ofgem Making a positive difference for energy consumers

Making the electricity system more flexible and delivering the benefits for consumers

Position paper

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Overview:

The energy sector is changing. Generation is becoming more distributed and variable, and consumers are benefitting from new ways to monitor and manage their energy use. There are opportunities for new business models and technologies to emerge, and for existing businesses to develop, to deliver better services for consumers.

To make the most of the opportunities offered by these changes, and to deliver against our carbon commitments, while providing reliable and secure supply at minimum cost, we need to consume and produce electricity more flexibly.

We propose to initiate work, focused around priority areas, to make sure that regulation supports an efficient, flexible energy system, which delivers benefits for consumers. We will progress these work areas as part of a broader programme of work with the Department for Energy and Climate Change (DECC), intended to manage the transition to a smarter energy system. We welcome your engagement over the coming year.

Context

In January of this year, we published an open letter launching our work on Flexibility.[1] We said we would bring together work across Ofgem to enable us to take a holistic view of system flexibility.

In this letter we set out the scope of our work. We have, and will continue to, focus on three sources of electricity flexibility – demand-side response, energy storage, and distributed generation.

Our examination has been limited to the electricity sector. We recognise the important interactions with gas and will continue to consider learning from the gas sector that may be applied to electricity. Equally, whilst heat has not been part of our scope (and is not part of our regulatory remit) we recognise there are interlinkages we need to be mindful of. We have not been looking at policies to promote energy efficiency, where government is leading. However, we will continue to consider links between energy efficiency policy and potential actions to facilitate efficient use of flexibility sources.

Since publishing the open letter, we have been working internally and with stakeholders to understand the issues which prevent the efficient and diversified use of flexibility across the system. We would particularly like to thank Judith Ward from Sustainability First for her contribution to this work.

This position paper is the product of the thinking conducted over the past few months.

We have identified a number of priority areas in which we intend to take forward actions in the next phase of work. These are areas where we can play a role and where we have found there to be broad consensus that actions are needed to achieve benefits for consumers. These priority areas are described in detail in Chapter 3.

Further work will be needed in the future to support the longer term transition to an efficient and flexible energy system. We will be working with DECC on Flexibility, and as part of this, we will be thinking about the further actions that may be necessary and how the transition might be made.

Our work on Flexibility has the potential to contribute to all five consumer outcomes set out in our corporate strategy.[2]

[1] 'Open letter: facilitating efficient use of flexibility sources in the GB electricity system' - https://www.ofgem.gov.uk/ofgem-publications/92669/flexibilityprojectopenletterjan2015.pdf

[2] Please see chapter 3 for further detail.

Associated documents

- *Open letter - facilitating efficient use of flexibility sources in the GB electricity system* Ofgem, 28 January 2015
  https://www.ofgem.gov.uk/publications-and-updates/open-letter-facilitating-efficient-use-flexibility-sources-gb-electricity-system

- *Summary of responses to discussion paper - Non-traditional business models: Supporting transformative change in the energy market* Ofgem, 30 September 2015
  https://www.ofgem.gov.uk/publications-and-updates/non-traditional-business-models-supporting-transformative-change-energy-market

- *Quicker and more efficient connections: next steps* Ofgem, 30 September 2015
  https://www.ofgem.gov.uk/publications-and-updates/quicker-and-more-efficient-connections-next-steps-0

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Executive Summary

The energy sector is undergoing a fundamental, structural change. We are moving away from the linear 'one-way' flow of electricity from large generators, through transmission and distribution networks, to passive consumers. Instead we are now moving to a system where generation is distributed and more variable, where consumers can better monitor and manage their energy use, and where new technologies and business models are emerging.

It is hard to tell precisely what the future system will look like – among other things, this will depend on the pace and nature of these changes. Whatever it looks like, we will need to produce and consume energy more flexibly in order to make the most of the opportunities provided. Doing so will allow us to make significant cost savings, both for the decarbonised electricity system, and for individual consumers.

We want to take priority steps now to enable this. We will work to ensure consumers are at the heart of future regulatory arrangements to support a flexible and efficient energy system.

We define flexibility as 'modifying generation and/or consumption patterns in reaction to an external signal (such as a change in price) to provide a service within the energy system.' The efficient and diversified use of flexibility will produce a more interactive system which produces savings for consumers.

Currently, the main source of flexibility we use is generation. For instance, when there isn't enough supply to match demand, we generate more and build more cables to carry it. As we decarbonise, simply building more power stations and cables to meet demand when the wind isn't blowing, or the sun isn't shining, is neither sustainable nor efficient. We also need to be able to make the most of times when we generate more than we need.

Instead we can look at new forms of flexibility. We can use batteries to store electricity when it is plentiful, or when there is too much for the network cables to carry. Consumers can make more informed choices about when they use electricity. For instance, businesses could make small changes to when they use air conditioners or other appliances, in order to make savings. We can also use low carbon electricity which we generate locally at home or at work – for example from a rooftop solar panel – to help reduce the costs of transporting it and save us money on bills. In future, buildings could be designed to include generation and energy storage, so that people using them can manage their electricity to make savings. More work needs to be done to make these approaches part of everyday life.

This year Ofgem conducted work to understand the issues which may be inhibiting flexibility. This position paper sets out our findings and the priority areas we intend to work on over the next year in order to ensure regulation supports an efficient, flexible energy system. We will-

- Encourage Distribution Network Operators to take a more active role in network management, moving to future Distribution System Operator roles and engaging effectively with the System Operator.

- Clarify the role of aggregators.
- Clarify the legal and commercial status of storage.
- Explore how to support more large industrial and commercial customers to participate in providing flexibility.

We will also-

- Examine and feed into European discussions on how future distribution charges may need to evolve. We see this as a longer term piece of work which we will be initiating thinking on now.

We look forward to progressing these work areas as part of a broader programme of work with DECC, intended to manage the transition to a smarter energy system. Our work will also form part of a wider portfolio of related work in Ofgem, looking at issues related to the future development of the system.

The opportunities from flexibility and the challenges to enable it are not unique to Great Britain. They are being considered across the world and will be integral to the development of the European internal energy market. We will continue to work closely with the European Commission and other energy regulators to bring about the necessary changes. We will also continue to gather learning and to use international experience and analysis to inform our work.

1. What is flexibility and why is it needed?

Chapter Summary

This chapter outlines our view of the changing electricity system. It explains the role that flexibility can play in supporting it and in contributing to a dynamic, efficient and competitive future market. It also outlines our role in making sure that the regulatory arrangements support the efficient and diversified use of flexibility.

Delivering sustainable, reliable and affordable electricity

1.1. The electricity system is in the midst of one of the most significant periods of change in its recent history. It is critical that consumers realise the full benefits of this change, with a system that is able to deliver against our carbon commitments, while providing reliable and secure supply at minimum cost. Traditionally, we have varied our supply to meet consumer demand. In a low carbon system where generation is more variable, an efficient system can only be achieved where we consume and supply energy more flexibly.

The changing electricity system

1.2. Supply is changing. The UK is committed to reducing greenhouse gas emissions by 80 per cent relative to 1990 levels by 2050.[3] The UK also has a shorter term target under the European Renewable Energy Directive to achieve 15 per cent of final energy consumption from renewable energy sources by 2020.[4] New environmental regulations may also mean that more fossil fuel power plants are shut down. These changes will bring benefits and opportunities for existing and new market participants. They will also present some challenges for the energy system, as more renewable generation leads the amount we produce to vary more, and less predictably, over the day and year.

1.3. Demand is changing too. We are using electricity more for things like transport and heating. It is important that we ensure enough electricity is available to meet these needs, while also having opportunities to lower our bills by changing when and how we use electricity.

1.4. The electricity system of the future may look very different from now. Several recent or planned developments could support this transition.

[3] Further information on this commitment can be found here: http://www.legislation.gov.uk/ukpga/2008/27/part/1/crossheading/the-target-for-2050 .
[4] Further information on the Renewable Energy Directive can be found here: https://ec.europa.eu/energy/en/topics/renewable-energy/renewable-energy-directive

Making the electricity system more flexible and delivering the benefits for consumers

1.5. Smart meters[5] and smart grids[6] will give consumers new opportunities to manage their energy consumption and lower their bills. This will bring benefits, but could also challenge traditional business models, prompting an evolution in the role of industry parties and their interactions with consumers.

1.6. Existing parties, such as suppliers, will be able to use smart technology to offer more tariffs which reward customers for changing when they use energy. Non-traditional business models,[7] whether offered by existing parties or new entrants, could also provide both essential and new services. Examples of emerging business models include the provision of more local services (eg community energy), bundled services (for instance demand management as part of an energy service contract), and new models of consumer participation (eg where consumers begin to vary their demand, and/or generate their own electricity).

1.7. Improvements in existing technologies such as solar and wind, as well as the development of new technologies such as energy storage, could help decarbonise the energy system, while ensuring enough supply. New, innovative products such as smart thermostats or home batteries could help consumers smarten the way they use electricity. Where consumers sign up to a Time of Use (ToU) tariff for instance,[8] these technologies could help save money on bills, sometimes with very little effort or behaviour change required on behalf of the consumer.

1.8. Realising the potential of these developments is key to ensuring the future electricity system is resilient, while delivering against the UK's carbon targets at a fair cost for consumers.

Understanding flexibility and how it can help

1.9. Flexibility is a key feature of energy markets. We define it as modifying generation and/or consumption patterns in reaction to an external signal (such as a change in price, or an electronic message) to provide a service within the energy system.[9]

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[5] Further information on smart meters can be found here - https://www.gov.uk/guidance/smart-meters-how-they-work

[6] Different people have different understandings of the term 'smart grid'. One commonly used description is an electricity network that can intelligently integrate the actions of all the users connected to it - generators, consumers and those that do both - in order to efficiently deliver sustainable, economic and secure electricity supplies.

[7] This refers to business models offering new products or services, or new ways of delivering these, that are different to those traditionally provided in the existing energy market. Those offering such services have diverse motivations (technological, social and environmental as well as financial) and ownership arrangements, and operate at various scales.

[8] A tariff where the charges vary by the time when the energy is consumed, for example through different unit rates for energy consumed during the day and during the night.

[9] For a more detailed definition of Flexibility, please see here. Please note that a slight variant of this definition has been used to date in the Electricity Balancing Significant Code Review, where flexibility is defined as 'the ability to ramp generation or demand up or down quickly in response to changing market conditions'. For the purposes of the next stage of work on flexibility we will retain the definition currently

1.10. It is used by several market participants across the energy value chain, to manage their operations efficiently. As we note above, the main source of flexibility has historically been generation. Market participants such as suppliers, the system operator (SO) and generators would typically buy or sell electricity generated by power plants to meet demand and system needs.

1.11. But system needs and consumers' needs can and will change. Given the carbon emissions targets and expected increase in overall demand for electricity, the traditional approach of investing to increase peak capacity of generation and networks infrastructure is no longer sustainable or efficient.

1.12. Simply building power plants to meet expected peak demand and to manage greater variations in supply (known as intermittency) from renewable sources, would mean having a lot of excess generating capacity during most of the day, and long periods of the year. This is expensive and inefficient.

1.13. If we don't modify our consumption patterns to use or store energy when it is available, eg at times of high renewable generation (such as sunny or windy days) with low demand, some low-carbon generators may have to be 'constrained off' at a cost. We are already beginning to see this happen.

1.14. It can also become necessary to 'constrain off' some renewable generation when there isn't enough network capacity to carry it. We could reinforce the networks to cope with much higher loads, which could help to reduce the times when renewable sources are prevented from supplying electricity to the system. But reinforcing the network for the peak stress it might face for a short period of the day or year, is very expensive compared with the short periods of the day or year when that investment delivers real benefits to consumers.

1.15. New sources of flexibility both on the supply and the demand side could help respond to consumers' changing needs while delivering a resilient, sustainable and affordable electricity system.

1.16. Flexibility can help in several ways. Flexibility providers can-

- Shift consumption to a different period of time
- Reduce demand at key times (ie with a net reduction in overall consumption)
- Increase consumption when needed (ie with a net increase in overall consumption)

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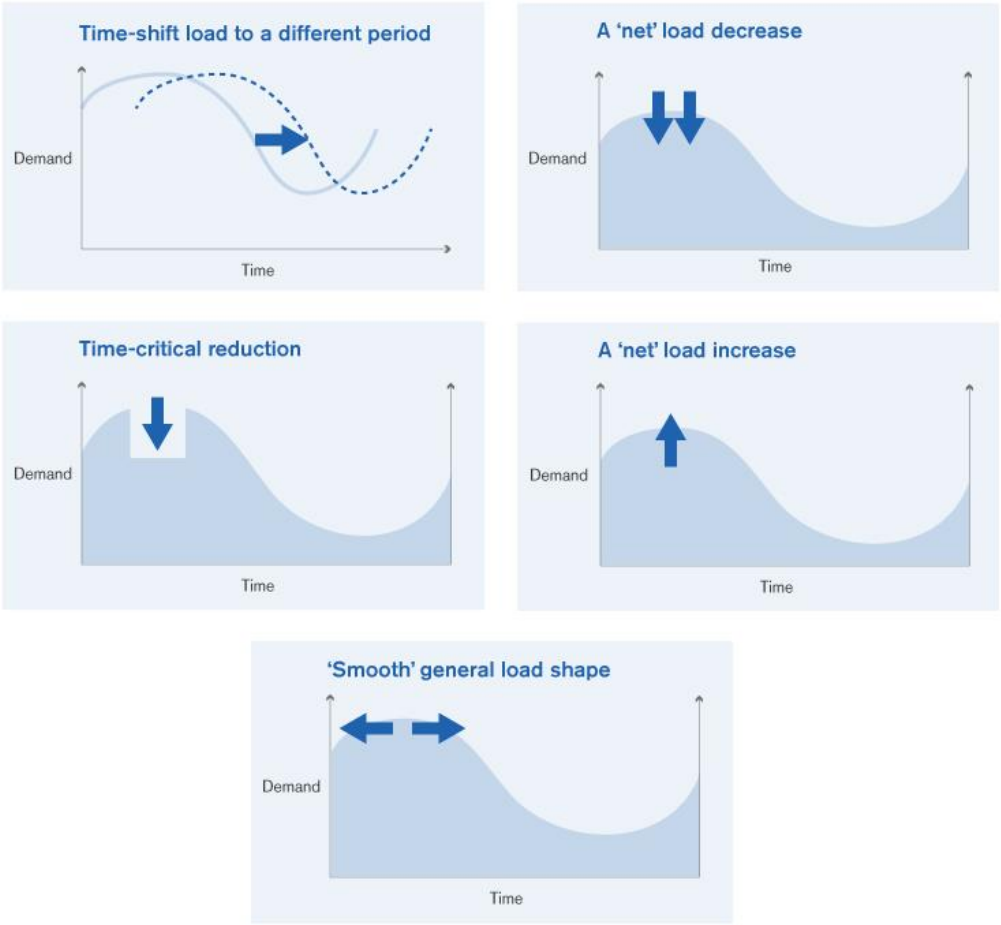
being used in European discussions, but intend to keep it under review.

1.17. These actions can be taken in response to a price or electronic signal, for instance to help manage a system fault or to match demand with inflexible supply from renewable sources.

1.18. The graph below illustrates a number of different ways flexibility can contribute to the electricity system. Each of these is delivered via one or more of the three approaches described above.

Figure 1 - How flexibility can help manage the electricity system[10]



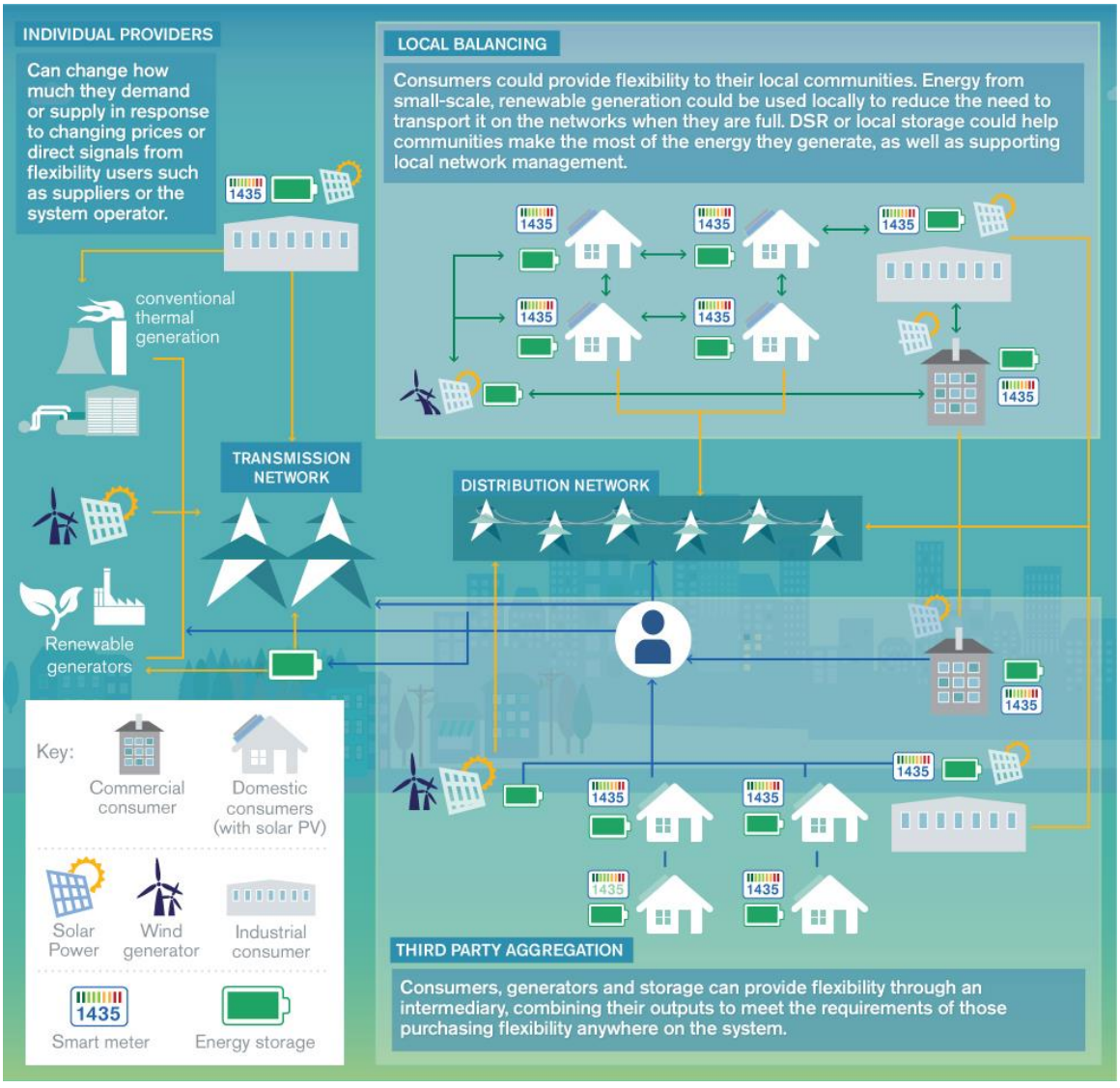
1.19. Flexibility in these forms can reduce the need for expensive and carbon intensive peaking plants, and can reduce network costs by avoiding or deferring

[10] Figure adapted from A Discussion Paper on Smart Demand Response by the ENA and Energy UK - http://www.energynetworks.org/modx/assets/files/news/publications/Smart_Demand_Response_A_Discussion_Paper_July12.pdf

reinforcement, enabling cheaper and more timely connections, and enabling more efficient resolution of network issues.

1.20. We believe the future system will need to be characterised by the smarter and more efficient use of traditional and new flexibility sources, in order to benefit consumers as much as possible. Figure 2 presents some roles that different sources of flexibility could play in the future electricity system.

Figure 2 – Flexibility in the future electricity system



1.21. In order to be flexible, the future system should feature an efficient and sustainable mix of generation sources both at system and local level. It should have access to and make use of sufficient cross-border electricity flows. It should feature the increased and efficient deployment of demand-side response (DSR), where

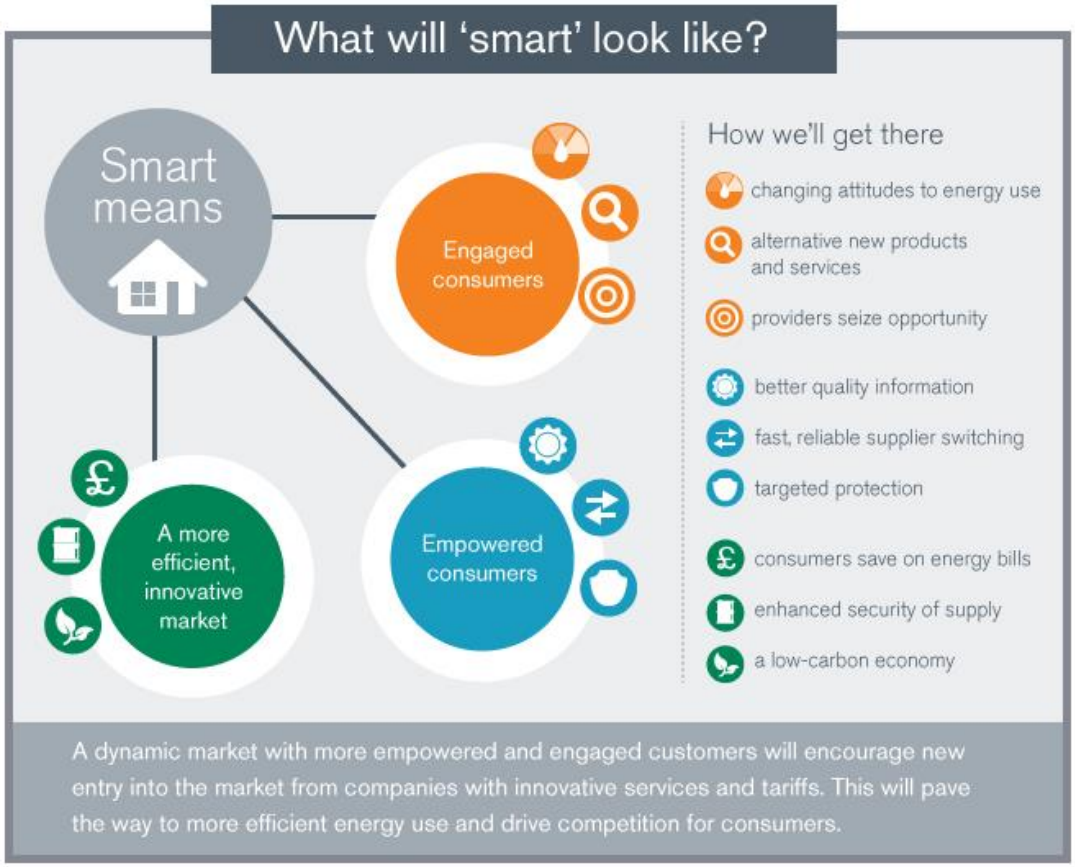
consumers can choose to change their pattern of consumption in response to market signals, in order to make savings on their bills. It should incorporate emerging flexibility sources, such as storage, to help manage the system. It should also enable new business models to participate (from both existing and new market actors) and support more efficient provision of flexibility.

Benefits for consumers

1.22. The transition to a smarter, more flexible electricity system has the potential to bring many benefits to consumers. We have published our vision for future smarter energy markets where consumers will play an active role and the energy system will efficiently provide services to them.

1.23. Figure 3 below presents a snapshot of our vision, also available on our website.[11]

Figure 3 - Our vision for a smarter energy market for consumers



[11] The vision is available on our website at this link

1.24. We are progressing a number of pieces of work which we see as key to achieving this vision. One is the change of supplier project, which is looking to deliver reliable next-day switching. Another is Flexibility, a key element of our vision. The paragraphs below explain how we see flexibility playing a part in this future market vision.

Engaged consumers

1.25. The future electricity system will provide opportunities to increase consumers' engagement through greater awareness and participation. Consumers could become more engaged by becoming key providers of flexibility, delivered for example through DSR.[12] They could also support system resilience by taking steps to permanently reduce their load and/or by generating electricity – for example from a rooftop solar panel – either consuming it directly themselves (reducing the need to transport it), selling it, or storing it for future use. Whilst greater participation in flexibility opportunities can support greater engagement, consumers who do not wish to become more actively engaged can also use technologies and services to manage energy use on their behalf and make savings.

Empowered consumers

1.26. The new system could empower consumers by giving them access to information and tools to understand their energy consumption and manage their bills. For example, consumers could use the information provided by smart meters to assess their energy consumption and to shop around for the best offer. This could include TOU tariffs (a form of DSR) or other products such as smart thermostats which, with minimal effort, could help them change when they consume energy and save on their energy bills.

More efficient, innovative market

1.27. More consumer engagement and participation in the energy markets, including increased uptake of flexibility products, would enable consumers to make better use of electricity and change the way they interact with market actors, many of whom may be third parties, such as energy service companies (rather than traditional suppliers). This would let individual consumers save on their energy bills. It would also help realise system benefits that can be enjoyed by all consumers as a result of lowering infrastructure costs, and environmental benefits by contributing to decarbonising the energy sector. Overall this should lead to a more efficient, innovative market.

1.28. Overall, flexibility should contribute to a more dynamic, efficient and competitive market which delivers benefits for consumers.

[12] By demand-side response we mean actions by consumers to change the amount of electricity they take off the grid at particular times in response to a signal.

Our role

1.29. As regulator, we have a key role to make sure that regulatory arrangements facilitate an efficient current and future energy system. We think it is in energy consumers' interest to have an efficient electricity system characterised by the increased and diversified use of flexibility. We are committed to making sure regulations create the right environment for market actors to participate, invest in and deliver this, so the benefits for consumers can be realised as soon as possible.

1.30. This year we conducted work to understand what issues should be addressed to facilitate the use of new flexibility sources across the value chain. This position paper sets out our findings and next steps.

1.31. In our work we recognised that changes to address these issues may pose challenges to existing market actors, but these changes will also create new opportunities.

1.32. We are keen to work with stakeholders and partner organisations to understand the changes needed and how to move to a smarter and more flexible electricity system.

2. Our position on flexibility

Chapter Summary

This chapter describes the work we have undertaken on flexibility so far this year. It outlines a range of issues we identified in enabling new forms of flexibility and routes to market, and potential actions which could help with these. It also describes our approach to prioritising the actions we need to take in the short term.

Flexibility in GB

2.1. As described in chapter 1, the use of flexibility is not new to the GB electricity system. Until now, however, flexibility has mostly been provided by increasing or lowering supply – eg from gas peaking plants or hydro plants – to meet capacity requirements, maintain system balance and manage imbalance (cash-out) risks.

2.2. Some flexibility has been provided by demand-side actions. Large industrial users provide DSR, typically for system balancing purposes – such as when reserves are running low and the system operator is seeking to reduce demand in the system – or for avoiding high transmission charges ('triad avoidance'). Also a small portion of domestic consumers have been providing flexibility, for example consumers on Economy 7 tariffs or on a radio tele-switching regime.[13]

2.3. More could be done, however, to enable consumers and new technology to realise their flexibility potential, to bring more benefits across the value chain.

Our work this year

2.4. In January this year we began some work to understand better how to increase and diversify the use of flexibility in the electricity system. We wanted to understand what issues prevent the efficient use of flexibility across the value chain, and what actions are needed to kick-start new flexibility sources.[14]

2.5. As an outcome of this work, we have identified a number of priority areas (described in the next chapter) that we plan to focus on in the coming year. In this chapter, we describe the process and analysis which led to our decision to focus on these areas.

[13] Please see here for further detail: https://www.ofgem.gov.uk/ofgem-publications/82288/state-market-customers-dynamically-teleswitched-meters.pdf.

[14] Please note that the scope of our work has not included a qualitative assessment of the potential of different flexibility sources in GB. DECC has undertaken research into the Future Potential for DSR in Great Britain and will be publishing their report in autumn 2015.

Our approach

2.6. In our work we focused on the three new sources of flexibility that we identified, through our analysis and stakeholder feedback, as having the greatest potential both in the short and medium term: DSR, energy storage and distributed generation (DG).[15]

2.7. To inform our work, we-

- Firstly, considered who the users and providers of flexibility are and whether they face issues in using and procuring flexibility.
- Secondly, for each provider of flexibility, we assessed what routes to market are currently available to them (eg the capacity market, the balancing market or the provision of services to the networks) and whether these routes could be explored further or new routes opened.
- Finally, we developed actions that could address the issues and identified which ones needed prompt attention.

2.8. Internal analysis, international and domestic research, stakeholder engagement and work done by industry and other organisations informed our assessment.

2.9. Several recent and ongoing pieces of work relevant to flexibility, both within Ofgem and elsewhere have been key inputs to our thinking. We have also been feeding into discussions at European level.

2.10. We are going to be working very closely with DECC on issues related to flexibility over the coming year, and as we move into the next phase of work we will continue to manage links and interactions with other relevant projects in Ofgem and Europe. We outline the range of related work areas in the next chapter and further details are in Appendix 2.

Our analysis

Users and providers of flexibility

2.11. To understand how flexibility is currently provided and used across the value chain, we considered a range of market actors with a key role in flexibility, particularly looking towards the future:

[15] By distributed generation we mean electricity generating plant(s) connected to the distribution network rather than the transmission network.

Table 1 – Providers of flexibility

Providers of flexibility	
Industrial and commercial (I&C) consumers	While some already provide flexibility, and many of the enablers are in place, more consumers (and the system more widely) could benefit from greater participation by I&C consumers.
Domestic consumers	While few consumers already provide flexibility, the majority could play an active role in providing flexibility, such as demand response, once smart meters (and other supporting technologies) are in place to enable it.
Energy storage providers	While storage has been providing flexibility in other countries, and pumped storage has historically played a strong role in GB, the potential of battery and other forms of storage to smooth intermittent generation or contribute to local balancing has not yet been fully realised in the UK.
Distributed generation	The volume of DG on the system has increased in recent years. While this can pose challenges, creating greater need for flexibility, DG can also provide flexibility, creating opportunities to supply locally and provide other services to market actors.
Aggregators[16]	These new entrants could enable more flexibility by acting as intermediaries between multiple parties and could bridge the gap between consumers and traditional market participants.

2.12. We note that interconnectors (and efficient cross-border trading arrangements to support their use) are also an important provider in the current and future flexibility mix, and will affect the value of other forms of flexibility. Our analysis has been focussed on the GB market arrangements but we note that interconnection capacity is set to increase in the future. We have recently approved the cap and floor arrangements for a number of interconnectors to Belgium, Denmark, France and Norway. We expect GB's interconnector capacity to increase from 4GW to over 10GW by 2021.[17] We continue to feed into discussions on delivering the European internal

[16] Aggregators are third party intermediaries specialising in coordinating or aggregating demand response from individual consumers to better meet industry parties' technical requirements for specific routes to market.

[17] We confirmed our cap and floor regulatory regime for the Nemo interconnector in December 2014. In August 2014 we extended our cap and floor regime to other near-term electricity interconnectors. We have since granted a cap and floor regime in principle to the NSN interconnector (March 2015) and the FAB Link, IFA2 and Viking Link projects (July 2015). We expect to make a decision on the Greenlink project to Ireland in autumn this year. We confirmed our regulatory decision on the ElecLink project in September 2014. More information is available at: https://www.ofgem.gov.uk/electricity/transmission-networks/electricity-interconnectors.

energy market through both the Agency for the Cooperation of Energy Regulators (ACER) and the Council of European Energy Regulators (CEER).[18]

Table 2 – Users of flexibility

Users of flexibility	
Suppliers	Suppliers use flexibility to manage imbalance (cash-out) risks. While this has so far been achieved primarily by buying and selling electricity, there is also scope for suppliers to act on the demand side by encouraging their customers to shift or reduce their demand at peak times.
Distribution network operators (DNOs) and transmission network operators (TOs)	DNOs and TOs could use flexibility to defer or avoid investments, support cheaper and more timely connections, or to better manage issues on their networks. The TO makes decisions about this in conjunction with the SO, and using SO system security services (see Figure 4 below).
System operator	The SO is currently the greatest user of flexibility, which is provided through balancing services for reserve and frequency management purposes, and for system security.
Generators	Generators could use flexibility to balance their positions before gate-closure. We understand that, currently, generators typically do this by altering the amount generated (or the generation they procure), rather than eg accessing DSR or storage products.

Available routes to market

2.13. Flexibility providers and users access one another through a range of routes to market, for example by providing DSR capacity in the capacity market and balancing services such as reserve and frequency response.

2.14. Figure 4 below shows the routes to market which are currently available for a range of providers of flexibility, and which of these are currently used in practice. A green tick means that the route to market is used and a red cross that the route is not used. The question mark indicates that the route is used sporadically.

[18] Further information on the internal energy market can be found here: https://ec.europa.eu/energy/en/topics/markets-and-consumers/single-market-progress-report. Further information on ACER can be found here: http://www.acer.europa.eu/The_agency/Pages/default.aspx. Further information on CEER can be found here: http://www.ceer.eu/portal/page/portal/EER_HOME.

Figure 4 - Routes to market available by user and provider of flexibility[19]

		Capacity	Generation	Balancing				Networks		All
Users		Government	Generation	Suppliers	SO Frequency response	SO Reserve services	SO System security services	DNOs	TOs	Aggregators
Providers										
Generation	Distributed connected generation	✓	?	✓	✓	✓	✓	?	TO will co-ordinate with SO and make use of SO System Security Services to manage constraints and connections as efficiently as possible	x
	Flexible thermal generation	✓	✓	✓	✓	✓	✓	x		x
	Renewable generation	x	✓	✓	✓	✓	✓	x		x
Demand-side	Transmission connected demand	✓	?	✓	✓	✓	✓	x		✓
	Distributed connected demand	✓	?	✓	✓	✓	✓	?		✓
	Domestic demand	x	x	?	x	x	x	?		?
	Aggregators	✓	?	✓	✓	✓	✓	?		?
Storage	Pumped storage	✓	?	?	✓	✓	✓	x		x
	Battery storage	?	?	x	x	x	x	?		x

2.15. While several routes to market are open and used, there are issues that prevent increased participation of new flexibility sources across the value chain, hindering flexibility benefits being realised for the system and for consumers. We have considered which issues prevent the increased and diversified use of flexibility, and ways to address them.

Issues and barriers for flexibility

2.16. For each provider and user of flexibility, we considered whether they are facing any barriers that prevent them from realising the full benefits of flexibility. We identified four types of barriers in our analysis, with the following issues in each category -

- **Cultural barriers** - these include a lack of understanding of the value of flexibility for some providers (such as domestic and I&C customers), and a lack of willingness to provide/use flexibility due to, for example institutional biases, lack of confidence in the flexibility programmes, and lack of trust in other market actors.
- **Regulatory barriers** - these include a lack of clarity of the role and responsibilities of parties in using and providing flexibility, and gaps or deficiencies in the regulatory framework, for instance around the definition of storage.
- **Commercial barriers** – even where the role of parties may be clear, there may be no (or only limited) commercial incentives on parties to use

[19] We will continue to reflect on this analysis as our work progresses, and as the market develops.

and provide flexibility. Equally, the technical and commercial details of flexibility products/contracts may not align with providers' requirements or abilities (eg in the case of I&C customers, storage providers, and aggregators).

- **Structural barriers** - these include costs relating to investment, R&D, and economies of scale for some providers of flexibility. The complexity of market arrangements for suppliers and others, and the uncertainty of response, may increase the cost of procuring some forms of flexibility.

2.17. Further detail on the barriers we identified through our analysis and engagement with stakeholders is in Appendix 1.

Potential actions

2.18. Because the issues are several and diverse, different actions may be required to address them. We have considered what these could be. Some actions could be for industry or other parties to take, while others could be for us. The focus of our proposed work for the coming year is on those actions we consider to be a priority, and where we could play a key role.

Potential actions identified

2.19. The range of possible actions we identified could be divided in three groups depending on their objective-

- Actions to ensure that the **regulation of market participants allows for, and encourages, new entry and new business models**. This may include, if necessary, amending, creating or removing regulations.
- Actions to **increase participation in flexibility opportunities** by raising awareness of the benefits of flexibility and by monitoring the markets and regulated companies.
- Actions to ensure industry processes, and coordination across the value chain, **maximise the value of flexibility**.

2.20. Table 3 below is a non-exhaustive summary of the actions identified in each area, which could support the diversified and efficient use of flexibility.

Table 3 - Potential actions identified

Objective	Potential actions:
Regulation allows for and encourages new entry and new business models	• Clarify the legal and commercial status of storage. • Clarify the role and responsibilities of aggregators. • Encourage the transition from DNOs to Distribution System Operators (DSOs). • Ensure the settlement arrangements[20] and our regulation of network companies place the right incentives on market participants to encourage the use and procurement of flexibility.
Participation in flexibility opportunities increases	• Raise awareness and explore programmes for increasing the participation of I&C consumers in flexibility opportunities. • For domestic consumers, promote the benefits of flexibility and raise awareness of the ways to participate in flexibility opportunities, alongside ensuring necessary consumer protections are in place to build confidence. • Keep regulation under review to ensure it clearly sets out roles and responsibilities and adequately rewards efficient use of the electricity system infrastructure.
Industry processes and coordination across the value chain maximise the value of flexibility	• Make any necessary changes to code governance to ensure it is appropriate for markets and new market actors. • Monitor industry progress to ensure appropriate changes to codes are made to facilitate the use of new flexibility sources.

2.21. Some actions may depend on future developments, or affect others. As noted in Chapter 1, we believe that in order to benefit consumers, the future system will need to be characterised by the smarter and more efficient use of flexibility.

Prioritising actions

2.22. In order to determine the areas of focus for the next phase of work, we prioritised the potential actions considering the following questions:

a) *Is there broad consensus among stakeholders that the issue requires prompt action?*

Our initial focus should be on addressing those issues that are broadly recognised as priority, either because they prevent benefits from being

[20] This refers to the imbalance settlement process administered by Elexon. Further information can be found here: https://www.elexon.co.uk/knowledgebase/trading-settlement/.

realised in the short term, or because they present an obstacle to this in the medium/long term.

b) *Would addressing the issue depend on future developments of the electricity system?*

The precise composition of the future energy system will depend on factors such as the pace of change in new technologies and services, as well as developments in energy systems globally. We have given priority to those actions that should be taken no matter what the precise composition of this future system.

c) *Would consumers be affected if the action is not taken promptly?*

Most importantly, we have prioritised those actions that will help address issues that could cause detriment or limit the benefits of flexibility to consumers.

2.23. Applying the prioritisation criteria above, and considering ongoing wider work, we identified four areas of work that require prompt action, as well as a further longer term area we are planning to initiate thinking on now. We present them in the next chapter.

3. The way forward

Chapter Summary

This chapter outlines the next steps we intend to take over the coming year. It explains how this work will help deliver our corporate strategy. It also presents a suite of relevant established policies, ongoing work and wider activities which set the broader context for our areas of focus.

Our conclusions

3.1. More work is necessary to assess the needs of the future energy system, how these will best be met by a 'flexibility mix' and the right role for regulation. Our immediate focus will be on those areas where there is broad consensus that actions are needed now to achieve benefits for consumers.

3.2. We identified two areas where changes are already occurring and there is agreement on the need for further actions-

- Firstly, the **role of existing market actors is changing** and work is required to support these changes. For example, established actors such as DNOs and industrial and commercial consumers now have greater opportunities to participate in flexibility, and will need to transition to new roles to make the most of these opportunities.

- Secondly, **non-traditional business models** are likely to play a larger role in the energy sector. This could be the case, for example, for aggregators or storage providers.

3.3. Our focus in the next 12 months will therefore be to work on specific interventions which build on these changes to help realise the benefits of flexibility as early as possible. The journey to the future electricity system is a longer term transition which will require work on many fronts, including those projects outlined in Chapter 3, and ongoing engagement with industry and others. These actions do not seek to complete the necessary changes, but rather address specific priority issues as a step towards enabling key new roles and business models for the future system.

Next steps

3.4. We will act to facilitate the transition to new roles for existing parties. In particular, we will focus on the roles of two existing market participants in flexibility-

- DNOs; and
- Industrial and commercial consumers.

3.5. We will also work to enable new business models, focussing on two types-

- Aggregators; and
- Storage providers.

3.6. Alongside this, and maintaining interactions with the work areas above, we will also-

- Examine how future distribution charges may need to evolve and feed into European discussions on this question. We see this as a longer term piece of work which we will be initiating thinking on now.

3.7. We will start work immediately. We will build on the work to date (including the learnings from the Low Carbon Network-Fund (LCNF)[21] and the thinking undertaken through Workstream six of the Smart Grid Forum[22]) and will engage with stakeholders in carrying out our work. We will provide an update on the development of these workstreams in spring 2016.

3.8. We look forward to progressing this work as part of a broader programme of work with DECC, aimed at managing the transition to a smarter energy system. We will also be working closely with other related workstreams in Ofgem, described in greater detail in Appendix 2.

3.9. All of our work will be used to feed into discussions at European level, both with the European Commission, and with other European and international energy regulators. We will also continue to gather learning and to use international experience and analysis to inform our work.

3.10. Alongside the work we will be taking forward on flexibility, Ofgem will also continue to work with the Competition Markets Authority (CMA) and DECC on the next steps for wider half hourly settlement.

3.11. The following sections give an overview of our reasons for focusing on our chosen work areas in the next 12 months, and set out the actions we intend to take.

[21] Further information on the LCNF can be found here: https://www.ofgem.gov.uk/electricity/distribution-networks/network-innovation/low-carbon-networks-fund.
[22] WS6 is a working group of the Smart Grid Forum (SGF), investigating the commercial and regulatory challenges of implementing a smart grid in Great Britain. Further details can be found here: https://www.ofgem.gov.uk/electricity/distribution-networks/forums-seminars-and-working-groups/decc-ofgem-smart-grid-forum/work-stream-six.

Our proposed actions: facilitating the transition to new roles

Encouraging the transition from DNOs to DSOs

3.12. Flexibility can support efficient network management. It can offer alternative solutions which avoid or defer the need for reinforcement, support cheaper and timelier connections – for instance the connection of DG - and which support more efficient resolution of issues on the network.

3.13. Our work has emphasised the value and importance of DNOs managing their networks more flexibly, in both the near and longer term, for a cost-effective low carbon transition. DNOs have engaged with innovation opportunities through their price control to develop flexible new approaches to network challenges. However, our analysis identified some issues and barriers to the increasing use of flexibility on the distribution networks. These include some hesitance to embrace new practices as business as usual, and a lack of clarity on some key arrangements, such as how DNOs would engage with consumers to procure flexibility, and the relationship between the SO and a future Distribution System Operator (DSO) where there is greater involvement in local balancing.

3.14. **We will therefore-**

- Engage with DNOs and other stakeholders in clarifying the **future role of DNOs**, including the transition to DSO roles, and the nature of their interactions with the SO.[23]
- Continue to engage with active and ongoing **European discussions on the future role of the DSO**. This will be supported by a clearer view of the future role of DNOs in GB.
- Work to **remove any barriers to DNOs transitioning to DSO functions**. This will build on our work on Flexibility to date and thinking undertaken through the DECC/Ofgem Smart Grid Forum.
- Finally, we will **consider what steps are needed to effect the transition**. This will consider stages towards an efficient transition and arrangements needed, including between industry parties, to support and encourage the efficient transition to a fuller role for DNOs in managing their networks.

3.15. Linked to this work area, we have recently instigated workshops with Distributed Generators, DNOs, TOs, the SO, DECC and the Energy Networks Association (ENA) to share understanding of the impacts that DG can have on the wider system and to identify solutions to mitigate these and any regulatory barriers that might exist.

[23] Please note that for the purposes of this position paper, we use the term 'DSO' to encompass the future intended functions of DNOs, to be clarified through the workstream.

Enabling increased I&C participation

3.16. There are opportunities for consumers to lower their bills through the provision of flexibility to the system.

3.17. The scale of change required to enable widespread domestic participation is significant, with technological enablers such as smart meters and other smart technologies playing a crucial role. Alongside this, supporting IT systems will need to be in place and there will need to be a movement towards increased customer engagement with the market and innovative offers.

3.18. In the I&C segment of the market however, many of the flexibility enablers are already in place (including meters capable of recording and submitting half-hourly consumption data,[24] half hourly settlement with the associated supplier and central IT systems, and ToU network charges). Demand from I&C consumers represents more than half of electricity demand at peak times.

3.19. For these reasons we consider the most immediate customer benefits to be found through facilitating greater I&C participation. These consumers – in particular large industrial consumers - have traditionally provided some flexibility to the system. But many, including commercial customers, are prevented from participating more fully because they are unclear about the monetary benefits of providing flexibility, as well as of the programmes available to them.

3.20. **We will therefore-**

- Explore how to support more **large industrial and commercial consumers to participate in providing flexibility**, including in wholesale markets and smart grids.

3.21. We will do this by-

- Gathering further information on the **potential and value of flexibility** in the I&C segment of the market.
- Engaging with stakeholders (using existing groups wherever possible to avoid duplication of resources) to **raise awareness of the opportunities and understand the concerns and needs of I&C customers**.

3.22. We note that National Grid has recently launched its 'Power Responsive' initiative,[25] which will provide a forum for I&C customers and other stakeholders to share knowledge, and identify and resolve challenges for new providers of flexibility.

[24] Please note that some services, such as Short Term Operating Reserve and Firm Frequency Response in the balancing market, also require more bespoke metering arrangements.
[25] http://www.powerresponsive.com/

We are participating in these discussions and we would encourage stakeholders to participate where possible.

3.23. We consider wide-scale domestic participation to remain a critical part of the future flexibility mix. A range of the other priority areas identified in this project will support this. We will continue to examine other changes necessary in future phases of our work on Flexibility, and through Ofgem's continued engagement with the CMA and DECC on next steps for wider half hourly settlement.

Our proposed actions: enabling new business models

Clarifying the role of aggregators

3.24. Aggregators are third party intermediaries who specialise in coordinating or aggregating flexibility from individual consumers, to better meet the needs of those procuring flexibility. In doing so, they are able to bridge the gap between consumers and traditional market participants. For example, they may contract with multiple customers who can provide some demand response and 'bundle' it to meet the user's quantity and technical requirements. They can also play a role in streamlining the participation process for consumers, and in helping them to understand what action they can take to make savings.

3.25. In recent years, aggregators have played a growing role in the provision of flexibility. By acting as intermediaries between end consumers and other market participants, they have delivered more flexibility, mainly via DSR, from the I&C segment of the market.

3.26. There is no current regulatory definition of aggregators, setting out their role and interactions with other industry parties. This has not prevented some from entering the market and contracting with industry parties - however, it could hinder the full realisation of the benefits of DSR, for example where the impacts on other parties are not appropriately accounted for. For instance parties, including aggregators, have noted the need for more formal arrangements to make sure that balancing costs are appropriately apportioned when DSR actions are taken. We also know that aggregators and others need to be able to agree a means of measuring the performance of demand-side response resources, by measuring usage against an agreed 'baseline' of business as usual load.

We will therefore-

- Explore in greater detail the role of aggregators in providing flexibility. We will seek to **clarify their role in the market** and the relationship with other industry participants.
- In doing so, we will also explore the need for **policy intervention and regulatory oversight** at this stage. As an example, this could include scoping plans for further work in areas such as baselining and balancing impacts.

- The role of aggregators and their relationship with industry parties is being discussed at European level as well. We will use our work to **contribute to the European debate**.

Clarifying the legal and commercial status of storage

3.27. Our work on Flexibility, and discussions with industry, have highlighted that storage could potentially play a significant role as a new provider of flexibility in the electricity system. For example, excess renewable electricity on sunny or windy days can be stored, and released at a time when demand is higher or when the network is less constrained.

3.28. However, there are several issues which could act as barriers to storage developing and reaching its full potential in the near term. In particular, the regulatory/legal classification of storage is unclear. Storage can be classified variously as "consumption" and/or "generation" and/or "supply". This creates regulatory challenges. In particular the generation/supply classifications can create problems under the third package where storage is undertaken by a network operator.

3.29. **We will therefore-**

- Work with DECC to clarify the **scope of this issue and identify approaches to addressing it**, in discussion with the industry.
- Undertake work with DECC to **clarify the legal and commercial status of storage** and **explore whether changes to the regulatory and commercial framework are needed** to enable its efficient use, seeking input on options from stakeholders.
- Where changes are needed, they will be informed by **considering the interactions and implications of a new regulatory framework for storage on all segments of the market**, including interactions with energy efficiency policies.
- We will use our work to **contribute to European debate** around the role of storage.

Our proposed actions: other work

3.30. The extent to which, and how, distribution network tariffs should change over time is a question related to a range of the work areas above. We see this as a longer term piece of work which we will be initiating thinking on now.

3.31. Our current distribution network tariffs are designed to balance cost reflectivity with other aims such as practicality, and supporting effective competition, among others. It is important that we think about how changes to the charging methodologies reflect these objectives, while considering how appropriate price signals might be delivered to support the efficient provision of flexibility across the

value chain. Where network tariffs reflect times of system stress, and where these price signals feed through to network users (eg consumers), this could better support network users in responding and providing flexibility to the system.

3.32. Discussions on this have been taking place at European level through the DSO working group (DSO WG) – a group of the Council of European Energy Regulators. The working group recently published a conclusions paper setting out the views gathered through consultation with interested stakeholders.[26] Among other things, the group considered there to be a number of relevant factors to take into account when considering the appropriate structure of network tariffs. These include: cost reflectivity, risks associated with DNO cost recovery, compatibility with retail competition, simplicity and predictability, the costs/benefits of changing and administering the charging structure, and the need to consider these issues as part of a coherent system-wide approach.

3.33. Through CEER, national regulatory authorities intend to undertake further work to analyse the benefits of different approaches to both use of system and connection charges and to ensure that network tariffs are not a barrier to DSR.

3.34. **We will therefore-**

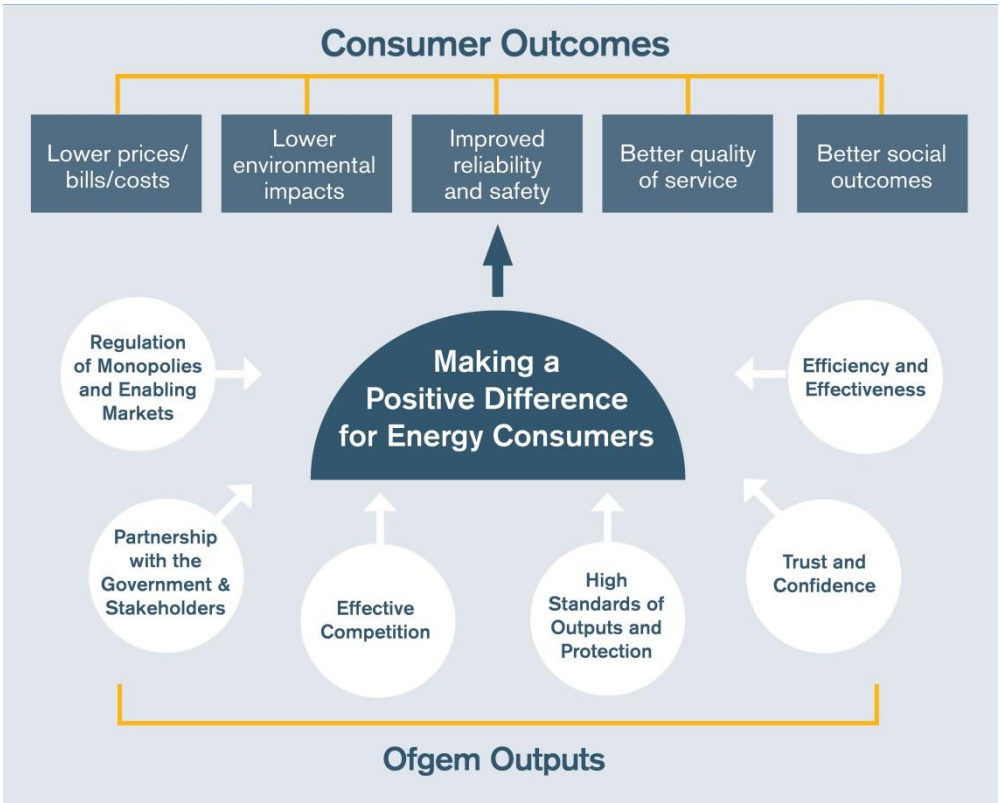
- Work domestically and with Europe, to consider the existing distribution charging methodology and do **more analysis on the potential benefits of different approaches** (eg ToU charges, service related tariffs, capacity and consumption based charges, and/or discounts).
- We will make sure that in doing so we **maintain interactions** with the work areas above.

[26] http://www.ceer.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_PAPERS/Cross-Sectoral/Tab1/C15-DSO-16-03_DSO%20Conclusions_13%20July%202015.pdf

How the proposed work will help deliver our corporate strategy

3.35. In Chapter 2 we outlined our approach to identifying the priority areas we intend to focus on over the coming year. The analysis we have undertaken since January concluded that prioritising the areas highlighted in the previous section has the potential to contribute to the five consumer outcomes in our corporate strategy and in Figure 5 below.[27]

Figure 5 - Consumer outcomes



3.36. The transition of existing parties to new roles, and the emergence of new providers of flexibility, will contribute to an energy system with more and cheaper sources of flexibility where parties can use alternatives to traditional generation or reinforcement. The areas of work we propose will help to create an increasingly flexible, sustainable and affordable electricity system, supporting our consumer outcomes.

[27] Our corporate strategy is available on Ofgem's website at the following link.

3.37. They will contribute to-

1. **Lower bills than would otherwise have been the case** by-
    - facilitating competition and new entry;
    - providing for more efficient system balancing;
    - avoiding the need for additional peaking plant;
    - avoiding curtailment and wastage of renewable energy, enabling lower cost energy onto the system;
    - providing opportunities to delay or avoid network investment;
    - giving consumers routes to sell their flexibility and save on their electricity bills; and
    - potentially reducing consumption.
2. **Reduced environmental impacts both now and in the future** by-
    - supporting cheaper/more timely connection of renewables while minimising restrictions that need to be placed on the amount generated;
    - helping to manage the intermittency of renewable generation, through more efficient balancing; and
    - limiting the need for high carbon plants.
3. **Improved reliability and safety** by-
    - avoiding network and system faults, eg associated with heavy loading; and
    - providing networks with tools to manage post fault events.
4. **Better quality of service, appropriate for an essential service** by-
    - enabling new entry and new products and services with potential to drive choice and improve quality of service, alongside better consumer access to information.
5. **Benefits for society as a whole** including support for those struggling to pay their bills-
    - Efficient use of flexibility can help in driving down overall system costs. This has the potential to deliver benefits for society as a whole. However, it will also be important to consider the distributional effects of specific policies to ensure consumers are protected and costs and benefits are appropriately apportioned between individual participants and the wider system/society.

Wider work

3.38. There is a lot of wider activity related to flexibility, which we have taken account of in our work and we will continue to engage closely with. Key initiatives in GB and Europe are summarised here, with further detail on each in Appendix 2.

3.39. Several recent and established policy developments, both within Ofgem and at National Grid, are relevant for flexibility. These include-

- **Electricity balancing significant code review (EBSCR):** EBSCR addresses issues with existing cash-out arrangements that impede the value of flexible resources from being revealed in the wholesale market. We have committed to monitor the impact of introduction of the EBSCR reforms. We will be engaging with industry later this year to seek views on our monitoring programme.

- **New balancing initiatives**: A range of new balancing initiatives have been introduced by National Grid, across system security, reserve and frequency response services. Ofgem has a role in approving the creation of new services, where we consider them to be in the interest of consumers. The new balancing initiatives support greater demand-side participation, both through the provision of new demand-side services, and through the introduction of new initiatives to make it easier for demand-side providers to participate in existing services (for instance enabling them to build up volumes gradually). As illustrated in figure 1, chapter 1, demand-side providers can provide value to the system by reducing their consumption in response to a signal, but they can also provide value by increasing their consumption at appropriate times. In recognition of the latter, National Grid have been developing the requirement and contracting format for a Demand Turn Up service, with the intention to begin contracting in early 2016. These initiatives are summarised in more detail in Appendix 2.

- **Network innovation stimuli:** Funding is available through price controls for network companies to develop and trial novel, innovative network solutions with benefits to consumers. LCNF was a key feature of the last price control (DPCR5) and has been a springboard for smart, innovative approaches to network management. Multiple elements of the new RIIO regime will work in combination to incentivise companies to trial new technologies or ways of working and to adopt those which will benefit consumers.

3.40. There are also several current and relevant pieces of work in Ofgem. Together, these will help to inform a view of the regulatory framework needed to support future development of the energy system. We are considering the interactions and will continue to engage closely as we take our proposed work areas forward. Key current Ofgem projects/work areas include-

- **Non-traditional business models (NTBMs):** This project seeks to understand better the drivers, consumer benefits and risks of NTBMs. Stakeholder responses to a discussion paper earlier this year highlighted four key themes, which included new models of flexibility in a changing energy system and the contribution of NTBMs to this.[28] Specific references were made to storage, embedded generation, and DSR and the information gathered has been a key input to our work on Flexibility.

[28] The Non-traditional business models discussion paper and summary of responses can be found here: https://www.ofgem.gov.uk/publications-and-updates/non-traditional-business-models-supporting-transformative-change-energy-market

- **Future wholesale markets:** This project aims to evaluate what a wide cross-section of market participants are anticipating and what their outlook on the electricity wholesale market is. It explores how the interactions between energy, capacity and balancing markets will affect stakeholders and their investment decisions over the next 3-5 years.

- **Quicker, more efficient connections**: This explores how earlier investment in new infrastructure could speed up the connection process. The work also considers how connections could be facilitated without the need to build new grid capacity.[29]

- **Congested infrastructure**: We are considering a range of issues relating to increasing levels of congestion on parts of the network which is restricting the ability of new customers to connect. More flexibility could contribute to resolving these constraints while avoiding expensive upgrades. As part of this work, we are considering how the interactions between DNOs, transmission owners (TOs) and the SO can be improved.

- **Future retail regulation**: This project is examining how to evolve our approach to regulating the retail market in line with our commitment in the Ofgem 2015-16 Forward Work Programme that *"over time we hope to rely more on general standards of conduct rather than detailed rules about what companies can and cannot do"*. Adopting a more outcome focussed approach should help enable innovation and support parties in introducing new forms of flexibility.

3.41. There is also much developing thinking and discussion within industry and among wider stakeholders on issues relating to flexibility. Current groups include-

- **DECC-Ofgem Smart Grid Forum (SGF):** The SGF brings together industry, government, the regulator and other stakeholders and works to facilitate the development of smart grids in GB. In particular, the thinking developed by its Workstream six, on regulatory and commercial barriers and enablers for the development of smart grids, has been a key input to our work on Flexibility.

- **National Grid's Power Responsive initiative:** Recently launched, the 'Power Responsive' initiative will provide a forum for I&C users and other stakeholders to share knowledge and identify and resolve challenges for new providers of flexibility.

- **ENA Shared Services Group:** This group is developing a shared services framework for DSR, paving the way for industry arrangements to facilitate smart grid developments.

[29] Please see https://www.ofgem.gov.uk/publications-and-updates/quicker-and-more-efficient-connections-next-steps-0

3.42. Enabling flexibility and overcoming the barriers to realising its potential are not unique to GB. These challenges and opportunities are being considered across the world and will be integral to the future European internal energy market. Consequently, flexibility issues are being recognised and discussed at the European level by a number of European bodies including the European Commission, the European Network of Transmission System Operators for Electricity (ENTSO-E) and other European regulators through both ACER and CEER. Active European groups and publications related to flexibility include-

- **European Commission's 'Summer Package':** Published in July 2015, this included a consultation on electricity market design which sought to gather stakeholder views on a range of issues, including important elements relating to flexibility. The package also included a retail market communication: 'Delivering a New Deal for Energy Consumers', and a working paper on self-consumption.

- **European Commission's Smart Grids Task Force Expert Group 3 (EG3):** EG3 was established to produce recommendations for the deployment of flexibility. Its January 2015 report contains a set of recommendations for the deployment of flexibility across the value chain. An updated version of this report, containing a refined set of recommendations, is expected to be published later this year.

- **CEER DSO Working Group (WG):** CEER published a conclusions document on the 'Future Role of the DSO' in July this year following a consultation at the end of 2014. The conclusions document recognises that there is no single model for the role of the DSO across Europe and instead presents four overriding principles and a framework to help determine the activities DSOs should and should not do. It also highlights areas for future work including analysing the benefits of different types of distribution use of system and connection charges, as well as the development of a regulatory toolbox for flexibility contracts.
- **CEER/ACER Flexibility Task Force (FTF):** The FTF aims to further investigate the concept and definition of flexible response, and its benefits and challenges across the value chain, mapping its existence and market features in Europe. Its current focus includes exploring the challenges and barriers for using and procuring flexibility across the value-chain, current initiatives to enable flexible response, and market arrangements for equal participation of the demand side.

Next steps

3.43. We will be progressing our work as part of a broader programme of work with DECC, and in close collaboration with related projects in Ofgem and in Europe. We will engage with stakeholders in carrying out our work, and welcome input and feedback on this publication and our broader thinking. We plan to hold a joint workshop with DECC in the spring. We will also provide an update on the development of the work in spring 2016.

Appendix 1 – Key barriers for providers and users of flexibility

Table 4- Key barriers for providers of flexibility

	Non- dom consumers	Dom consumers	Storage	DG	Aggregators
Cultural barriers	- Difficult to understand the value of flexibility (£) - Difficult to gather information on the flexibility products/programmes available and how to participate in them - Perceived risk of disruption to their business if they provide flexibility	- Difficult to understand the benefits of flexibility - Perceived risk associated with automation may prevent uptake of flexibility offers			
Regulatory barriers (role of parties)	- Regulation re. role of these parties in the market (eg whether and how they could sell flexibility) may need to be clarified	- Lack of clarity in the regulatory framework over roles and responsibilities of different market actors (other than licensed suppliers) towards domestic consumers may cause detriment or limit benefits	- Lack of clarity on the legal status of these assets	- Connection regime needs to be clarified - Role and contribution of DG needs to be clarified in the FiTs regime	- Regulatory framework does not provide for a clarification of the role of these parties
Commercial barriers (incentives)	- Technical and commercial requirements of flexibility products may not fit with the characteristics of the providers - Providing flexibility not core business for many of these consumers so value (£) may not justify the effort to sign a contract and provide the service	- Terms of contracts of offers available may be difficult to understand - Perceived value (£) of flexibility may not be enough to incentivise uptake	- Technical and commercial requirements of flexibility products may not fit with flexibility that storage can provide	- Benefits of using DG for flexibility need to be correctly priced to incentivise investments	- Technical and commercial requirements of flexibility products may not fit with the characteristics of the providers
Structural barriers (costs)	- Ongoing perceived risk and associated costs of providing flexibility may be too high compared to perceived benefits	- Upfront costs of smart devices may be too onerous for some consumers	- High capital costs - Perceived limited reliability of storage could make it a second-best choice for providing flexibility	- If uncapped, flexible connection agreements may deter connection	- Perceived risk of 'outsourcing' control of own energy consumption may increase the costs of successfully signing a contract

Table 5 - Key barriers for users of flexibility

	Suppliers	DNOs	TO	SO
Cultural barriers	- Using new flexibility sources not core business yet - Existing level of system changes (eg smart meter roll-out, switching programme, energy efficiency policies) could divert attention from flexibility	- Perceived higher risk of adopting new practices	- Perceived higher risk of adopting new practices	- Perceived higher risk of adopting new practices
Regulatory barriers (role of parties)	- Regulation to be kept under review to ensure licence obligations allow for efficient procurement of flexibility	- Future role of DNOs, including relationship with consumers and transition to a DSO role, needs to be clarified to better support the inclusion of flexibility in DNO business plans - Regulation to be kept under review to ensure licence obligations allow for efficient procurement of flexibility	- Regulation to be kept under review to ensure licence obligations allow for efficient procurement of flexibility	- Regulation to be kept under review to ensure licence obligations allow for efficient procurement of flexibility
Commercial barriers (incentives)	- Some reforms to industry processes necessary to further incentivise parties to use and contract for flexibility	- Price control regime needs to ensure that benefits of using flexibility can be fully captured - Charging regime needs to be in line with approach to using and valuing flexibility	- Price control regime needs to ensure that benefits of using flexibility can be fully captured - Inter-network management issues to be addressed and this may take time/not be priority for both parties	- If procurement of flexibility largely based on price (provided all requirements are met), traditional sources of flexibility preferred at times of low wholesale prices - Structure and length of incentives regime needs to 'capture' benefits of using flexibility (both in the short and in the long term)
Structural barriers (costs)	- Complexity of market arrangements may increase cost of entry for new actors	- High investment costs may not be justified if delivery of flexibility by providers is not guaranteed		

Appendix 2 – Wider work on Flexibility

1.1. This appendix summarises work related to flexibility both within Ofgem and by others in the UK and Europe.

Recent and established policy developments

1.2. Several recent and established policy developments, both within Ofgem and at National Grid, are relevant for flexibility. These include-

Electricity balancing significant code review (EBSCR)

1.3. Launched in 2012, and with an initial implementation date of November 2015, the EBSCR reforms aim to support the delivery of security of supply at least cost. The reforms address issues with existing cash-out arrangements that impede the value of flexible resources from being revealed in the wholesale market. They ensure cash-out prices provide market participants with a balancing incentive that more accurately reflects a) the marginal cost to the SO of addressing imbalance and b) the value that consumers assign to secure supplies. As cash-out prices influence wholesale market prices, the reforms therefore stimulate an efficient response through the wholesale market to evolving needs – for example signalling the growing value of flexibility as the level of intermittency increases on the system. We have committed to monitor the impact of the introduction of the EBSCR reforms. We will be engaging with industry later this year to seek views on our monitoring programme.

New balancing initiatives

1.4. Ofgem has a role in approving the creation of new balancing services, where we consider them to be in the interest of consumers. In 2013, we approved NGET's application to introduce two new balancing services, the Supplemental Balancing Reserve (SBR) and Demand Side Balancing Reserve (DSBR). These services provide NGET with additional tools to help balance the system if margins tighten.

1.5. DSBR offers a new opportunity for the demand side to participate in balancing services by shifting or shedding demand when instructed by NGET as the SO, while SBR is a service primarily targeting generators that will be held outside the wholesale market and for use only as a last resort in winter periods of high demand.

1.6. The DSBR service offers half-hourly metered non-domestic consumers (both aggregated or single sites, above a threshold of 100kW) payments to reduce their demand between 4pm and 8pm on winter weekdays. NGET launched a pilot of DSBR in 2014, contracting 318MW from 12 companies, of which 39 per cent offered demand suppression, and the remainder from small embedded generation or storage accruing to a supplier's consumption amount.

1.7. For this upcoming winter (2015/16), DSBR competed with SBR to provide NGET with additional balancing services. A total of 487MW from 17 companies were awarded contracts.

1.8. National Grid have consulted on the extension and development of both services into 2016/17 and 2017/18 during this summer and have subsequently written to Ofgem to request a direction under Special Licence Condition 4K to roll over the funding arrangements to allow this.

1.9. National Grid have also introduced two further new Balancing initiatives over the last 6-12 months; STOR Runway and FFR Bridging.

1.10. The STOR Runway contract is a an opportunity for Demand-Side Providers to secure a contract for an envelope of volume which will then be grown in their portfolio within an agreed timeframe to be delivered as new STOR volume.

1.11. FFR Bridging is an opportunity for Demand-Side Providers and other small parties to secure a contract within which to develop a portfolio of new FFR volume. The aim of the contract is to address the current arrangement that limits the entry into the FFR tendered market to parties who already have 10MW or more of contracted volume. It is clear that it is possible for Demand-Side Providers to achieve this level of volume over time. However there is no route to market for this volume until 10MW has been achieved. This contract aims to bridge this gap and reduce the barrier to entry into the FFR market. The FFR Bridging contract is for a set term of one or two years, with a mandated price per MW.

1.12. National Grid have also been developing the requirement and contracting format for a Demand Turn Up service with the intention to begin contracting in early 2016. This is a service aimed at parties who can offer a demand increase upon instruction for given availability periods. The initial proposals are focused on the requirement and how National Grid would see the service used. This has been shared with industry to get feedback. The feedback will be used to further develop the service and help to finalise it.

Network innovation stimuli

1.13. Funding is available through price controls for network companies to develop and trial novel, innovative network solutions with benefits to consumers. LCNF was a key feature of the last price control (DPCR5) and has been a springboard for smart, innovative approaches to network management.

1.14. Following the end of the DPCR5 price control period, we will be initiating a review of the benefits of the LCNF. We will be publishing an open letter inviting views later this year.

1.15. Under the new RIIO price control regime, which has been running for electricity transmission since 2013 and for distribution since April this year, the Network Innovation Competitions (NICs) will continue to provide a basis for network companies and partners to develop innovative solutions for consumers' benefit. In RIIO-ED1 savings for consumers were included in companies' business plans and an

innovation rollout mechanism provides ongoing support for embedding novel practices into network businesses. In combination, these elements of the price control should create incentives for companies to trial new technologies or ways of working and to adopt them, or others, which are demonstrated to benefit consumers.

Current work in Ofgem

1.16. Several related pieces of work are being progressed simultaneously in Ofgem. Together, these work areas may inform wider questions about the energy system. We will continue to engage closely and consider the interactions as we take our work on Flexibility forward. We outline the range of related work areas below-

Non-traditional business models

1.17. Recently, there has been a wave of new entry to the energy market and many of these entrants have new and non-traditional business models (NTBMs). This is a trend we expect to continue.

1.18. Some of these NTBMs could in the future transform the energy market and deliver desirable outcomes for consumers. These include: lower bills; lower environmental impact; improved reliability and safety; better quality of service; and, better social outcomes.

1.19. We want to ensure that regulation does not stand in the way of organisations which can deliver these outcomes. But, because energy is an essential service, we must also protect the interests of existing and future electricity and gas consumers. And this means we need to understand the benefits, costs and risks of any change to regulation.

1.20. Earlier this year we released a discussion paper for comment, to engage in a dialogue with stakeholders on this area. We hoped to better understand the drivers, consumer benefits and risks of NTBMs. Ultimately, we are interested in their transformative potential and how regulation may impact upon them both now and in the future.

1.21. Four main themes have emerged from our ongoing analysis of stakeholders' responses. Two themes relate to how NTBMs could transform the energy system-

- New models of flexibility in a changing energy system
- Local energy

1.22. The other two are cross-cutting themes concerned with the implications for regulation-

- Enabling diversity and innovation
- Consumer protection and service

1.23. A summary of responses to the NTBM discussion paper has been published alongside this document.[30]

1.24. The vast majority of respondents said that regulation needs to become more flexible and agile to enable NTBMs. It needs to accommodate, respond to and enable energy system change. We already have a number of projects underway examining elements of this change. In light of responses we are considering whether we should examine these issues in the wider context of our work on regulation and future energy system arrangements.

1.25. With this in mind, we are considering where our efforts are best focused next, and will publish a proposed course of action by the end of the year.

Future Wholesale Markets

1.26. The Future Wholesale Markets (FWM) project leads on from the previous Future Trading Arrangements (FTA) project. FTA focussed on the principles behind GB electricity trading arrangements and explored which (if any) needed to change in the context of challenges and opportunities presented by Electricity Market Reform (EMR), the European Target Model, market and technological developments. These were explored from summer 2013 to the end of 2014 through the FTA Forum, a stakeholder group with Ofgem, DECC and industry.

1.27. FWM's purpose is to evaluate what a wide cross-section of market participants are anticipating and what their outlook on the electricity wholesale market is. It explores how the interaction between energy, capacity and balancing markets will affect stakeholders and their investment decisions going forward. The introduction of fundamental regulatory and government policy reforms (eg EMR, EBSCR, Secure and Promote) and the release of the CMA's provisional findings have given a clear rationale for this work.

1.28. The project has been gathering evidence through bilateral meetings with industry parties to evaluate views on the outlook for electricity wholesale markets in the three to five year timeframe. This intelligence will form an input into our thinking

[30] Please see https://www.ofgem.gov.uk/publications-and-updates/non-traditional-business-models-supporting-transformative-change-energy-market

surrounding what our regulatory policy agenda should be in electricity wholesale markets.

Congested infrastructure and quicker, more efficient connections

1.29. Our work on congested infrastructure and quicker, more efficient connections stems from a number of related issues.

1.30. Distributed generation (DG) has grown dramatically in the last five years. Government subsidies, the cost of technologies (particularly solar photo-voltaic) and the emergence of non-traditional business models have all contributed towards growth. The geographic distribution and rate of growth however have been erratic and challenging to predict.

1.31. The traditional view was that DG would lead to a reduction in flows on the system and generally this has been the case. In parts of the network however, generation now outstrips demand, leading to the need for potential upgrades to both distribution and transmission networks and placing more demands on the SO to keep the system in balance. Where networks are constrained by capacity levels, further growth in generation can be extremely expensive, for both the generator looking to connect and consumers more generally, and increase lead times for connection.

1.32. In our work on congested infrastructure, we are considering how best to address these issues and recognising the contribution flexibility could play in resolving grid constraints. As part of this work, we are considering the potential for improvements in the interactions between DNOs, TOs and the SO.

1.33. Alongside this work, our consultation on 'Quicker, more efficient connections' explores how investing earlier in new infrastructure could speed up the connection process and when it might be appropriate for different parties (developers, DNOs) to carry this cost. Our next steps on this work have been published alongside this document.[31]

1.34. In our consultation we also considered how more efficient use of existing capacity could facilitate connections without the need for new grid capacity to be built.

1.35. This is a complex issue. DG sits alongside other generation, smart grids, storage and DSR as one ingredient of the future low-carbon energy system. It is possible that the next wave of innovations (eg energy storage) may rebalance the system towards more localised self-sufficiency. We believe that more flexibility in

[31] Our consultation and next steps on this work can be read here: https://www.ofgem.gov.uk/publications-and-updates/quicker-and-more-efficient-connections-next-steps-0

how networks are managed could be the most effective way of avoiding costly (and unnecessary) grid upgrades.

Future retail regulation

1.36. This project is examining how to evolve our approach to regulating the retail market in line with our commitment in the Ofgem 2015-16 Forward Work Programme that *"over time we hope to rely more on general standards of conduct rather than detailed rules about what companies can and cannot do"*. Adopting a more outcomes focussed approach should help enable innovation and support parties in introducing new forms of flexibility.

DECC work

1.37. The work set out in this publication will form part of a wider programme of work we are undertaking with DECC, aimed at managing the transition to a smarter energy system. It is planned that this joint project will run from autumn 2015 to autumn 2016. Alongside DECC, we will seek to update stakeholders on progress in spring 2016 and gather stakeholder views on developing thinking.

Industry work on flexibility

1.38. There are many groups working on flexibility and smart grids within industry.

1.39. Together with DECC, we have been closely engaged with industry in the Smart Grid Forum, which works to facilitate the development of smart grids in GB. In particular the thinking developed by Workstream six, which considers regulatory and commercial issues – barriers and enablers – to the development of smart grids, has been a key input to our work on Flexibility.

1.40. Workstream six has included participants from a range of industry and consumer groups, putting it in a strong position to provide insights into cross-industry questions. It has undertaken detailed thinking on a range of relevant areas, including the value of flexibility across the value chain and notification requirements for DSR actions. It has also identified enablers for DG, storage, and for community energy provision of flexibility, as well as energy efficiency and technical enablers to ensure the benefits from smart meters can be maximised. Among other issues, workstream six has highlighted details of regulatory and commercial barriers to the development of storage and other flexibility services across the value chain. Throughout, Workstream six has sought to ensure that approaches to the development of smart grids are considered from a consumer perspective.

1.41. National Grid has also recently launched its 'Power Responsive' initiative, which will provide a forum for I&C users and other stakeholders to share knowledge and identify and resolve challenges for new providers of flexibility.

1.42. Additionally, work by the ENA and National Grid on the shared services framework for DSR is paving the way for industry arrangements to facilitate smart grid development.

European work

1.43. The importance of flexibility is also recognised by the European Commission and other European regulators. Enabling flexibility and overcoming the barriers to realising its potential are not challenges and opportunities unique to GB. They are being considered across the world and will be integral to the future European internal energy market. The Commission, CEER,[32] and advisory groups like the Smart Grid Task Force have been, and continue to, consider what frameworks are necessary to embed flexibility into the European energy system in the best interest of consumers.

1.44. The key work areas related to flexibility are summarised below.

European Commission's 'Summer Package'

1.45. In July the Commission published a 'Summer Package' containing a consultation on electricity market design as well as a retail market communication - 'Delivering a New Deal for Energy Consumers' and a Commission Staff working document - 'Best Practices on Renewable Energy Self-consumption'.[33]

1.46. The electricity market design consultation is gathering stakeholder feedback on important elements relating to flexibility including; the obstacles to demand response; the future role and governance rules for DSOs; as well as a possible European approach to distribution tariffs and the treatment of self-generation.[34]

1.47. The deadline for responses to the consultation is 8 October. CEER will be drafting a response throughout August/September using input from regulators, various working groups and task forces.

1.48. The Retail Communication outlines ten steps necessary to put consumers at the heart of the new energy system. These include providing consumers with *"possibilities to become active energy players and gain from action, for example adjusting and reducing their consumption as prices evolve, helping balance out renewable energy variability by embracing demand response or producing or storing energy*."

[32] CEER is the Council of European Energy Regulators
[33] See here: https://ec.europa.eu/energy/en/news/new-electricity-market-consumers
[34] See here: http://ec.europa.eu/energy/sites/ener/files/documents/1_EN_ACT_part1_v11.pdf

1.49. The Commission Staff working document on self-consumption looks at the process of consumers producing and consuming some or all of their own electricity behind the meter (either instantaneously or in a deferred manner through decentralised storage). The paper gives insight into lessons learned from national schemes on self-consumption of renewable energy and illustrates best practice in this area.

European Commission's Smart Grids Task Force Expert Group 3 (EG3)

1.50. EG3 is a workstream of the European Commission's Smart Grid Task Force set up to produce recommendations for the deployment of flexibility. Following the publication in January of the EG3 Report[35] containing recommendations for the deployment of flexibility across the value chain, the expert group has developed further thinking on three areas -

- Consumers – how to engage consumers in demand-side flexibility (DSF) and enable timely access to metering data while ensuring data privacy.
- Markets – how to consider contractual agreements among market participants and consumers, as well as assessing the potential of flexibility.
- Regulation - how to incentivise grid operators to enable and use flexibility and how to improve price signals to incentivise consumer response.

1.51. An updated version of this report, containing a refined set of recommendations, is expected to be published later this year.

CEER DSO Working Group

1.52. CEER published a conclusions document on the 'Future Role of the DSO' in July this year following a consultation at the end of 2014. The consultation document recognised the significant changes happening at distribution level in both electricity and gas across Europe and the influence DSOs could have on the development of new markets and business models. It examined three key areas-

- the role of the DSO and the need for regulatory oversight;
- the DSO-TSO relationship; and
- economic signals (innovation, capex vs opex, network charges) and contractual arrangements.

[35] See here: https://ec.europa.eu/energy/sites/ener/files/documents/EG3%20Final%20-%20January%202015.pdf

1.53. The conclusions document that followed in July of this year recognises that there is no single model for the role of the DSO across Europe and instead presents four overriding principles for DSOs to help inform a framework to help determine the activities DSOs should and should not do. DSOs -

- Need to be increasingly innovative and explore cost-effective smart and flexible solutions to running the grids of the future.
- Must engage effectively with stakeholders, including new entrants and business models.
- Have an important role as neutral market facilitators in well-functioning energy markets.
- Must recognise that consumers own their data, and serving as neutral market facilitator should not automatically confer on the DSO the status of data management coordinator.

1.54. The conclusions document also highlights the key areas for future work including analysing the benefits of different types of distribution use of system and connections charges, as well as the development of a regulatory toolbox for flexibility contracts. The DSO WG is planning to undertake more work and analysis on the key aspects of the future DSO-TSO relationship for both electricity and gas.

CEER/ACER Flexibility Task Force

1.55. The objective of the Flexibility Task Force (FTF) is to further investigate the concept and definition of flexible response, and its benefits and challenges across the value chain. In particular the following working areas regarding the development of flexible response will be addressed in 2015 -

- Bring together the work done by other task forces and working groups, and develop a definition of flexible response.
- Explore the high level challenges for using and procuring it across the value-chain.
- Understand the current initiatives in the European markets to enable flexible response.
- Understand the existing market arrangements' ability to enable DSF participation on equal footing with other types of flexibility.
- Consider barriers for participation of DSF in the markets.

1.56. Based on previous studies and/or papers including the Commission's Expert Group 3 work, the FTF will first conduct a survey to map the existence and main market features of flexible response and Demand Side Flexibility (DSF) across the value chain in Europe. This survey will inform an internal report on the current status of flexible response, and will set out opportunities and challenges for the integration of DSF into the market. The internal report could describe relevant practices in this

area and will aim to provide regulators with a toolkit for considering how to enable flexible response. It will build on the questionnaire about the use of flexibility that ACER carried out in 2014.