energy flows. By having this capacity to interface the grid, DG and DER will also be capable to support innovative forms of flexibility and to react to cost-reflective network tariffs that consider local grid conditions by adapting their behaviours.

4. How can we ensure that digitalised distributed power generation (renewables, flexibility via e-mobility, etc.) is not a liability to the resilience of the EU electricity system?

Digitalisation must be achieved in a secure way as to not compromise system operation. It must be assured that only the system operator to which the asset is connected is able to interact with the assets and that the communication between them is encrypted. This is needed to ensure reliable operation of the system and to avoid undesirable activations that might endanger system operation.

Further to this, there is also a need to define and establish clear and adequate EU-wide cyber security policies and standards, guidelines and certificates which must ensure a minimum level of security requirements for devices and systems across the EU electricity system and proper interconnection with the utilities' mission critical systems. These standards should apply to everyone and everything equally in order to ensure a high standard of practice and accountability to protect the quality of supply of the European electricity network.

The regulatory frameworks should include market-based signals for flexible and firm capacity (including cross-border) to enable the integration of large-scale renewables. Therefore, regulators should allow DSOs to develop and operate storage when the technical and economic conditions justify it.

5. What is the right approach of information sharing at a higher level? (e.g. events, etc.)

Sharing best practices, information, collaboration and learning from real examples across the EU is a key factor for overall success in protecting the European energy sector and power grid in particular. This should follow a strong chain of command.

Multi-stakeholder trust-based cooperation assures that all parties add complementary value to the general objective, facilitating a common understanding of the challenges, threats, best practices, incidents and preparedness. In this context, sectorial collaboration as well as ICS-CERT collaboration seem to be the most beneficial models.

Working in associations is a significant step to share information and best practices cross-border amongst all CRITIS branches.
Public Private Partnership collaboration is deemed to be useful as well and would mean the energy sector cooperates to find a CSIRT, which then communicates with the authority according to the NIS Directive in each Member State.

6. New skills and capabilities, Research and Development

The digitalisation of the energy transition must be supported by new technological developments and upgrade of skills of energy companies and public administration.

Question

1. **How can we promote digitalisation in energy Research & Innovation as part of the next framework programme, ensuring a close link with energy policies and full consistency with EU energy and climate objectives.**

    - Through education to both energy companies and public administration so that everyone is aware of the common policies, objectives and reasons for needing them;
    - Through digitisation in the different initiatives of the programme, including in the description of the topics the use of new technologies to develop new services and business models;
    - Through pilot projects which clearly contribute to the overall objectives and can place themselves within the bigger picture. This can be done through stimulating regulations which should lead to more pilots, implementing new ideas and innovations that should give us more insights into the practical impacts of the energy transition and all its different features;
    - Though R&I that should be properly designed to address policy, regulatory, technological and societal changes, and there should be a much higher connection between the energy policies and the results from H2020 projects;
    - Trough sandboxes which should be established to test new regulatory proposals before changing the rules. The experimentation approach is necessary, especially regarding flexibility at the distribution level which must be very local. Regulatory reviews are particularly relevant to avoid artificial barriers which limit DSOs in their capacity to effectively act as neutral and regulated agents.
    - Through a Horizon 2020 call for setting up a high value academy/ course to be followed by all senior executives in the energy sector in Europe, including certification.

7. Horizontal actions, communication and awareness

In order to increase its impact on the energy sector, digital solutions must be understood throughout the energy sector including consumers. SMEs and consumers will need support in understanding the processes and seizing the benefits of digitalization. Industry is likely to apply innovative ICT solutions, however, optimizing the consumer interface might remain a challenge. The entire sector should gain awareness about engaging in digital solutions in a legal and secure way.

Questions

1. **How could consumer trust and engagement be fostered when implementing digital solutions in the energy sector?**

    - By creating a consumer-centric system of sharing energy data, especially sensitive data related to consumption. This would help in arriving at a solution that the consumer can trust. Grid operators generally are in a good position to provide customers with new and digital solutions as they act as "neutral" market players and therefore often are trusted and respected. When it comes to customer engagement, two factors contribute greatly: financial benefit and security of data and supply.

    - By making sure that it is clear who owns the data and that the owner is in control over who the data is shared with and that his/her permission can also be revoked. Crucial to consumer trust (as well as for trust in the wider energy market) is also that any data (sharing) platform is operated in a neutral way by a neutral party.

    - Smart products like self-consumption or home devices will help customers adopting digital channels and engagement with their energy usage. In any case, customers will always be more engaged when solutions offer substantial financial benefit and/or increase their personal convenience. Given the current public focus on climate change and climate protection, there might be a niche of customers who are willing to accept higher costs or less convenience to a certain degree, if the digital solution aids this higher purpose. It can be assumed however that this is not true for the mass market.

2. **What are the benefits of digitalisation? Which initiatives already exist in Europe? How can awareness be fostered?**

Benefits of digitalisation are:

- lower cost of energy supply
- higher security of supply
- better work safety

- new customer offerings
- greater data accuracy and faster access to them
- the ability to collect and use the acquired (often very different) data to effectively perform all processes
- support for the decision-making process through the use of advanced, automated forecasting and planning techniques
- the ability to make quick analyses of large amounts of data
- process automation

Smart Solutions based on digitalization such as smart metering, smart mobility, smart solar, smart home and smart insights will help to the customers not only for economical savings but also for adoption of digital channels and engagement with their energy through insights.

To conclude, digitalisation leads to a smarter, cost-effective and efficient operation of the electricity distribution system and allows for the empowerment of consumers and facilitates their active participation in the energy markets.

However, this does not happen without investments, notably during the transition phase in which we live nowadays. As such, digitalisation should not be seen as an end in itself but rather as a means to shape an active energy transition with customers at its heart. It is also important to ensure that the public is made aware of the benefits of digitalisation mentioned above and that there is a joint commitment to this topic both in politics and in the energy industry.
All these benefits depend on the availability of data. DSOs are actively working to further unlocking value for society by making open data available in a secure, transparent and regulated way, respecting the highest privacy, data protection and network security standards, and by contributing to the deployment of a more flexible system.