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DSG

CEER Consultation on Dynamic Regulation to Enable Digitalisation of the Energy System

Conclusions Paper

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INFORMATION PAGE

Abstract

Digitalisation is one of the three pillars of CEER's "3D Strategy" for the period 2019-21. CEER held a public consultation on how to enable digitalisation of the energy system in the consume interest, from March to May 2019, to seek input to help regulators prioritise the actions they can take to benefit consumers over the course of the 3-year strategy. CEER received 47 responses from external stakeholders. Non-confidential responses and our Evaluation of Responses are available on the CEER website.

This resulting CEER Conclusions Paper on Dynamic Regulation to Enable Digitalisation of the Energy System (C19-DSG-09-03) presents CEER's view on the implications of digitalisation for the energy sector and for consumers in particular.

The three implications of digitalisation for the energy system are:

- 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.

The value propositions of digitalisation for energy consumers are:

- Cost savings
- Convenience
- Choice
- Consumer participation
- Quality and security of supply

This CEER Conclusions Paper has six main conclusions, and identifies five priorities and seven recommendations for follow up by CEER, National Regulatory Authorities (NRAs) and other relevant stakeholders.

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CEER and the consultants thank the stakeholders who generously gave their time to be interviewed in preparation of the consultation paper.

Finally, CEER also acknowledges the valuable feedback input provided by the 47 external stakeholders who responded to our digitalisation public consultation.

Target Audience
NRAs, European Commission, Member States, gas/electricity consumers, consumer representative groups, academics and other interested parties.

Keywords
Digitalisation, dynamic regulation, consumers, energy consumers, flexibility, smart technology, distribution network, transmission networks.

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Related Documents

CEER Documents

- CEER'S 3D Strategy (2019-2021) Conclusions paper
https://www.ceer.eu/documents/104400/-/-/483aa2de-7785-f5bb-87fb-4b0398fcfe0b

- CEER White Paper series
https://www.ceer.eu/white-papers

- CEER Cybersecurity Report on Europe's Electricity and Gas Sectors
Ref: C18-CS-44-04; 26 October 2018
https://www.ceer.eu/documents/104400/-/-/684d4504-b53e-aa46-c7ca-49a3d296124

- CEER Draft Guide on Bundled Products
Ref: C18-CRM-PEER-07-06; 19 September 2018
https://www.ceer.eu/documents/104400/-/-/96ec6f1e-d4af-8a5b-b114-c9e6c1fdaadd

- CEER Report on Smart Technology Development
Ref: C17-RMF-101-04; 5 June 2018
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https://www.ceer.eu/documents/104400/-/-/e5186abe-67eb-4bb5-1eb2-2237e1997bbc

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Table of Contents

EXECUTIVE SUMMARY 8

1 INTRODUCTION 12

1.1 Background to Consultation 12
1.2 Defining Digitalisation 13
1.3 Relationship to 'Decarbonisation at least cost' 14
1.4 Relationship to 'Dynamic Regulation' 14

2 WHAT IS THE VALUE PROPOSITION FOR CONSUMERS OF DIGITALISATION OF THE ENERGY SYSTEM? 16

2.1 The Implications of Digitalisation for the Energy System 16
2.1.1 Digitalisation Increases the Productivity of the Current Energy System 16
2.1.2 Digitalisation Enables New Services that Alter Energy Demand 19
2.1.2.1 Smart Buildings and Heating / Cooling as a Service 19
2.1.2.2 Mobility as a Service 20
2.1.2.3 New Retail Pricing Models and Products 21
2.1.3 Digitalisation Enables New Platforms and Marketplaces 22
2.1.3.1 Peer-2-Peer Trading 23
2.1.3.2 Flexibility Marketplaces 25
2.2 Value Proposition for Energy Consumers 27
2.2.1 Cost Savings 28
2.2.2 Convenience 29
2.2.3 Choice 29
2.2.4 Consumer Participation 30
2.2.5 Quality and Security of Supply 31

3 WHAT NEEDS TO HAPPEN TO ENABLE THE BENEFITS OF DIGITALISATION AND PROTECT AGAINST THE RISKS? 32

3.1 Getting Useable and Accessible Data 32
3.1.1 Generating Data 32
3.1.2 Making the Data Accessible and Interoperable 33
3.2 Managing Data Risks and Consent 36
3.3 Cost-Reflective Price Signals 39
3.4 Using the Data for Flexibility 41
3.5 Consumer Access to Energy Markets 42
3.5.1 Mitigating Consumer Risks of Digitalisation 42

3.5.2 Consumer Products and Intermediaries 43
3.6 Innovation and Future-Proofing Regulation 46
3.6.1 Managing Risks..46
3.6.2 Digitalised Energy Regulators 47
3.6.3 Supporting Digital Innovation..48

4 CONCLUSIONS AND NEXT STEPS 49

ANNEX 1 – LIST OF ABBREVIATIONS 53

ANNEX 2 – SUMMARY OF THE PRIORITIES AND RESPONSIBLE PARTIES......................54

ANNEX 3 – ABOUT CEER..56

List of Figures

Figure 1: Integrated Market Model 26
Figure 2: What is the Key Technology for the Digitalisation of the Energy Sector 33
Figure 3: Should Energy Suppliers be Able to Know What Their Consumers Have Used Every Hour?.. 37

EXECUTIVE SUMMARY

Background

Fundamental changes are ongoing in the energy sector. Beside the fundamental transition to a sustainable and green economy, a second wave of technological change affected the energy sector - digitalisation - which implies new opportunities for stakeholders and operators but also new challenges for market participants and regulators.

In this context, the Council of European Energy Regulators (CEER) has set digitalisation as one of its key strategic policy areas where CEER is working to facilitate competition that benefits active energy consumers whilst protecting the more vulnerable in society. Digitalisation is not an objective in itself. Instead, digitalisation is a useful tool to reach the overarching objective of a flexible and sustainable energy system that deliver benefits ultimately for energy consumers.

Objectives and Contents of the Document

How is digitalisation going to manifest itself in the complex energy systems that have developed over decades? What does digitalisation mean for the consumer? What is the role of energy regulators in stimulating change in a positive manner for the consumer? These are crucial questions addressed by this report. It identifies five top priority areas for further work by NRAs and CEER, network operators and stakeholders to develop a future-proof strategy on digitalisation.

The document has four chapters:

1) Introduction
2) What Is the Value Proposition for Consumers of Digitalisation of the Energy System?
3) What Needs to Happen to Enable the Benefits of Digitalisation and Protect Against the Risks?
4) Conclusions and Next Steps

The three implications of digitalisation for the energy system are:

- 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.

The value propositions of digitalisation for energy consumers are:
- Cost savings
- Convenience
- Choice
- Consumer participation
- Quality and security of supply

Brief Summary of the Six Conclusions

Our CEER public consultation and this resulting report have highlighted a pathway to getting the best out of digitalisation in the energy sector. Core elements of a sustainable regulatory strategy on digitalisation in the energy sector are:

Giving the right price-signals: Generation, consumption and network data needs to be given a clear market value to incentivise prosumers and their intermediaries to profit from using the data to optimise their behaviour.

Encouraging Distribution System Operators (DSOs) to use flexibility: A great deal of the value in data comes from DSOs making efficient use of the information to increase the system efficiency.

Empowering consumers: Following the 2019 "Clean Energy for All Europeans" legislative package (CEP), digitalisation needs to be used to empower consumers to ensure that they can access the value propositions resulting from increased digitalisation of the energy sector. For example, value comes not from having a smart meter installed but from using it for more efficient consumption.

Generating the right sort of data: Appropriately granular data on the electricity system is needed, data which is beneficial for managing the whole system.

Making data accessible and useful: Data needs to be collated and made available not only to network operators but also to current and potential market participants:

- **Accessible and interoperable** data for current and potential market participants, subject to appropriate cost-benefit analysis.
- **Secure**, in line with cybersecurity and data protection requirements.

Allowing innovation: For consumers to benefit from innovation and digitalisation, regulators and DSOs need to be adaptable and respond to developments in markets.

Brief Summary of the Five Priority Areas to follow up

*P 1. **Ensuring effective price-signals**: CEER recommends that NRAs as part of their regular processes review network tariffs to ensure they are fit for the future given the availability of data from digitalisation. Tariffs should give the right price-signals to actors to effectively use available data, and avoid unduly distorting markets. Active customers who utilise new technology must receive cost-reflective signals reflecting the costs and benefits they bring to the network which requires well-functioning markets. All consumers, including those who are unable or choose not to engage, should pay a fair contribution towards the fixed costs of the system. CEER to review progress on this during 2021, in line with the 3D Strategy.*

*P 2. **Promoting DSO use of flexibility**: CEER recommends that NRAs as part of their regular processes review network tariff regulation to remove capex bias and encourage the use of flexibility services where economic. CEER to review progress in* *implementing the recommendations of this paper and collate best practices during 2021, in line with the 3D Strategy.*

P 3. ***Enabling market-based flexibility****: DSOs to explore market-based procurement for flexibility services, considering use of a flexibility marketplace where efficient and reviewing whether network tariffs send the right signals for network users. CEER to publish the planned paper on procurement of flexibility by DSOs beginning of 2020 and based on that decide on further actions.*

P 4. ***Getting and making the data accessible and useful:*** *DSOs to focus on the quality of their network data and data on distributed energy resources connected to their networks within the relevant legal framework, to ensure that:*

- *they utilise data effectively where this will improve efficiency of their planning, operations and investment;*
- *where appropriate ensure relevant network data is available to current and potential market participants in an accessible manner, and*
- *the opportunity to improve the interoperability of data and institutional arrangements for holding and sharing the data should be further explored.*

DSOs and other data owners should learn from those who move first in this area. CEER to work with stakeholders to facilitate this work.

P 5. ***Fostering innovation:*** *Regulators develop best practice approaches to enable trials of new products and business models ("sandboxes"), taking into account the whole system approach. CEER to provide a forum for exchange of learning from both EU-funded and national trials and studies and to feed back into the parameters for new trials.*

The above priorities will be integrated into CEER's work programme under years 2 and 3 of our 2019-2021 "3D Strategy". These will be developed along with the following recommendations, corresponding to ongoing tasks that national regulators are carrying out. CEER may also address some of these issues at European level.

Brief Summary of the Seven Recommendations

R 1. ***Ensuring data protection:*** *for data privacy and competition issues, energy regulators should work with the authorities responsible for data protection and competition to ensure mutual understanding of the issues in the energy sector and to ensure energy companies adopt best practices.*

R 2. ***Strengthening cybersecurity****: as a minimum, take forward the recommendations in the recent CEER report on gas and electricity cybersecurity.*

R 3. ***Monitoring market evolution:*** *Regulators to monitor development of platforms and new marketplaces and seek to establish adequate oversight and feedback from stakeholders. Where barriers are identified, regulators to promote a level playing field for alternative technologies.*

R 4. ***Designing the right grid service products:*** *DSOs and TSOs to review 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.*

R 5. ***Deepening TSO/DSO relationships:*** *Regulators to review progress on TSO/DSO relationship in a more decentralised system and where necessary engage more closely in discussions to define respective responsibilities.*

R 6. ***Empowering consumers through new products:*** *NRAs to monitor experience with new products and consider whether additional steps to empower or protect consumers are needed, and energy regulators to cooperate with other regulators through PEER to promote effective consumer protection. CEER to publish a summary of experience across Europe once there is sufficient experience to learn from, considering also lessons from telecoms and financial services markets where relevant. Particular attention is merited on distributional issues – whether some parts of society are being "left behind" by developments*[1]*.*

R 7. ***Regulating intermediaries:*** *Regulators to consider best model for regulation of intermediaries including responsibility for balancing and, where applicable, capacity requirements where they are selling energy. Where not already in place, consider arrangements for a default supplier for inactive customers.*

During 2021, and as part of 3D Strategy, we will review progress against these recommendations and assess the best way forward to get the most out of digitalisation.

[1] CEER's Customer and Retail Markets Working Group is planning to work on related topics. The WG is for instance planning to prepare a case study report on innovative business models and consumer protection and a CEER position paper on digitalisation as a driver for better retail market functioning. These items and more are part of the CEER consultation of its 2020 Work Programme: https://www.ceer.eu/pc-work-programme-2020

1 Introduction

1.1 Background to Consultation

The energy sector is undergoing fundamental change. Having been relatively unaffected by technological changes – particularly in customer experience – which have transformed other sectors over the past decades, we now see new developments in how we use, produce, transport and transact energy coming forward at an accelerating pace. Underpinning many of these changes is a growth in the availability and use of data and digital technology.

In this context, the Council of European Energy Regulators (CEER) has set digitalisation in the consumer interest as one of three key strategic policy areas in its 3D Strategy (2019 - 2021)[2] where CEER is working to facilitate competition that benefits active energy consumers whilst protecting the more vulnerable in society. The two other strategic policy areas are decarbonisation at least cost and dynamic regulation. From CEER's perspective, digitalisation is not an objective in itself, but a means to deliver benefits for the energy system and ultimately for energy consumers. Indeed, digitalisation is a necessary tool to reach the overarching objective of a flexible and sustainable energy system.

To deliver the strategy, key questions include: how is digitalisation going to exhibit itself in the complex energy systems that have developed over decades?, what does digitalisation mean for the consumer?, and what is the role of energy regulators in stimulating change in a positive manner for the consumer? From March to May 2019, CEER ran a public consultation to explore the value proposition of digitalisation for energy consumers, the enablers required to unlock the benefits of digitalisation, and to identify risks and challenges in digitalisation. Here we outline our conclusions from that consultation, outlining five priority areas for further work by NRAs, network operators and NRAs.

The impact of digitalisation on the energy sector is being explored and debated by energy sector organisations, academics and institutions. There is a growing body of research on the digital technology advances, the business models and the implications for the energy system – for example the work of the European Technology and Innovation Platform on Smart Networks for Energy Transition[3] and the EU Observatory on the Online Platform Economy.[4] The value of this CEER paper is that considers the potential regulatory measures to unlock the benefits from the perspective of energy consumers. It primarily considers developments over the next decade.

[2] CEER 3D Strategy https://www.ceer.eu/eer_publications/ceer_papers/cross-sectoral
[3] International Energy Agency, Digitalization and Energy, 2017, p.22.
[4] https://ec.europa.eu/digital-single-market/en/expert-group-eu-observatory-online-platform-economy

1.2 Defining Digitalisation

In the energy sector, information technologies have played a key role in the development of competition historically and in the reduction of transaction costs via a better coordination of network systems. With digitalisation, we can think of increased availability (lower cost) of data, which is more readily analysed (becoming information) and transmitted/communicated to give effect to actions. Digitalisation of the sector is the sum product of the changes made by companies and customers to utilise this. The key drivers of digitalisation include[5]:

- Data being more readily available digitally due to falls in the costs of sensors;
- Analytics is the use of data to provide info and insights, which is advancing due to machine learning and artificial intelligence; and
- Connectivity, the exchange of information between humans, devices and machines, via digital networks.

Digitalisation is already happening in all sectors of the economy, enabled by the growth in connectivity. According to the International Energy Agency (IEA), more than 3.5 billion people globally use the internet, 54% of households globally have internet and in the last 5 years mobile phone subscriptions have reached 7.7 billion[6]. National Digital Agendas are also in place in many Member States and reflect the strategies put forward at EU Level[7]. This has led to a higher priority and awareness of digital policies and some Member States seem to go beyond having one National Digital Strategy by formulating and implementing more specific strategies on the various core issues of the Digital Single Market such as eGovernment (e.g. Italy, Greece and Slovakia), Industry 4.0 (France, Italy and Germany) and eSkills (Hungary, Luxemburg and the Netherlands).

Resisting digitalisation has been compared to resisting the internet.[8] The question isn't whether to adopt digital solutions, it is how to take the opportunities and protect against the risks. Like the internet, there is a technological revolution behind the scenes but arguably the most interesting and profound changes relate to people in the way they communicate, transact and live their lives. This is part of a broader Fourth Industrial Revolution which may place very different requirements on the energy industry as factories and workplaces, and connected machines will interact, visualize the entire production chain and make decisions autonomously. The energy industry will have to adapt to support these developments.

[5] International Energy Agency, Digitalization and Energy, 2017, p.22.
[6] International Energy Agency, Digitalisation and Energy, 2017, p 23.
[7] Communication of the Commission on the Mid-Term review on the implementation of the Digital Single Market Strategy COM/2017/0228 final from 10.05.2017; Shaping the digital single market.
[8] Audrey Zibelman, CEO of the Australian Electricity Market Operator (AEMO).

This CEER paper covers both the gas and electricity sectors, albeit to differing degrees. We expect that some of the impacts of digitalisation may be greater in electricity, particularly as the electricity system needs to be balanced in real time and sees more pressing need for flexibility with the huge growth in renewables. While these issues are also relevant in gas, and this could be extended through sector coupling, the discussion in this paper will tend to focus on electricity as this is where a greater impact is expected in the nearer term.

1.3 Relationship to 'Decarbonisation at least cost'

The climate agenda and "Clean Energy" objectives are major policy drivers for change in the energy sector. Energy regulators aim to remove all possible obstacles to allow an efficient and least-cost decarbonisation of the EU energy system. We see digitalisation as 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, 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 (including green mobility and efficiency), which can be facilitated by digitalisation.

We note that not all of the effects of digitalisation 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. However, while the effects of digitalisation can be mixed, it is a necessary pre-condition for cost-effective decentralisation of the energy sector which seems likely to result from decarbonisation.

1.4 Relationship to 'Dynamic Regulation'

The changes brought by digitalisation require a dynamic approach to regulation. Unlike with policy or regulatory change, policy-makers and NRAs are not driving or leading digitalisation and how the sector may evolve as a result is much harder to predict. This creates a challenge for policy makers and NRAs in being able to keep pace with the changes and ensuring that policy and regulation does not create an unjustified barrier to innovation while continuing to empower and protect consumers during the transition. The new digital reality will also increase the need for proper cooperation across economic regulators, and especially with telecoms regulators, to ensure consistent policy outcomes. CEER members appreciate this and actively seek to promote such cooperation through various initiatives such as the Partnership for the Enforcement of European Rights (PEER) project which promote collaboration across regulators from different sectors in the consumer interest.

This implies moving away from static, steady-state regulation to adaptable and agile regulation. It is no longer sufficient to focus on the efficient use of existing infrastructure and replacement and reinforcement investment. Regulation also needs to consider disruptive innovation and infrastructure transformation. As such, it could mean regulators adopting a more flexible approach based on general regulatory principles, keeping pace with and learning from market developments (including through trials and pilot projects) and being open to removing unjustified barriers, even if temporarily to understand the benefits of new approaches.

It also means that regulators themselves may need to change to engage with digitalisation and the innovation it brings. It may require regulators themselves to invest in data scientists and experts in data analytics, as some already have, where budgets allow. In the future, data may become one of the most valuable assets in the sector. Therefore, NRAs may find themselves not only having to use big data and analytics differently to inform regulatory decisions but may find what they regulate changes.

2 What Is the Value Proposition for Consumers of Digitalisation of the Energy System?

Simply generating data won't create value by itself. Rather, it should be regarded as an enabler that makes existing business models more efficient and allows innovative ones to emerge. This can then bring value to the system through the effective use of the information. Digitalisation has the potential to transform the energy system, the way the sector operates and how it interacts with other sectors (e.g. transport, heat, etc.).

NRAs have a broad range of responsibilities, with their primary duty being to ensure well-functioning markets in order to protect consumers. As such, in considering the implications of digitalisation for the energy system, the NRAs' objective is to enable the benefits to consumers and to protect them against risks.

The purpose of this chapter is to consider the potential value proposition of digitalisation of the energy system for consumers. It does this by considering:

- Firstly, the impacts of digitalisation for the business models in the energy sector; and
- Secondly, the value propositions of digitalisation for energy consumers.

2.1 The Implications of Digitalisation for the Energy System

Digitalisation has the potential to enhance productivity of the current energy system, enable new products and services as well as to disrupt and transform the way the sector transacts. Experience from other sectors where digitalisation of existing operations has already occurred demonstrates this. For example, the U.S. airline industry had an average capacity utilisation in the mid-50 per cent range, which increased to over 80 per cent following the introduction of digital technology to enable route optimisation, dynamic pricing of seats, online sales and ticketing of airline tickets among other measures[9].

The rest of this section considers three implications for the energy system from digitalisation; these are:

- 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.

2.1.1 Digitalisation Increases the Productivity of the Current Energy System

Digitalisation flows from the high-speed collection, processing and analyses and exchange of data in real time. Using this 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

[9] Kauffman Richard and O'Leary John How State-Level Regulatory Reform Can Enable the Digital Grid of the Future p.107/108 in Digital Decarbonisation, Promoting Digital Innovations to Advance Clean Energy Systems, edited by Sivaram Varun, June 2018. From James D. Dana Jr. and Eugene Orlov, "Internet Penetration and Capacity Utilization in the US Airline Industry," American Economic Journal: Microeconomics 6, no. 4 (November 2014): 106–37.

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 per cent of total annual power generation costs based on the enhanced global deployment of available digital technologies to all power plants and network infrastructure[10]. This estimate is based on reductions in system costs from: reduced operation and maintenance costs, increased plant and network efficiency and a 5-year life extension for both power plants and networks.

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. In the EU, losses on the transmission and distribution networks account for between 2.24% and 10.44% per cent across Europe[11]. Real-time information can also allow faster and more accurate detection of faults, improving system reliability and reducing cost.

Improved monitoring can allow earlier identification of changes in the operation of equipment on networks and power plants Early identification 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 example, sensory data and drones can be used to diagnose maintenance needs. Digital twins, live computer models of infrastructure can be used to run simulations of performance and could help operators to target upgrades to maximise efficiency gains[12]. It allows different options to be modelled and built in at the design phase and for upgrades and maintenance to be better planned. This may reduce maintenance costs and may also allow the current system to optimise system operation, planning and provide better reliability and security of supply. However, potential risks and misuse potential would need to be taken into account. The case studies below are for illustrative purposes only.

[10] International Energy Agency, Digitalisation and Energy, 2017, p.78
[11] CEER report on power losses October 2017, Ref: C17-EQS-80-03 18 October 2017, p.7.
[12] Sekaric Lidija, A Survey of Digital Innovations for a Decentralised and Transactive Electric Power System, p.40 in Digital Decarbonisation, Promoting Digital Innovations to Advance Clean Energy Systems, edited by Sivaram Varun, June 2018.

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, including areas of congestion on the network. Therefore, as discussed later in the consultation, it is worth considering who should have access to system data and how that could be facilitated.
By improving the design, operation and maintenance of supply assets and networks, there is also the potential to extend their operational life. Longer asset lives can defer or reduce the capital expenditure required in the long-run. The extent to which digitalisation will extend the life-time of the current system is unclear as new technologies are still emerging. Also, there are costs of investing in the software, hardware and additional network required to digitalise and extend the current energy system today, that may offset some of the longer-term capital expenditure savings. Nonetheless, the IEA estimates that close to USD 1.3 trillion of cumulative investment could be deferred over 2016-40, if the lifetime of all the power assets in the world to be extended by five years[13]. On average, investment in power plants would be reduced by USD 34 billion per year and that in networks by USD 20 billion per year[14].

Case Study: Reactive Technologies- digitalising the energy system[15]

Reactive Technologies is enabling the transition to a smarter, lower carbon energy system through the implementation of advanced communications technologies that deliver added value to generators, power grid operators and corporates.

Reactive Technologies partnered with National Grid ESO, the power grid operator in Great Britain, to demonstrate their world first inertia measurement and analytics service (GridMetrix). Such insight is a significant technological step change for the power industry globally as it allows grid operators to spend less on procuring balancing services, make more efficient operational decisions and more safely and effectively integrate renewable generation.

Reactive Technologies also offers flexibility services and power purchase agreements through its cloud-based optimisation platform (Tradenergy) to help generators, storage assets and corporates mitigate market risk and leverage all available commercial opportunities.

[13] In this estimate, assets must operate for at least 25 years in order to gain the full benefit of digitalisation. For those with fewer than 25 operational years remaining, their operational lives are extended in proportion, e.g. where a plant has ten more years of expected lifetime, its operations are extended by two years.
[14] International Energy Agency, Digitalisation and Energy, 2017, p.81.
[15] https://www.reactive-technologies.com/

2.1.2 Digitalisation Enables New Services that Alter Energy Demand

Digitalisation can impact the way we consume energy in buildings, use energy for transport and the products that we buy in future. It enables data to be collected, analysed and exchanged in order to better manage energy usage in buildings and for transport to become smarter and more interconnected. As such, decisions on energy usage are influenced by decisions in other sectors, including the heating, cooling and energy management systems in our homes and the transport services that we use. In this new perspective electricity becomes an' intermediate product or service rather than an 'end-product'[16].

The rest of this section considers the possibilities for new products and services, in examining the following examples:

- Smart buildings and heating/ cooling services (more tailored services)
- Mobility as a service (new energy uses in transport)
- New energy pricing models and products.

2.1.2.1 Smart Buildings and Heating / Cooling as a Service

Sensors can be deployed in buildings to detect presence and determine when to switch on lights and smart thermostats can regulate temperature remotely. Using this data, and analytics, such as machine learning of occupants' behaviour, the energy demands of a building can be managed using apps that allow occupants to programme their needs in terms of heating and to regulate the service. The energy management systems link with data from the energy networks and market prices, which allows buildings to help the energy system by shifting consumption away from periods of peak demand and/or towards periods with higher renewable generation. There has also been growth in household appliances (fridges etc) that are connected to communication networks, which increases the opportunities for demand-side response.

Such demand-side response is already operating in Europe, particularly for non-household buildings, where the IEA suggests that there may be greater savings to be gained in the EU[17] but is less established for households[18]. The IEA predicted that improving the operational efficiency of buildings by using real-time data could lower total energy consumption between 2017 and 2040 by as much as 10 per cent compared with their Central Scenario[19], assuming limited rebound effects in consumer energy demand. This suggests that there are potentially important benefits for the system in enabling the digitalisation of buildings.

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[16] Vasconcelos Jorge, The Energy Transition from the European Perspective, January 2017, p.8.
[17] See International Energy Agency, Digitalisation and Energy, 2017, p.42.
[18] See Eurelectric, 'Dynamic Pricing in electricity supply' (2017) http://www.eurelectric.org/media/309103/dynamic_pricing_in_electricity_supply-2017-2520-0003-01-e.pdf and ACER/CEER, 'Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2015: Retail Markets' (2016) http://www.acer.europa.eu/official%20electricity%20and%20gas%20retail%20markets.pdf
[19] In the IEA Central Scenario, electricity use in buildings is set to nearly double from 11 petawatt hours (PWh) in 2014 to around 20 PWh in 2040- see International Energy Agency, Digitalisation and Energy, 2017, p.42.

2.1.2.2 Mobility as a Service

The electrification of transport combined with digitalisation in both transport and energy could create 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. A number of EU countries have set targets to restrict the use of petrol or diesel vehicles from the 2030s or 2040s, providing an impetus for greater penetration of electric vehicles and their charging systems, and in some cases for compressed natural gas or hydrogen fuelled vehicles. A number of traditional car manufacturers, as well as new entrants, are already responding by offering both new vehicles for freight and passenger transport.

The electrification of transport, in particular, brings a new source of electricity demand. 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[20].

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.

[20] International Energy Agency, Digitalisation and Energy, 2017, p. 32.

2.1.2.3 New Retail Pricing Models and Products

Digitalisation enables new products and approaches to pricing for the provision of energy as a service to consumers or by consumers to others. Most of these are still at an early stage and it is unclear, which products, services and business models will prevail. However, in the future, there is likely to be much greater diversity in products, services and prices available to consumers.

In some EU Member States, e.g. the Nordic, Spanish and Estonian markets, dynamic energy retail pricing[21] for end-consumers has been introduced: the prices reflect the prices of the wholesale markets. The intention is that these price signals act as an incentive for consumers to move their flexible demand to times with low prices, e.g. by investing in automated energy management systems to lower their electricity bills. Under the Clean Energy Package proposals, all suppliers with more than 200,000 customers will be required to offer dynamic prices as one of their products.

Aggregators are emerging in many markets to act as a new intermediary for consumers by aggregating demand-side response, selling this in the wholesale market and sharing some of the benefits with end-consumers. Depending on whether aggregators are or contract with energy suppliers or not, this may be shared through reduced or separate payments, discounts on electricity bills, or flat fixed prices.

Digitalisation could further enable the offer of flat rate (non-kWh based) or bundled products as companies have better data on consumption. Experience from the telecoms market, where pricing has moved from price per units of usage has evolved to prices for packages of call time and data and repayment of handsets suggests that other models may prevail. Some companies are already offering fixed fees for a pre-defined volume of consumption or a bundle of products, including the cost of assets, equipment or devices or even the vehicles along with a volume of consumption. In this model, the energy provider takes the volume risk, which is managed by capping the consumption and charging consumers higher prices for volumes additional to that provided by the flat fee package. At first sight, this model could appear to be unhelpful for energy efficiency and demand side response, but this may be more than offset by the supplier including energy efficiency and demand side response measures within the package.

[21] Dynamic retail pricing means the calculation of the energy costs based on real-time pricing. It reflects the marginal network costs and/or generation costs of energy in the wholesale market. Currently, there is significant variation in the penetration of dynamic pricing among households in Europe. So far dynamic pricing for residential consumers only exists in the Nordic, Estonian and Spanish electricity markets.

We may see a rise in pay-as-you-go pricing models for home or mobility energy services, moving away from monthly or other periodic billing. With the emergence of smart meters[22] and apps, and new payment platforms and cryptocurrencies energy providers will be able to offer consumers cheaper and more convenient pay-as-you-go services, allowing consumers to choose when they pay for energy. Digitalisation could also help remedy the often criticized complexity of consumer billing information that may hinder rather than promote transparency due to simple information overload. The notorious length of bills could be reduced to essential information, and the rest will be accessible through more modern channels on demand and as required by individual customers.

Digitalisation allows consumers consumption data and retail prices to be analysed to provide consumers accurate, up to date information on available offers, where the consumer consents. In a number of markets, price comparison websites are providing this service with business models based on either the energy suppliers paying commission or consumers paying for the service. There are also service providers taking this a step further and becoming ‘auto-switchers’, with a mandate from consumers to regularly review the market and switch to the best deal on the consumer’s behalf.

Overall, we do not necessarily expect any one model (kWh sales, dynamic pricing, bundled products etc) to be universal, but rather to see more diversity in the market. This of itself may make it more challenging for consumers to understand what they are buying.

Case Study: Flipper – an automatic switching service[23]

Flipper’s mission is to ensure that consumers ‘never worry about overpaying for energy again. We’ve made the tedious and complicated process of energy switching hassle-free for our members.’

Flipper is an auto-switching service that switches consumers each time they can find a better a better deal. Flipper does not take commission from energy suppliers, so as to be impartial, and charges consumers an annual membership fee of £25 from the point at which they start to make savings of at least £50.

Flipper uses consumers’ consumption data and algorithms to search the market and work out the best deals for consumers.

2.1.3 Digitalisation Enables New Platforms and Marketplaces

Digitalisation not only enables new products and services but is an essential prerequisite for 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

[22] For CEER’s views on good practice in implementing smart meters, including their functionalities and services provides consult Final Guidelines of Good Practice on Regulatory Aspects of Smart Metering for Electricity and Gas (https://www.ceer.eu/documents/104400/-/-/561c5c44-7b2a-4269-ed2a-9e5877b0451f).

[23] https://flipper.community/?msclkid=24a6c8f4286717c483d194ddcb2f9584&utm_source=bing&utm_medium=cpc&utm_campaign=Flipper%20Brand%20Search&utm_term=flipper&utm_content=Flipper%20Brand%20Search

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 observed in the gas sector as well with the potential development of local green gas sources and smart meters. There are differing estimates as to the extent to which consumers will become prosumers in the EU. According to CE Delft, by 2050 83 per cent of households could become prosumers[24].

Digital and decentralised platforms and marketplaces enable new business models that rely on decentralised, potentially multi-level trading involving prosumers, new intermediaries (or in some cases removes the need for intermediaries) and existing market participants. Many of these digital marketplaces are in their early stages and it is difficult to predict the business models that will succeed in future. Some of the business models being trialled focus on efficiently balancing supply and demand ‘behind the meter’ rather than in the wholesale, balancing or ancillary markets themselves. Also, in some cases the technology is also in its early stages. Blockchain technology, which tracks transactions securely to prevent them being altered and allows automated decision-making without intermediary clearing transactions, is being explored and may provide the platforms for future marketplaces for multi-level trading. However, there are still barriers to overcome with blockchain including privacy issues and its ability to achieve sufficient scale.

The rest of the section considers two models for future electricity markets based on recent trends[25]. These are:

- Peer-2-Peer trading
- Flexibility marketplaces

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. Nonetheless, in the following discussion we focus on electricity as this is where a greater impact is expected in the nearer term.

2.1.3.1 Peer-2-Peer Trading

Peer-2-Peer platforms provide a marketplace for producers and consumers to directly buy and sell electricity to each other. Similar to Airbnb, it is inspired by the concept of ‘prosumers’ engaging directly in a shared economy to buy and sell their own services. Each participant engages to balance their individual energy supply and demand, receiving back-up supplies from the wholesale market as required and are able to optimise costs. As such, the platform providing the Peer-2-Peer marketplace acts as a facilitator rather than an energy supplier. These markets can exist to facilitate trading between individuals or at a community level. All parties involved need to fulfil the prevailing obligations for balancing, cost bearing etc. and are not be separated from but integrated in existing markets.

[24] CE Delft, ‘The potential of Energy citizens in the EU’ (2016) p.3.
[25] See Y. Parag and B. Sovacool, 'Electricity Market Design for the Prosumer Era' (2016) 1 Nature Energy. p 7-9 envisages 3 models for prosumers and differentiates between Peer-2-Peer trading, Prosumer to Grid and Organised Prosumer Groups.

From an energy system perspective, peer-to-peer platforms currently bring a new 'behind the meter'[26] marketplace that impact the way the sector currently transacts. A number of new contractual arrangements are required: including between the new market participants, between new market participants and the platform but also between new market participants or the platform and existing market participants. For example, it also raises important questions about the appropriate network charges for users of such platforms; to ensure on the one hand, that participants in peer-2-peer platforms pay a fair share of the grid costs that they continue to rely on for back-up while recognising that charges should reflect benefits, for example if these business models reduce grid usage. Also, unless the platform is provided by an energy supplier, it may dis-intermediate the role of traditional energy suppliers, or reduce their role to that of a back-up supplier, which brings changes to the supplier-consumer relationship.

Peer-2-Community platforms provide for a Community to balance the supply and demand of electricity for a group of consumers/ prosumers. The Community does this by using assets owned by individual prosumers (solar panels on buildings, storage batteries or in future flexibility from electric vehicles or buildings) or using collectively owned or centralised assets (such as Community windfarms or storage). Once the Community has optimised its collective position, it may then trade with the wholesale, balancing or ancillary markets in order to buy additional or sell excess electricity. The Community can operate virtually, where the balancing is within a bidding zone but not local or as a physical micro-grid system. The concept is to serve the interests of a group of consumers/prosumers. In an effort to broaden understanding on experiences with energy communities, CEER published a report (June 2019) on the Regulatory Aspects of Self-Consumption and Energy Communities.

While new platforms are a consequence of increased digitalisation, platform-based interaction is not expected to replace all existing markets.

Case Study: Sonnen- a community of prosumers[27]

Sonnen's goal is 'clean and affordable energy for everyone'. This translates as 'a world in which everyone is able to cover his energy needs with decentralised and clean energy source. Everyone can connect with each other to share energy where and when it's needed.'

Sonnen believes in the idea of prosumers where customers generate electricity through PV panels on their roof and the ability to store electricity in their battery. In a complex energy world, sonnen's customers generate their own sustainable energy, become independent from traditional energy suppliers and have economic advantage through self-supply and the sonnenFlat (a fixed- fee for a set level of consumption) as an additional energy contract.

[26] From the consumer's perspective, it is the grid and the energy industry that is "behind the meter", so from this perspective such arrangements might better be termed "in front of the meter".
[27] https://sonnengroup.com/sonnenbatterie/

The customers generate around 70% of energy demand through self-supply while the remaining energy is generated through the sonnenCommunity. This virtual energy pool connects the decentralized storage systems to ensure both stable energy supply and to help stabilise the grid. The sonnenCommunity in Germany operates virtually, where the trades in the Community are of a contractual nature and physical flows use the existing networks. When required, sonnen buys additional energy and sells excess energy in the market. In Puerto Rico, sonnen is investing in micro-grids and is involved in the development of 'smart cities' inter-connected communities of up to several thousands of homes in the US.

2.1.3.2 Flexibility Marketplaces

As previous CEER papers have addressed extensively,[28] with the increase in intermittent generation there is a growing need for flexibility in the electricity system to respond to fluctuations of supply and demand. CEER strongly supports a market design that ensures all sources of flexibility efficiently contribute to this, taking advantage of the opportunities offered by new technologies on a level playing field. Flexibility can come from generation, demand and storage, at large scale or small.

There are a number of value streams for flexibility providers: the energy market, through energy portfolios, capacity mechanisms, the system wide grid (including the balancing market) and the local grid (services to DSOs). Flexible resources should be able to access multiple revenue streams without unnecessary restrictions. At present, their ability to do so varies. Limitations include missing price signals or contracting opportunities, perhaps particularly for local grid services (for example in cases where tariffs do not reward flexibility), and minimum size requirements and administrative requirements, which may be eased through the role of aggregators. Where it is more efficient (taking account of the evolving needs of system operation and long-term benefits) for DSOs to use flexibility services to solve local constraints in their networks and defer reinforcements in the grid, they should do so. This requires DSOs to be able to uncover offers from flexibility providers and such providers to have a clear enough signal to invest.

One way to achieve this is through flexibility marketplaces, which 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[29]. 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. The concept of this model is that the 'prosumer' is an actor in the energy system and participates in these new markets to help balance supply and demand.

[28] For example, European Energy Regulators White Paper #3 on Facilitating Flexibility, 22 May 2017 and the CEER conclusions paper on Flexibility Use at Distribution Level, Ref: C18-DS-42-04, 17 July 2018.

[29] In some Member States markets for some of these services, such as balancing, already exist https://www.smarten.eu/wp-content/uploads/2017/04/SEDC-Explicit-Demand-Response-in-Europe-Mapping-the-Markets-2017.pdf

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.

In the longer term, separate flexibility marketplaces may be undesirable as flexibility is traded in existing marketplaces and the granular locational value of local grid services is priced appropriately (for example, possibly through nodal pricing or other forms of pricing).

While new platforms are a consequence of increased digitalisation, platform-based interaction are not expected to replace all existing markets.

In the meantime, there are several aggregation models and flexibility markets being trialled, as the following case studies illustrate. Like all case studies in this report, they are for illustrative purposes only. Further analysis is required to assess the actual potential of different types of market places.

Case study: NODES flexibility market

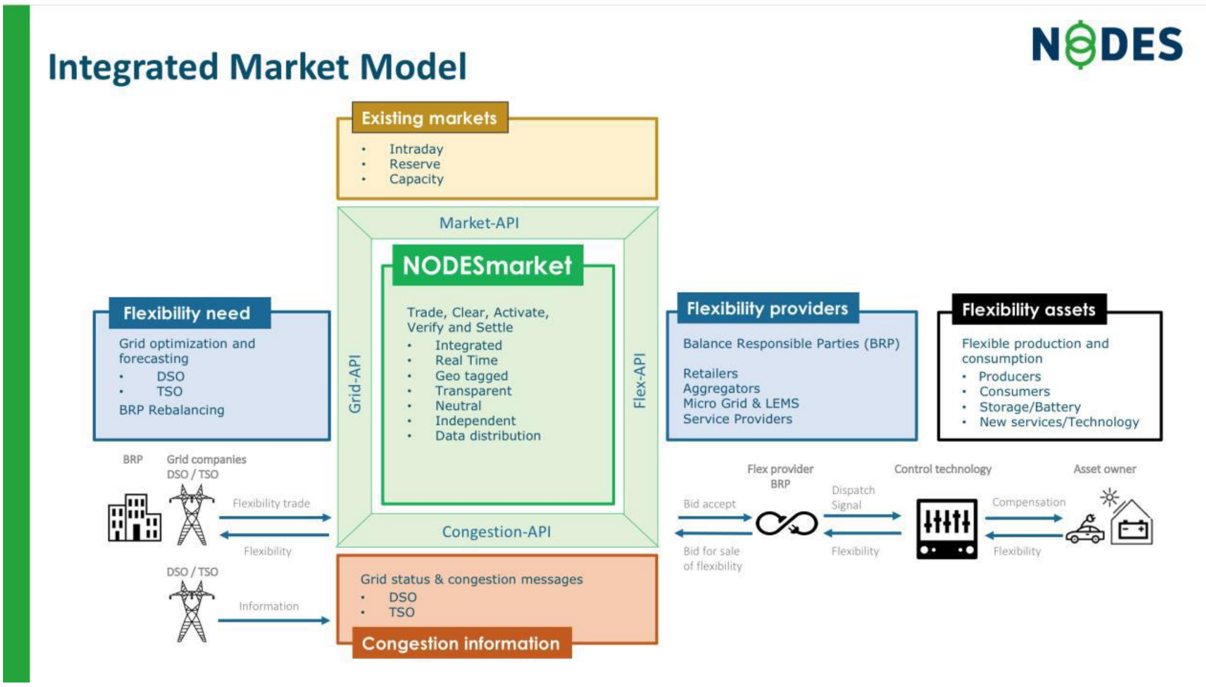

Figure 1: Integrated Market Model

The project sponsors Agder Energi and Nordpool describe the market as follows:

To the left in the figure above are those who need flexibility: DSO and TSO. In addition, BRPs might retrade committed flexibility with other BRPs which offer cheaper flexibility. These buyers will have to define their willingness to pay for activation of flexibility at particular GLs and feed this information continuously into NODES via an API. The flexibility is made available by the flexibility providers who will act on behalf of the owners of the flexibility assets and feed these offers into NODES via another API.

The flexibility providers will need to have a business model with the asset owners in place, and technology that make it possible to activate the flexibility by those who have bought it. For the majority of operating hours during a year the flexibility is not needed locally at the actual GL – often it is needed only a few hundred hours a year. But it can still have a value in the rest of the system, for balancing purposes by the TSO or in the ID market for the BRPs. NODES will establish an interface that makes the flexibility available for these markets. The flexibility providers can also differentiate their offers depending on whether the flexibility assets are sold locally or centrally. Selling locally at one specific GL in many cases can be riskier, as there are fewer alternatives if the seller needs to rebalance due to unforeseen unavailability of some assets. Contractual positions in the ID market are much easier to rebalance. Thus, the price for flexibility is foreseen to be cheaper in the ID market than at a specific GL.

***Case Study: Next Kraftwerke* - Digitalization of the energy sector by Virtual Power Plants**[30]

Similar to car sharing services without owning a car fleet and hotel booking platforms that do not own hotels, Virtual Power Plants are agents of a democratic shift in power supply: responsibility is shifted back to society. VPP operators don't own power plants; they just optimize the way in which every linked asset – still owned by a third party – is used. Next Kraftwerke offers a Virtual Power plant that digitally networks thousands of electricity producers and consumers. Networking brings together the performance of the participants - numerous small installations in different locations can be controlled and coordinated from one central location. This is made possible by two components: the central control system, in which all processes converge, and the Next Box, through which the individual systems are integrated into the virtual power plant.

2.2 Value Proposition for Energy Consumers

Digitalisation may bring benefits to the energy system by increasing productivity and transforming the way the sector does business, but the key question is what this means for energy consumers. Energy consumers fall into different segments from large industrial consumers, small and medium size businesses through to household consumers. This paper focuses on the latter category, recognising that there is a big difference among these consumers in the level of engagement in the retail market[31]; hence it is important to

[30] https://www.next-kraftwerke.de/unternehmen/technologie
[31] In 2014 the average switching rates for electricity and gas were 6.3% and 5.5% respectively in the EU but with a large difference between Member States. See CEER Report on commercial barriers to supplier switching in EU retail energy markets Ref: C15-CEM-80-04, 7 June 2016, p11.

differentiate between different types of consumers, with some (today, the majority) being passive or inactive (for example, those who have never switched energy supplier). The definition of active consumers under the Clean Energy Package is those who have self-generation, who may participate in the market either directly through market platforms or indirectly via intermediaries, such as aggregators or service providers. As such, switching supplier is only one of the decisions for active consumers rather than the extent of their activity. The rest of the section considers the following value propositions for energy consumers:

- Cost savings
- Convenience
- Choice
- Consumer participation
- Quality and security of supply

2.2.1 Cost Savings

As digitalisation creates the potential for increased efficiency, it is expected that it lowers the cost of operating the existing system and support the efficient implementation of the forthcoming transformation. The extent to which this results in lower bills for end-consumers depends on the extent to which these efficiencies outweigh or offset the increase in investment required to digitalise the system. While there may be net gains for power plants and network operators to invest in sensors and digital technology to enhance productivity, there is also a potentially significant increase in electricity demand from new sources, such as transport, for some countries heat[32] and from connected devices. On the other hand, greater awareness of energy consumption from better information for consumers and more efficient and convenient controls, may improve home energy efficiency.

Any increase in demand is likely to create the need for more capacity on the existing networks, which could be provided via network upgrades or flexibility enabled by flexibility marketplaces. Therefore, it will be important to ensure that investment is made to maximise efficiency from a whole-system perspective (not just from the perspective of individual actors).

Any cost savings from the efficiencies in the current system will lower bills for consumers if they are passed on. Regulators have a role in setting or approving the charges imposed by network operators. The efficiencies in the power generation, reflected in lower or flatter wholesale prices also need to be passed through to consumers in retail prices and the impact of taxes and subsidies also needs to be managed to avoid these offsetting savings in the energy component. Also, to access the greatest cost savings, consumers may need to invest in PV solar panels, batteries, home energy management systems, electric vehicles or digitalised home appliances which means that savings will only be generated over a longer period. They may also share the cost savings with intermediaries, such as energy suppliers, aggregators and service providers. Therefore, consumers' decisions to invest will depend on a number of factors:

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[32] A number of European countries, particularly those with gas-fuelled heating systems, are considering the options for decarbonisation of heat. These include the electrification of heat but also using biomass or hydrogen.

- the consumer's own circumstances and preferences (e.g. interest in new technology);
- the extent of the energy savings;
- the finance arrangements for new equipment/ devices (e.g. as we have seen with PV solar panels it may favour certain consumers if the costs are incurred up front and returns made over a period of time, whereas mobile phone service providers offer options to buy handsets upfront or to pay for them as part of a monthly bundle);
- whether the products and services bring consumers other benefits that they value; and
- whether the data management is secure and reliable.

2.2.2 Convenience

Digitalisation has the potential to bring consumers convenience that could act as an independent driver of consumer engagement. Smart buildings could bring increased comfort by ensuring that temperatures and lighting in homes match consumer needs and preferences. Digitalised home appliances may not only connect to home energy management systems and provide efficiency or demand-side response but may facilitate consumers' lives. For example could digitalised and connected fridges alert consumers of the need to purchase groceries or could even interface with supermarket delivery services and automate requests, alongside providing frequency response to the system operator? Taxi-based apps or car sharing services already bring consumers greater convenience by allowing consumers to access and share passenger transport in real-time. While potentially some time off, automated transport options could bring further convenience by removing the need for drivers; further enabling car sharing and perhaps removing the need for some consumers to own vehicles, changing the use of electricity and the implications for the local electricity network.

The value proposition from new products or services enabled by digitalisation may also come from unexpected sources. Prior to the birth of the mobile phone, few predicted that the value proposition for consumers would come from sms messaging and subsequently, from the data enabling access apps and online services. This has changed the way we communicate and therefore, we should expect digitalisation in the energy sector to have unexpected, knock-on impacts to the way we live our lives. Of course, one of the challenges is that increased convenience and comfort may increase demand for these services, posing further challenges for the energy system, as described above.

2.2.3 Choice

By enabling the provision of new products and services digitalisation provides consumers with greater choice of prices, products and services. In many European retail markets, consumers traditionally have fairly limited options in terms of fixed or variable prices but as described above, there is likely to be much greater diversity. In competitive retail markets, consumers are likely to have choices between dynamic prices, fixed rates for capped levels of consumption, pay-as-you-go (PAYG) charges or products bundling consumption with equipment, devices or assets. With the potential for much greater diversity and choice of products, services and pricing models in the market, the role of price comparison sites and switching services is likely to become more important in the future.

In some European retail markets, consumers can already specify their preferences for ‘green’ or ‘renewable’ sources of electricity. The potential development of green certificates for gas could also facilitate such a trend in the gas sector. As described above, digitalisation enables better integration of renewables, storage and flexibility into the energy system through data and the marketplaces to manage renewables. However, also in line with the EU’s 2020 objectives, digitalisation could also improve the efficiency of traditional energy sources[33] and facilitate innovation that could increase future demand for electricity and gas.

With many companies, not just energy suppliers but also car manufacturers, big data companies and potentially also household appliance manufacturers considering the options for digital products associated with energy, there is also potential for greater choice and diversity in the types of energy providers in future markets. This brings choice for consumers on the companies to engage with but also choice in the quality and type of service that they receive. This could include more tailored and/ or personalised services and pricing as well as more responsive customer service.

2.2.4 Consumer Participation

Digitalisation can facilitate consumer participation in the energy retail market. As discussed above, it facilitates product comparison and switching decisions for consumers and enables home management and mobility services, which result in indirect consumer participation, via intermediaries who manage the interface with the market. As discussed above, the driver for consumers is likely to be the extent of cost savings, the value of the convenience or comfort these products bring as well as whether the financing options facilitate participation.

Digitalisation also facilitates direct engagement by active customers in digital marketplaces and, in future, potentially wholesale markets. Cost savings or financially optimising one’s position may also be a driver for prosumer engagement in these markets. This may particularly be the case for prosumers with higher volumes of consumption, which could, in future, include household prosumers whose demand increases to cover transport, heat and a wider range of digital devices. Consumers may engage directly or via intermediaries, which in future, could include energy portfolio managers offering services to a wider range of consumers, depending on the complexity of decisions.

The value propositions may also include promoting autonomy/ self-sufficiency or being part of a shared economy. For some, there is value in being able to balance their own supply and demand, increase self-sufficiency and potentially reduce one’s carbon footprint. For others being part of a Community, where members are part of a shared economy with common values may also have a benefit.

[33] Victor David G, Digitalization: An Equal Opportunity Wave of Energy Innovation, p.26, bullet 2 in Digital Decarbonisation, Promoting Digital Innovations to Advance Clean Energy Systems, edited by Sivaram Varun, June 2018. They note that the efficiencies brought by digitalisation can equally lead to increased productivity of fossil fuel plants and to the extraction of oil, coal and gas further upstream.

The question of how much digitalisation will increase participation and engagement in the market is hard to predict as it will depend upon the factors highlighted above. As CEER has highlighted, many consumers do not switch energy supplier in the current energy markets due to the perception of insufficient savings, complexity of the switching process and low levels of trust in traditional utilities[34]. Digitalisation may help address some of these barriers by enabling new products and new value for consumers, facilitating switching and providing the opportunity for new players to enter the market. However, the extent to which these barriers are addressed will depend upon consumers' perceptions of the barriers associated with the new products and services and whether new trusted service providers and business models are able to enter the market.

Even if there is an increase in consumer participation, it is likely that some consumers will remain inactive. One of the key challenges for policy makers will be in ensuring these customers are not disproportionately disadvantaged by the digital divide (including a simple lack of IT-infrastructure in form of sufficient access to high-speed internet). It will be important to consider measures to ensure that the benefits are available to as wide a range of consumers as possible, e.g. hence financing options are important. It will also be important to consider how to protect those consumers, who are not able or choose not to engage, including ensuring that an energy service is available and that they do not face disproportionately high prices as a result of non-engagement. (e.g. they should not face a disproportionate share of costs for networks).

2.2.5 Quality and Security of Supply

By enabling active demand management and other flexibility, where this option has been assessed as system-beneficial, digitalisation should facilitate RES penetration while maintaining a high level of quality and security of supply at European and local levels.

In a developed society, quality and security of electricity supply is key for the security of assets and people, and for the performance of the economy. While the current level of quality and security is often taken for granted, challenges involved in maintaining the current levels in an evolving electricity system should not be underestimated. From this perspective, digitalisation offers DSOs the ability to locate network failures or malfunctioning more quickly while providing improved information to identify the potential causes of the problems. By improving both curative and preventative maintenance, this is assumed to strongly contribute to increase the quality of supply.

Moreover, when enabling active demand management and other flexibility, digitalisation is assumed to facilitate the penetration of a higher share of variable RES generation while preventing the risks for security of supply resulting from system imbalance or network congestion. This could strongly accelerate the European energy transition and allow for the more rapid connection of new digital infrastructure to the power grid. Nevertheless, it has to be ensured that possible digital solutions are secure and fulfil a certain security-standard to withstand attacks, such as cyber-attacks.

[34] CEER Report on commercial barriers to supplier switching in EU retail energy markets Ref: C15-CEM-80-04, 7 June 2016, p 7.

3 What Needs to Happen to Enable the Benefits of Digitalisation and Protect Against the Risks?

As explained above, digitalisation comes through better use of data and digital technologies. Hence, the fundamental enabler is to collect and make available the data to the relevant market participants. First of all the relevant data must be generated and collected through smart metering and network monitoring. Secondly it must be made available for use by the relevant market participants in a safe, reliable and accessible manner. This has a technical component but also a behavioural aspect – the owners of the data need to (continue to) be willing to provide it to third parties who develop business models, and the data needs to be accessible enough for service providers to be able to use it. Data interoperability is necessary to ensure technology neutrality, promote competition and avoid 'vendor lock-in'. Data helps reveal market value through effective price-signalling. With these fundamentals in place regulation should be appropriate to allow innovation in the secure and efficient use of data.

In this chapter, we set out priority actions for regulators and public authorities to enable digitalisation and protect consumers against the risks. We also consider how regulators themselves can take advantage of digitalisation to improve the practice of regulation. It will be key to maintain technology-neutrality of regulation and avoid any form of vendor lock-in. The overwhelming majority of respondents felt that the analysis presented in this part of the paper is correct and agreed with our proposed areas of focus. They also proposed a number of relevant topics and suggested that some our focus' areas be refined or that we put more emphasis on particular aspects.

3.1 Getting Useable and Accessible Data

3.1.1 Generating Data

The most obvious enabler for digitalisation is smart meters. In an audience survey at the 2018 CEER Consumer Conference, 60% felt smart meters were the key technology for digitalisation (Figure 2.1). Smart meter roll-outs are happening across Europe, supported by the 3rd Energy Package and the Clean Energy package (CEP), albeit at differing rates and with varying degrees of functionality and interoperability. The European Commission predicts that close to 200 million smart meters for electricity will be rolled out in the EU by 2020[35]. At the same time European energy regulators note that, especially for deep digitalisation and in the longer run, other sources of data will become increasingly relevant; such network data and data from EVs and home appliances. The concept of the Internet of Things (IoT) is relevant in this context and rules on ePrivacy will play a role.

[35] Commission, 'Report from the Commission: Benchmarking smart metering deployment in the EU-27 with a focus on electricity and Commission' COM (2014) 0356 final and Commission, 'Evaluation Report accompanying the document Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast)' SWD (2016) 410 final. It will require an investment of €45 billion. 72% of European consumers will have a smart meter for electricity. Nonetheless, some countries still do not deploy smart meters.

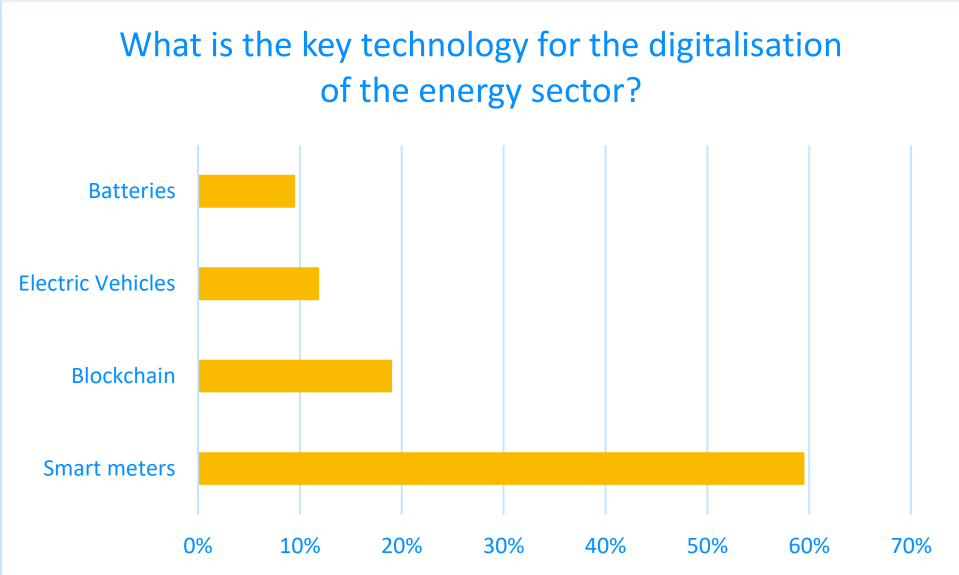

Figure 2: What is the Key Technology for the Digitalisation of the Energy Sector

Smart meters don't just need to be installed, but to be kept up to date – technology is developing rapidly and by the time a smart meter roll-out lasting several years is complete, the technology will have moved on. It may be possible to provide updates through software rather than hardware, but updates will nonetheless be required. For customers that do not yet have a smart meter, the Clean Energy Package will provide an entitlement to receive one, subject to certain conditions, within a four-month timeframe.[36]

As well as demand data, there is also a deficit on the generation and network side. Data for large generators and at transmission network level is collected, and increasingly made available. For example, ENTSOs make available more of the data and projections they used for modelling TYNDP. But for decentralised generation and distribution networks, required data may be lacking and even if it exists, not necessarily of sufficient quality for efficient decision-making nor held in an accessible form.

Collecting consumption data is a first step, and with smart meters it should be recognised that the volume of data will be dramatically increased, which may increase risks. The Clean Energy Package also sets out requirements for the data to be held in a way that is efficient and secure, compliant with the General Data Protection Regulation[37] and provided to eligible parties.

3.1.2 Making the Data Accessible and Interoperable

Copious amounts of collected but inaccessible data will do little for improving the efficiency of the power system. How the data is processed and made available for actors to use will be critical to the success of 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

[36] For comparison, , the Australian Electricity Market Commission has recently introduced a rule that consumers can have a new smart meter fitted within 6 working days on demand or exchanged for an existing meter in 15 days: https://www.aemc.gov.au/rule-changes/metering-installation-timeframes

[37] Regulation (EU) 2016/679 of the European Parliament and of the Council.

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. CEER doesn't take a view on whether centralised or decentralised solutions are better.

More important than the organisational approach is the requirement for appropriate accessibility and interoperability such as use of application programme interface (API) or general electronic data interchange (EDI) layer. Allowing the interoperability of data provided between networks was consistently highlighted by stakeholders as an important requirement to enable 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.

For example, an innovative service provider should be able to provide power services in one DSO network, and with minimal effort, be able to transfer its successful technology and business model not just to other DSO networks in the same Member State, but also to any other Members State where they believe they can realise value. Their technology should be able to use the data in the new location with minimal costs. The format of the data provided should not present a significant barrier to this.

If DSOs are involved, appropriate unbundling will be essential. Network owners or other central providers may play a central role collating this data and making it accessible. Where this is the case, NRAs will need to ensure that no new conflicts of interest arise. Following the thrust of the CEP, such central data providers should as a rule remain neutral facilitators for other market actors to participate in markets. Exceptions to this rule should be highly limited to where they are strictly necessary and face clearly defined limitations and criteria.

Open and accessible data on energy and network usage is important both for efficiency of DSO activities and to facilitate competition and reduce the barriers for distributed energy resources to compete, for example in providing flexibility. Intelligence on distribution networks and distributed generation would inform actors of potential value in flexibility markets that they can unlock. We consider this an important enabler for new entrants to be able to enter power markets and develop new ways to provide flexibility services, as they will need this data to identify where and how their innovations will work in practice. Easy entrance by innovative firms is crucial in allowing markets to develop in a competitive manner. However, misuse potential would need to be taken into account.

Where new entrants (whether distributed resources or new retail business models) are at a competitive disadvantage through lack of access to industry data, DSOs and NRAs should consider how to level the playing field. For example, if it is difficult for storage to know where best to connect, or the extent to which revenues may be available from providing constraint management solutions, DSOs should consider providing interactive maps and/or network data and models, without endangering security. If it is difficult for new entrants to develop products due to lacking data that incumbents already have, data handlers should consider provision of GDPR-compliant aggregated or anonymised data

Again, the Electricity Directive makes important provisions (articles 31 and 32) with, for example, a minimum requirement of a transparent network development plan published at least every two years. While development plans may only be updated periodically, in a digitalised world, it should be possible for at least some DSOs to go beyond an infrequent report to a live, accessible digital replica of the network which enables network users to model and consider alternative developments and interrogate the network options in a more interactive manner. Publications of interactive maps, such as the network capacity mapping tool from Western Power in Australia,[38] could be a useful start.

Particularly in countries with multiple DSOs (in some cases, hundreds), some consistency of approach would be useful. If potential providers need to request data in different formats from multiple companies and learn how to interpret each one in turn, this is likely to represent a barrier to entry. As discussed above, allowing the interoperability of data provided between regions was consistently highlighted by stakeholders as an important requirement to enable innovation in energy services to be applied by companies across borders. This does not mean that DSOs need to use the same format for their internal records, rather that the data needs to be interoperable and accessible. The technical solutions that comply with interoperability requirements should remain flexible enough to remain scalable and efficient for very small to very large DSO (from 100 to 30 million customers).

The relevant access to data for the use and provision of flexibility needs further consideration. The data which the DSO and the network user should receive have different functions: The DSO needs the necessary data to allocate and activate the flexibility whereas the network user (or potential user) needs the data to participate in a non-discriminatory way in the market to offer their flexibility potential. DSOs are increasingly deploying sensors and monitoring technology on distribution networks – as digitalisation proceeds this is becoming cheaper, but the incentives on DSOs to roll-out such technology may partly depend on the regulatory framework.

Where decentralised assets are owned by consumers (such as EVs or PV panels), understanding the location and volume of such assets will help DSOs optimise their networks further and enable flexibility providers to gauge the market for their services. One approach is to oblige either the installer/vendor or the customer to register them, for example with the DSO, who then includes them in its database. However, this is likely to achieve less than complete coverage, particularly without a customer-centric design is used to make it as convenient as possible and to demonstrate some benefit from data provision. An alternative approach could be to use data available within the system to infer the presence of such assets using machine learning. In any case, the privacy rights of the consumers must be respected.

[38] https://westernpower.com.au/industry/calculators-tools/network-capacity-mapping-tool/

Priority

P4 ***Getting and making the data accessible and useful****: DSOs to focus on the quality of their network data and data on distributed energy resources connected to their networks within the relevant legal framework, to ensure that:*

- *they utilise data effectively where this will improve efficiency of their planning, operations and investment;*
- *where appropriate ensure relevant network data is available to current and potential market participants in an accessible manner, and*
- *the opportunity to improve the interoperability of data and institutional arrangements for holding and sharing the data should be further explored.*

DSOs and other data owners should learn from those who move first in this area, for example through developing digital twins. CEER to work with stakeholders to facilitate this work.

3.2 Managing Data Risks and Consent

In this section we consider risks directly associated with data, and in particular privacy and data protection, competition issues and cybersecurity.

Rights to access smart meter data are governed by the General Data Protection Regulation (Regulation (EU) 2016/679 of the European Parliament and of the Council) and prospectively the Clean Energy Package. Taken together, this puts the end-consumer in a strong position – the data is the property of the consumer and they control how it is shared.

Box[39]: The lawful bases for processing are set out in Article 6 of the GDPR. At least one of these must apply whenever you process personal data:
(a) Consent: the individual has given clear consent for you to process their personal data for a specific purpose.
(b) Contract: the processing is necessary for a contract you have with the individual, or because they have asked you to take specific steps before entering into a contract.
(c) Legal obligation: the processing is necessary for you to comply with the law (not including contractual obligations).
(d) Vital interests: the processing is necessary to protect someone's life.
(e) Public task: the processing is necessary for you to perform a task in the public interest or for your official functions, and the task or function has a clear basis in law.
(f) Legitimate interests: the processing is necessary for your legitimate interests or the legitimate interests of a third party, unless there is a good reason to protect the individual's personal data which overrides those legitimate interests. (This cannot apply if you are a public authority processing data to perform your official tasks.)

In an audience poll at the 2018 CEER customer conference, 80% of the audience felt that suppliers should only have access to granular demand information if the customer consents.

[39] Source: Information Commissioner's Office https://ico.org.uk/for-organisations/guide-to-the-general-data-protection-regulation-gdpr/lawful-basis-for-processing/

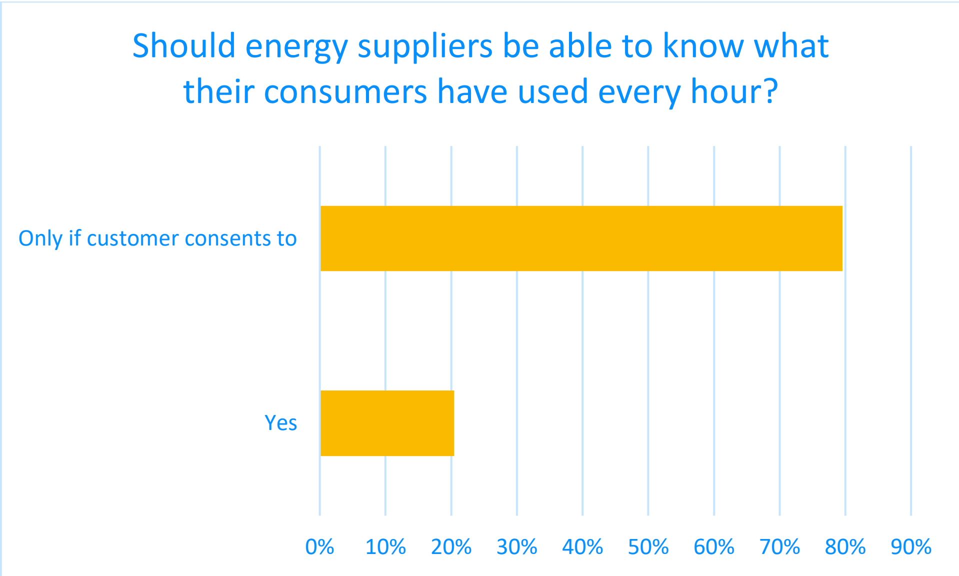

Figure 3: Should Energy Suppliers be Able to Know What Their Consumers Have Used Every Hour?

As the value of electricity varies typically every hour to 15 minutes, access to granular demand information is essential both to ensure suppliers and potentially customers are charged accurately for the electricity consumed, but also to secure the benefits of smart metering. This being the case, customers may consent to and trust the party holding their data (for example, not to sell on the data to third parties). Beyond the need for billing individual consumers, data can then be aggregated or anonymised without losing value.

Nonetheless, many European countries have seen some degree of backlash against the roll-out of smart meters. Concerns are expressed in terms of the costs and benefits, privacy, health and in some cases disruption (meter fitting or interoperability). It is important that energy companies provide the best experience possible for consumers in rolling out smart meters and make clear the genuine benefits in a way that engages consumers. We also note the risk that techniques used to anonymise data at present may not be sufficient to retain anonymity in future as more sophisticated analytical techniques (and the computing power to make use of them) are constantly being developed.

In the longer term, norms will become established and it could be that the balance of power passes to established suppliers. For example, CERRE, 'Empowering electricity consumers in retail and wholesale markets' (2017)[40] warns that "thanks to smart meters and demand-response programs, large quantities of precise information will be collected… Consumers will progressively lose the initial informational advantage on their electricity needs… and service suppliers will be able to extract more rents from consumers… Another question(s) are …Will it be legal to sell data on consumption profiles? Will data on profiles be viewed as an essential facility for new entrants?"

[40] http://www.cerre.eu/sites/cerre/files/170309_CERRE_EnergyConsumers_Final.pdf

These considerations highlight important potential competition concerns. Where data is an increasingly valuable asset in a competitive market, it can increase barriers to entry and expansion and make innovation more difficult. The Clean Energy Package already addresses many of the key issues here, through arrangements for provision of data, non-discrimination provisions, unbundling, etc. We have discussed above (in recommendation 2) more proactive steps that can be taken to provide aggregated or anonymised data for new entrants to help level the playing field and the recommendations at the end of this chapter on facilitation of pilots and trials are also relevant. The privacy of individual customers needs to be respected, without creating an anti-competitive position due to legacy relationships that lead to some market participants having access to valuable data and smaller providers or new entrants being excluded.

However, the data is initially acquired and then held, cybersecurity will be an issue. This issue has been discussed in the CEER paper on cybersecurity. [41]

With the increase in devices connected to electricity networks, cybersecurity risks are increasing. At the same time, the industry is increasingly addressing the risks, including at the design stage of new systems. It will be important that industry continues to share learning – we understand there is some reluctance in the industry to share information once cyber-attacks have occurred, possibly due to a desire to avoid admitting to having been subject to an attack (or possibly due to concerns about liability for data breaches). We acknowledge that complete disclosure of such incidents may be problematic as per rules on protection of critical infrastructure and that government agencies other than energy regulators are competent. However, a degree of detail technical understanding is necessary to inform regulatory action of energy regulators.

In addition to concerns about cybersecurity, we have heard concerns about increased availability of system data raising concerns for physical security. The concern is that better information makes it easier to attack plant and to have a bigger impact. We recognise the need for a careful approach, with any restrictions being properly justified.

[41] CEER Cybersecurity Report on Europe's Electricity and Gas Sectors, Ref: C18-CS-44-04 26-October-2018. See also World Economic Forum (2019) paper on Cyber Resilience in the Electricity Ecosystem: Principles and Guidance for Boards, http://www3.weforum.org/docs/WEF_Cyber_Resilience_in_the_Electricity_Ecosystem.pdf

Recommendations

R 1 ***Data protection:*** *for data privacy and competition issues, energy regulators should work with the authorities responsible for data protection and competition to ensure mutual understanding of the issues in the energy sector and to ensure energy companies adopt best practices.*

R 2 ***Cybersecurity:*** *as a minimum, take forward the recommendations in the recent CEER report, including that:*

- *Even non-Operator of Essential Services (OES) actors should apply cybersecurity standards as close as possible to those of OES.*
- *NRAs should encourage operators to meet compliance with the Directive on Security of Network and Information Systems and provide support in transposing horizontal regulation into sector-specific best practices.*
- *Competent authorities need to be prepared to monitor and evaluate cybersecurity expenditures, particularly of regulated entities.*
- *Management of energy-sector entities, including NRAs, should provide clear guidance on cybersecurity governance, including, the proper place and role for the chief information security officer (CISO).*
- *TSOs/DSOs/Suppliers should have a cybersecurity strategy and they should set clear and effective cybersecurity measures prior to embracing new technologies such as cloud computing or systems for the handling of Big Data.*
- *CEER and ACER may promote "cultural" change through activities such as partnerships and awareness campaigns.*

3.3 Cost-Reflective Price Signals

Cost-reflective tariffs are key to ensuring behaviour is correctly incentivised. Stakeholders agree that 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, while keeping in mind the volatility limitations mentioned above.

For instance, if there is potential value to the network for a customer to shift the charging period of their EV, then one way to ensure that consumers see this value is to ensure that the optimal shift in behaviour is reflected in the prices. Where consumers are less active, intermediaries will be encouraged to support consumers in realising this value only once it has been given a monetary value through prices. Another way is to focus more on cost reflective approaches from the grid access tariffs, which have a controllability of EV as precondition and set higher charges if network users wish not be interrupted.

In addition to new ways of buying energy, consumers or their agents are also increasingly providing services back to the grid. Once the right price-signals are in place, digitalisation facilitates this through enabling new platforms and marketplaces. Whoever is responsible for procurement of flexibility will need access to the appropriate tools at distribution level, in a similar way to now at transmission level. This may include establishment of a local flexibility market or mechanism. In either case, price signals will need to include locational and time components at a disaggregated level. Consumers' interests are best served by taking steps to ensure adequate liquidity of flexibility providers, which may require consideration of interoperability standards (for example, avoiding some DSOs not being able to use vehicle to grid services from some car manufacturers or charging point providers).

Regulators will need to consider whether (and if so, how) to regulate platforms. At a minimum, information flows need to be considered to enable regulators to monitor the impact on consumers. Platforms could be required to register for authorisation and get access to system data in return. Regulators will want to understand the implications of alternative technologies such as blockchain and where undue barriers are identified, consider how best to address these issues.

Priority

P 1 ***Ensuring effective price-signals:*** *CEER recommends that NRAs as part of their regular processes review network tariffs to ensure they are fit for the future given the availability of data from digitalisation. Tariffs should give the right price-signals to actors to effectively use available data, and avoid unduly distorting markets. Active customers who utilise new technology must receive* ***cost-reflective signals*** *reflecting the costs and benefits they bring to the network which requires well-functioning markets. All consumers, including those who are unable or choose not to engage, should pay a fair contribution towards the fixed costs of the system. CEER to review progress on this during 2021, in line with the 3D Strategy.*

Recommendation

R 3 ***Monitoring market evolutions:*** *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 promote a level playing field for alternative technologies.*

3.4 Using the Data for Flexibility

For the network companies, digitalisation can work alongside decentralisation of the sector to give access to new sources of flexibility. Regulators should ensure that network price controls encourage DSOs and TSOs to take advantage of these options where they are more efficient than investing in new network capacity. This requires review of the incentive framework to address the traditional bias towards capital expenditure. The CEER paper on "Incentive Schemes for Regulating Distribution System Operators, including for innovation"[42] proposed total expenditure (totex) regulation, which addresses the main financial incentive, but is not in place across most of the EU.

Regulators will want to consider whether balanced incentives are sufficient or whether, given DSOs will be choosing between (temporarily) procuring flexibility or building their own assets. This was highlighted as important for ensuring a level playing field and allowing competition to drive down operational costs.

As well as incentives for efficiency, steps may be needed to give DSOs the tools they need to procure network services and manage their networks more actively. For the market design, this could include under certain regulatory preconditions a review of any explicit restrictions (except of unbundling requirements), enabling platforms with locational prices or local flexibility products benefitting the grid or establishment of a flexibility market. Before introducing market-based approaches, it shall be assessed whether there is enough competition and liquidity. If market-based approaches do not lead to an efficient outcome and involve an over average misuse potential (dec-inc game or other abusive behaviour), non-market based approaches might be preferable.

The allocation of roles and responsibilities for network operation and planning between TSOs and DSOs are the subject of ongoing discussion. It is clear that TSOs and DSOs need to work well together, avoiding duplication of work and ensuring that efficient options are taken forward, whether for grid reinforcement or for procurement of flexibility. But there are different views about their relative roles and there may be benefit in gaining experience from different models being applied on a national level.

Priorities

P 2 ***Promoting DSO use of flexibility:*** *CEER recommends that NRAs as part of their regular processes review network tariff regulation to* ***remove capex bias*** *and encourage the use of flexibility services where economic. CEER to review progress in implementing the recommendations of this paper and collate best practices during 2021, in line with the 3D Strategy.*

P 3 ***Enabling market-based flexibility:*** *DSOs to explore market-based procurement for flexibility services, considering use of a flexibility marketplace where efficient and reviewing whether network tariffs send the right signals for network users. CEER to publish the planned paper on procurement of flexibility by DSOs beginning of 2020 and based on that decide on further actions.*

[42] Incentives Schemes for Regulating Distribution System Operators, including for innovation A CEER Conclusions Paper Ref: C17-DS-37-05, 19 February 2018.

Recommendations

R 4 ***The right product definitions:*** *DSOs and TSOs to review 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.*

R 5 ***TSO/DSO relationship:*** *Regulators to review progress on TSO/DSO relationship in a more decentralised system and where necessary engage more closely in discussions to define respective responsibilities.*

3.5 Consumer Access to Energy Markets

Customers have different needs, values, interests and expectations. They may therefore engage in different ways. For smaller consumers and households, some may engage directly through their suppliers (for instance by opting for time of use tariffs, dynamic price con-tracts or by producing electricity in their homes). Others might prefer to engage with intermediaries offering services, such as aggregators or energy communities that could play a more important role in offering easy and accessible ways of participation. For larger customers, the electricity market already offers opportunities for participation at a relatively low threshold.

Consumers should be exposed to relevant price signals and receive, in return, tangible financial incentive from adjusting their consumption pattern accordingly. New pricing models as well as new intermediaries will need to be carefully monitored by regulators, as different pricing designs can lead to confusion among consumers and result in no major impact on switching behaviour or consumer satisfaction.

3.5.1 Mitigating Consumer Risks of Digitalisation

As noted in chapter 2, we can expect to see a growing range of pricing models for energy such as dynamic pricing, subscription models and pricing according to comfort levels rather than kWh.

CEER has long argued that customers should be exposed to price signals at the retail level. However, it must be recognised that, with dynamic prices, there is a risk that consumers get caught during high price periods and receive unexpectedly high bills. For sophisticated customers, informed and able to take the risk, this may be acceptable. But what ensures that customers who are less engaged and perhaps less able to bear the risk do not find themselves in a problematic position?

There is also a danger that digitalisation will only benefit those consumers already engaged and digitally skilled, and leave behind or disadvantage those currently unengaged and digitally excluded. They should not be penalised with disproportionately high prices. The providers of the new energy-related digital services, along with customer associations and public authorities must play a role of educating current and future customers; education on the purpose and benefits of digital opportunities, including support for those vulnerable. Furthermore, customer education, along with appropriate cybersecurity technologies, will be key to prevent unwanted data leakage and data abuse.

To leverage consumer participation in the market, several potential behavioural barriers should be addressed:

- Raising awareness of the potential benefits in participating in the market;
- Improving trust in the energy market, utilities and in others service providers;
- Offering adequate technologies and software platforms to overcome market complexity;
- Preventing the risk of technology reject by providing the proper level of information and education on potential health and privacy risks;
- Preventing disincentives and misuse potential.

3.5.2 Consumer Products and Intermediaries

In the digitalised energy sector, we can expect intermediaries to offer alternative products to customers. In a well-functioning market, we would expect to see the needs of different types of customers being addressed, potentially with products that encourage demand side response whilst providing protection against price shocks. Typically, such new products may require consumers to have smart meters, so where consumers do not yet have smart meters installed, the products cannot be deployed. Other intermediaries offer different types of service, such as switching between traditional energy suppliers.

Currently in some markets, suppliers can block consumers accessing services from others. The Clean Energy Package recognises the role of aggregators in particular and allows consumers to conclude a contract with them without suppliers' permission (Electricity Market Directive Art. 13[43]). However, this raises the question of how these and the potential wide range of other intermediaries are regulated, compared to suppliers. For example:

- Suppliers are often licensed/ authorised and face a number of regulatory requirements concerning prices, sales and marketing, billing etc. How should these requirements evolve and which should apply to other intermediaries?

- Consumers need to know they will get a fair deal from switching sites. We can expect to see more automatic switching providers in future, which may be beneficial for consumers if their interests are aligned with consumer benefits but could also be less transparent.

- Similar questions may arise if new intermediaries emerge in future- such as energy portfolio managers to manage the consumers buying, selling choices across their electricity and gas consumption, transport services and other home products - particularly as decisions are increasingly automated.

Further benefits and risks to consumers could come from bundled products covering a range of sectors. The CEER/PEER paper on bundled products sets out principles for companies to follow in offering bundled products and for consumers to consider.[44]

[43] Directive 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU.

[44] PEER Draft Guide on Bundled Products, A CEER Public Consultation, Ref: C18-CRM-PEER-07-06 19 September 2018, https://www.ceer.eu/documents/104400/-/-/96ec6f1e-d4af-8a5b-b114-c9e6c1fdaadd

In addition to consumers purchasing a bundle of products, there may be issues arising from appliances being used for multiple purposes. For example, whereas solar panels might be optimised for the value of energy, EVs are for transport and fridges for food first, even if they then optimise energy second. When this works well, there may be marginal benefits for consumers. But what happens if things go wrong, for example if an algorithm ends up paying a very high price for energy, or does not manage the temperature sufficiently and the food goes off? It may not be clear to the consumer what has happened, even if it is clear which company is responsible and how disputes are addressed.

The main role for regulators in new service provision is to consider relaxing or removing rules which get in the way, where relevant to promote interoperability and to consider whether additional consumer protection measures are needed.

The established model of sales of energy as a commodity (kWh) is not necessarily the best model for the future. It will be important to enable other models, such as dynamic pricing, flat or subscription products, energy as a service, switching services and bundled products to be marketed to consumers. These new products will need to be carefully monitored to understand the benefits and risks for consumers. For example, for products where consumers pay a flat rate up to a defined level of consumption and a higher rate for going beyond their "allowance", there may need to be strong information requirements to warn customers, as with dynamic pricing. To the extent this differentiation strengthens competition, regulators should consider fall-back provisions when things go wrong, such as a supplier going out of business (for example, a supplier of last resort).

In particular, we expect many consumers will not engage with new services, at least initially, and this may include a greater proportion of vulnerable customers. Regulators may want to pay particular attention to ensuring such customers are treated fairly and not left behind, which could include establishing terms for the residual universal service or default supplier.

Regulators may also need to work with other organisations to improve the information and understanding available to consumers, to help those who choose to engage to get the benefits from doing so.

Increasingly, a digitalised energy sector will see consumption decisions automated through smart homes and the like. And network operation decisions will increasingly be automated through smart grids. But we also expect automation on the commercial side – for example through algorithms setting prices. This could allow for more targeted price discrimination based on willingness to pay, and gives rise to concerns about, for example, algorithms colluding with each other.

In other sectors, customer segmentation has already moved from having a handful of customer types to bespoke services segmented to the individual. For example, the advertising associated with search engines is individually targeted. In the energy sector, further consideration will be needed on how far such differentiation is acceptable for an essential service, which is likely to depend on whether the outcomes as seen as fair – for example, do they result in higher-income customers consistently getting better offers than customers with lower incomes?

Overall, regulators will need to facilitate competition (implying removal of unnecessary barriers to new products) whilst empowering and, where needed, providing for protection of consumers through principle-based regulation and requirements on provision of information for consumers. Maximising reliance on general consumer law will help in some aspects, such as bundled products, but may not be sufficient. Furthermore, in the enforcement of consumer rights in the digital environment, EU-wide enforcement cooperation among public authorities is often slow and needs to be strengthened to prevent non-compliant traders from exploiting gaps and territorial and other limitations in Member States' enforcement capacity. A key piece of legislation to boost fairness in e-commerce transactions is the Unfair Commercial Practices Directive (UCPD). But EU consumers often do not know their rights, and businesses, especially new digital and collaborative business models, may not comply as they are unsure which rules apply to them.

This is why regulators should strive to:

1) ensure a strengthened and more efficient enforcement cooperation framework that will increase legal certainty, particularly for traders and consumers active across borders;

2) make the case for additional powers where needed to enable authorities to (jointly) act faster to stop widespread online infringements.

Some energy sector rules, such as meeting security of supply obligations and balance responsibility need to apply to all participants. As a principle, it seems preferable to scope regulation based on activities (e.g. marketing to consumers) and potential abuse of market dominance rather than business structure. When it comes to electricity and gas networks, regulation shall continue to focus on natural monopolies and the underlying regulatory provisions for it.

We recommend further analysis of other markets that have undergone similar changes, such as telecommunications in respect of bundles and alternative charging models and financial services in respect of sophisticated products with significant risks, to see what lessons can be learnt for energy.[45]

[45] CEER is currently developing a paper on New Services associated with DSOs, which considers, among other things, DSO involvement in telecommunications.

Recommendations

R 6 ***New consumer products:*** *NRAs to monitor experience with new products and consider whether additional steps to empower or protect consumers are needed, and energy regulators to cooperate with other regulators through PEER to promote effective consumer protection. CEER to publish a summary of experience across Europe once there is sufficient experience to learn from, considering also lessons from telecoms and financial services markets where relevant. Particular attention is merited on distributional issues – whether some parts of society are being "left behind" by developments.*

R 7 ***Regulating intermediaries:*** *Regulators to consider best model for regulation of intermediaries including responsibility for balancing and, where applicable, capacity requirements where they are selling energy. Where not already in place, consider arrangements for a default supplier for inactive customers.*

3.6 Innovation and Future-Proofing Regulation

As the availability and value of data increases, new and existing energy service providers will develop new ways to realise the value behind digitalisation. The main role for regulators in new service provision is to consider relaxing or removing rules which get in the way, where relevant to promote interoperability and to consider whether additional consumer protection measures are needed. Such an approach will promote innovation and competition for actors to get the most out of digitalisation. A range of intermediaries are starting to innovate and provide an interface between consumers and energy markets.

Beyond intermediaries lies the P2P and Energy Communities approaches. These models allow for the disintermediation of suppliers, but through involving groups of customers or prosumers rather than each customer interacting with an intermediary in a bilateral relationship. The Clean Energy Package requires Energy Communities to be facilitated, although the practical implementation issues will only become clear over time.

The Clean Energy Package also makes clear that prosumers (active consumers) trading below certain levels are not suppliers (Article 21- Renewables Directive). In some countries, national legislation already addresses these issues (such as the Netherlands and France).

3.6.1 Managing Risks

From a consumer perspective, it is not just a question of how these business models can enter the market, but about the allocation of responsibility when things go wrong. To the extent that energy sector requirements do not apply, the consumer will be reliant on general consumer protection and contract law. As a minimum, consumers need to be aware of the risks they are accepting and enter into such arrangements with informed consent. In any event, responsibility for energy imbalances cannot be avoided.

Going further, while these alternative business models may increase competition, an intrinsic part of competition is that some businesses fail. How are consumers protected in these circumstances? Does there need to be default arrangements for inactive customers? And/or a supplier of last resort to continue supply if a consumer's current provider fails?

If P2P or energy community approaches are successful, one risk is that they benefit unduly from reducing use of the grid whilst still relying on it for back-up. Given the sunk costs in networks, full grid defection is unlikely to be economic[46], but it is often encouraged by the structure of charges relying heavily on kWh components. Even if network tariffs perfectly reflect the costs associated with incremental changes in network use, there will generally be a large residual or fixed element necessary to ensure network companies recover their revenue entitlement. This is often also recovered through the kWh charge and it is this element that can lead to questions of distributional impacts and, in extremis, the “death spiral” concern of reducing network usage leading to higher charges for those who remain, encouraging them to reduce usage and so on.

3.6.2 Digitalised Energy Regulators

As the energy sector digitalises, regulators will be expected to keep pace. This will require new skills and capabilities – in information technology, big data, data science and artificial intelligence. As well as technical capabilities, new approaches to behavioural insight (including in particular behavioural science and economics) will be needed, and potentially consideration of ethical and moral questions. Close cooperation with consumer associations would be a particularly helpful channel. To make the most of the opportunities, regulators will need access to key information, but will need to avoid being overloaded by endless data. CEER stands ready to deepen our engagement and exchange of knowledge with stakeholders on a continuous basis to improve our collective knowledge, as a sector, about digitalisation and its implications.

As well as employing relevant experts, regulators will need to consider the implications for their core business. Much of the information that regulators today collect from the companies that they regulate may in future be available through other means, reducing information asymmetry. Digitalisation of regulators will allow for data collection to be streamlined, and in turn will hopefully increase the amount and quality of data available to regulators, while reducing the overall administrative burden on companies. In any event, it would be ironic for regulators to focus on digitalisation of the sector and continue to expect manual population of information requests through spreadsheets.

Apart from these technical considerations, regulators will be faced with potential new forms of market abuse and accumulation of market power, manipulating algorithms, etc. Monitoring processes as well as employed technology will have to adapt accordingly.

Moreover, digitalisation may well prove to be a catalyst for the ongoing blending of once separate business areas (e.g. energy, telecom, finance, etc). This will require an increasingly aligned approach towards policy making and regulation from all involved stakeholders.

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[46] With some exceptions – for example, microgrids may be a more efficiency solution in some remote locations.

3.6.3 Supporting Digital Innovation

More generally, the uncertainty over future developments mean that regulators need to adopt a more agile approach, rapidly responding to new products and service proposals and removing barriers where appropriate. For many of the enablers discussed in this chapter, the "optimal" approach is unclear – not least as technologies are developing quickly. 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.

Regulators will often be able to move faster on a limited trial than on changing the rules for the entire market. In this environment, there is value in exploring different products and business models, which may require controlled relaxation of regulations for trials. In doing so, a balance needs to be struck between the commercial confidentiality of innovators and the benefits of sharing information on alternative options to inform other potential innovations. Often it can be difficult to assess in advance where specific regulatory barriers lie, so regulators can also benefit substantially from the information revealed through pilot projects.

There are a range of different models already being adopted for enabling feasibility studies and trials. Substantial public money is being spent, for example, through the EU's Horizon 2020 programme. In some countries, the regulatory framework for networks encourages TSOs and DSOs to invest in deployment of innovative technologies on their networks. For more consumer-facing trials, alongside any funding, regulatory support through derogations or a "sandbox" may be needed.

In some cases, involving regulators in design of trials and studies may improve the information that they provide, for example through encouraging consideration of all customer impacts, including on vulnerable and less engaged customers. Regulators should also follow trials that are funded from other sources (such as Horizon 2020) and ensure that learning is shared across Europe.

It should also be noted, that NRAs don't have absolute freedom of action and need to stay within the bounds of existing legislation. This legislation may need to be adjusted to the new digital realities to become more flexible and conducive to modern regulation. European regulators count on the stakeholders' support in future discussion with both the European institutions as well as national governments to make the necessary changes possible.

Priority

P 5 ***Fostering innovation:*** *Regulators develop best practice approaches to enable trials of new products and business models ("sandboxes"). Taking into account the whole system approach. CEER to provide a forum for exchange of learning from both EU-funded and national trials and studies and to feed back into the parameters for new trials.*

4 Conclusions and Next Steps

Digitalisation is the most promising means we have to deal with some of the biggest challenges we are starting to face on the energy system, from the integration of intermittent renewables to local network constraints as our electricity grids evolve. It also represents an opportunity to get the most value out of the existing system. Our end goal must be to generate and harness data on the energy system to deliver the best outcome for consumers.

We expect that the impacts of digitalisation may be greater in electricity, particularly as the electricity system needs to be balanced in real time. There is a more pressing need for electricity supply and demand flexibility, which is increasing with the huge growth of in renewable electricity generation. As these issues are also relevant in gas, sector coupling/ sector integration can also help. However, the discussion in this paper focuses mainly on electricity as this is where a greater impact is expected in the nearer term.

This project has highlighted a broad - but clear - pathway to getting the best out of digitalisation in the energy sector. As this paper shows, the stages on this pathway include: generating the right sort of data; making this data useable; providing; giving the right-price signals for using the data; empowering consumers; and allowing innovation in utilising the data.

Giving the right price-signals: Generation, consumption and network data needs to be given a clear market value to incentivise prosumers and their intermediaries to profit from using the data to optimise their behaviour.

Encouraging Distribution System Operators (DSOs) to use flexibility: A great deal of the value in data comes from DSOs making efficient use of the information to increase the system efficiency.

Empowering consumers: Following the 2019 “Clean Energy for All Europeans” legislative package (CEP), digitalisation needs to be used to empower consumers to ensure that they can access the value propositions resulting from increased digitalisation of the energy sector. For example, value comes not from having a smart meter installed but from using it for more efficient consumption.

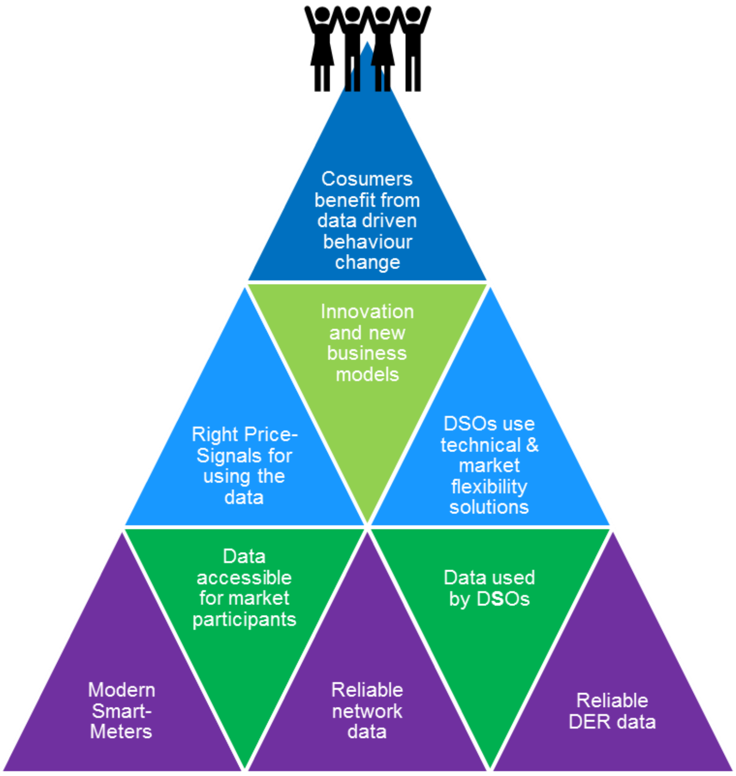
Generating the right sort of data: Appropriately granular data on the electricity system is needed, data which is beneficial for managing the whole system.

Making data accessible and useful: Data needs to be collated and made available not only to network operators but also to current and potential market participants:

- **Accessible and interoperable** data for current and potential market participants, subject to appropriate cost-benefit analysis
- **Secure**, in line with cybersecurity and data protection requirements

Allowing innovation: For consumers to benefit from innovation and digitalisation, regulators and DSOs need to be adaptable and respond to developments in markets.

The destination of this pathway is to allow consumers (directly or through their intermediaries) to use innovative technology to be rewarded for changing their behaviour in a way that benefits the electricity system. At the same time, DSOs will be able to play an even more active role in managing the generation, load and electricity transport in their networks. The following diagram shows how we see this pathway, building from the ground up to a smarter energy system for consumers.



Member States are at different stages along this pathway, and the manner in which local energy systems have evolved means that there are not necessarily one-size-fits-all optimal solutions. NRAs are best placed to have a detailed understanding of where they are on each of these stages at the pathway, and what the best actions will be. NRAs should use their regulatory tools to promote the best solutions in each area.

However, there is also ample room for cooperation amongst NRAs through CEER. While the individual flexibility needs and markets may be largely local, the potential to spread innovation, investment and competition, and get the most out of digitalisation will require a high degree of cooperation and learning from each other. The work we take forward will need to build on and promote the progress already made across Europe in the sector[47].

[47] Work under the IEA's ISGAN is a useful starting point for assessing smart-grid development: http://www.iea-isgan.org/our-work/annex-2/

With the help of stakeholders' responses to this consultation, we have identified 5 key priorities where CEER, NRAs and DSOs can add the most value over the remaining 2 years of the 3D Strategy.

*P 1. **Ensuring effective price-signals**: CEER recommends that NRAs as part of their regular processes review network tariffs to ensure they are fit for the future given the availability of data from digitalisation. Tariffs should give the right price-signals to actors to effectively use available data, and avoid unduly distorting markets. Active customers who utilise new technology must receive cost-reflective signals reflecting the costs and benefits they bring to the network which requires well-functioning markets. All consumers, including those who are unable or choose not to engage, should pay a fair contribution towards the fixed costs of the system. CEER to review progress on this during 2021, in line with the 3D Strategy.*

*P 2. **Promoting DSO use of flexibility:** CEER recommends that NRAs as part of their regular processes review network tariff regulation to **remove capex bias** and encourage the use of flexibility services where economic. CEER to review progress in implementing the recommendations of this paper and collate best practices during 2021, in line with the 3D Strategy.*

*P 3. **Enabling market-based flexibility: DSOs** to explore market-based procurement for flexibility services, considering use of a flexibility marketplace where efficient and reviewing whether network tariffs send the right signals for network users. CEER to publish the planned paper on procurement of flexibility by DSOs beginning of 2020 and based on that decide on further actions.*

*P 4. **Getting and making the data accessible and useful**: DSOs to focus on the quality of their network data and data on distributed energy resources connected to their networks within the relevant legal framework, to ensure that:*

- *they utilise data effectively where this will improve efficiency of their planning, operations and investment;*
- *where appropriate ensure relevant network data is available to current and potential market participants in an accessible manner, and*
- *the opportunity to improve the interoperability of data and institutional arrangements for holding and sharing the data should be further explored.*

DSOs and other data owners should learn from those who move first in this area, for example through developing digital twins. CEER to work with stakeholders to facilitate this work.

*P 5. **Fostering innovation:** Regulators develop best practice approaches to enable trials of new products and business models ("sandboxes"), taking into account the whole system approach. CEER to provide a forum for exchange of learning from both EU-funded and national trials and studies and to feed back into the parameters for new trials.*

The above priorities will be integrated into CEER's work programme under years 2 and 3 of our 2019-2021 "3D Strategy". These will be developed along with the following recommendations, corresponding to ongoing tasks that national regulators are carrying out. CEER may also address some of these issues at European level.

R 1. ***Ensuring data protection:*** *for data privacy and competition issues, energy regulators should work with the authorities responsible for data protection and competition to ensure mutual understanding of the issues in the energy sector and to ensure energy companies adopt best practices.*

R 2. ***Strengthening cybersecurity****: as a minimum, take forward the recommendations in the recent [CEER report](#) on gas and electricity cybersecurity.*

R 3. ***Monitoring market evolution:*** *Regulators to monitor development of platforms and new marketplaces and seek to establish adequate oversight and feedback from stakeholders. Where barriers are identified, regulators to promote a level playing field for alternative technologies.*

R 4. ***Designing the right grid service products:*** *DSOs and TSOs to review 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.*

R 5. ***Deepening TSO/DSO relationships:*** *Regulators to review progress on TSO/DSO relationship in a more decentralised system and where necessary engage more closely in discussions to define respective responsibilities.*

R 6. ***Empowering consumers through new products:*** *NRAs to monitor experience with new products and consider whether additional steps to empower or protect consumers are needed, and energy regulators to cooperate with other regulators through PEER to promote effective consumer protection. CEER to publish a summary of experience across Europe once there is sufficient experience to learn from, considering also lessons from telecoms and financial services markets where relevant. Particular attention is merited on distributional issues – whether some parts of society are being "left behind" by developments[48].*

R 7. ***Regulating intermediaries:*** *Regulators to consider best model for regulation of intermediaries including responsibility for balancing and, where applicable, capacity requirements where they are selling energy. Where not already in place, consider arrangements for a default supplier for inactive customers.*

During 2021, and as part of the 3D Strategy, we will review progress against these recommendations and assess the best way forward to get the most out of digitalisation.

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[48] CEER's Customer and Retail Markets Working Group is planning to work on related topics. The WG is for instance planning to prepare a case study report on innovative business models and consumer protection and a CEER position paper on digitalisation as a driver for better retail market functioning. These items and more are part of the CEER consultation of its 2020 Work Programme: https://www.ceer.eu/pc-work-programme-2020

Annex 1 – List of Abbreviations

Term	Definition
API	Application Program Interface
BRP	Balance Responsible Party
CEER	Council of European Energy Regulators
CEP	The Clean Energy Package
CISO	Chief Information Security Officer
DSO	Distribution System Operator
EDI	Electronic Data Interchange
ENTSO	European Network of Transmission System Operators
ETIP SNET	European Technology and Innovation Platform – Smart Network and Energy Transition
EV	Electric Vehicle
ID	Intraday
IEA	International Energy Agency
GDPR	General Data Protection Regulation
GL	Grid Location
LNG	Liquified Natural Gas
NRA	National Regulatory Agency
P2P	Peer to Peer
PAYG	Pay as you go
PEER	Partnership for Enforcement of European Rights
PV	Photovoltaic
TSO	Transmission System Operator
TYNDP	Ten Year Network Development Plan
UCPD	Unfair Commercial Practices Directive
VPP	Virtual Power Plant

Annex 2 – Summary of the Priorities and Responsible Parties

Priority	Summary	Responsible parties	Dates
P 1. Ensuring effective price-signals	As part of their regular processes, NRAs to review network tariffs to ensure that customers receive cost-reflective signals. CEER to review progress on this during 2021, in line with the 3D Strategy.	NRAs, CEER	CEER report in 2021
P 2. Promoting DSO use of flexibility	NRAs to review network tariff regulation (as part of their regular processes) to remove capex bias and encourage the use of flexibility services where economic. CEER to report on progress in implementing the recommendations of this paper and collate best practices during 2021, in line with the 3D Strategy.	NRAs, CEER	CEER report in 2021
P 3. Enabling market-based flexibility	DSOs to explore market-based procurement for flexibility services, and reviewing whether network tariffs send the right signals CEER to open a dialogue with DSOs on this.	DSOs, CEER	2019 CEER report in 2020 on flexibility
P 4. Getting and making the data accessible and useful	DSOs to focus on the quality of their network **data** and	DSOs, DSO-entity,	Workshop in 2020

Priority	Summary	Responsible parties	Dates
	data on DER…. They will make this data available to current or potential market participants in an accessible and safe manner. Data must be **interoperable**…. Learn from those who move first in this area, e.g. developing **digital twins).** CEER to work with stakeholders to facilitate this work	CEER	
P 5. Fostering innovation	Regulators develop best practice approaches to enable "sandboxes" CEER to provide a forum for exchange of learning and feed back into the parameters for new trials.	NRAs, CEER	

Annex 3 – About CEER

The Council of European Energy Regulators (CEER) is the voice of Europe's national energy regulators. CEER's members and observers comprise 39 national energy regulatory authorities (NRAs) from across Europe.

CEER is legally established as a not-for-profit association under Belgian law, with a small Secretariat based in Brussels to assist the organisation.

CEER supports its NRA members/observers in their responsibilities, sharing experience and developing regulatory capacity and best practices. It does so by facilitating expert working group meetings, hosting workshops and events, supporting the development and publication of regulatory papers, and through an in-house Training Academy. Through CEER, European NRAs cooperate and develop common position papers, advice and forward-thinking recommendations to improve the electricity and gas markets for the benefit of consumers and businesses.

In terms of policy, CEER actively promotes an investment friendly, harmonised regulatory environment and the consistent application of existing EU legislation. A key objective of CEER is to facilitate the creation of a single, competitive, efficient and sustainable Internal Energy Market in Europe that works in the consumer interest.

Specifically, CEER deals with a range of energy regulatory issues including wholesale and retail markets; consumer issues; distribution networks; smart grids; flexibility; sustainability; and international cooperation.

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More information is available at www.ceer.eu.