CEER's Input on the EU Strategy for Smart Sector Integration

CEER Public Note

19 May 2020

1 Background / Context

This document, in the next section, gives CEER's 15 May 2020 response to the European Commission's request for input from all stakeholders and EU citizens on the EU Strategy on Smart Sector Integration that is in the process of being prepared. In this request for input for their strategy, the European Commission posed a series of specific questions that stakeholders/citizens could respond to. CEER responded to most of these questions and they are each indicated below, before the CEER response.

According to the European Commission in their introduction to the request for input, "[I]n order to meet our climate objectives, while also guaranteeing secure and affordable energy for consumers, we need to better link up our energy system and exploit the synergies enabled by an integrated energy system". The European Commission's questions follow up on this effort to think about such a more-integrated energy system. For more on the European Commission's thinking, see the link in the preceding paragraph.

Please note that these responses draw mostly upon the following CEER publications:

- A 2020 Vision for Europe's energy customers – 13 November 2012 (updated June 2014)
- Conclusions Paper on Incentives Schemes for Regulating Distribution System Operators, including for innovation – 19 February 2018
- CEER's 3D Strategy (2019-2021) – 9 January 2019
- Conclusions Paper on New Services and DSO Involvement – 22 March 2019
- Conclusions Paper on Dynamic Regulation to Enable Digitalisation of the Energy System – 10 October 2019
- ACER/CEER: The Bridge Beyond 2025 Conclusions Paper – 19 November 2019
- Paper on Electricity Distribution Tariffs Supporting the Energy Transition – 20 April 2020

CEER would also point readers toward several upcoming 2020 publications from our work programme relevant here, including:

- Report on Procedures of Procurement of Flexibility
- Paper on Whole System Approach
- Report/Papers on Regulatory Innovations for Electricity and Gas Sectors Coupling

2 The European Commission's input questions and CEER's responses

What would be the main features of a truly integrated energy system to enable a climate neutral future? Where do you see benefits or synergies? Where do you see the biggest energy efficiency and cost-efficiency potential through system integration?

[1]CEER supports the effort to foster an integrated energy system to enable a climate-neutral future in an efficient way, which CEER sees as its strategic priority to promote decarbonisation at least cost. Cost-efficient decarbonisation of the energy sector needs a cross-sectoral (electricity and gas) and whole system approach, keeping in mind all aspects: wholesale, networks, retail and potential impacts on infrastructure development. It also needs to factor in impacts on the electricity and gas sector from decarbonisation of mobility and building sectors (green mobility, efficiency…). **Main features would include [non-exhaustive]:**

- Integrating (fully) renewables in all segments (retail, wholesale and networks).
- Effectively and fairly managing the transition towards a low carbon energy system.
- Facilitating decarbonisation at least cost by two means:
  - Developing an energy market design with a minimal level of subsidy mechanisms (including cross subsidies and indirect schemes); and
  - Optimising the whole energy system cost to achieve decarbonisation at least cost, taking account of both gas and electricity, while maintaining a high level of security of supply.
- Building consumer confidence in the market by ensuring all consumers benefit in a fair way, notably through the efficiency of the network tariff, and promote the participation of consumers without discrimination between consumers/prosumers.

A whole system approach is an important part of this. In terms of regulation of network operators, this requires the network operator to look at net benefits on a wider basis than their own grid. It, for example, would involve coordination and interaction with other DSOs and TSOs. A true whole system approach (WSA) would embrace electricity, gas and heat with the aim of achieving the best overall approach for consumers. Given that CEER represents NRAs, it has taken an especially close look at what this would mean for DSOs:

- **The WSA is based on a wider vision of the network system as part of the entire value chain.** In order to implement the WSA, DSOs are to consider consequences of their decisions on other actors in the value chain and seek an efficient solution. In some situations, externalities not fully priced in must be considered by regulators. For instance, DSOs and TSOs should optimise the network system as a whole rather than focusing on minimising the DSO's and TSO's costs separately from each other. This could mean the TSO taking action to address a problem at distribution level or the DSO taking action to address a problem at transmission level if one or the other is the most efficient approach. NRAs should ensure that in these cases funding flows in the right direction. A further example is metering (in most countries this activity is carried out by DSOs): the interaction between DSOs as meter operators and other actors on the energy market is of great importance. Therefore, the benefits of smart metering should not be viewed only in light of DSOs' activities (for instance, valuable information for grid operation and investments), but also in terms of positive effects on all parties that use data on energy consumption and production (e.g. on distributed generation) to enhance their operations.

[1] This response is mainly taken from CEER's 3D Strategy (2019-2021) – 9 January 2019; the Conclusions Paper on Incentives Schemes for Regulating Distribution System Operators, including for innovation – 19 February 2018; and ACER/CEER: The Bridge Beyond 2025 Conclusions Paper – 19 November 2019.

- **Societal net benefit is the main criteria of the WSA**. Regulatory decisions must consider the societal net benefits. If externalities are not fully priced in, the decisions of one single DSO may, from its own cost-benefit point of view, appear disadvantageous for the DSO or its direct grid users but may be beneficial for the system as a whole. In such a case, the DSO could receive some form of incentive to carry out an activity beneficial for the system that they would otherwise drop if they were regulated only on their endogenous benefits and costs.
- **The WSA supports an efficient "system transformation" due to distributed resources.** The growing dynamic and interactions between TSOs, DSOs, market parties and prosumers at both low voltage and higher levels makes the coordination at these different systems more and more necessary. In a scenario of large diffusion of distributed resources, a more holistic approach based on wider cost/benefit analysis may lead regulators to provide the right incentives to DSOs for improving network system performance to the benefit of consumers. One example is for NRAs to consider allowing DSOs to share the benefits for the system of the reduction of dispatching costs generated by DSOs' investments, as is already in place for TSOs in some EU member states.
- **The WSA requires NRAs to take into consideration life-cycle costs**, provided that this approach does not generate misleading price signals or biased investment decisions, promoting, for instance, hardware investment over software investments. One way to do this is to use TOTEX regulation (i.e. superseding CAPEX regulation separate from OPEX regulation) to bring the necessary added value to the whole system approach.
- **The WSA helps in minimising inefficiencies**. The WSA approach is considered valuable because it can improve efficiencies in the energy system, as long the objectives of all stakeholders are aligned. Regulators who adopt the WSA can (incentivise the) search for the most efficient solution for the whole system. This means, *in primis*, to clarify the TSOs' and DSOs' roles, and avoid inefficiencies, especially in network planning and investment, integration of demand side response and distributed generation.

More generally, as new technologies and locations for supply of "green gas" are considered and substitution between energy vectors increases, **gas (or electricity) network assets may become one of several ways to provide solutions to meet the low-carbon energy needs of consumers (i.e. one of the competing options), instead of being the only way and hence an essential facility.** The owners of those network assets have a vested commercial interest in how those assets are used and developed, and so may not be incentivised to encourage more economic alternatives to come to the market through forward-thinking and planning. Or, on the contrary, they may have an interest in participating in the energy transition through the development of activities which could be potentially open to competition. **The role of network operators in the decarbonisation context should be clear in a smart sector strategy**, to ensure that their involvement does not foreclose potentially competitive activities or distort competition in these activities.

A smart sector strategy should also consider that **it may be inappropriate for the TSOs, as owners/operators of one of the competing options for providing energy system management, to have a monopoly over the identification of system needs**. There is a need for a coherent whole system approach across multiple sectors, including integration of power-to-gas and with energy management services for households, transport, services and industry. Scenarios should be driven by the National Energy and Climate Plans established in Regulation (EU) 2018/1999 on Governance of the Energy Union, to ensure that they are in line with the EU policy objectives. This may be facilitated by establishing, at European level, consistent definitions, criteria and policy scenarios, such as the speed of decarbonisation in different sub-sectors, the extent of technological innovation and energy efficiency improvements, and trends in demographic and economic factors.

A WSA would include flexibility and consider all energy vectors (electricity, gas(es)) on an equal footing in terms of their value and all stages of the energy value chain.

CEER will have more to say on this with the planned publication in 2020 of a CEER *Report on Procedures of Procurement of Flexibility* and a CEER *Paper on Whole System Approach*.

What are the main barriers to energy system integration that would require to be addressed in your view?

[2]**Barriers (or challenges) to energy system integration would include [non-exhaustive]:**

- Managing the penetration of renewable energies in the market, their impact on network designs and their technical functioning (variability, reverse flows, etc.) to ensure adequate security of supply.
- Providing for an effective regulatory oversight and new regulatory approaches for a fast-growing diversity of new market models, business models and market actors.
- Steering efficient investment in a context of price volatility on wholesale energy markets with a market-based approach, in order to best manage risk.
- Adopting a whole system approach to minimise consumers' bills, including via energy efficiency.
- Taking decisions in a context of major uncertainty and adapt to different market circumstances, notably the role of gas, the share of green gas, electricity storage advances, the electrification of transport and future trends of green mobility and other technological developments, as yet unforeseen.

Consumer welfare issues will be all the more important in the context of closer interlinkages between sectors, including energy, and how consumers will interact with each of them. With this in mind, CEER recalls the enduring relevance and importance of the core principles of the CEER-BEUC 2020 Vision for Energy Consumers: **Reliability, Affordability, Simplicity, Protection and Empowerment** (RASP). CEER and BEUC are currently working to renew and reinforce these principles, looking ahead to 2030 and within the context of the energy transition and the objective of achieving carbon neutrality by 2050.

As smart system integration policies are developed and implemented, CEER considers that the challenges identified for the digitalisation of the energy sector in CEER's 3D Strategy could also be relevant in a multi-sectoral context:

- Ensure **consumer rights protection, including non-discrimination, is fit-for purpose** given new market paradigms (data privacy, contract laws…) with consumer-centric regulation.
- Effective **regulatory oversight of cross-cutting issues with other sectoral authorities and new market models** (block chain, bundled products…).
- Cybersecurity: helping to **identify and manage the potentially increased threat to security of supply, market manipulation and data protection** associated with digitalisation (and decentralisation) in the sector.
- **Identify and mitigate risks associated with those consumers who may be "left behind"**, as not all innovative services, devices, etc. are accessible to, or wanted, by all.

[2] This response is mainly taken from CEER's 3D Strategy (2019-2021) – 9 January 2019 and A 2020 Vision for Europe's energy customers – June 2014.

- In order to keep up with innovation and the global trend of digitalisation, regulators must be ready to allow new interpretations of their regulatory work and changes in the regulatory framework.

Furthermore, as noted in CEER's "Conclusions Paper on Dynamic Regulation to Enable Digitalisation of the Energy System", pre-existing incumbent advantages as regards access to key market enablers (such as data) can create barriers for new entrants. Such competition risks could arise when integrating different sectors, each having their own established market players.

What role should renewable gases play in the integrated energy system?
What measures should be taken to promote decarbonised gases?
What role should hydrogen play and how its development and deployment could be supported by the EU?

[3]Renewable gas could include blending biogas, biomethane, synthetic methane or hydrogen into natural gas, or using biogas, biomethane, synthetic methane or hydrogen in place of natural gas. This includes "power-to-gas", where the resulting gas could be synthetic methane or hydrogen. It may also include carbon capture and use or storage where relevant.

Renewable or "green gas" production assets could be developed in a competitive market, supported in the early stages for technology development reasons, if government policy so decides. There is a wide range of different decarbonisation technologies and it is not yet clear which ones will end up providing the most economic solutions, and in which locations and combinations.

In an integrated energy system, the potential expansion of renewable gases and their use in power-to-gas give rise to a number of technical issues, such as the definitions of various decarbonised energy products in technical terms, as well as in terms of being "green", and technical standards for connections and gas quality. To the extent that blending of other gases into natural gas becomes more prevalent, variations in gas quality standards across borders should not become a barrier to trade. In any case, the interoperability requirements of the Interoperability and Data Exchange Network Code should remain applicable.

In terms of promotion of decarbonised gases, CEER would urge careful consideration of the role of monopoly regulated entities. For some assets, it is still unclear whether they are better treated as part of the competitive market or as monopoly infrastructure. We already see TSOs looking to invest in assets that are arguably for competitive activities, for example power-to-gas or renewable gas facilities. For power-to-gas assets, moreover there may be issues where differences in tariffs or market rules between gas and electricity cause distortions or unintended consequences. For example, differences between the gas day and electricity day (i.e. the period covered by day-ahead auctions) could increase risks. The terms on which renewable or "green gas" production assets connect to the existing gas system and the tariffs they pay should put them on **a level playing field with other technologies**. In this way, they can compete fairly in the wholesale market, benefiting from the greenhouse gas reduction value they provide. These issues and risks need to be considered carefully in how a smart sector integration strategy would organise and promote such integration. CEER favours adopting consistent principles at European level and a dynamic regulatory approach, rather than including detailed rules in legislation at this stage.

[3] This response is mainly taken from the ACER/CEER: The Bridge Beyond 2025 Conclusions Paper – 19 November 2019.

This will need to be supported by **effective definitions and monitoring**. Definitions and criteria should unambiguously determine the different types of decarbonised gas and the extent to which each can be regarded as “green” or “low carbon”. It is also necessary that they can be easily modified or be general enough to include new gases/technologies that may emerge. In addition to effective definitions and monitoring, reliable fundamental data on gas production assets in place and planned should be systematically collected from TSOs, DSOs and GO issuing bodies, and should be available at European level. Otherwise, proper regulatory and other assessments of renewable gases’ effects on the sector will be difficult to carry out.

Regarding **the role of hydrogen**, if end consumers are supplied with pure hydrogen conveyed through a network of pipes this may be an example of assets with monopoly characteristics. In many countries, there is no regulatory framework for these assets today and it is unclear whether they would or should fall within the same regulatory framework as natural gas networks.

In terms of blending of hydrogen in gas networks, CEER would urge for a strategy to call for preparatory assessments coordinated at European level at least in terms of principles or methodology. Security takes on a special relevance when dealing with hydrogen. National and regional conditions differ and it will be important that any EU-wide thresholds for hydrogen admixture do not prevent significant development of blending in regions where this can proceed quickly, nor require excessive investment in other regions where flows of hydrogen remain marginal.

Overall, one of the main issues regarding renewable gases in an integrated energy system is **uncertainty as to how new assets and activities will be treated in regulation**. The historical system was not designed with these new assets and activities in mind and they may, by chance, currently be treated differently in different countries depending on the precise wording of legislation or regulation, highlighting the need for uniform definitions and criteria to be met for a product to be designated as “low-carbon” or “green”. On the other hand, it is currently uncertain whether and how such assets and activities will develop, so it may be considered prudent to “wait and see” rather than closing down choices too soon. The challenge for a smart sector strategy is to **provide sufficient predictability to promote efficient investment without taking decisions that preclude innovation and efficient investment**.

How can energy markets contribute to a more integrated energy system?

[4]Tariff design is an important part of energy markets. As such, CEER has given some consideration of how distribution network tariffs can be best designed in light of the energy transition and a sector that is increasingly digitalised and decentralised.

Improvements in the available information about the real-time status of the network and the consumption of each individual customer make it more realistic to implement dynamic tariffs. A dynamic tariff means that the price signal is defined at shorter notice, possibly close to real-time. This contrasts with static tariffs, where the price signals are associated with predetermined time periods. **Dynamic tariffs are one way that DSOs could make use of flexibility to avoid or defer reinforcement, which is due to increasing intermittent production and variation in consumption/load.** One way of implementing dynamic tariffs is through a critical peak price (CPP).

[4] This response is mainly taken from the Paper on Electricity Distribution Tariffs Supporting the Energy Transition – 20 April 2020.

The objective of a dynamic network tariff is to promote more efficient network use under a scenario where network use has become more uncertain (e.g. due to intermittent production or new consumption patterns) and where new technological solutions are enabling demand response (smart meters, automation, storage). **Being dynamic, the price signals can be sent closer to real time, increasing the cost-reflectiveness of the network tariff, which should achieve a more cost-efficient system, benefitting all network users.**

A strategy that would recognise the potential value of dynamic tariffs would also take into consideration the prerequisites (a detailed forecasting model, estimates of long-term avoided costs and the IT infrastructure to send price signals to network users) **as well as new questions raised by their use** such as how customers should be informed of tariffs, how regulators should regulate tariff setting, and how they should be integrated into the system of tariff or revenue cap incentive regulation.

The tariff structure is not the only instrument to incentivise implicitly beneficial network behaviour of grid users. Another instrument is to explicitly procure both production and demand side flexibility for purposes such as congestion management or to reduce or delay the need for network expansion. Flexibility services procurement could be useful for increasing efficiencies in the operation and development of the networks. **A smart sector strategy should consider how both static and dynamic network tariffs can interact with flexibility procurement to lower network costs**, appropriately differentiating between the situation where it interacts with static network tariffs vs dynamic network tariffs.

A cost-reflective tariff design will be fundamental for the energy transition, promoting efficient utilisation of the existing network and signalling the cost of expanding the network further. In a more-integrated energy system, retailers and other third party actors give customers a better opportunity to respond to more complex tariff signals than they would have on their own, for example through new technology that allows engaged users to react to the information from their smart meters (e.g. by offering their flexibility for the potential to save money). “Behind the meter” options using smart technology to react to various price signals, would also make it easier for retailers and other third-party actors to combine retail offerings with storage, EV charging management and aggregation, etc. **Given this, a smart sector strategy should consider that it is important that more cost-reflective tariffs providing incentives for an efficient use of the network are introduced.**

A smart sector strategy will want, to the degree possible, foster the development of smart tariffs, i.e., ones capable of dealing with a smarter environment, characterised by smart appliances, aggregators and price comparison tools. **A smart distribution tariff needs to strike an adequate balance between reflecting the cost drivers of distribution networks and ensuring that network users equipped with smart technologies are able to react to the signals.**

Traditionally, energy generally flowed from the highest to the lowest voltage level. As a result, distribution tariffs have traditionally been allocated on the grounds that each network user should pay for the voltage level of connection, as well as for all voltage levels above. **In a more-integrated energy system, a network with substantial decentralised generation, together with storage facilities and prosumers, might observe inverted power flows (from lower voltage layers to higher voltage ones) on a frequent basis. This will open the debate about whether network users connected at higher voltage levels should be charged for lower voltage grids.** A strategy should consider that regulators may consider adjusting the cost cascading principle in order to take into account reverse power flows in the light of the fact that such an adjustment may lead to significant impacts on network users.

The energy transition will also challenge the way network tariffs are charged to producers and consumers. **In a traditional power system**, generation reacts in a passive manner to changes in consumption and, as a result, **most tariff structures allocate almost the entire cost of distribution tariffs to consumption. In a modern power system, with network investment required to facilitate distributed generation and more elastic demand and intermittent generation, that rationale could be questioned.** A strategy should keep in mind that NRAs should assess the need for introducing network tariffs for producers, where they are not yet applied, and (where they are already applied) assess the risks of increasing distribution tariffs for producers, with regards to avoid creating distortions in the wholesale market and the development of a decentralised power system.

Article 18(1) of Regulation (EU) 2019/943 includes a provision that network charges – if applied to producers – shall 'not discriminate positively or negatively between production connected at the distribution level and production connected at the transmission level'. In CEER's view, NRAs should develop efforts to have a common methodology to set network tariffs for producers connected at both distribution and transmission levels, taking into account availability of information and the need to aggregating data. Regulation (EU) 838/2010 is relevant in this context, as it sets limits on the transmission tariffs that can be charged to producers in different Member States.

Energy storage will be one of the crucial factors for integrating more renewable energy into the power system, because it enables a combination of intermittent RES with rather inelastic demand, while meeting the technical requirement that power supply matches demand at all times in the network.

Regulation (EU) 2019/943 establishes that "network charges shall not discriminate either positively or negatively against energy storage". Since a storage facility may withdraw energy from or inject energy into the distribution network, it can be regarded as both a consumer and a producer located at the same network connection point. **As such, non-discrimination would suggest that energy storage should be subject to distribution tariffs applicable to both energy withdrawals and, where applicable, energy injections. Nevertheless, the cumulative charges for withdrawal and injection must reflect the value of storage to the system** [double charging for storage facilities should be avoided]. A storage facility operated with the purpose of improving network utilisation can decrease the need for future network investment, while a storage unit operated inefficiently from a network perspective can increase future distribution costs. The distribution tariff design should be able to reflect the positive or negative impact that storage facilities might have.

Electrification of transport is one of the pillars for decarbonisation. Integrating a large amount of EVs represents a challenge because it may increase the need for more capacity on the distribution network, in particular on the low voltage network. But it also represents an opportunity, because an efficient charging regime can encourage flexibility, enabling better integration of intermittent RES. **Cost-reflective distribution tariffs are an important prerequisite and may play a crucial role for a successful integration of EVs. Without "smart charging", increases in demand for capacity during peak times could necessitate large grid investments. These costs could be reduced through incentivising smart charging, i.e. charging during hours where the network has available capacity. A smart sector strategy will want to include smart charging and take into account the risk of poor price signals here.** For example, with a volumetric tariff, charging an EV using a fast charger costs the same as using a slower charger. However, the two technologies impose very different costs upon the distribution network.

How can cost-efficient use and development of energy infrastructure and digitalisation enable an integration of the energy system?

[5]CEER's work on digitalisation notes three fundamental implications for the energy system:

- **Digitalisation increases the productivity of the current energy system;**
- **Digitalisation enables new services that alter energy demand; and**
- **Digitalisation brings new platforms and marketplaces that transform the sector.**

Given these impacts, digitalisation can enable giving the right price signals to market participants; encourage DSOs to use flexibility; empower energy consumers (from concomitant data and technology); generate better, more accessible and more useful data; and facilitate innovation.

Digitalisation is a key enabler for efficient decentralisation of the energy system, **enabling large numbers of different sources of energy and flexibility to be effectively integrated. Cost-efficient decarbonisation of the energy sector needs a cross-sectoral (electricity and gas) and whole system approach**, taking into account all aspects: wholesale, networks, retail and potential impacts on infrastructure development. It also needs to factor in impacts on the electricity and gas sector from decarbonisation of mobility and building sectors (including green mobility and efficiency), which can be facilitated by digitalisation.

It should be noted that not all of the effects of digitalisation of the energy system are positive for decarbonisation. More effective use of data can reduce the cost of fossil fuels and reductions in the cost of energy and mobility may lead to rebound effects increasing demand.

Some examples of ways of how digitalisation is related to cost-efficient energy sector use include that with increased and more-granular data, **operators of gas and electricity networks, power plants and other asset operators and users (storage, LNG terminals, etc.) can make better informed decisions on investment, operation and maintenance**, which improve the operational efficiency and productivity of assets, reduce cost and may ultimately extend asset life. In the electricity sector, the IEA estimates that the overall savings from these digitally enabled measures could be in the order of USD 80 billion per year over 2016-40, or about 5% of total annual power generation costs based on the enhanced global deployment of available digital technologies to all power plants and network infrastructure.

Better use of data, alongside machine-learning techniques, can **improve the design and development of both fossil fuel and renewable production**. Sophisticated modelling of wind farms can improve siting of individual turbines, making more effective use of the wind resource. Similarly, new techniques to analyse seismic data can improve the efficacy of oil and gas exploration. The development costs of both renewable and fossil fuel energy sources are likely to be reduced.

Sensors on supply sources (power plants, gas supply and storage) and networks can provide **continuous and real-time information about the infrastructure, which improves the efficiency of operations, reducing the costs associated with system operation**. Data on network flows and voltage can be analysed to reduce the losses on the networks, increase hosting capacity of distributed generation and grid utilisation.

[5] This response is mainly taken from the Conclusions Paper on Dynamic Regulation to Enable Digitalisation of the Energy System – 10 October 2019

Improved monitoring can allow earlier identification of changes in the operation of equipment on networks and power plant and **allows maintenance to take place before the problem worsens**, becomes more expensive to resolve and results in unplanned outages. Where maintenance is needed digitalisation also enables it to be more targeted and better planned, which reduces the costs and the downtime.

For network operation to be optimised, data on the performance of all assets, devices and infrastructure can also be shared between parties. In **modelling network infrastructure to identify efficiency gains, transmission and distribution system operators can take into account the performance of power plants, storage and other connected devices**, which might produce, consume and/ or provide demand-side response. Similarly, power plants and other connected devices will also be best placed to optimise design, location and operational efficiency, if they have access to data on the state of the whole system.

For **electrification of transport**, there are both challenges and benefits for the energy system. From the perspective of the energy system the ability for digitalisation to provide the connected infrastructure to charge vehicles powered by electricity or to enable the automation of road transport will have an important impact on demand for electricity. The electrification of transport brings **a new source of electricity demand** while reducing direct fossil fuel usage. This has sparked debate in the sector about the challenges of managing this additional demand, particularly in real-time, at local sub-station levels, where congestion may emerge in the system. **Digitalisation can also contribute to ways to manage the challenge of increased demand**, particularly at peak times. Firstly, it can provide visibility of the location and charging status of vehicles. Secondly, using vehicles-to-grid communications technology, it can allow for charging to be shifted to periods of lower consumption (demand-side response) and allow vehicle batteries to be used to store excess electricity (providing flexibility), therefore helping the system. Companies are investing in the systems and software to enable demand-side response through ‘smart plugs’ and flexibility through vehicle-to-grid technology.

Digitalisation of transport also enables transport systems to become more efficient, which could help reduce the additional demand for electricity for transport and minimise its impact on the energy system. By providing real-time data on the location and potential routes for vehicles, it allows companies to offer consumers optimised travel routes, apps providing such services are already available. Communications technology can be used to allow freight transport not only to optimise routes but to drive in close proximity, saving on fuel (or electricity consumption in future) without compromising safety.

Furthermore, **digitalisation could alter the way consumers use vehicles and impact the demand for electricity to fuel transport.** There are already ‘shared mobility’ services, where digital technology allows consumers to use shared taxi services in real-time. The development of automatic vehicles for road transport, where automated systems replace human intervention, could increase this trend and help manage electricity demand. More shared mobility would enable vehicle right sizing and further maximise vehicle efficiency although it could also increase comfort of road transport and increase the journeys and the demand for electricity from transport. Automatic vehicles could also help with directing vehicles to the most appropriate charging points and help system operators to manage the constraints on the grid.

Digitalisation is both a prerequisite for and enables **new platforms and marketplaces, which allow collective management of diverse inter-connected assets that could transform the way the sector uses resources and does business.** These new platforms can provide the data and connectivity for active ‘prosumers’, consumers who produce electricity from solar panels and potentially store it in batteries, to sell electricity and become active in balancing the supply and demand of electricity. In the future**, this could include flexibility from smart controls in buildings and/ or electric vehicles. Such a dynamic may be implemented in the gas sector as well, contributing to the potential development of local green gas sources and gas smart meters.** In the gas sector, the need for such platforms and marketplaces may be less as the gas system does not need to be balanced in such short timeframes. However, distributed sources of gas (such as biogas) are growing and flexibility management in gas (including line pack management) also requires actions by system participants. **Sector coupling could require more granularity and interaction, both as far as gas to power and power to gas are concerned.**

Flexibility marketplaces use digital technology to allow consumers directly or indirectly via an aggregator to sell electricity and/or flexibility services to network operators and/or to other market participants. They can be used by market participants to balance their positions or by network operators and market participants to manage energy systems. If consumers are able to directly participate in such markets and decisions become automated, aggregators may find their role becomes one of energy portfolio/ fund managers, rather like fund managers in the financial markets. Such markets may operate at local levels or at regional/ national levels to help manage congestion on the system and potentially to reduce losses through local balancing**. From an energy system perspective, flexibility platforms can provide a mechanism to integrate renewables, storage and other sources of flexibility in the energy system or to improve their utilisation for the system.** They may be a vehicle for the trade of flexibility at local/distributional level and the need for visibility and multi-layer trading of flexibility products at local, regional and national levels.

How data is processed and made available for actors to use will be critical to a successful energy sector strategy that incorporates digitalisation. There are a range of models available to Member States for organising the collection and distribution of this data. These hubs will hold smart meter demand information, network information and customer information to facilitate switching. Other options include more decentralised information solutions and separate market roles, such as for data access and distribution.

More important than the organisational approach is the **requirement for appropriate accessibility and interoperability of data,** such as use of application programme interface (API) or general electronic data interchange (EDI) layer. This enables the efficient use of the energy system, allowing providers to expand their geographical scope of operation, increasing competition, realising new value, and bringing down consumer costs.

Cost-reflective tariffs are important in any sector to ensuring behaviour is correctly incentivised. **For a more-integrated energy sector, cost-reflective price signals are one of the critical enablers for digitalisation to transform available data into products that consumers (or their agents) can use to release value.** The effective collection and use of data to build more accurate price-signals can ensure that any such cost-reflective pricing is as accurate and so as proportionately effective as possible. In an integrated energy system where consumers provide services back to the grid, digitalisation facilitates this through enabling new platforms and marketplaces.

In general, the uncertainty over future developments means that **a strategy for smart sector integration will need to have an agile approach built in**, rapidly responding to new products and service proposals and removing barriers where appropriate. This creates challenges for regulators and policy-makers in retaining openness and not jumping to lock in solutions too soon. In some cases, simulation models can be a useful tool, although they will not always capture real world behaviour accurately. CEER would note that NRAs do not have absolute freedom of action and need to stay within the bounds of existing legislation. A strategy could begin to consider areas of legislation that may need to be adjusted to the new digital realities to become more flexible and conducive to modern regulation.

What policy actions and legislative measures could the Commission take to foster an integration of the energy system?

CEER has several recommendations for policy and legislation on this topic taken from the mentioned published papers:

- Clear definitions and categorisation of decarbonised gases, including carbon capture and use or storage, should be established in European legislation, and consistent principles should be applied across the EU to facilitate the blending of decarbonised gases. Legislation should be sufficiently flexible to allow the emergence of new gases/technologies.
- A technology-neutral, level playing field should be established between different conversion and storage facilities across the energy sector, so that they face equivalent categories of costs in network tariffs and levies, and equivalent recognition of environmental and security of supply benefits. To facilitate this, ACER could be requested to undertake an assessment of the current situation and provide recommendations.
- New assets and activities should be facilitated through regulation, including a sandbox model at EU level for pilot, small scale projects and appropriate differentiation between competitive and monopoly activities. Any subsidies are a matter for governments rather than regulators and should not take the form of discounts on or exemption from network tariffs in any case. TSOs and Distribution System Operators (DSOs) should only be allowed to undertake potentially competitive activities under strict rules and as a last resort. While it is too early to be definitive, large-scale hydrogen networks could be expected to provide regulated third party accessing.
- For infrastructure planning, an effective regulatory framework at EU level, similar to that existing in some Member States, is needed to ensure a level playing field for new solutions. The existing network operators face challenges from decentralised solutions and can no longer be regarded as completely neutral. Improvements in network code governance introduced in the Clean Energy Package for the electricity sector are needed in the gas sector as well.
- Data privacy, ensuring competitive access to data, and cybersecurity are essential for digitalisation to promote a more-integrated energy system; policy and legislation should always support this.
- Legislation should support the ability of regulators to monitor development of platforms and new marketplaces and seek to establish adequate oversight and feedback from stakeholders. Where barriers are identified, regulators should be enabled to promote a level playing field for alternative technologies.
- Legislation should support regulators to oversee DSOs and TSOs in regard to reviewing product definitions for grid services which make most efficient use of the services that distributed resources are able to provide without unnecessary restrictions (such as high

minimum size requirements). As far as practical, this should be consistent across markets. Legislation and policy should also enable regulators to encourage deepening of TSO-DSO relationships so as to enable decentralisation and sector integration where appropriate.

- In the context of a more-integrated energy system, the boundary between the network operator's core activity and the provision of other services must [continue to] be drawn clearly; this is particularly important in the context of integrating different energy systems. Clear boundaries help ensure TSO/DSO activities are confined to those that may be carried out by the neutral market facilitator and do not overlap or interfere with activities that should be left to market players.
- Policy should reflect that the following activities are, in principle, open for competition (list not exhaustive): Providing flexibility services (including storage), the development, ownership and operation of EV charging points, and the provision of direct services to consumers (including specific energy efficiency advice), data analysis services and enriched data to third parties.
- It is crucial that network operators do not neglect their core tasks and retain separation between their regulated activities and other service provisions, even as the energy system changes to a more-integrated one. Cross subsidisation should continue to be avoided.
- As the transition in the energy sector progresses, policymakers and regulators should continue to develop their thinking regarding activities which may involve TSOs and DSOs. By creating more clarity regarding market structures and defining more clearly the roles of the different players and stakeholders in a rapidly developing energy landscape, legislators and regulators can facilitate the development of additional market activities.
- CEER emphasises the need for NRAs to review the current tariff structures to identify how they can be improved, for example to create stronger incentives for efficient usage of the grid. Topics that require further thinking about include dynamic network tariffs' potential and the interaction with procurement of flexibility. NRAs – *and where required also legislators* – will need to anticipate circumstances, such as the completion of the smart meter roll-out and aggregators offering flexibility for procurement by DSOs, in order to allow for a smooth introduction of improved tariffs structures.