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.

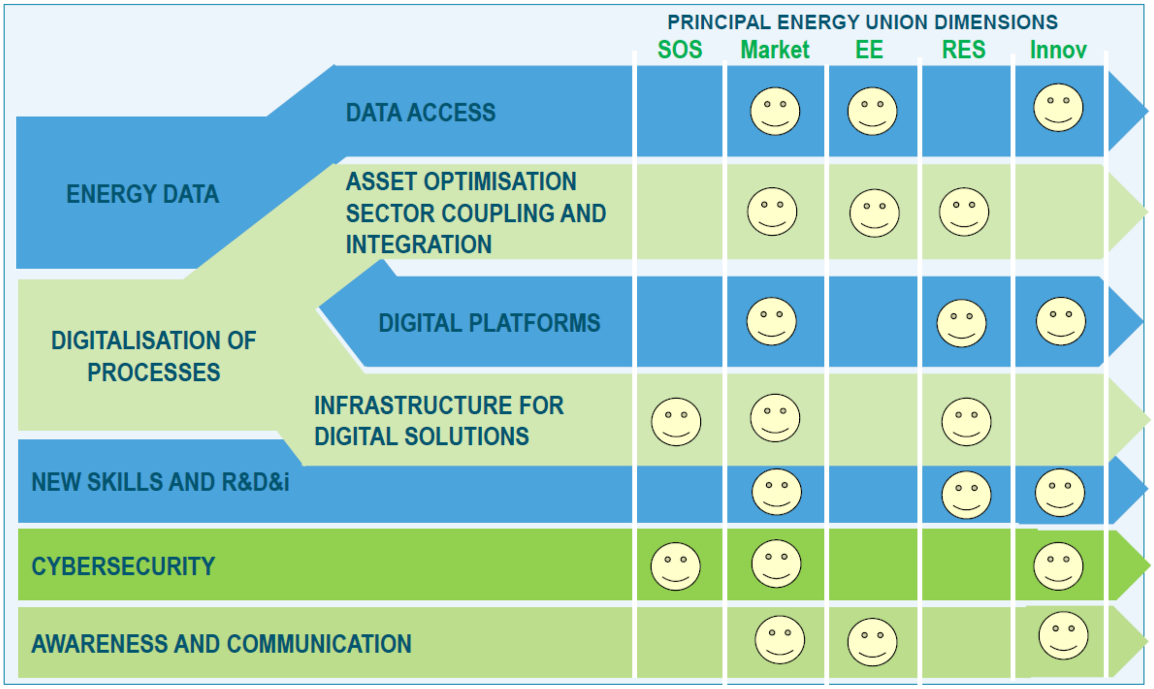
To achieve these objectives, five mutually reinforcing dimensions work together to balance the overarching energy triangle (energy security, sustainability, competitiveness) and enable the achievement of the **2030 climate and energy framework**. These dimensions are: (1) Energy security; (2) Internal 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?**

Access to non-sensitive energy data is crucial for a successful energy transition. It supports citizen engagement, providing more choices, as well as more comprehensive, seamless, intuitive, personalised, ethical, and engaging services. Moreover, in order to facilitate a successful energy transition, it is crucial that data for customers and market participants is accessible in an easy, transparent, and non-discriminatory way, while ensuring that the consumer's personal data is fully protected. Additionally, open access to non-sensitive energy data would increase the security of the energy supply and industrial competitiveness, since it would support the creation of new business models and market opportunities.

Access to non-sensitive energy data may be improved through the **establishment of digital platforms (the sum of connected digital interfaces) and data hubs (also known as data exchange platforms)**, as they help increase the accessibility of energy and related data in a transparent and secure manner, and can be user-friendly for end customers.

Examples of best practices include two digital data platforms in Estonia and Denmark:

- **The data platform Estfeed, in Estonia**, allows market participants to access energy and related data in a fair, open, and secure manner.[1] The Estonian TSO Elering launched the Estfeed data platform, which connects smart meter, market price, weather forecast, heating data, grid congestion, and other sources of Internet of Things (IoT) data with third party application providers and final customers.

  The platform does not store data but facilitates access to existing data in one single place. Third parties like demand response providers or energy monitor services can access smart meter data for free when signing a Memorandum of Understanding and with the explicit consent of customers. For instance, in 2017 a digital power purchase agreement technology company, WePower, used Estfeed to access the anonymised production and consumption yearly data for Estonia to simulate and execute energy transactions on the Etherium blockchain. This was the first time that the full energy consumption and production data for a whole country was simulated on a blockchain.

[1] www.solarpowereurope.org/wp-content/uploads/2018/12/When-solar-policy-went-digital-SolarPower-Europe-report-v13-14.12.2018.pdf

- Another example of a data platform that facilitates access to non-sensitive energy data is the **data hub implemented by the Danish TSO Energinet**, which simplifies and manages communication and data exchange, standardising processes between market participants in Denmark.[2] The data hub hosted metering data collected by DSOs – on tariffs, subscriptions, and fees (i.e., "wholesale master data") – and details on final customers, such as metering point ID, connection status, grid area, and maximum kW. The data hub, so far, does not handle hourly data, but this is expected to change in 2020.

  End consumers can view their data through their supplier's platform, or a central website, and the data is open to researchers via Statistics Denmark. Users can grant third parties' access to their data via the Danish e-signature system called *nemID*.

Replicating these models at the EU level could support further consumer engagement and spur the development of new services. To this aim, however, the European Commission should consider further action at the EU level. In particular:

- **Member State governments and regulators should mandate a neutral third party to establish similar digital platforms, data hubs, and data access solutions**, which could include (but does not necessarily have to be) the TSO (as described in the example of Estfeed).
- **Enable market participants to use existing digital platforms and data hubs from third parties,** and access useful weather, market, generation or consumption data supporting the development of new consumer services.
- **Digital platforms, data hubs and data access solutions should have the ability to handle real-time meter readings from all consumption and generation points** (from both import and export meters).
- **Digital platforms, data hubs and data access solutions should include a permission system for final customers** to give third parties access to their data in a secure way. The permission system can function on a blockchain-based authentication system or similar technology.
- **Grid data access should be expanded beyond TSOs and DSOs.**
- **Customer data must be made easily available to the customer and third parties** if the customer requests it. This shall be an explicit customer right.
- **Performance targets on data access should be established for TSOs and DSOs.** The right to data access for customers must always be accompanied with clear performance targets for the grid operators (i.e., it is not enough that a right to data access exists).

[2] www.solarpowereurope.org/wp-content/uploads/2018/12/When-solar-policy-went-digital-SolarPower-Europe-report-v13-14.12.2018.pdf

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

A consumer powered energy transition is a key pillar of the European Energy Union; since data access and consumer engagement are two sides of the same coin, their enhancement and broader adoption is crucial for a successful energy transition.

We define **interoperability as the ability of multiple systems or components with different hardware and software platforms, data structures, and interfaces to exchange information with minimal loss of content and functionality.**

A consumer powered energy transition would be further enhanced with the **roll-out of smart appliances and smart meters, designed to enable user-centred and interoperable services**. The roll-out of smart devices go hand-in-hand with the development of EU-wide interoperability principles and transparent procedures for safely sharing and protecting the data.

Interoperability is critical to enable the uptake of new business models and services related to self-consumption and energy management services. Particularly, the possibility for smart appliances (washing machine, fridge, etc) and flexibility sources (electric vehicle, heat pump, residential battery, public charging station) to talk to each other ("exchange data") and transmit interoperable data to market players is crucial for a fruitful energy transition. **It enables "sectoral integration" and supports a cost-efficient pooling of flexibility and demand response services, to the benefit of the consumer and the energy transition.**

However, industries operating these various flexibility and energy management sources (home appliances, EVs, etc) sometimes **operate with different technologies and standards which complicates the development of integrated flexibility offers for end-users.**

Examples of promising initiatives on interoperability standardisation to facilitate the exchange of data between smart devices across sectors include:

- The **EEBus initiative is considered by many to be the strongest interoperability initiative in Europe** and has created a "common language for energy" which is attempting to overcome the highly fragmented array of protocols in the smart home and smart grid space.[3]
- **SPINE is a platform-neutral message exchange standard part of the EU driven SAREF 4 ENER,** that allows one global language for household appliances to communicate with one another about energy, and thereby crossing the boundaries of industries and countries. With SPINE, household appliances can speak the same language, communicate with energy managers, smart home systems and with each other in an

[3] www.solarpowereurope.org/wp-content/uploads/2018/09/Digitalisation_and_Solar_report_SolarPower_Europe_MEDIUM_RES.pdf

integrated home ecosystem, providing the benefits of smart energy management for consumers and allowing power suppliers and grid operators to check the load of their customers in a secure manner, while doing it anonymously and directly.[4]

To encourage the deployment of similar initiatives and strengthen the level of data interoperability in Europe, the European Commission should consider the following:

- Develop a **"baseline" standardised data format** as soon as possible, on which individual devices or service manufacturers will then add additional features to. The standardisation may apply to **data that is necessary to develop the basic energy services**, not all data involved in the process; for example, Nest (Google) and Samsung are developing their 'Works with Nest' and "Works with Samsung Smart Things" smart-home ecosystems.
- **Define which data exactly can be standardised** at EU level to increase interoperability.
- **Standardisation should be done in a way that it does not prevent innovation, but that enables it**. Need to be cautious in locking-in standard data formats too early not to prevent innovation and in choosing a wrong standard data format.
- **Data is broadcasted in an anonymised way**.

Furthermore, beyond mere interoperability the three following aspects should be considered: (1) universal availability of non-personal DSO/TSO data, (2) a right to one-click customer data access, and (3) data access performance targets for DSOs/TSOs.

- **DSOs and TSOs shall make all non-personally identifiable grid data available to other market participants.**

For example, DSOs and TSOs shall make available the data on the stress their transformers and substations experience due to the take-up of renewables in a certain area so that all interested parties could develop solutions that are more innovative than just building a larger transformer (e.g. using demand response or storage) and offer them to the DSOs/TSOs.

- **All customer data must be made easily available to the customer and third parties if the customer requests it. This shall be an explicit customer right.** To become an active customer as envisioned in the EU Clean Energy Package, data access must be as easy as using a smart phone app. Detailed meter data, contract details, price information, etc., must not only be available in theory, but, with just a few clicks; easy data access means customers will make use of their data.

Example: A customer with solar panel considers buying a storage facility, i.e., a battery. In most countries, all relevant data to make an informed consumer decision (yearly consumption, yearly production of solar panel, contractual price / kWh) is stored and owned by the DSO.

[4] https://esmig.eu/news/major-european-alliances-are-closing-gap

Consumers should be able to request that the DSO makes this information available to interested third parties, so they can provide an offer to the customer.

- **Define performance targets for TSOs / DSOs for data access.** The right to data access for customers must always be accompanied with clear performance targets for the grid operators, i.e., it is not enough that a right to data access exists.

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)?

New digital technologies and data driven services are breaking down the traditional boundaries between key sectors of the economy (energy, transport, buildings), opening the door to a new era of flexibility and supporting the achievement of a carbon neutral economy.

Smart demand response, sector coupling and energy systems 4.0 – the opportunities are countless to make the most of the energy transition. The digitalisation of the power system has proved to be extremely efficient to improve network operation and facilitate the integration of renewables at central[5] and distributed level.[6]

Example of best practice for a data-driven self-consumption business model developed by Alpiq in Switzerland:[7]

- **GridSense controls electrical equipment such as heat pumps, boilers, electric car sharing stations and batteries** autonomously and in a decentralised manner. It uses adaptive intelligence to measure, learn and anticipate user behaviour. It is equipped with a self-learning algorithm that controls building technology appliances as effectively as possible. It uses this information to ensure constantly optimised energy consumption within a building. With this technology, a conventional house is transformed into an energy-efficient smart building. Via intelligent switching of loads, GridSense also contributes to the development of a smart grid, thus helping to level out grid load.

  With GridSense, Alpiq offers turn-key energy services for utilities, from solar PV to heat and e-mobility to end customers. It also offers full transparency of energy consumption information and smart home integration, as it enables utilities to give their customer a detailed and fully transparent picture of their consumption data. Moreover, with

[5] Grid Intelligent Solar, SolarPower Europe 2019

[6] Digitalisation of decentralised installations help maximise self-consumption ratios (reducing the use of the distribution grid) and supports smarter interaction between on-site solar installations and the energy system, for example allowing the storage of feed-in of solar energy when most relevant for the system.

[7] www.solarpowereurope.org/wp-content/uploads/2018/09/Digitalisation_and_Solar_report_SolarPower_Europe_MEDIUM_RES.pdf

GridSense, utilities can plan future energy sales more precisely and optimise their purchasing of electricity in their market.

More generally, at the system level, data-driven aggregation services can advance the energy transition by providing grid flexibility services while engaging consumers to become a crucial part in this transition.

To increase access to non-sensitive data, promote the uptake of data-driven services and new business models that enhance integration of multiple sectors (such as GridSense), the European Commission should encourage the following elements:

- **Create mixed power pools (portfolio of distributed energy resources)** to aggregate different smart solutions from several sectors such as energy-transport-buildings to maximise their combined potential, unlock flexibility and grid ancillary services, e.g. an aggregator should have the option to pool electric vehicles and smart appliances to benefit from an heterogenous portfolio used for diverse system needs.
- **Better forecast of solar generation** to facilitate its integration in the energy system.
- **Enhance adaptive intelligence to measure, learn and anticipate user behaviour,** i.e. user intention.
- **Accurate assessment of the energy performance of buildings** to encourage renovation and increase accountability.
- **Transparency of non-confidential data,** e.g. energy consumption information and smart home integration, information from a home-based charging station and energy consumption from the household and the PV system on their rooftop, and in general non-confidential generated from all sectors involved in the energy transition.
- **Increase consumer empowerment across the different industries.**
- **Smart use of data** by using smart devices to allow energy resources (usually left without supervision) to be used in a more effective way.

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

Fair access to data at EU level is crucial to enhance energy efficiency, consumer engagement and capture the full potential of demand response, by enhancing behavioural changes for end-users. Consumers with transparent and easy access to building-related data (e.g. through apps or in-house displays) are more likely to react to data signals and adapt their consumption patterns to the system needs. As such, faire access to data fosters:

- **Innovative business models** if data access is granted to third parties, which can assess the potential and manage the energy consumption of buildings and/or provide flexibility services to the electricity grid.

- **Fair competition between aggregators** (obtain an incentive to provide flexibility) **and suppliers** (that do not always have an incentive to provide flexibility).
- **Cost-efficient** assessment/engineering measurement of the potential of energy efficiency measures in buildings to perform demand response.

Demand response schemes are important because they offer substantial economic, societal and technical benefits, they:

- **Enable and improve consumer engagement**, so owners of rooftop solar PV systems would have a crucial role in the energy transition.
- **Help manage variable renewable energy sources** such as solar PV without storage.
- **Reduce peak and overall demand**, thereby reducing electricity bills, further benefiting rooftop PV systems owners.

The Energy Efficiency Directive includes legal provisions on how the market should be designed to enable demand response. However, despite the provisions of demand response in EU legislation and the high potential of demand response in EU countries, only 6 countries out of 28 provide a conducive framework to take advantage of that potential, while in other 6 countries the demand response development is opening.[8,9] Thus, the Energy Efficiency Directive is a good first step, but more needs to be done to enable a large-scale demand response deployment.[10]

Furthering data access to increase energy efficiency in buildings and consumer engagement to provide demand response, is crucial for a fruitful energy transition. However, data access to customers and third parties is not guaranteed. Therefore, to realise the full potential of data in the energy transition, we recommend the European Commission consider the following:

- **Enable the use of historical data from buildings to make informed assessments.** We need to have access to that information since network operators can have access to data that covers a long period of time. Having access to historical data enhances the understanding and the potential of that data.

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

A better integration of variable renewable energy into the grid can be achieved through **better weather forecasting, since it allows for a better anticipation of the electricity generation from solar plants.**

[8] http://www.europarl.europa.eu/RegData/etudes/STUD/2017/607322/IPOL_STU(2017)607322_EN.pdf
[9] https://www.smarten.eu/wp-content/uploads/2017/04/SEDC-Explicit-Demand-Response-in-Europe-Mapping-the-Markets-2017.pdf

Long-term and short-term forecasting to improve investment decisions in the solar sector is driven by accurate meteorological data. **The provision of free (open, public) data on meteorological conditions can leverage advanced technologies such as Artificial Intelligence to make solar generation more predictable, reduce the investment risks and therefore make solar generation more profitable,** by reducing the need for storage, grid integration, and system operation and maintenance.

Short-term forecasting is particularly driven by calculation-intensive meteorological modelling. Delivering this meteorological modelling data in an open data project to the solar community will boost innovation and further decrease the cost of integration of solar power into the grid.

Therefore, better weather forecasting would bring the following benefits:

- **Maximise the cost-effectiveness** of incorporating solar power into the grid while reducing infrastructure investments needs and maintaining or increasing system stability and reliability.
- **Improve efficiency and reliability** of system operation by improving congestion management and balancing of the grid before real time.
- **Provide economic benefits**, e.g. more profitable trading on the wholesale market.
- **Advance the market uptake for flexibility resources**, such as solar PV with storage.

Several weather forecasting services require statistical details on the location of renewable generators, their size and configuration, etc., and rely on numerical weather predictions, satellite data and/or statistical forecasting and filtering methods. Most products combine several of these techniques. Good practice requires numerical weather predictions for day-ahead forecasting and a combination with satellite data for intra-day forecasts. In all cases, good practice requires statistical filtering which in turn requires a near-real-time data feed from the monitoring system to the forecast provider. For best practice, the forecast provider should also be informed about scheduled outages and the expected duration of forced outages.

Here we present a best practice case study that builds upon high resolution meteorological data that helps to forecast and integrate variable renewable energy into the electricity system:

- **3E's Dynamic Solar & Wind Energy Maps are a good example of applications building upon high resolution meteorological data from 3E's Data Services**. The technology that 3E has developed generates high accuracy dynamic maps and applications to display the real-time, historical evolution, and forecasted electricity production of renewable energy assets across cities, regions or even continents.

  High resolution solar and wind meteorological data from 3E's Data Services is used in combination with detailed information on installed capacity (MW) of solar and/or wind renewable assets to accurately calculate the real-time generation, the historical evolution, and even the 48 hours-ahead forecasted solar and wind energy generation, in 15 minutes intervals. When available, additional data from transmission system operators (TSOs) and/or distribution system operators (DSOs) is used as well. The maps display several indicators, among others: solar and wind energy generation (MWh), energy consumption covered by renewable energy sources, number of equivalent households/inhabitants, avoided CO_2, equivalent electricity to power electric vehicles.

3E's Dynamic Solar & Wind Energy Maps are accelerating the digitalisation of the renewable energy sector and creating new service opportunities for solar, increasing awareness of public communities and helping shape the regulatory environment. A version of this tool "The European Solar Power Live Map" was made in collaboration with leading solar experts of 3E and SolarPower Europe. The Flemish Solar & Wind power map (*Stroomvoorspeller*) was recently developed by 3E providing high resolution information and including also on-shore and off-shore wind energy in addition to solar energy.

These maps are hosted as web-applications and can easily be integrated in any website, providing different dynamic views and indicators showing how renewable energies are powering our electrical grids and supporting the transition towards a renewable energy supply. Policy makers, industry, and the public are using these maps to explore the solar potential across regions supporting the development of renewable energy sources and opening opportunities for additional products and services.

To maximise the impact of open meteorological data for the provision of energy system services, the European Commission could encourage the open access to more details data such as:

- **Provide free data about statistical details** on the location of the renewable generators, their size and configuration, etc. The provision of data about scheduled outages and the expected duration of forced outages is also recommended.

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?**

Digital platforms (the sum of connected digital interfaces) and a digitalised energy system are crucial to guarantee markets openness, fairness, and to develop smarter flexibility services accessible for anyone.

Digital platform that manage flexibility are flexibility platforms where trading, dispatch and / or settlement of flexibility is facilitated or coordinated. One type of flexibility platform is the flexibility market platforms, where buyers and sellers of flexibility meet to trade flexibility.

In current flexibility market platforms, buyers and sellers of energy close deals anonymously, and only energy traders use these platforms. In the future, it is expected that flexibility market platforms offer flexibility products to target, for example, the TSO or DSO as a customer.

Particularly, to procure flexibility services, several digital platforms have been developed in Europe, for example:

- The **EPEX SPOT local flexibility market is an open and voluntary market-based congestion management platform,** efficiently centralizing local flexibility offers with physical impact, which can be used by TSOs and DSOs to proactively alleviate congestion. EPEX SPOT acts as a neutral intermediary between flexibility supply from flexible assets and flexibility demand from system operators. It supervises price formation and guarantee a high level of transparency. The aim is to: a) create new opportunities for market participants to value their flexible assets; b) create new opportunities for system operators to avoid or defer costly grid expansion and allow for a higher reliability, security of supply and coordination. This is possible thanks to the high degree of digitalization and automation of the platform that powerfully coordinates system operators at all grid levels, guaranteeing efficient use of flexibility resources.

  The EPEX spot digital platform supported the uptake of innovative system and consumer services such as:

The Enera pilot project in North West Germany, developed by the energy group EWE AG and the European Power Exchange EPEX SPOT with the system operators Avacon Netz, EWE NETZ and TenneT. Enera is a smart local flexibility market platform available to system operators and flexibility providers of the project consortium. It operates during the intraday timeframe, so that the DSOs and the TSOs can procure flexibility for the distribution or transmission grids to proactively alleviate congestion[11].

LO3 Energy has partnered with EPEX SPOT to enable local prosumers and consumers to become players in the wholesale market.[12] LO3 Energy is setting up community microgrids in Europe, where the participants could use their transactive energy platform, Exergy, to buy and sell energy through its associated easy-to-use app not only peer-to-peer but also at wholesale prices across borders to anyone in the EPEX SPOT network.[13] Exergy provides solar prosumers a higher value for their power via increased flexibility and transparent price signals, which is crucial to advance the energy transition.

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?**

Digital platforms and intelligent solar solutions are crucial for a successful energy transition, as they can leverage the potential of intelligent solar to provide flexibility and balancing to the energy system.

Existing and new digital platforms should be developed around **facilitating (i) fair access to data, (ii) data exchange, (iii) interoperability, and (iv) ensuring data sovereignty**. To this aim, the European Commission should consider the following aspects:

On facilitating a fair access to data:

- **Enable an easy access to digital platforms by the customer** (as well as market parties offering flexibility to grid operators).
- **Enable that data is broadcasted in digital platforms in an anonymised way**.

On facilitating data exchange and interoperability:

[11] www.usef.energy/app/uploads/2018/11/USEF-White-Paper-Flexibility-Platforms-version-1.0_Nov2018.pdf
[12,10] https://lo3energy.com/creating-revolutionary-new-energy-market/
[11] https://sonnengroup.com/

- **Enhance the use of platforms that enable the integration of smaller sizes of installations such as solar prosumers and the exchange of data** (like Exergy, see question above)**.**
- **Develop minimum technical standards for the output of connected interfaces:** as a platform is the sum of connected interfaces, the connection within the different interfaces must fit to each other. These standards, however, should not be too restrictive to allow and to advance innovation.
- **Ensure interoperability with platforms** developed by TSOs and DSOs (or jointly),
- **Define what data exactly can be standardised** at EU level to increase interoperability.
- **Develop a "baseline" standardised data format** as soon as possible, on which individual device or service manufacturers will then add additional features to. The standardization may apply to **data that is necessary to develop the basic energy services**, not all data involved in the process; for example, Nest (Google) and Samsung are developing their Works with Nest' and "Works with Samsung Smart Things" smart-home ecosystems.

On ensuring data sovereignty:

- **Standardisation should be done in a way that it does not prevent innovation, but that enables it**. Need to be cautious in locking-in standard data formats too early not to prevent innovation and in choosing a wrong standard data format.

Moreover, we recommend **avoiding setting mandatory requirements for the geographical scope of digital platforms**: The geographical scale of implementation of digital platforms should depend on the nature of the service provided and location of users (neighbourhood, regional, EU).

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?**

A digital platform must integrate rules of governance designed to facilitate interactions between the interfaces, since these interactions are the main source of value. In this regard, energy communities should have a more active role in defining the governance of digital platforms.

Rules should define a level playing field including, among others, rules on security and interoperability.

Example of best practice of governance of platforms include the data platform Estfeed, in Estonia, and Energinet, in Denmark, which have been previously described in Section 1 Question 1. Here we briefly describe them again:

- The **data platform Estfeed** allows market participants to access energy and related data in a fair, open and secure manner.[14] It connects smart meter, market price, weather forecast, heating data, grid congestion and other sources of Internet of Things (IoT) data with third party application providers and final customers.
- The **data hub implemented by the Danish TSO Energinet** simplifies and manage communication and data exchange and standardise processes between market participants in Denmark.[15]

To ensure a neutral, secure and transparent governance of digital platforms, the European Commission can follow the recommendations below.

On establishing the digital platform:

- **Member State governments and regulators should mandate a neutral third party to establish similar digital platforms, data hubs and data access solutions**, which could include (but does not necessarily have to be) the TSO (as described in for Estfeed).

On managing and accessing the platform:

- **Ensure open access to non-personal DSOs and TSOs grid data for market participants.**
- **Open access to all market participants to use existing digital platforms and data hubs from third parties.**
- Data hubs need to have **access to remote monitoring of single components** (firmware).
- All market players should have **equal access to information**.

On the participants:

- Governance should **provide the rules of who participates and how they create value**.

On ensuring transparency and security of users:

- Digital platforms, data hubs and data access solutions should **include a permission system for final customers** to give third parties access to their data in a secure way. The permission system can be based on a blockchain-based authentication system or similar technology.
- Digital platforms with **open architecture** may motivate third parties (those who supply data) to participate. Opening too little means that third parties cannot participate and add value.
- The establishment of **minimum requirements to guarantee transparency**, use of **open communication protocols** and guarantee that if end-users decide to **switch platforms**, they can carry their data with them.

[14] www.solarpowereurope.org/wp-content/uploads/2018/12/When-solar-policy-went-digital-SolarPower-Europe-report-v13-14.12.2018.pdf
[15] www.solarpowereurope.org/wp-content/uploads/2018/12/When-solar-policy-went-digital-SolarPower-Europe-report-v13-14.12.2018.pdf

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)?**

Several of these data-driven service models are already being used. Because data-driven service models are still in their infancy and the sector is very fast and dynamic, it is hard to define models of the future. However, we do see big solutions trends emerging identified in the reports "When solar policy went digital" [16] and "Digitalisation and Solar".[17] These solutions trends use innovative technologies such as blockchain, artificial intelligence and big data analytics, etc. that are contributing to provide the services mentioned in the question. From a solar perspective, the key technologies are:

- Big data analytics and artificial intelligence (AI)
- Internet of Things (IoT) and connected smart objects
- Robotics and drones
- Smart meters
- Blockchain
- Mobile, 5G and wireless connectivity
- 3D printing
- Cloud and low-cost computing

The application of these technologies to solar and the energy sector will create new business models, generate new sources of value and better integrate PV into the grid. They can be used to manage electricity flows, perform energy forecasting, create new remuneration/financing mechanisms, and create new ways of managing transactions to the benefit of the consumer.

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)?**

As new patterns of energy production and consumption arise, the future grid will be decarbonised, decentralised, digitalised and democratised, as solar energy communities of solar prosumers could offer project developers and utilities large flexibility benefits to manage energy grid.

[16] www.solarpowereurope.org/wp-content/uploads/2018/12/When-solar-policy-went-digital-SolarPower-Europe-report-v13-14.12.2018.pdf
[17] www.solarpowereurope.org/wp-content/uploads/2018/09/Digitalisation_and_Solar_report_SolarPower_Europe_MEDIUM_RES.pdf

Example of best practice of digital platforms to support sharing energy within energy communities include:

- **Sonnen has created the world's first virtual power plant consisting entirely of home-storage systems named sonnenCommunity[18] that is open to cross-border participation** stretching from the North Sea to the Alps. The sonnenCommunity is a community of sonnenBatterie owners across Germany, Austria, Switzerland and Italy. The members can share their self-produced electricity with other members of the sonnenCommunity, so their electricity surplus will not be fed into the conventional electricity grid but into a virtual power pool that serves other members in those times of the day when they cannot generate enough electricity due to non-optimal weather conditions. Additionally, the members receive revenues from stabilizing the electrical grid. Last year, Sonnen's virtual power plant was qualified to provide primary frequency control grid services (which require 30 seconds reactivity) in the control area of the German TSO TenneT. This is the type of frequency is usually provided by conventional power plants, and solar plants are ready for it.

  Sonnen uses blockchain to control such a self-balancing system in real time, the advantage is that both the households and the distribution grid operators have transparency with regards to every kilowatt hour that is traded between participants. Transactions are transparent and there are no additional costs for electricity trading.

Solar prosumers will be at the core of the energy transition. The examples clearly show how to increase solar prosumer's engagement in this transition, how to facilitate sharing of energy within energy communities, how to create new opportunities for solar prosumers to value their flexible assets, and how to allow cross-border participation.

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 the cornerstone for a successful and cost-efficient sector integration strategy. In Europe, as more economic sectors are being electrified to mitigate emissions, digitalisation would be key to pull synergies among sectors and increase their value.

Digitalisation and electrification, therefore, go hand in hand. Digitalisation can facilitate sector coupling and integration between, for example, the energy and transport sectors by enhancing their automatic interaction with the electricity grid. For instance, behind the meter communication can enable interaction between smart charging of electric vehicles and smart devices in buildings which can offer their demand-side flexibility to grid operators and participate to electricity markets.

Example of best practices that enhance sector coupling and sector integration through digitalisation include:

- **SolarEdge provides a solution which couples the electric vehicle, charging station and solar rooftop.** SolarEdge's EV charging single phase inverter enables homeowners to charge their electric vehicles directly from the power of their solar rooftop, maximizing their solar usage (self-consumption), and further reducing their electricity bills. Another benefit is that SolarEdge provides users a monitoring platform; thus, homeowners can track their charging status, control vehicle charging, and set charging schedules. They will also benefit from the ability to charge the electric vehicles up to 2.5 times faster than a standard charger through an innovative solar boost mode that utilises grid and PV charging simultaneously.[19]

- **EnnexOS from SMA is an IoT platform for energy management that offers modular solutions for sales support, planning, simulation, configuration and the operation of decentralised energy supply systems.** It allows to link the various energy sectors, combining all energy sources like PV systems, combined heat and power (CHP) units

[19] www.solaredge.com/products/ev-charger#/

and heat pumps or sources of demand like heating, air conditioning, cooling and lighting systems. This allows energy flows to be optimised, and to optimised energy consumption and costs. By incorporating battery storage systems, this energy can also be used at any time of the day.[20]

The digital technologies applicable to sector coupling as the same as for the digitalisation of solar:

- Big data analytics and artificial intelligence (AI)
- Internet of Things (IoT) and connected smart objects
- Robotics and drones
- Smart meters
- Blockchain
- Mobile, 5G and wireless connectivity
- 3D printing
- Cloud and low-cost computing

Ensuring data access, data interoperability and data standardisation across sectors (as sector integration implies to connect all your devices), is critical to foster sector coupling and achieve a successful decarbonisation of all economic sectors.

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

Digitalization is a critical missing link to Europe's green industrial revolution. To tap on the large benefits of digitalised assets and digitalised solar, it is crucial to make digital technologies and digital business models accessible to the wide audience, including the electricity or district heating grids in Southwest and Central Europe. Therefore, we recommend the European Commission the following aspects:

- **Mandatory and minimum requirements in EU legislation** to foster innovation and deployment of digitalised assets. For example, every new renovation in buildings to equip the buildings with smart infrastructure and smart charging.
- **Public procurement in buildings, transport, energy, etc. should promote smart meters and smart solutions** (grid intelligence solar, smart charging, smart buildings) through regulation or market incentives.
- **Allow digital assets to receive remuneration from the market.** For example, the Electricity Directive set key principles to foster the business model of aggregators which in certain cases require the installation of remotely monitored and controlled assets,

[20] www.solarpowereurope.org/wp-content/uploads/2018/09/Digitalisation_and_Solar_report_SolarPower_Europe_MEDIUM_RES.pdf

often financed through the participation to electricity markets. Indirectly, having the right market to generate value with a smart and flexible installation is an economic incentive which is not exploited in most countries (because of lack of market readiness and related infrastructures).

- **Adapt existing support measures for energy efficiency and renewable energy.** For example, EU funds could provide a specific support for some regions to finance such investments, this could be done combining existing incentive schemes – notably for energy efficiency services (green certificates) and self-consumption (feed-in tariffs) with a bonus to solutions which integrate smart component.
- **Promote research projects** (e.g. in next H2020 calls) **to answer critical questions involving the solar sector and digitalisation** to build the business case for such digital investments (e.g., what can be detected and anticipated, over which time horizon)**.**

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?**

Along with facilitating the deployment of solar, digitalization can also help facilitate the deployment of renewable power-to-gas by combining different types of renewable electricity generation (e.g. a virtual power plant and hybrid sites), which can then increase the business case for green hydrogen in the medium term.

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?**

No opinion.

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?**

No opinion.

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

Energy-smart appliances are critical to connect all sectors in the economy (sectoral integration), specially through electrification, and can provide large benefits not only for the energy system but also for consumers. The European Commission estimates that by 2025 the volume of controllable smart appliances in Europe will be at least 60 GW, which could reduce

Europe's peak demand by 10% and contribute to large monetary savings, since controllable smart appliances could avoid the investment of additional infrastructure, among others.

Moreover, the digitalisation of appliances can unlock additional sources of flexibility and enable "solar-connected infrastructures" – such as buildings and electric vehicles (EVs) – to adapt to the energy system's needs to generate additional value. Therefore, smart appliances support a more flexible and resilient energy system, paving the way for a solar-powered future.

Particularly, **smart buildings with smart appliances should interact with the energy system as they can provide valuable energy services (demand response, flexible energy generation and energy storage) for the integration of solar power in the grid**[21]. Moreover, as solar prosumers have the potential to provide flexibility services to the grid, they should be able to reap the full benefits of the flexibility they provide.

To support the development of smart appliances in Europe, we recommend the European Commission to consider the following:

- **Encourage occupants in buildings to generate and self-consume renewable energy and be able to sell the energy to the grid and heat networks**.
- **Enable the participation of consumers in demand response**, this applies to all players (including smaller players).
- **Make dynamic pricing contracts for energy supply and network tariffs available for all consumers**. Coupling dynamic pricing contracts with smart meters and controls would allow consumers to adopt their energy consumption according to time-dependant dynamic tariffs, and encourage energy to be stored when price is low and then be used when price is higher – this can be applied to several types of storage like vehicle batteries and hot water tanks.
- **Encourage aggregation services**. Aggregators should be able to compete on a level playing field in all markets.
- **Remove regulatory and market barriers to participation in aggregation services** (such as minimum bid requirements).
- **Ensure customers have the freedom to contract the aggregator of their choice, without requiring the supplier´s permission** in order to encourage consumer´s trust in aggregation.
- **Encourage energy storage possibilities in buildings and do not create barriers to its use,** such as requirements on the positioning of batteries in residential buildings
- **Encourage synergies between smart buildings and electric vehicles,** and the **deployment of electric vehicles and smart charging infrastructure in new and renovated buildings,** as smart charging can prevent costly spikes in power demand and can operate as storage to deliver valuable services to the electricity system.

[21] http://bpie.eu/wp-content/uploads/2017/06/PAPER-Policy-recommendations_Final.pdf

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

A full integration and interaction of buildings with the energy system is a key driver to achieve climate neutrality and guarantee system benefits. On-site renewable energy, smart buildings and energy-smart appliances are the cornerstone to decarbonise the European building stock.

Smart buildings and energy-smart appliances also support a more flexible and resilient energy system by providing smart energy generation, control, storage, demand response, and a connection with electric vehicles, paving the way for a solar-powered future.

To fully play their part in the energy transition, smart buildings combining on-site generation, storage and smart appliances would benefit from regulatory framework that favours decentralised flexibility and ensure it can contribute on a level playing field with other sources of flexibility. In this regard, the European Commission should consider the following:

- **Provisions from the Electricity Market Design Regulation and Directive as regards Active consumers (Directive, article 15), short-term markets (Regulation, articles 6, 7, 8) and aggregation services (Directive, article 17)** must be fully implemented by Member States as of January 2021.
- **Decentralised renewable energy solutions** including distributed generation, energy storage and demand response in buildings **should be developed hand-in-hand with innovative, digital services using real-time monitoring, predictive analytics and automated response**. This will enable demand-side flexibility, enhancing buildings' interaction with the energy system, and will convert simple energy users into smart and active players that can make their demand more flexible and help to balance the electricity system.

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

There are mainly two possibilities to provide solar electricity to a charging station: either the renewable system is located on-site, directly connected to the charging station and in some cases, to another load, for instance a building in the case of rooftop PV; or is located off-site and uses the grid to supply electricity to the charging station, for example via a power purchase agreement.

Digital solutions today allow the differentiation of the electricity sources used to charge electric vehicles, as well as the differentiated metering of these electricity sources. This is particularly interesting where the charging station is supplied, at least partly, with renewable electricity.

- The monitoring of electricity sources used for charging is possible thanks to an **energy management system that controls the sources being used (solar PV feed-in or grid electricity) based on various information** (solar PV feed-in, electricity prices, consumer preferences). Installing a monitoring system on the charging station allows further optimisation, as the charging process can be adapted to the feed-in of the PV system.
- **Digital technologies also allow for differentiation of the electricity sources supplied to charging stations close to real-time.** In the case of an on-site PV system directly connected to the charging station, an algorithm processes data from smart meters located at the grid connection point and the charging station. In the case of an off-site PV system, one can measure the solar electricity used at a charging station with an algorithm processing the data from different smart meters located at the solar plant and at the charging point.

Such differentiated metering solutions are key to value renewable electricity used in transport. However, real-time metering of renewable electricity used in transport can be complex and costly to implement, as it requires investment in the right amount of metering system. Additionally, the maximisation of real-time charging on renewable electricity should be incentivised by other schemes, such as self-consumption frameworks that exempt from grid fees the self-generated electricity consumed behind-the-meter.

Alternative and more simple metering solutions should be used to value renewable electricity used in transport. For instance, **the renewable electricity used in transport could be metered on an annual basis relying on Guarantees of Origins,** or by adopting power purchase agreements as currently practiced for renewable corporate sourcing.

Finally, **distributed ledger technologies such as blockchain can support the traceability of electricity used in transport**, as they enable to guarantee the origin of the electricity used through a cost-efficient traceable procedure in energy transactions.

Example of best practice of a monitoring system that allows for differentiation of electricity sources at charging stations, as well as examples of best practise to:

- The **Austrian company Fronius proposes such a "solar smart charging"** offer to commercial and industrial customers. This requires access to information from the electric vehicle (such as the state of charge). However, currently there is no streamlined possibility to access these data and it depends on bilateral agreements with EV manufacturers, which poses a major barrier to this model.
- The **credit trading schemes of the Dutch Energy for Transport Registry.** To realise the EU target of renewables in transport set up by the Directive on Renewable Energies, fuel suppliers are obligated to supply a certain share of renewable fuels. The Dutch

Energy for Transport Registry is an innovative implementation of this obligation aimed at supporting electric mobility. It grants to charging stations operators credits corresponding to an amount of renewable electricity supplied at stations, which can then be sold to obligated fuel suppliers to fulfil their renewable energy obligation.

To tap on the potential of these solutions, we recommend the European Commission to consider the following aspects and to addresses them soon:

- **Encourage the installation of monitoring systems** on the charging stations.
- **Enable access to non-confidential information** from the electric vehicle (such as the state of charge).
- **Encourage the use of digital technologies** such as smart meters to differentiate electricity sources at real-time, both when electricity is produced at the same charging station or off-site.
- **Incentivise the maximisation of real-time charging** on renewable electricity by tapping on other schemes, such as self-consumption frameworks that exempt from grid fees the self-generated electricity consumed behind-the-meter.
- **Encourage an adoption of a variety of renewable energy sourcing models**, such as renewable power purchase agreements and renewable energy offers from utilities or electricity suppliers. The purchase of electricity using these models should be bundled with Guarantees of Origin to certify that the electricity comes from renewable sources.
- **Encourage the use of blockchain technologies** to track the electricity used in the charging station.

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?**

Digital technologies are transforming the global energy system, making it more connected, reliable, sustainable and democratised. Therefore, SolarPower Europe, through the "Go Digital"[22] declaration (March 2017), encourages EU policymakers to embrace the digital revolution and "go digital" when thinking about future electricity market design.

Example of opportunities that a digitalised energy network would bring to decentralised and/or energy communities models include:

- **Digitalisation allows a more cost-effective integration of decentralised renewable energy** (better planning and system balancing) for example through the integration of **grid sensors or better algorithms.**
- **Digital solutions enhance the business model for decentralised energy and prosumer models**, enabling the provision and remuneration of flexibility services, thanks to smart appliances, demand response services and digital flexibility trading platforms. Digitalisation also helps tracking the use of network infrastructure, allowing for fair pricing of network use;
- **Digitalisation fosters the development of community energy models** which require complex management systems and services (digital platforms, blockchain), as well as advanced power electronics (inverters, trackers)

The Brooklyn Microgrid (BMG), is an example of highly digitalised and advanced microgrid system that enables an isolated electricity community to become self-sufficient, access secure electricity supply via collective self-consumption, and receive additional remuneration:

- **Brooklyn Microgrid (BMG), is a peer-to-peer marketplace for locally generated, renewable energy**, that harness the buying power of Brooklyn residents by having

[22] http://www.solarpowereurope.org/wp-content/uploads/2018/07/Go-Digital-Declaration-140318.pdf

them participate in a simulated energy marketplace.[23,24] The neighbours, with and without PV systems buy and sell solar power from each other on a blockchain platform –Exergy– that automatically documents each transaction. On the Exergy platform, solar prosumers, can transact energy autonomously in near-real time with consumers on the platform in their local marketplace.

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

Digitalisation will revolutionise the way we manage electricity grids, assets and services.

- **Digital appliances such as smart meters and grid sensors** allow for a more granular and precise management of local congestions and bottlenecks, as well as a better use of distributed flexibility sources
- **Digital monitoring services allow for a better forecast of the generation from renewable and distributed energy sources**, which procures useful information for better system management
- **Through intelligent plan control (digital power electronics such as inverters) paired with solution-oriented plan sizing, solar can create cost-effective flexible capacity supporting supply/demand adjustment.** Utility-scale solar PV can provide features such as ramping capability, voltage support, frequency regulation and other services more accurately than conventional power plants.
- **Digital business models such as aggregation, peer-to-peer trading platforms and smart collective self-consumption** procure additional flexibility sources to the electricity grid.
- **By enabling sectoral integration, digital technologies (meters, smart appliances, algorithms) harvest the contribution of flexibility sources outside of the energy system** such as electric vehicle batteries and buildings

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 development of energy infrastructures should go hand in hand with digital and telecommunication infrastructures, as new digital & energy services usually go hand in hand.

[23] https://www.brooklyn.energy/
[24] www.solarpowereurope.org/wp-content/uploads/2018/09/Digitalisation_and_Solar_report_SolarPower_Europe_MEDIUM_RES.pdf

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

No opinion.

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

Smart grids and digital solutions are especially important to manage flexibility to help manage and stabilise complex energy systems such as off-grid or poorly connected island systems.

Solar-based off-grid microgrids are being developed in several EU areas that do not have access to electricity, leap frogging traditional technologies and moving to new digital solutions such as blockchain.

- **The Smart Islands Energy System (SMILE) projects combines different smart grid technologies to support the stable energy supply of three different islands** (Madeira in Portugal, Orkney Islands in the UK, and Samsø in Denmark). Smart grid technologies enable aggregators to pool the flexibility of battery technology, power to heat, power to fuel, pumped hydro, electric vehicles, electricity stored on board of boats with predictive algorithms and connected appliances. This system reduces peak demand, help stabilise the energy grid and enhances energy efficiency.[25]

Poorly connected arears experience similar problems on land. **Microgrid technologies combined with innovative digital tools such as blockchain and peer to peer trading** enable isolated electricity community to become self-sufficient, access secure electricity supply via collective self-consumption, and receive additional remuneration:

- **Brooklyn Microgrid (BMG), is a peer-to-peer marketplace for locally generated, renewable energy, that harness the buying power of Brooklyn residents by having them participate in a simulated energy marketplace.**[26,27] The neighbours, with and without PV systems buy and sell solar power from each other on a blockchain platform –Exergy– that automatically documents each transaction. On the Exergy platform, solar prosumers, can transact energy autonomously in near-real time with consumers on the platform in their local marketplace.

[25] www.h2020smile.eu/about-the-project/
[26] https://www.brooklyn.energy/
[27] www.solarpowereurope.org/wp-content/uploads/2018/09/Digitalisation_and_Solar_report_SolarPower_Europe_MEDIUM_RES.pdf

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 Cybersecurity[28] 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 Recommendation on Cybersecurity should be implemented in all Member States. As the European energy system becomes "smarter", guaranteeing on cybersecurity is crucial for ensure security of supply and protect the privacy of EU consumers. If not done properly, digital connected infrastructures can backfire on detriment of the society. For this reason, all technologies should be built with cyberthreats in mind before they are introduced into the system, including elements on artificial intelligence and cybersecurity.

Moreover, **we suggest implementing additional regulatory frameworks for artificial intelligence, cybersecurity and data sharing,** but these frameworks should not prevent at all innovation.

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

No opinion.

[28] 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

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

Digitalised distributed renewable power generation can contribute to strengthen the resilience of the EU electricity system because smart and storage technologies installed in renewable energy assets (such as smart inverters installed in PV systems) allow to manage and, ideally, minimizing potential consequences in the grid as a result of these disruptions.

Particularly, digitalised distributed renewable power generation can provide flexibility services to the grid and guarantee (individual) security of supply (such as for hospitals, chemical industry, etc.) thereby reducing the use of the public grid and local congestions. When digitalised distributed renewable power generation is combined with heating and cooling systems and storage solutions, they can support an even more flexible, connected, and strong economy, becoming the backbone of a successful decarbonisation strategy.

- **The study "Value of Distributed Solar PV in Spain"**[29] shows that distributed solar PV, as in self-consumption, generates a positive net value by avoiding capital and capacity investments in transmission and distribution infrastructure, compared to a scenario without deploying additional distributed solar. The study shows that solar self-consumption can avoid upgrades or construction on new power plants and associated capital costs. Additionally, solar self-consumption can avoid the cost from carbon dioxide emissions allowances.
- SolarPower Europe's Grid Intelligent Solar report published in December 2018 demonstrates that **smart inverters technologies combined with advanced plant controls (power electronics) enable solar PV plants (even larger ones) to provide power regulation, voltage support and frequency responses which help strengthening the reliability of the grid even with high penetration of renewables.**

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?

The examples mentioned in the question above clearly show that distributed **renewable energy solutions, when combined with digitalisation, smart appliances and storage solutions, can support an even more flexible, connected, and reliable energy system**, becoming the backbone of a successful decarbonisation strategy.

[29] https://storage.googleapis.com/planet4-eu-unit-stateless/2018/10/76e0777c-20181004-rp-value-of-solar.pdf

To support the uptake of such solutions, the European Commission should look at efficient ways to promote the roll out of smart and digital technologies together with solar and renewables.

- **Develop policy instruments to promote the development of distributed storage solutions and smart appliances,** to enable distributed renewable installations to interact with the energy system, optimizing self-consumption ratios and providing useful flexibility and balancing services when required.
- **In light of the upcoming review of the European State Aid Guidelines for Energy and Environment, renewable tenders could value projects which are able to supply a certain generation profile or provide ancillary services to the grid** (so-called "grid intelligent solar" as defined in SolarPower Europe's Grid Intelligent Solar report). This could be satisfied by a specific technology (wind, solar, depending on the existing generation load) or a combination of technologies (hybrid plant combining wind+solar+storage or upgraded with power electronics). This would support investment in flexible and digitalised solar installations in Europe.

One key missing link is the ability for regulators, system operators and policy makers to evaluate the real flexibility potential of decentralised renewable solutions and integrate this potential in critical modelling exercises for policymaking, such as Europe's 2050 decarbonation strategy.

For example, **the European Commission scenarios and the PRIMES modelling used for the 2050 strategy fall short on acknowledging the contribution of decentralised clean energy solutions** to a sustainable and cost-efficient decarbonisation pathway. Moreover, as stated in the Clean Energy Package legislation, there is the need to evaluate the costs and benefits of distributed energy resources to develop adequate political and regulatory frameworks.

To make the most of distributed generation and ensure it is being developed in symbiosis with the needs and physical capacity of the energy system, we encourage the European Commission to:

- Complete its 2050 decarbonation scenarios, by **undertaking an in-depth study on the socio-economic costs and system benefits of as well as barriers to decentralised energy solutions**, including system flexibility, so that digitalised distributed power generation is not a liability to the resilience of the EU electricity system.
- **Encourage a better forecasting of distributed solar generation** for the TSOs to facilitate its integration in the energy system and have better grid planification and reduce investments in the grid.

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

For information sharing at higher level, we recommend:

6. **Create studies representing best practices** from innovative stakeholders and **recommendations and guidelines from the European Commission to Member States.**
7. **Regular dialogues between stakeholders and Member States.**
8. **Exchanges among Member States through dedicated Concerted Actions**.
9. **Dedicated events organised jointly by the IT and energy sector**, as we need both sides to talk and provide answers to the questions provided in this Consultation.

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?**

To promote digitalisation in energy Research & Innovation it is crucial to facilitate the introduction of **big data analytics and digitalization efforts (Industry 4.0),** which can provide news insights into what can be done in Research & Development & Innovation (R&D&I).

Using digital technologies and big data analytics may increase the pace of technology development and innovation, since they can provide a better funnel of information where machines may help researchers and other stakeholders find new patterns in shorter time.

To promote digitalisation in energy research and innovation, the European Commission next framework programme, could focus on supporting the following:

- **Support the creation of state-of-the-art laboratories and innovation centres** with a focus on leveraging digital technologies on renewable energy and other digital technologies like smart meters, smart connected objects, drones, robots or 3D printing.
- **Foster interactions** between **regulation and policy** on one hand and **research and innovation projects** on the other, e.g. by assigning at least one representative of European and/or member state regulatory and policy-making units (DG ENER, ACER, etc.) to each project with a mandate to challenge, learn and provide specific inputs.
- **Adapt the specifics of project evaluation and management of digital technology to research and innovation projects**, that includes the adoption of rapid development cycles, iterations between conceptual stage and implementation stage, etc.
- Invest, as a procurement project, in **European digital platforms for remote collaboration and data sharing**.
- **Promote research into the digitalisation of the solar sector** to develop technologies and solutions to empower consumers to become active players in the energy transition.
- **Encourage access to data bases and information at European level about how PV plants operate** (statistics about quality, technical defects, reliability) and the sharing of anonymise data to be used in research and development.
- **Encourage research and innovation on how solar prosumers manage the energy flows**.

- **Encourage research and innovation on improving weather forecasting** to enhance solar power predictability.
- **Provide sets of good-quality data to funded research & innovation projects** to be used for result benchmarking, to accelerate the early phases of projects, and to foster convergence towards common data models and application programming interfaces (APIs).
- **Support research & innovation projects that use open standards** (open-sourced) and tools using **blockchain technology**.

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?

To foster consumer trust and engagement when implementing digital solutions in the energy sector, we recommend:

- Provide consumers **direct access to the data they generate and receive** (including the possibility to save it).
- Ensure **energy services remain simple and reliable**.
- Provide a **robust and clear framework on data privacy**.

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

Digitalisation is crucial in the energy sector to **better manage the growing complexity of the energy system, as it allows for better use of energy storage and demand-side flexibility**. It can help system operators integrate larger shares of renewable and unlock new revenue streams for solar PV installations through the procurement of grid services.

Digitalisation can also **empower citizens** as they may gain control over the energy flows in their households and be compensated for the solar electricity they generate from their rooftops.

Moreover, digitalisation will greatly improve several aspects of citizens' life's as when converting buildings into smart buildings; for example, it would be possible to recognise and react to users' and occupants' needs in terms of comfort, health, indoor air quality and safety. In doing so, **digitalisation also unlocks a whole new industrial area for solar companies to provide new services to consumers and develop high-added value technology solutions to combine on-site renewable solutions and smart energy management services.**

To foster the awareness of the multiple benefits arising from digital technologies and digital business models, we recommend the organisation and promotion of industry events (conferences, workshops, etc.) from all type of industries, that encourage the exchange of knowledge and know-how between representatives from the European Commission, public entities, etc. and representatives from all industries.