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Creating the right environment for demand-side response

Consultation

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Overview:

Demand-side response - customers responding to a signal to change the amount of energy they consume from the grid at a particular time – has the potential to reduce customer bills, enhance security of supply and contribute to sustainable development. For various reasons, this potential is likely to increase significantly over time. To help enable the realisation of these benefits, our longer-term objective is to have regulatory and commercial arrangements that create an environment that supports efficient system-wide use of demand-side response.

This document considers and seeks stakeholder views on whether current regulatory and commercial arrangements are fit for purpose or may in some way constrain the development of demand-side response. This work will inform existing and future policy development in this area.

Context

Major influences on the energy sector include the need to attract significant investment in energy infrastructure and the transition to a low-carbon economy. Ofgem's programme of projects for 2013-14 recognises and responds to these in an appropriate and timely way while delivering against our principal objective - to protect the interests of both existing and future energy consumers. We have grouped the activities within our work programme around the following four themes:

- Promoting value for money
- Promoting security of supply
- Promoting sustainability
- Ensuring efficient delivery of Government consumer and environmental programmes

The work introduced in this document aims to look across the whole supply chain to consider how current market arrangements might constrain the system-wide development of demand-side response. This work is part of our smarter markets programme where we identified demand-side response as a key reform area to help deliver "smarter markets" that are more efficient, dynamic and competitive, delivering better outcomes for consumers. The Programme will run over a number of years and is our way of managing the links between these projects, both in terms of the potential benefits that can be realised and how the necessary reforms are designed and implemented.

Demand side response is one of the priority reform areas of the programme. Demand-side response is likely to make an increasingly important contribution across the first three themes above. We recognise that the regulatory framework plays a key role in determining the use of demand-side response and this issue will be explored in a number of the projects within in Ofgem's 2013-14 programme.

This consultation is the first step in meeting our longer-term objective for demand-side response; to create a market environment that supports its efficient use across the supply chain. This work runs in parallel with a range of other initiatives across Ofgem that are considering the role of demand-side response such as our work with government in considering the opportunities and issues associated with the development of a smart grid.

Associated documents

All documents are available at www.ofgem.gov.uk:

Factsheet: How managing your energy use could help you, April 2013

Promoting smarter energy markets: a work programme, July 2012, Ref: 110/12

Open letter: Update on Electricity Balancing Significant Code Review and new process to review Future Trading Arrangements, February 2013, Ref: 20/13

Electricity System Operator Incentives: consultation on a scheme for 2013, March 2013, Ref: 29/13

Strategy decision for the RIIO-ED1 electricity distribution price control: Overview, March 2013, Ref: 26/13

The Retail Market Review – Final non-domestic proposals, March 2013, Ref: 38/13

The Retail Market Review – Final domestic proposals, March 2013, Ref: 40/13

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Executive Summary

The electricity sector is undergoing significant change as part of the transition to a low-carbon economy. Efficient energy use will play a key role in this transition. Ofgem is committed to encouraging all customers to consume energy more efficiently, both in terms of how much they consume and when. Demand-side response – customers responding to a signal to change the amount of energy they consume from the grid at a particular time -– could play an increasingly important role in supporting this aim. It has the potential to reduce bills for consumers, enhance security of supply and contribute to sustainable development.

Some customers, particularly in the larger non-domestic sector, already provide demand-side response services to a range of market participants, either directly or through aggregators acting as intermediaries. The roll-out of smart metering could open demand-side response to a far wider range of customers by making it cheaper and more feasible to provide. Electrification of transport and heating could also make it easier for customers to be more flexible about how and when they consume electricity. We expect these developments to encourage suppliers and others to develop new offerings that reward changes to consumption patterns and help reduce system costs. Work by Ofgem and others has estimated that the uses and value of demand-side response are likely to increase significantly over time.

More widespread opportunities to use demand-side response are an important part of our vision for "smarter markets" that are more efficient, dynamic and competitive, delivering better outcomes for consumers. Our Smarter Markets Strategy, published in July 2012, highlighted demand-side response as a key work area under the Smarter Markets Work Programme. In this strategy we set out our objective to create a market environment that supports the efficient, system-wide use of demand-side response.

The regulatory framework plays a key role in determining the use of demand-side response. This includes network price controls in transmission and distribution, settlement arrangements, supply licence conditions and System Operator incentives. Ofgem has been undertaking relevant work in each of these areas. For example, through the RIIO-ED1 process, Ofgem is examining how distribution network operators should be able to use demand-side response over the next price control period. Industry and others have also been seeking to identify and address barriers to demand-side response. This is the first Ofgem document to look across the whole supply chain to consider how current market arrangements might constrain the system-wide development of demand-side response.

Our initial conclusion is that current arrangements do not meet three essential pre-conditions for the longer-term development of demand-side response:

- Industry parties need to be confident that there is value for them in demand-side response which justifies the investment
- The value of offering different demand-side response services needs to be signalled effectively to customers.
- Customers need to be aware of the opportunities to provide demand-side response, able readily to access information on options and able to act.

The potential value of demand-side response to the electricity system is well documented. However, for industry parties to have a commercial incentives to invest to realise these opportunities, the incentives that they face need to better reflect the true value of demand-side response to the system. This could require changes to existing arrangements such as cash-out and settlement. Parties also need to be confident that customers' commitments to provide demand-side response can and will be met, measured and verified. Finally, there needs to be clarity around the rights of different parties to access demand-side response, for example in cases where different parties may have competing interests.

The different uses and value of demand-side response then need to be signalled to customers. This could be done in a range of ways, from price signals that vary through time, to restrictions on consumption, to customers choosing to give another party control over particular loads at particular times. Smart metering creates new opportunities to sharpen those signals and for customers to benefit from adapting their consumption patterns. Challenges also arise from these opportunities. For example, the potential for more variable tariffs or interruptible supply raises questions around the appropriate level of customer protection needed, in particular for vulnerable customers.

Finally, even if a range of offerings were available to customers, evidence suggests that consumers will not necessarily engage. Our Retail Market Review reforms aim to develop a clearer, simpler and fairer market. In turn, this should provide a stronger base of consumer engagement from which to develop these more sophisticated offerings. Industry parties face a challenge to build customers' awareness and appetite for demand-side response. Moreover, they will need to present the options in ways that are straightforward for customers to access and enable customers to act on that information. Intermediaries and automation may help enable customers to realise the value of shifting their consumption.

Some of the challenges identified could be addressed through incremental change to existing regulatory and commercial arrangements. Indeed, we welcome action by industry to address specific barriers to market development. In the longer term, however, some inherent characteristics of current arrangements are likely to hold back the efficient, system-wide use of demand-side response. This is likely to require a more fundamental reform of market arrangements at some point.

At a high level, there are various possible future models for transacting around demand-side response. There is a spectrum of options, including customers contracting directly for demand-side response with industry parties across the supply chain, or through more centralised arrangements. Each could involve intermediation through third parties. This document does not consider further the form that such reformed arrangements could take; that would be for future consideration.

We welcome views on whether we have identified the main challenges to creating the right environment for demand-side response. In addition, we seek views on how Ofgem, industry and others can address the key challenges we have outlined. In the light of responses to this consultation, we will identify whether and, if so, when further action is needed beyond existing work, how we think this can best be taken forward and who by. We intend to publish our conclusions this autumn.

1. Introduction

1.1. For demand-side response to make a real contribution to solving the challenges facing the electricity system, the market environment must support customers in changing the way they use electricity. In our Project Discovery consultation of February 2010, we highlighted that industrial and commercial consumers are active in demand-side response, but participation could be increased and extended to the mass market if short-term price signals are sharpened and barriers are removed.[1] In July 2010, we published a discussion paper that considered the outlook for customers playing a more active role in the energy market by changing the times at which they consume electricity.[2] The paper provided an initial view of the value of increasing the ability of consumers to be more flexible in their electricity use. It also set out the various issues that need to be addressed to encourage greater demand-side response in the electricity sector.

1.2. A wide range of work across Ofgem has begun to address some of the issues identified in our 2010 discussion paper. This includes our work on settlement reform, the role of demand-side response in wholesale markets, our input to DECC's proposals on the design of the capacity market and our work with government and industry on the development of smart grids. In November 2012, we held an event to gain participants' views on the challenges and gaps in current demand-side response work, roles within the industry for taking future work forward and, in particular, views on what Ofgem's role should be.[3]

1.3. In addition to the attractiveness of terms offered, many behavioural factors affect customers' engagement with the energy market and will influence their willingness to provide demand-side response.[4] Steps we are taking through our Retail Market Review aim to encourage and equip customers to engage effectively in the market now and make it easier in the future for customers to realise benefits of smart metering.[5] This engagement will take time to evolve, especially for customers new to demand-side response.

1.4. We welcome the important contribution to the debate made by key stakeholders across industry and academia, which we refer to throughout this document. This includes, but is not limited to:

- Sustainability First's work on GB Electricity Demand and the Smart Demand Forum.[6]
- The research and trials being undertaken by industry under Ofgem's Low Carbon Network (LCN) Fund.
- The Energy Network Association (ENA) and Energy UK discussion paper on issues relating to demand-side response.[7]

[1] *Project Discovery - Options for delivering secure and sustainable energy supplies*, Ofgem, February 2010
[2] *Demand-side response: A discussion paper*, Ofgem, July 2010
[3] *DSR Autumn Event: summary of discussion*, Ofgem, November 2012
[4] *What can behavioural economics say about GB energy customers?*, Ofgem, March 2011
[5] Further details of the Retail Market Review are available on the Ofgem website at http://www.ofgem.gov.uk/Markets/RetMkts/rmr/Pages/rmr.aspx
[6] *GB Electricity Demand Project*, Sustainability First

1.5. It is also important to recognise relevant developments at the European level. In October 2012, the EU adopted the Energy Efficiency Directive which establishes a common framework of measure for the promotion of energy efficiency within the Union. Article 15 of the Directive requires that National Regulatory Authorities should encourage participation of demand-side resources, including demand-side response, alongside supply in wholesale and retail markets. In addition, European network of transmission system operators for electricity (ENTSO-E) has developed the demand connection code as part of the suite of network codes proscribed for under by the European Third Energy Package.[8]

The purpose of this consultation

1.6. The right environment for demand-side response is an important part of our vision for "smarter markets" that are more efficient, dynamic and competitive, delivering better outcomes for consumers.9 Our Smarter Markets Strategy, published in July 2012, introduced our longer-term objective for electricity demand-side response, which is to:[10]

create a market environment that supports the efficient system-wide use of demand-side response, which has the potential to reduce bills for consumers, enhance security of supply and contribute to sustainable development.

1.7. The regulatory framework plays a key role in determining the use of demand-side response. For example, suppliers' incentives are driven in part by competitively-determined wholesale prices and settlement arrangements and DNO incentives are driven by industry-led network charging methodologies and by distribution price controls set by Ofgem.

1.8. The aim of this consultation is to articulate the challenges associated with achieving our longer-term objective for demand-side response and to seek your views on these challenges. We also aim to identify whether further action is needed to address these challenges, beyond ongoing work. Your views as stakeholders will contribute to a vital evidence base that will inform our recommendations. Responses to this consultation will feed into related work being carried out throughout Ofgem, highlight any gaps and inform our views on whether anything new is to be done (whether through current or new work) and, if so, how we think it can be taken forward.

1.9. Given that we set many of the rules that will impact the future development of demand-side response, Ofgem necessarily has a role in examining how well the regulatory framework enables commercial arrangements that provide for the efficient use of demand-side response, across the supply-chain. This work aims to provide an

[7] *Smart Demand Response: A Discussion Paper*, ENA/Energy UK, July 2012
[8] The demand connection code provides for a process where system operators can make the case for frequency response demand-side response capability to be included in European design standards. The level of these parameters will be proposed by the system operator and assessed by national regulators. The code is currently with the European Commission for their consideration.
[9] *Promoting smarter energy markets: a work programme*, Ofgem, July 2012
[10] We are constraining the scope of this work to electricity demand-side response only. We are aware of the potential for Gas demand-side response, however given the complexity of assessing the whole supply chain we have chosen to focus on electricity only.

evidence base that will help any required reforms to be developed and delivered in a coordinated, joined-up way that benefits consumers.

1.10. Demand-side response is not an end in itself. Other competing (and sometimes complementary) solutions such as storage and interconnection could also provide alternative ways to make the electricity system more flexible. Our longer-term objective focuses on enabling demand-side response to compete with these other solutions, to improve the efficiency of the electricity system for the benefit of consumers.

1.11. Establishing the potential and limitations of the current arrangements is a necessary step before asking more fundamental questions about different market models and market structures and developing any policy solutions. Therefore, while we introduce the idea that an alternative market structure may be one way to address some of the issues in the conclusion of this document, we exclude any assessment of how new market structures or routes to market could meet the challenges we identify.

1.12. Nonetheless, one important new mechanism will be the capacity market currently being designed by the Government.[11] Although not currently in place, DECC's intention is to run an auction in 2014 for delivery in 2018-19 and is therefore likely to be a consideration for customer and industry parties for their current operational and investment decisions. Therefore, we recognise that the capacity market is likely to be a key element of market design to consider if any changes are made in the future.

Structure of the document

1.13. The document is structured as follows:

- **Chapter 2** explains what demand-side response is, how it can benefit the electricity system and why these potential benefits are likely to increase.
- **Chapter 3** introduces preconditions that must be met to allow the market for demand-side response to develop effectively and test whether today's regulatory and commercial arrangements satisfy these preconditions.
- **Chapter 4** we conclude with a discussion of how arrangements could adapt or change, including high-level alternative models of what future arrangements could look like. Finally we outline next steps for this work.

1.14. Appendix 1 summarises the questions we are seeking your views on. Appendix 2 provides a summary of relevant Low Carbon Network (LCN) Fund projects. Appendix 3 provides a glossary.

[11] As part of its Electricity Market Reform (EMR), the Government plans to introduce a capacity market to help secure the UK's energy supply.

1.15. Alongside this consultation we have also published a factsheet that gives a simple overview of what demand-side response is and how it can help customers save money.[12]

[12] *How managing your energy use could help you*, Ofgem, April 2013

2. The potential of demand-side response

What is demand-side response?

2.1. For the purposes of this document, we define demand-side response as actions by customers to change the amount of electricity they take off the grid at particular times in response to a signal. As such, we refer specifically to 'transactable' demand-side response, where a customer chooses to change the way they consume energy. This could include choosing to change their behaviour and habits to alter their energy consumption, or choosing to let somebody else help them manage or control their energy consumption. These examples differ from ('non-transactable') system management activities that cause no discernable change in the quality of electricity supply and in which a customer has played no part. Transactable demand-side response differs from interruptions to customers' electricity supply that they have not chosen to incur.

2.2. We focus in this document on incentives and arrangements for demand-side response, rather than the means by which customers can provide it. Currently much of the demand-side response provided by larger non-domestic customers is delivered by substituting stand-by generators. While arguably unhelpful in terms of environmental impacts, this response could still be critical for security of supply. Different types of demand-side response could contribute differently to sustainable development. Looking ahead, it may be necessary to examine the merits of different ways to provide demand-side response. However, as a first step, this document focuses on ensuring demand-side response can compete with other ways of providing flexibility or adequacy, regardless of how customers go about providing and delivering it. We therefore do not examine the effects of demand-side response beyond the electricity system (such as environmental impacts).[13]

2.3. Demand reduction has an important role to play in addressing the challenges faced by the electricity market as part of the transition to a low-carbon economy. Demand-side response can often indirectly lead to overall reductions in energy use, potentially helping to reduce peak demand.[14] However, this consultation focuses on identifying specific issues and challenges within current arrangements for demand-side response only rather than permanent demand reduction actions solely aiming to improve energy efficiency. The Government is leading on the policy options to encourage permanent reductions in electricity use.[15]

2.4. Some customers are already providing demand-side response today. These are mainly large non-domestic customers, due to economies of scale of load shifting and because larger customers are more likely to be metered half hourly, which can lower investments required to monitor and verify a response.[16] Those domestic

[13] Our principal objective is to protect the interests of existing and future consumers and this includes their interest in the reduction of electricity-supply emissions of targeted greenhouse gases. Ofgem is progressing a range of work to this end elsewhere.
[14] *GB Electricity Demand- Context and 2010 Baseline Data*, Sustainability First, October 2011
[15] See for example, *Energy Demand Reduction: Consultation on options to encourage permanent reductions in electricity use*, DECC, November 2012
[16] *Demand side response in the non-domestic sector*, Element Energy for Ofgem, July 2012

households that participate in demand-side response tend to do so through time-of-use (ToU) tariffs. These tariffs charge less during off-peak periods, incentivising customers to shift consumption away from peak periods. Chapter three provides more detail on how different customers currently provide demand-side response to various industry parties.

Why is demand-side response important?

2.5. Customers have always had the potential to shift their demand. Now this potential is increasing for a number of reasons, as set out below. As it does so, new potential competitive opportunities materialise, offering an avenue for innovation and new products.

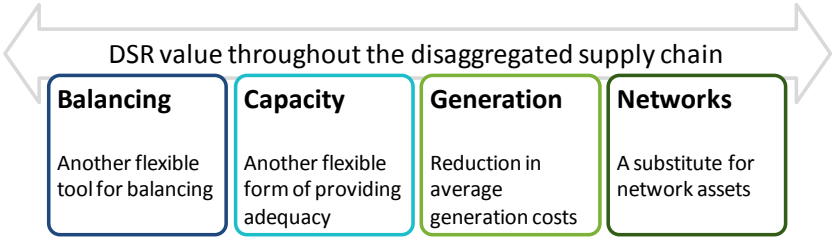
- **The electricity system is being upgraded.** Ofgem has estimated that due to plant closures and the need to replace and upgrade the UK's electricity infrastructure, over the next decade the UK electricity sector could need around £110 billion of capital investment.[17] Demand-side response provides one way to reduce or delay some of these investment costs, which will ultimately be passed through to customers' bills. Furthermore, demand-side response may be a valuable tool, alongside others, for managing the increasing contribution that intermittent generation is expected to make to the generation mix.
- **We are changing the way we use electricity.** As more heating and transport is electrified over time, overall electricity consumption is expected to rise[18], as well as consumption at peak times.[19] The technologies behind this electrification, such as heat pumps and electric vehicles, could make it easier for customers to be more flexible about how and when they consume electricity.
- **Smart meters will open up opportunities.** Larger non-domestic customers already have advanced metering, which can help to lower the cost of monitoring and verifying demand-side response. Government's ambition is for all households and other small energy customers to have smart meters installed by their energy suppliers by 2019. Smart meters will provide new opportunities for domestic customers to improve their understanding of their energy consumption, by giving them better information about their consumption, in a more accessible form. Half-hourly consumption data from smart metering could make contracting for demand-side response easier by providing a means to verify changes in consumption. Furthermore, a combination of two-way communication and potential load-switching functionality provided by smart metering could provide opportunities for customers to negotiate new types of contract, for example to limit their load in some way.

[17] *Project Discovery Energy Market Scenarios*, Ofgem, October 2009.
[18] 2050 Pathway Analysis, DECC, July 2010
[19] For example see *Demand-Side Response: Conflict Between Supply- and Network-Driven optimisation,* Pöyry, November 2010

How is demand-side response used?

2.6. Demand-side response is a term encompassing many types of change in energy consumption. These changes can lower electricity costs in many ways, so the value they can provide is divided between various uses for different parties in the disaggregated supply chain (Figure 1).

Figure 1: Use of demand-side response across the electricity system



Balancing

2.7. The **System Operator** (SO) is required to balance electricity supply and demand second-by-second across the system.[20] To achieve this, the SO responds to short-term unanticipated changes in supply or demand, such as inaccurate supplier demand forecasts, unexpected plant outages or inaccurate wind generation forecasts. Balancing services are one way that it does this. Demand-side response already competes to provide balancing services to the SO, so could reduce overall balancing costs where it costs less to implement than alternatives. Demand-side response also has the potential to reduce the cost of the SO managing physical constraints in the electricity transmission network.

2.8. Demand-side response also has the potential to help **suppliers** balance their energy portfolios. Suppliers need to balance their contracted energy sales and purchases prior to 'gate closure', one hour before each half-hour settlement period. Any imbalance exposes them to charges through the 'cash out' mechanism. Dispatching demand-side response could be more cost effective for suppliers than adjusting their position on the wholesale market or using their own generation (for vertically-integrated suppliers). Demand-side response could be particularly useful to help suppliers manage unexpected mismatches in their supply and demand. Both demand increases and decreases could be valuable for suppliers.

Reduction of average generation costs

2.9. Shifting demand from higher-demand periods to lower-demand periods could reduce the need for higher-cost peaking generation thereby lowering average costs for **generators**. Furthermore, by flattening the pattern of electricity usage over

[20] National Grid has a licence condition to control frequency within +/-1 per cent of nominal system frequency (50.00Hz), as specified in the 'Electricity Supply Regulations'

time, ie load shape, demand-side response has the potential to increase operating efficiency of existing generation plant; allowing them to run at higher load factors.[21]

2.10. Demand-side response can also help accommodate increasing amounts of intermittent generation on the system as wind generation load factors could be improved by employing demand-side response. When wind levels are high, demand-side response can be used to increase demand at a specific time to help avoid the need for wind curtailment. On the other hand, demand-side response can also be employed to reduce demand at specific times when wind levels are lower than expected.

A substitute for network assets

2.11. The **Transmission Operator** (TO) will be faced with greater network-management challenges as heat and transport electrification increases demand in the long-run and more renewable generation is installed. Demand-side response provides the TO with one way to reduce the level of peak demand and hence avoid or delay additional investment in transmission networks. The value derived from demand-side response by the TO varies by time and location. Demand-side response provides the greatest value for the TO at times of the year that coincide with the three Triad periods.[22] Demand-side response could also be used by the TO for managing pre- and post-fault constraints at specific points on the network.

2.12. Similarly, the distribution networks may require significant investment as increasing electricity demand puts ageing assets under further strain, particularly if take-up rates of electric vehicles, heat pumps and other technologies increases. Demand-side response provides the **Distribution Network Operators** (DNOs) with an alternative solution for managing increases and changes in demand on the network and could reduce or defer the need for network investment in reinforcement.

2.13. Local and national load profiles differ considerably and distribution network investment requirements are sensitive to local factors, such as thermal loading and voltage. Distribution network costs can therefore vary by voltage level and location, so the value of demand-side response derived by the DNOs will also be influenced by these factors. A range of industry work is exploring the scale of benefits that demand-side response could provide to DNOs and what these benefits will depend upon (see chapter three).

Capacity

2.14. The GB energy system faces a number of challenges as existing plant closes and as the system moves towards a greater proportion of low-carbon generation. The economic consequences of power supply failure can be considerable.[23] Demand-side response availability has the potential to provide spare capacity to the system,

[21] Load factor refers to the proportion of output that a power station produces relative to the output it would produce if it could be operated at maximum output 100% of the time.
[22] The three half hours over the winter period with highest demand.
[23] See 3.28 for our work under the Electricity Balancing SCR and the estimation of the value of lost load.

which could reduce the volume of generation capacity which needs to be available to maintain any given security-of-supply level.

Summary

2.15. Table 1 summarises potential demand-side response value.

Table 1: Use and value of current demand-side response routes to market

Industry party	***Use***	***Value characteristics***	***Suitability of route to market***
Supplier	Avoidance of imbalance charges	Value derived from demand-side response on a regular basis when suppliers need to balance their energy portfolio.	Depending on their form, time-of-use tariffs could range from easy for customers to engage with, to difficult. However, suppliers' incentives to offer time-of-use tariffs appear to be dulled by current arrangements. Moreover, customers could potentially get more value from dynamic tariffs than static ones, but the barriers to suppliers offering these tariffs are greater.
SO	Provision of balancing services	Value derived from demand-side response on a regular basis. Value largely independent of location, except for some location-specific constraint management purposes.	Contracted balancing services are generally well suited to sending signals about the SO's value of demand-side response. However, these routes to market do not suit smaller customers well without the help of a third party such an aggregator.
TO	Cost savings from reduced/deferred transmission network reinforcements and constraint management	Value derived from demand-side response infrequent. Coincides with three triad periods a year. Value derived dependent on location.	Triad charges are reasonably suited to signalling the value of demand-side response to the TO, but only for half-hourly metered customers. The TO is also reliant on suppliers passing these through.
DNO	Cost savings from reduced/deferred distribution network reinforcements and constraint management.	Value derived from demand-side response infrequent. Coincides with distribution network peaks. Value derived dependent on location.	Distribution charges have significant limitations as a means for DNOs to signal the value of demand-side response. Furthermore, DNOs are reliant on suppliers to pass these signals through. Bilateral arrangements could offer DNOs ways to send more tailored signals to consumers, but are less well suited to smaller customers than large. These arrangements may require more granular consumption data that smaller

			customers without smart meters (or RTS services) cannot yet provide, but this will change as smart metering is rolled out.

3. The right environment for demand-side response

3.1. For demand-side response to play an increasingly full role in the energy system, this needs to be facilitated by appropriate regulatory and commercial arrangements. We have set out below our view of the preconditions that need to be met to realise our long-term objective for demand-side response. We then assess how far today's regulatory and commercial arrangements meet these preconditions and whether any changes that are needed could be delivered through an evolution of current arrangements or would require more fundamental reform. We would welcome views on whether we have identified all the relevant issues across the different parts of the value chain and on the priorities for any Ofgem action.

3.2. The preconditions that we have identified are:

i) ***Industry parties*** *need to be* ***confident*** *that there is value for them in demand-side response to justify the investment*
ii) *The* ***value*** *of demand-side response services needs to be effectively* ***signalled*** *to customers*
iii) ***Customers*** *need to be* ***aware*** *of the opportunities to provide demand-side response, able to readily* ***access*** *information on options and able to* ***act****.*

3.3. At the end of this chapter we summarise the key challenges that need to be overcome if each precondition is to be met and the overall objective achieved and outline relevant work already underway against each challenge. We have listed a number of questions for stakeholders throughout each section. These questions are summarised in Appendix 1.

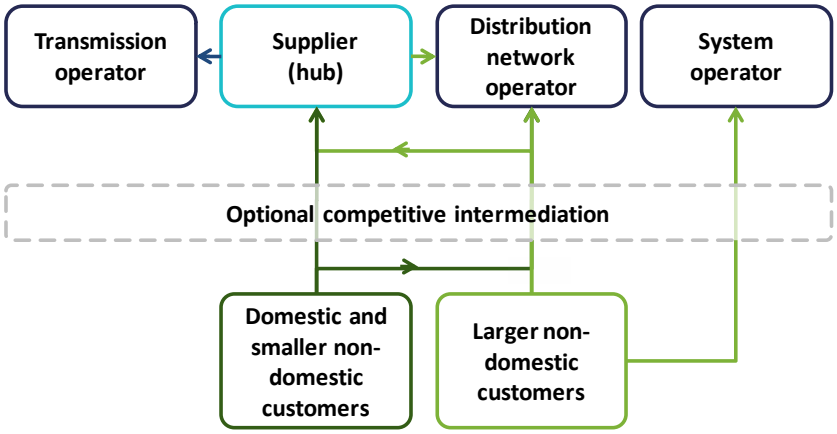
Current arrangements

3.4. The competitive retail electricity market works using a 'supplier hub' principle, whereby most customers (except some larger customers) deal only with their supplier. Suppliers recover their own costs and also pass on costs from further up the supply chain, such as wholesale energy costs, network charges and environmental levies.

3.5. As noted above, many parties across the supply chain value flexibility. For demand-side response to be effective they need to be able to transmit a signal about this value to customers. As outlined in Figure 2, within the supplier-hub framework there are conceptually two basic ways that this can be done, which we term "routes to market":

- Sending signals indirectly to customers via their supplier as part of a modified supply contract
- Sending signals directly to customers as part of a bilateral contractual arrangement, separate to the customer's supply contract. In some cases an intermediary such as an aggregator may be involved.

Figure 2: The supplier hub or bilateral arrangements



3.6. In practice, at present, the only significant opportunity for smaller customers to be rewarded for demand-side response is through ToU tariffs. These include Economy 7 tariffs where the supplier reflects the different DNO charges in their contract with the end customer. For larger customers there are some examples of customers contracting directly for demand-side response, for example through providing balancing services to the SO such as Short Term Operating Reserve (STOR) directly (or via an aggregator).

3.7. In today's market parties across the supply chain can use a range of different routes to market to give them access to the demand-side response that customers can provide. Below we outline each party's use for demand-side response and the routes to market available to them today. For many of these routes to market, demand-side response is not their primary purpose or function.

3.8. The **System Operator** is required to balance the electricity system nationally, but must do so within the operational constraints of the system, requiring it to take some specific balancing actions. The SO can use demand-side response through the following routes to market (but can balance the market in other ways too):

- **Frequency response** – Frequency Control by Demand Management provides frequency response through the interruption of customers to help ensure that the system frequency is maintained within specified limits.
- **Fast Reserve** – a service that provides a fast and reliable source of extra power at times of greater than forecast electricity demand.
- **STOR** – the provision of additional power ahead of day to deal with unforeseen demand increases or generation unavailability.

3.9. Demand-side response provides the **Transmission Operator** with one way to reduce the level of peak demand and hence avoid or delay additional investment in transmission networks. Demand-side response can also be used by the TO for managing pre- and post-fault constraints at specific points on the network. The sole route to market for the TO is through its transmission charges:

- **Transmission charges** recover the cost of the assets used to facilitate the flow of power across the transmission system. The methodology used to calculate price is intended to charge generation and consumption according to their contribution at peak times (which determines transmission capacity requirements). Therefore users with higher demand during three periods of peak system use between November and February each year (triad periods) pay a higher TNUoS tariff on their consumption.[24]

  Large customers that are metered half hourly[25] and smaller customers that are metered non-half-hourly both have a time-variant component to their charge on consumption. Larger customers' charges depend on their demand at maximum system demand during the triad period. Smaller customers are charged based on annual energy (kWh) consumed during the period 16:00 to 19:00hrs over the relevant financial year.

3.10. **DNOs** can use demand-side response to reduce the level of peak demand on distribution networks and hence avoid or delay additional investment. They can also use demand-side response for managing pre- and post-fault constraints at specific points on the network. There are currently three main routes to market through which DNOs can use demand-side response:

- There are two separate **distributing charging methodologies** used by DNOs to calculate distribution use of system (DUoS) charges. The EHV Distribution Charging Methodology (EDCM) provides a site-specific incremental price signal to very large users connected to the extra high voltage tier (or the high voltage tier in some cases) of the distribution network. This includes time bands under which EDCM customers can be rewarded for shifting usage off peak.

  The Common Distribution Charging Methodology (CDCM) applies to most customers that are connected to the high voltage tier and to all that are connected to the low voltage tier. CDCM charges are based on the average costs imposed by each generic type of customer, rather than being site-specific. Non-half-hourly metered customers do not typically have time bands, although some customers may be placed on an Economy 7 tariff where they can be rewarded for shifting demand off-peak. For commercial customers with half hourly metering, the CDCM has three time bands which allow distribution networks to signal the changing value of flexible demand to some extent.
- DNOs can contract for the provision of demand-side response through **bilateral arrangements** with larger half-hourly metered customers (eg non-firm connection agreements). These arrangements set out how usage could be reduced to ensure that no upstream reinforcement is required.
- **Radio Teleswitching** is the main mechanism for the dynamic switching of non half-hourly tariff registers. In the majority of cases, customers who are on these arrangements have their electrical storage and immersion heating controlled remotely via the Radio Teleswitching Service.

[24] Transmission Network Use of System (TNUoS) charges
[25] Only customers that are metered half hourly can choose triad charging because charges are based on actual metered consumption within specified periods.

3.11. **Suppliers** are incentivised to balance their portfolios nationally, by trading on national wholesale electricity markets that set one price across Great Britain for each product. Time-of-use tariffs are the main route to market that suppliers can use today to encourage customers to provide demand-side response and can take two forms:

- The **static time-of-use tariffs** in the market today were primarily developed to support customers who are able to shift a significant share of their electricity consumption to off-peak time periods. All major suppliers offer Economy 7 tariffs, which offer cheaper electricity at night but more expensive rates during the daytime.[26] Currently, the peak and off-peak periods and prices in most ToU tariffs in GB are fixed in advance (i.e. static ToU tariffs). This basic form of demand-side response shifts electricity use away from peak periods and is often attractive to customers with night-time electric storage heaters, or other usage patterns that allow them to shift consumption away from daytime hours.
- Suppliers are currently trialling the use of **dynamic ToU tariffs**, such as critical peak pricing, whereby the price communicated to the customer is signalled in real time, whether that is day-ahead price alerts or intra-day price differentials. Suppliers also offer specific tariffs for Radio (or Dynamic) Teleswitching functionality.

Looking ahead

3.12. In future, routes to market for demand-side response could take many forms. There are many ways to send signals to customers about the value of adapting their consumption. These could include prices that vary over time (either dynamically or statically), tariff agreements that limit consumption at certain times, auctions to provide availability, or contracts to give up control over some consumption.

3.13. Many larger non-domestic customers already have advanced metering (or will do by 2014) which records half-hourly usage. Most domestic customers and small businesses have their consumption pattern estimated based on profiles half-hourly metered. Looking ahead, more sophisticated metering and settlement arrangements will make it easier to verify that demand-side response is delivered in line with customers' commitments. Some domestic and smaller non-domestic customers have Economy 7 or similar meters which record usage across broader (eg day/night) time periods. However the rollout of smart metering to all domestic and smaller non-domestic customers by 2019 will enable half-hourly meter readings and also the capability for load-control to be effected remotely.[27]

3.14. While the main opportunities for demand-side response are currently in the larger non-domestic market, this could change in future. The rest of this chapter considers what else is needed to help more customers to benefit from these future opportunities.

[26] Some suppliers also offer tariffs with three different time periods (known as Economy 10 tariffs).
[27] *Government response to the consultation on the second version of the Smart Metering Equipment Technical Specifications: Part 1*, DECC, January 2013

Precondition 1: Industry parties need to be confident that there is value for them in demand-side response to justify the investment

3.15. As discussed in chapter 2, there are a number of parts of the supply chain where there is value in having more flexibility. For these parties to have the incentive to invest the time and resources in trying to secure demand-side response they need to be confident that they can obtain an adequate return.

3.16. Parties looking to offer demand-side response services will need to make investments, including:

- **System investment.** Suppliers, aggregators or other industry parties will need to invest in systems and equipment to implement demand-side response. This would include, for example, IT systems to communicate with smart meters, conveying the value of demand-side response at any given time, and billing systems to be able to provide more sophisticated dynamic tariffs. In addition, a customer's response needs to be both monitored and verified, which may require specific equipment or resource.
- **Informational investment.** For industry parties to assess the benefit that they could gain from using demand-side response, they will need to build knowledge and understanding of the customer potential. This is a complex task given the diverse range of energy usage patterns across different customer types and the varying willingness to change these patterns. Aggregators have developed expertise in assessing non-domestic customers' capability to provide demand-side response. However, only a small proportion of the market currently provides demand-side response. Little is known about the potential across the rest of the market. There needs to be investment to build this knowledge and understanding.

3.17. There will also be additional costs associated with raising awareness and acceptability of demand-side response offerings. These investment requirements are an important consideration for market participants who need to be sufficiently certain that these investments will pay off. However, two factors might increase the risk associated with investment in capability to use demand-side response:

- **Uncertainty around the value of demand-side response.** We outline in chapter 2 some of the factors influencing the value of demand-side response. Many of these factors are uncertain, which increases the riskiness of any investment.
- **Regulatory and commercial arrangements.** Rules governing the operation of the market and their influence on commercial arrangements in the market could affect the revenue streams against which investments need to be made.

Key challenges

3.18. Our longer-term objective for demand-side response will not be met unless regulatory and commercial arrangements create the right environment for parties to be confident to invest.

3.19. The key challenges that we have identified in this area are:

- Revealing the value of demand-side response across the system
- Securing delivery of demand-side response
- Clarifying interactions between industry parties

Revealing the value in the system

3.20. While there is real value to be delivered in terms of demand-side response across the supply chain, regulatory and commercial arrangements need to enable industry parties to see and capture that value. Table 2 summarises the extent to which current commercial and regulatory arrangements allow the value of demand-side response to be revealed to industry parties.

Table 2: Current arrangements and the value of demand response

Arrangements	***Incentives to use demand-side response***
Cash-out (imbalance) signals	As stated in Project Discovery, Ofgem has had longstanding concerns with the ability of short-term price signals to fully reflect the value of flexibility and security of supply at times of system stress. One of the consequences of insufficient short-term signals is that the incentives to develop demand-side response are reduced.[28]
Settlement arrangements	Most customers are currently settled based on estimated profiles of their consumption over the course of the day. Any changes in customers' actual consumption, such as those resulting from demand-side response, would not be reflected in their suppliers' settlement positions. This currently prevents suppliers from saving money by encouraging demand-side response, unless they assign a different settlement profile to those customers providing demand-side response. As a result, there is currently little financial incentive for suppliers to offer products such as ToU tariffs.
Network price controls	The introduction of the Revenue = Incentives + Innovation + Outputs (RIIO) model for the next network price controls provides that operational cost savings are equally rewarded as investment in network assets. This includes through encouraging load shifting to avoid or defer investment.

3.21. As is clear from Table 2 there are a number of areas where it is already recognised that more work needs to be done to provide stronger incentives on industry parties to develop demand-side response. The work that is underway to address these issues is summarised under the relevant work section below.

Securing delivery of demand-side response

3.22. To be able to rely on demand-side response, industry parties need to be confident that it is being delivered in line with contractual commitments or at least to measure the extent to which it has been delivered. The degree of confidence

[28] *Project Discovery: Options for delivering secure and sustainable energy supplies*, Ofgem, February 2010

required will vary depending on the use. For example, for balancing services the SO highly values certainty that any demand-side response that is called will be delivered. In other areas it may be less critical, such as where suppliers look to reduce their exposure to peak wholesale costs.

3.23. Securing delivery of demand-side response is in part dependent on the type of mechanism used. For example, having some form of direct load control can help to secure delivery through physical control. In comparison, price signals rely on customer response, so could be less certain, especially if the route to market relies on a supplier to pass on these prices. Aggregation can also help to improve delivery certainty by providing a portfolio of customers from which response can be called.

3.24. However, for each mechanism there is a need for some form of monitoring and verification, to provide the basis for a contractual arrangement. This can be provided more readily for back-up generation but is particularly challenging in the context of changes in consumption given that demand varies over time. As a result, determining the baseline against which the demand-side response should be calculated is a non-trivial task that could benefit from industry cooperation.

3.25. The same issues apply to demand reduction measures and work is being carried out by DECC in the context of its Electricity Market Reform. Work has been done on this in the US and some of the existing GB arrangements such as STOR have had to address this issue. However, with a wider scope for demand-side response this becomes more challenging.

Clarifying interactions between industry parties

3.26. Demand-side response arrangements in the market today tend to involve a customer agreeing to provide demand-side response to one party in the supply chain, for example to the DNO. However, when one party uses a customer's demand-side response it can have knock-on effects for other parties in the supply chain; effects that can either benefit or harm those other parties.[29]

3.27. Cross-party impacts can be complex and their scale and impact depends crucially on system conditions at the time.[30] Industry parties need to have clarity around their rights, to help reduce the risk associated both with using demand-side response themselves, or other industry parties using demand-side response. These impacts are summarised in Table 3.

[29] Assessment of DSR price signals, Pöyry for ENW and National Grid, December 2011
[30] For example, where a DNO uses demand-side response to manage flows on their network following a fault; potentially affecting the demand-side response available for the SO to call on, affecting the overall balance of the electricity system.

Table 3: Cross-party impacts of demand-side response

Party	***Impacts***
System Operator	The SO is primarily affected by actions that others might take after gate closure. This would be limited to actions taken by DNOs to manage their networks, or by aggregators on their behalf.
Distribution network operators	DNOs' network planning could be affected if customers' peak consumption changes as a result of providing demand-side response. They could be affected operationally (and indirectly, financially) by actions taken after gate closure by the SO, especially if these actions are to increase demand at times that coincide with local network peaks.
Suppliers	Suppliers remain unaffected by demand-side response actions taken by customers that are settled using an estimated consumption profile. However, suppliers could be forced out of balance by other parties calling demand-side response actions from their half-hourly metered customers. If these actions were predictable, suppliers would have an opportunity to adjust their position. If they were unpredictable (or after gate closure) suppliers would be unable to respond, leaving them potentially exposed to imbalance charges as a result.

3.28. In some cases these conflicts are handled by the inclusion of exclusivity rights in contracts, as with STOR. However, this could limit the potential opportunity for other parties and reduce the value a customer can get from their demand-side response. It is important that the regulatory and commercial arrangements provide the necessary certainty to parties that they will be able to access demand-side response without their actions being undermined by those of others. However, such actions must be proportionate and not preclude the use of demand-side response where it offers most value.

3.29. These effects are not new; they already exist in the market today. However, while volumes of demand-side response are currently relatively small and the potential in some areas is still untapped, stakeholders operating in the supply chain do not appear to see this as an urgent problem. Nevertheless, stakeholders participating in work on regulatory and commercial issues facing the development of Smart Grids have welcomed the inclusion of these cross-party issues in joint work with Ofgem.[31]

Relevant work

3.30. This section summarises the relevant work underway within Ofgem and by others that is addressing or furthering the thinking behind the issues and challenges identified above under precondition 1.

3.31. There is a range of work currently being progressed that explores the types of system and informational investment required to support the development of demand-side response:

[31] See below for further information on the work of Workstream 6 of the Smart Grids Forum.

- **Work Stream 6 (WS6) of the DECC/Ofgem Smart Grids Forum (SGF**) produced a report identifying the potential barriers to maximising the benefit of smart grid solutions in August 2012.[32] Following this, the group have now proposed a new work package which includes examining how DNOs might balance the risk associated with capital investment for demand-side response.
- The various network innovation funding schemes have the potential to be an important catalyst for investment in the smart grid and wider electricity system. They also help address the need for informational investment and the current uncertainties about the value of demand-side response. These schemes include:
    - As part of the current electricity distribution price control (DPCR5), Ofgem established the **LCN Fund**. This provides up to £500 million to encourage DNOs to trial new technologies and operating and commercial arrangements. The objective of these trials is to generate learning to help all DNOs understand how they can provide security of supply at value for money as Great Britain moves to a low-carbon economy. Appendix 2 lists the larger, second tier, projects that have been awarded LCN funding that are exploring the use of demand-side response within the smart grid. A condition of funding is that findings are made publicly available, helping support the development of the wider demand-side response market by filling an information gap.
    - The **Network Innovation Competitions** and **Network Innovation Allowance** apply the principles of the LCN Fund to all network sectors. These took effect for electricity and gas transmission and gas distribution in April 2013. They will apply to electricity distribution when the LCN Fund finishes in March 2015. The purpose of the new innovation support mechanisms is to encourage network companies to innovate to address issues such as the move to the low-carbon economy and issues that can deliver wider financial and environmental benefits to customers.[33]

Revealing the value in the system

3.32. In relation to the first key challenge identified under this precondition, a wide-ranging body of work is underway to address the need to reveal the true value of demand-side response in the system, including:

- **The Electricity Balancing Significant Code Review (EBSCR)**. This Significant Code Review aims to incentivise an efficient level of security of supply and address our longstanding concerns with short-term price signals identified in Project Discovery. The outcomes from this work could include making prices more reflective of scarcity conditions. This could incentivise greater use of flexibility within the market, which includes demand-side response.[34] Ofgem has jointly commissioned a study with DECC to estimate a range for the value of lost electricity load for domestic, SME and industrial and commercial customers. This will inform our work on the EBSCR.

[32] *Work Stream 6 Report*, Smart Grid Forum Work Stream 6, August 2012
[33] *Electricity Network Innovation Competition Governance document*, Ofgem, Feb 2012
[34] See the Ofgem website for the latest on the EBSCR.

- **Longer-term settlement reform** - In the July 2012 Smarter Markets work programme, we identified that changes to the settlement arrangements may be required to facilitate the longer-term development of smarter markets. In this context, we set out our objective to put in place settlement arrangements that use smart metering data to allocate energy in an accurate, timely and cost-effective way. We plan to define the problem and scope out the approach for addressing it over the coming year. Our intention is to publish our conclusions in Q1 2014. This will include details of any next steps, including the process for identifying and assessing potential options for reform.[35]
- **RIIO-ED1.** The strategy decision for the next electricity distribution price control places greater emphasis on incentives to drive the innovation needed to deliver a sustainable energy network that provides value for money to existing and future consumers. This includes consideration of demand-side response, where it is more efficient than other methods, to resolve network constraints and defer investment.[36]
- **The capacity mechanism.** As part of its Electricity Market Reform (EMR), the Government is looking to introduce a capacity market to help secure the UK's energy supply. The SO would run a centrally-procured auction for capacity that creates financial reward for providing reliable capacity to the system. The Government is keen for demand-side response to play a fair and equivalent role in the capacity market. Ofgem is considering and providing our views on DECC's proposals on the design of the capacity market.[37] The design of the capacity mechanism will have impacts on customers' options for providing demand-side response and could affect their ability to participate in existing or potential new routes to market.

3.33. In addition to the above, the following work is also relevant in addressing this challenge:

- **Capacity assessment.** Ofgem is required annually to produce an assessment of capacity margins that could be delivered by the electricity market over the next four years, as well as risks associated with these margins. In our 2012 Electricity Capacity Assessment report, demand-side response was reflected in National Grid's demand data, i.e. the demand data was net of demand-side response.[38] Following National Grid analysis, we assumed that demand-side response continued at current levels for the period of the analysis. There is the potential to review this approach for future assessments.
- **Future Trading Arrangements work.** We recently consulted on a proposed new project to test whether Great Britain's wholesale electricity trading arrangements are robust against future challenges. Specifically, the project will test whether they will deliver efficient operation of existing assets and appropriate incentives to invest in new capability and effective and

[35] For more information on longer-term settlement reform please see *Way forward on longer-term electricity settlement reform*, Ofgem, March 2013
[36] See here for the latest on RIIO-ED1.
[37] *Electricity Market Reform – Capacity Market Impact Assessment*, DECC, November 2012
[38] *Electricity Capacity Assessment 2012*, Ofgem, October 2012

efficient integration with European markets to the benefit of GB consumers.[39] This will include consideration of how demand-side response is treated within trading arrangements.

- **Electricity System Operator Incentives**. We recently consulted on proposals for the key characteristics of a financial incentive scheme for the SO to cover the period from 1 April 2013 to 31 March 2015.[40] Within the main scheme we do not propose to place any incentives on the SO to influence the way it uses demand-side response. However, alongside the main incentive scheme, we propose to introduce a number of additional incentives on specific outputs for the two year scheme duration. This includes a discretionary reward that would provide the SO with a route through which it could apply for funding for beyond 'business-as–usual' actions in developing new and innovative ways of balancing the system that lead to net benefits for consumers. This could include developing technology, processes and/or frameworks which provide a level playing field for all potential ancillary service providers, including demand-side response.

Securing demand-side response

3.34. Some work is being progressed by industry to address the second key challenge identified under this precondition: securing demand-side response to provide certainty to industry parties. Some of these projects, which have been provided funding through the **LCN Fund,** will be trialling monitoring and verification techniques and technologies.

Clarifying interactions between industry parties

3.35. In relation to the final key challenge identified under this precondition which relates to cross party impacts, the following work is being progressed:

- **Smart Grids Forum.** In the next phase of work, Workstream 6 proposes to investigate the options for how consumers can engage with a smart grid in order to manage their usage and avoid or reduce network reinforcement. For each option, the group proposes to assess how roles and relationships between industry parties may need to change.

  Related to this work, DNOs and the TO are already examining potential synergies and conflicts when using demand-side response.[41] The scope of work for Workstream 6 in FY2013/14 includes examining the commercial arrangements required to support smart grid options, including the high-level information flows between parties.

  The Smart Grids Forum has also supported the development of a proposal to form a working group examining future system operation issues, including how to accommodate new and more complex interfaces with suppliers, aggregators and customers.

[39] *Open letter requesting comments on review of future trading arrangements*, Ofgem, 18 February 2013
[40] *Electricity System Operator Incentives: consultation on a scheme for 2013*, Ofgem 6 March 2013
[41] This group is called the Demand-Side Response Networks Forum. Information about the group is available through Work Stream 6 of the Smart Grids Forum.

Consultation questions

Question 1: Are there any additional key challenges associated with revealing the value of demand-side response across the system? If so, please identify and explain these challenges.

Question 2: Can current regulatory and commercial arrangements provide the means to secure demand-side response being delivered? If not, what will regulatory and commercial arrangements need to deliver in future?

Question 3: Is current work on improving clarity around interactions between industry parties sufficient? If not, what further work is needed to provide this clarity?

Precondition 2: The value of demand-side response services needs to be effectively signalled to customers

3.36. Effective markets rely on customers exerting competitive pressure on their suppliers by making well-informed decisions about how much and when to consume based on accurate information about all the costs of consumption.[42] For the value of demand-side response to be fully realised, the electricity price that customers face would need to signal the overall cost of generating and delivering the electricity they consume at that time and location.[43]

3.37. Under precondition 1 we considered what needs to happen to ensure that industry parties see the overall cost. The question is then whether they can and do pass those signals on to consumers. Today many customers' prices are averaged across time, reflecting current metering arrangements, and also between locations, making the market simpler. Most customer electricity prices remain constant over the course of the day and between seasons.[44] On the other hand, the system-wide costs of generating and delivering electricity to the user change considerably through time. For example, generating energy at peak times in the winter is, on average, significantly more expensive than generating electricity at night time in the summer. Similarly, the costs of delivering energy through electricity networks can depend on the level of investment needed at each location to provide enough capacity.

3.38. Customers can only adapt their electricity consumption decisions if they get effective signals about the changing cost of this consumption, whether in the form of prices or through providing control over their load, for example.

3.39. In assessing the extent to which current pricing arrangements provide signals that are tightly targeted on the times and locations where demand-side response can add most value, there are a range of dimensions that need to be considered. These include the granularity of the time bands, whether they are static or dynamic, whether they can accommodate locational variations and whether they are direct or rely on suppliers to pass them through.

[42] *Assessing the effectiveness of potential remedies in consumer markets*, OFT, April 2008
[43] This is an example of an economic problem commonly known as an externality.
[44] Consumer Focus estimate that 19.5% of domestic customers are on a Time of use tariff. *Consumer Experiences of Time of Use tariffs*, Ipsos Mori for Consumer Focus, 2012

3.40. The more accurate the targeting, the more sophisticated any signals would need to be. There are obvious trade-offs to be considered in terms of ensuring that consumers can cope with that sophistication. In the current market the more targeted signals are typically offered to larger non-domestic customers who are better able to deal with these signals. We consider this issue further below.

3.41. Table 4 summarises how each route to market transmits value to the customer. It also gives an indicative assessment of the suitability of each for transmitting the required signal; its ability to create a response when demand-side response is most valuable to a party.

Table 4: Providing a signal

Party	Route to market	What is the signal?	How suitable is the signal?
System Operator (SO)	Contracted balancing services - including Short Term Operating Reserve (STOR), Fast Reserve and Frequency Response services.	Dispatch signal to contracted service provider or automated response.	Dispatch approach allows utilisation to be well targeted to periods in which the marginal value is highest to the SO.
Transmission Operator (TO)	Triad charges - the component of Transmission Use of System (TNUoS) charges that reflect consumption at the three half-hourly periods in the winter that reflect system peak.	Ex-post charges included within a supplier's TNUoS charges which they may pass on to half-hourly metered customers.	Targets time when demand-side response has highest value to the TO. However, may not maximise potential response as reliant on suppliers passing on the ex-post signal and customers/third parties forecasting capability.
Distribution Network Operator (DNO)	Distribution charging – some distribution use of system (DUoS) charges incorporate a time-of-use element.	Suppliers can choose to pass though the time-of-use element to half-hourly metered customers.	Low granularity of time bands is unlikely to effectively target response at times when demand-side response value to DNO is highest. Also reliant on supplier to pass through the signal to customers.
	Bilateral arrangements – DNOs can contract for the provision of demand-side response through bespoke arrangements with larger half-hourly metered customers.	Dependent on individual bilateral arrangements between the customer and DNO.	Utilisation can be restricted to the times and locations when and where DNOs value demand-side response the most.
	Radio Teleswitching - some DNOs control the switching signal for certain RTS regimes.[45]	Switching instructions broadcast to RTS meters via data encoded on 198 kHz Radio 4 longwave.	Provides DNO with targeted flexibility to manage local network constraints for some groups of meters.
Supplier	Time-of-use (ToU) Tariffs – a range of static and dynamic tariffs that could be combined with direct load control.[46]	Static tariff structures communicated via contracts. Dynamic tariffs reliant on smart meters or other communications for communicating prices. Can include direct load control or switching eg Economy 7 and Radio Teleswitching.[47]	Static tariffs have low granularity unlikely to target all the periods in which demand-side response has the most value for suppliers, particularly where this value derives from unexpected circumstances leading to high imbalance charges. Dynamic tariffs, potentially combined with direct load control or other automation, could allow suppliers to unlock more of the value of demand-side response.

[45] *Dynamic Switching Roadmap*, Elexon, August 2012
[46] Tariffs where prices and time periods are pre-defined are referred to as static. Tariffs where prices reflect actual market prices and are not set in advance are referred to as dynamic.
[47] Note that both suppliers and DNOs use Radio Teleswitching for specific regimes.

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Key challenges

3.42. Current arrangements have some characteristics that limit their suitability for transmitting appropriate signals about demand-side response. Overall, these factors dampen signals to customers about the changing value of their consumption at different times and from the potential value of their demand-side response. The key challenges that need to be addressed and which are considered further below are:

- Improving signals to customers
- Clarifying cross-party impacts
- Customer protection with more cost-reflective charges

Improving signals to customers

3.43. Some routes to market are currently more effective at signalling value to customers than others (summarised in Table 4). We summarise more detail of those available to each industry party below.

3.44. The range of services at the SO's disposal and the ability to call (or dispatch a signal for) demand-side response means that the SO can choose to use demand-side response when it values it the most and when it can provide services at a competitive cost. The SO balances the system within operational constraints, requiring it to take some location-specific actions. As a result, the SO may not always call on contracts in merit order. Parties providing balancing services to the SO may be rewarded for the locational value of those services. However, as the SO often uses bilateral contracts to procure many of its balancing services,[48] customers may find it difficult to understand the temporal and locational value of their demand-side response to the SO.

3.45. TNUoS charges do send a signal to customers about the value of flexibility at periods of high system demand. Customers can therefore lower their TNUoS charges by reducing consumption during the relevant 'peak' demand periods. However, the methodology suffers from some drawbacks that limit how well these periods of higher value of flexibility can be signalled. For example, Triad periods can only be identified ex-post, once maximum daily system demand is known for each day between November and February. As there is no signal indicating the time of system peak, customers can try to predict when these Triad periods will be to lower their costs.[49] This potentially reduces their ability to target their response to periods in which it is most valuable to the Transmission Operator.

3.46. The distribution companies do provide time-of-use signals via unit rates for different time bands, both to large customers via that EDCM and to CDCM customers that have half hourly metering. The time bands are calculated using historical data and fixed in advanced of each charging year. The time-of-use signal reflects network companies' longer-term costs associated with peak demand; being based on estimated costs of future reinforcement at peak time. However, the CDCM is not

[48] Please see National Grid's website for more information on the procurement process for the various balancing services.
[49] Or contract with another party to predict triad periods for them; a service offered by many companies.

currently set up to provide more dynamic forms of signal about the value of demand-side response. Doing so would require significant additional resource to adapt the methodology.

3.47. The EDCM provides site-specific charging, recognising that costs vary on a local scale within a DNO's network (not just at the regional level between different DNOs' networks). However, this is an intensive exercise, and it has not yet been practical to apply it to a wider range of customers. The CDCM does not provide site-specific charges, because it is calculated using data averaged across a DNO's network.

3.48. However, we note that DNOs can enter into bespoke bilateral contacts (eg interruptible contracts) with customers (including some CDCM customers). A DNO could target these contracts so as to get time-of-use and locational responses that will bring the most benefit, potentially allowing for more nuanced locational signals about the value of demand-side response.

3.49. In the case of supplier ToU tariffs, the low granularity of static ToU tariffs is unlikely to target demand-side response at times/locations when the value of demand-side response to the supplier is at its highest. More dynamic tariffs combined with a significant degree of automation or direct load control could offer the greatest flexibility to suppliers to target the use of demand-side response when it is of most value.

3.50. Improving signals to customers can happen through adaptation of current regulatory and commercial arrangements or by creating new ones. This is important to unlock incentives that will help realise potential even in relation to existing arrangements. The rollout of smart meters provides one solution to help overcome some of the barriers of communicating a clear signal to customers through either displaying signalling information on the in-home-display or through direct-load control capability.

Clarifying cross-party impacts

3.51. The issue of cross-party impacts is discussed under precondition 1 in terms of the rights of different parties and the need for clarity. In addition, for customers to receive the right signals about the value of any demand-side response they can provide, these cross-party impacts need to be incorporated. Customers' decisions can then take into account all the (positive and negative) impacts of providing demand-side response, across all parties in the supply chain. Until this happens there remains a problem that could lead to customers' consumption not reflecting its associated costs across the supply chain.

3.52. The indirect nature of many routes to market for demand-side response also means parties across the supply chain are often reliant on others to pass on signals to customers. For example, both the EDCM and CDCM rely on suppliers to pass through the differential price in different time bands to their customers. Without suppliers' cooperation, customers do not see different unit rates and cannot get the savings on offer from networks for shifting their consumption off peak.

3.53. Accommodating these impacts could, however, introduce more sophistication and complexity into contractual arrangements. We consider this point further later.

Customer protection with more cost-reflective charges

3.54. Prices charged to both domestic and non-domestic customers tend to be averaged across time and are largely averaged across different locations. These customer prices in part reflect prices being averaged further up the supply chain. This averaging of prices shields customers (particularly domestic customers) from the full extent of changing costs across the system.

3.55. Any move to more variable tariffs or any form of interruptible supply could increase the volatility of customers' bills and could create winners and losers, according to the profile of customers' consumption. Ofgem has a duty to protect all customers and we may need to review whether additional customer protections would be needed if such market developments materialise. For example, the potential for more variable tariffs or interruptible supply raises questions around the appropriate level of customer protection needed, in particular for vulnerable customers. These impacts would need to be well understood before any changes are made. Smarter Markets work on Consumer Empowerment and Protection will help to improve our understanding of these potential impacts.

Relevant work

3.56. This section summarises the relevant work underway within Ofgem and elsewhere that is addressing or furthering the thinking behind the issues and challenges identified under precondition 2.

Improving signals to customers

3.57. The challenge of improving signals to highlight to customers the true value of their demand-side response for the various routes to market is being progressed by a range of work, including:

- **Industry-led incremental change.** Through trials and incremental change industry parties are able to refine the signalling process in order to communicate effectively with customers for their respective routes to market.
- In our recent **RIIO-ED1 strategy decision** we outlined interim measures regarding the recovery of costs due to load and generation increases from existing domestic and small business (profile class 3 and 4) customers.[50] Ideally, DNOs would recover the costs from those customers who impose them. However, since this is currently not practicable we have decided that until DNOs have a means to accurately identify the customers who trigger cost, they will continue to recover the costs of any reinforcement caused by load or generation growth by existing domestic and small business customers through DUoS charges. This, in the interim, will limit the upfront incentive on customers to enter into a bilateral demand-side response arrangement with a DNO in order to accommodate new appliances without triggering costs. However, these customers could still provide demand-side response once

[50] *Strategy decision for the RIIO-ED1 electricity distribution price control: Outputs, incentives and innovation*, Ofgem, 4 March 2013

their appliance has been connected in return for payment. This could be to a DNO or other industry party.

Through the smart grids forum, we are also commencing a piece of work to understand how DNOs can engage with domestic and small business customers, once smart metering data is available, to help encourage them to manage their demand and help to avoid network reinforcement. This goes to the heart of what form a future smart grid should take and how it needs to interact with customers.

- **Government's Smart Metering Implementation Programme,** DECC is implementing the new regulatory and commercial framework for smart metering. Smart meters will be required to adhere to a standard specification, the second version of which is currently being developed by DECC. The design of smart meters and the end-to-end communication architecture and the associated regulatory and commercial framework will have implications for the extent to which demand-side response can be facilitated. For example, the rollout will widen the range of customers who can have half-hourly tariff bands (rather than the broader bands which Economy 7 and other similar meters can deliver today).

Customer protection with more cost-reflective charges

3.58. The following work is underway which looks at the issue of consumer implications:

- As part of **Ofgem's Smarter Markets Work Programme** we have set up a project examining Consumer Empowerment and Protection issues arising from smart metering and subsequent market development. We seek to realise our longer-term objective to have in place regulatory arrangements that empower and protect consumers, allowing them to participate effectively in smarter retail energy markets. This project will explore whether existing regulatory arrangements that influence how consumers engage with suppliers and the retail market are fit for purpose in the transition to smart metering. This will include distributional analysis of the potential impact of time-of-use tariffs on different types of customers.

Consultation questions

Question 4: Are there any additional key challenges associated with effectively signalling the value of demand-side response to consumers? If so, please identify and explain these challenges.

Question 5: Do you agree that signals to customers need to improve in order for customers to realise the full value of demand-side response? Does improving these signals require incremental adaptation of current arrangements, or a new set of arrangements?

Question 6: To what extent can current or new arrangements better accommodate cross-party impacts resulting from the use of demand-side response?

Precondition 3: Customers need to be aware of and able to access the opportunities

3.59. Ofgem's Retail Market Review has highlighted problems with the extent to which customers are currently engaged in the energy market. Creating the level of engagement needed for demand-side response creates further challenges and the steps being taken through the Retail Market Review are important in starting to build greater trust and confidence in the market. We remain committed to monitoring how well the market serves consumers. In particular, if our new rules are implemented, we review the package no later than 2017 and may well examine specific issues earlier as new information emerges, including through our Smarter Markets Work Programmer.

3.60. More specifically, previous work carried out by Ofgem on demand-side response highlighted that customers currently have a very low understanding of the nature of energy.[51] The research revealed that most domestic consumers are not aware that the wholesale price of electricity varies within the day according to demand and the amount of supply available to meet it.

3.61. Customers need electricity for other activities, rather than consuming it for its own sake. These activities are as wide ranging as customers themselves, from small (domestic) households to large industrial businesses. Moreover, even customers of the same size might be using electricity for vastly different reasons and so need electricity at very different times. For example, contrast a domestic home which consumes very little electricity in the daytime, with a small commercial premise that consumes most electricity during daytime opening hours.

3.62. In addition, different types of business will have different equipment and uses of energy which will affect how much flexibility they have to vary their consumption. Finally, cultural and behavioural factors can mean that customers with the same potential to provide demand-side response might provide very different responses to the same signal, depending on their level of engagement and other factors such as the value they place on continuity of supply.

3.63. For a range of reasons, therefore, customers' ability and willingness to shift their consumption to provide demand-side response will vary considerably within and between different customer groups, and may depend on the nature of the signals and level of incentive offered.

3.64. A number of studies have attempted to quantify demand-side response potential, including:

- The DECC/DEFRA/Energy Saving Trust (EST) household electricity survey provides up-to-date data about domestic patterns of consumption that can act as a starting point for estimates of domestic potential.
- Sustainability First's GB Electricity Demand Project has published a range of valuable research and analysis papers, including an analysis of the technical

[51] *Demand-side response: A discussion paper*, Ofgem, July 2010

potential and willingness of household customers to provide electricity demand reduction and demand flexibility.[52]

- Ofgem's 2010 demand-side response discussion paper considered domestic load shifting opportunities.[53]
- Ofgem also commissioned a report on demand-side response in the non-domestic sector, providing quantitative estimates of demand-side response potential, predominantly for commercial customers.[54]

3.65. Despite this it remains difficult to form a definitive picture of current market potential because of the multitude of uncertain factors on which the potential for demand-side response depends.

Consumer offerings in today's market

3.66. Table 5 outlines our initial assessment of how easily customers could access and engage with offerings available today to customers that are metered half-hourly. As smart metering is rolled out, more customers are likely to gain the ability to participate in routes to market that require half-hourly metering. However, it appears that many of the routes to market available to customers today could be less straightforward to engage with compared to an energy supply contract.

3.67. Few offerings are available for customers without half-hourly metering, although customers with Economy 7 or 10 meters can access some static time-of-use tariffs, while customers with Radio Teleswitch meters can provide a form of direct load control[55].

[52] *Paper 3 - What demand side services could customers offer - Industry Electricity Demand*, Sustainability First, September 2012
[53] *Demand-side response: A discussion paper*, Ofgem, July 2010
[54] *Demand side response in the non domestic sector*, Element Energy for Ofgem, July 2012
[55] However it is not clear whether customers can choose who controls their load (their supplier or their DNO).

Table 5: Ease of customer access to and engagement with routes to market

Party	Route to market	How can a customer access the route to market?	How easily can customers engage?
System Operator (SO)	Contracted balancing services	Can participate directly if able to meet technical eligibility requirements or via an aggregator.	Customers can either participate directly or via a third party such as an aggregator, which are crucial for those customers who cannot meet the minimum technical requirements alone.[56] Often requires exclusivity.[57] Understanding the penalties for non-delivery, different types of service (eg firm or flexible) and bilateral tender process is challenging. Comparing returns with other routes to market challenging.
Transmission Operator (TO)	Triad charges	Reliant on charges being made visible by the supplier. Triad warning service provided by some suppliers and aggregators.	Ex-post nature of reward makes it difficult for customers to compare with participation in other routes to market.
Distribution Network Operator (DNO)	Distribution charging	Reliant on use of system time bands being passed through by the supplier.	Easy to engage with this route to market as charges are clearly structured.
	Bilateral arrangements – (eg non-firm connection agreements).	Bespoke contracts with DNO. While bespoke bilateral arrangements between DNOs and non-domestic customers do exist, this route to market is not currently widely available beyond industry trials, although could become far more common in the near future.	Dependent on individual agreements whether customers can assess and understand the full implications of any new connection arrangements, including whether they affect customers' ability to provide demand-side response to others.
Supplier	Time of use Tariffs	Some suppliers provide HH customers access to ToU tariffs via tailored supply contracts.	Varying amounts of influence over tariff structure to suit needs at supply contract negotiation stage.

[56] *Turn down your profit, turn up your profit*, National Grid, 2008
[57] For most arrangements, National Grid requires customers not to provide any service from the contracted site that impairs their ability to provide the balancing service.

Key challenges

3.68. Following the approach adopted in the Retail Market Review, it may be helpful to think of the challenges in relation to consumer engagement in terms of the steps that the consumer needs to go through:

- They need to be **aware** of the opportunities presented by demand-side response
- They need to be able to **access** and **assess** the different options available – either themselves or through a third party intermediary
- They need to be able to **act** to take up a particular option and modify their usage to secure savings – either themselves or through some form of automation.

Raising awareness of the demand-side response opportunity

3.69. Previous Ofgem consumer research has highlighted that consumers have a very limited understanding of the nature of the energy system and hence why demand-side response is of value.[58] The rollout of smart metering is expected to help make consumers more engaged with their energy use by, for example, showing how much energy is used at different times of day. Building energy literacy in this way will help in laying the ground for companies looking to bring forward demand-side response propositions.

3.70. There will be segments of the market that are quicker to pick up on the opportunities. Larger industrial and commercial customers are more likely to have dedicated energy managers who will be more aware of the opportunities. Among domestic and smaller non-domestic customers, those who have the greatest potential in terms of demand-side response (in particular those with electric vehicles or heat pumps) may be more informed customers. However, there will be a significant challenge to ensure that the full range of customers is aware of the opportunities and view them positively.

3.71. However implemented, demand-side response products and the idea of being flexible with their electricity use will be new to most customers. Industry will therefore need to inform, educate and persuade customers of the benefits of these products for them to become mainstream.

Accessing and assessing the options

3.72. It is inevitable that demand-side response products will be more sophisticated than a standard supply contract; ranging from agreeing variable prices to giving up control over consumption to caps on maximum demand at particular times.

3.73. Customers need suitable product and service offerings if they are to participate in providing demand-side response. Furthermore, each customer might need a different product or combination of products to get the most out of the

[58] *Demand-side response: A discussion paper*, Ofgem, July 2010

demand-side response they can provide. On top of this, additional sophistication is added if multiple parties in the supply chain are to be able to offer customers some benefit for providing demand-side response. This reinforces our initial view that, as the market develops, many customers are likely to need their supplier or a third party to simplify engagement with this market in order to participate effectively.

3.74. Engaging with these products could therefore be more difficult, particularly for smaller customers. Research for the Commission for Energy Regulation (CER) in Ireland found that consumers would be less likely to accept the more dynamic tariffs given the challenges in interpreting them.[59] Even larger customers, some of which have a greater capacity to engage with demand-side response offerings, still find information and the complexity of the market a significant barrier to providing demand-side response.[60] For example, it can be difficult to compare returns and contractual terms, such as exclusivity and penalties for not delivering, between different offerings.

3.75. Effective consumer engagement requires that consumers can access and process the required information about their available choices, empowering them to make decisions which are in their interests.[61] Simpler demand-side response products may help consumers to engage, but could offer less scope for customers to provide value across the supply chain.[62] This challenge will need to be addressed if customers are to realise the full potential benefits of providing demand-side response.

3.76. In the market today third party intermediaries provide a vital service helping customers to understand the implications of taking up offerings for demand-side response. Many of these customers might struggle to access demand-side response offerings without such services.

3.77. Some TPIs, such as aggregators, act as customer agents that can help larger customers to navigate the market.[63] While they offer a range of service types, most tend to simplify the market opportunities that are on offer to customers, to help them understand what they can provide. Often aggregators' business models depend on expertise to assess what customers can provide and a detailed knowledge of the market which they can sell customers' capabilities into. Currently they typically only offer their services to larger customers, because they offer greater economies of scale and scope. While decreasing technological costs and barriers to participating in demand-side response could help them to offer services to smaller customers than today, it is unclear if they will ever extend their reach to domestic customers.

3.78. Other TPIs already help smaller customers to navigate the market but have different business models to aggregators, for example by operating on commission from suppliers or generating revenues from advertising. These services could hold

[59] *Demand Side Response in the domestic sector- a literature review of major trials*, Frontier economics and Sustainability first for DECC, August 2012
[60] *Demand side response in the non-domestic sector*, Element energy on behalf of Ofgem, July 2012
[61] *What does Behavioural Economics mean for Competition Policy?*, Office of Fair Trading, March 2010
[62] For example, *Time-of-use tariffs mandate, A report to the Commission for Energy Regulation*, Pöyry, December 2012.
[63] *Paper 3- What demand side services could customers offer? Industry Electricity Demand*, Sustainability First, September 2012

more promise for helping domestic customers to engage in more sophisticated products. The smart metering programme includes arrangements for third parties to access a customer's data with their consent which should facilitate the development of this market.

3.79. The full range of customers are all reliant to some degree on suppliers or TPIs to:

- signpost potential opportunities
- provide information on terms and conditions
- assist in comparing returns
- help them to participate where they do not have the capability to do so on their own (for example if participation requirements exclude smaller customers).

3.80. While TPIs are currently unregulated, there are questions about what more needs to be done to make this market effective. These include where there are barriers to intermediaries playing a full role but also whether any regulation is needed to give consumers confidence in dealing with these parties. Some of these issues were highlighted by the recent Retail Market Review which looked at the role of TPIs in the current retail market.

Acting to provide demand-side response

3.81. Having chosen to sign up to some form of demand-side response the consumer then needs to deliver the changes in consumption when required. Automation could help customers to do so. For example, a timer function on an appliance would remove the need for a time-critical active response from a customer, provided they were given enough warning. Customers may not need to actively respond at all if they agree to a greater degree of automation, such as direct-load control.

3.82. Automation also introduces new challenges for customers themselves and for industry. Customers might be reluctant to make up-front investments that could take years to pay off. Larger customers and their agents already face this challenge but, in the medium term, funding issues could restrict the expansion of demand-side response to smaller customers, for whom these challenges might be even more important. Similar challenges are already evident regarding demand reduction. Lack of access to capital and information were identified as key barriers to the take up of energy-efficiency measures by domestic customers and formed part of the rationale for the introduction of the Government's Green Deal initiative.[64]

Relevant work

3.83. This section summarises the relevant work underway within Ofgem and elsewhere that is addressing or furthering the thinking behind the issues and challenges identified under precondition three.

[64] *Final Stage Impact Assessment for the Green Deal and Energy Company Obligation*, DECC, June 2012

Awareness of the demand-side response opportunity

3.84. The following provides examples of work which is relevant to raising awareness of demand-side response opportunities among customers:

- The Government has recognised that many of the wider benefits of smart meters can only be realised if customers are effectively engaged. **DECC's Consumer Engagement Strategy** describes their view of effective engagement with smart metering and how it will be delivered across domestic and non-domestic consumers.[65] This includes an obligation on suppliers to set up and fund a central delivery body to assist with consumer engagement. While the initial focus will be on building awareness and support for the basic smart meter functionality, this body could potentially in future play a role in helping build awareness of demand-side response opportunities.
- **Ofgem's Retail Market Review** is implementing a range of policies seeking to make the retail market simpler, fairer and clearer. In doing so, these policies aim to help customers to better engage with the energy market as a whole. However, remedies are focussed on the supply market and the market for third party intermediaries, rather than specifically on demand-side response.

Accessing and assessing the options

3.85. The following provides examples of work which is relevant to the challenge of helping customers to access and assess their options for providing demand-side response:

- **Ofgem's TPIs project** – Our overall aim for improving consumer engagement in the energy market will be supported by improving consumer access to and confidence in intermediaries that help consumers to engage in the energy supply market. By the end of June we will publish an issues paper on the regulatory framework around TPIs and their activities. This will help us to assess whether the current regulatory framework remains fit for purpose given the various and evolving roles and TPI activities.
- Consumer Empowerment and Protection project within **Ofgem's Smarter Markets Programme** - One of the project's aims is to identify when the issues we describe above will begin to have a material effect on customers' engagement with the retail energy market and the market for demand-side response products.

Acting to provide demand-side response

3.86. In relation to the final challenge under precondition 3; ensuring that customers are able to act and deliver demand-side response, the following work is relevant:

[65] *Smart Metering implementation Programme Government Response to the Consultation on the Consumer Engagement Strategy*, DECC, December 2012.

- Some of these trials within the **LCN Fund** are looking specifically at how customers currently and could in the future engage with new technology and arrangements. Appendix 2 lists all the projects that have been granted LCN funding that are exploring the use of demand-side response within the smart grid. These projects are providing valuable evidence on all aspects of consumer engagement.

Consultation questions

Question 7: Are there any additional key challenges associated with customer awareness and access to opportunities around demand-side response? If so please identify and explain these challenges.

Question 8: Is any additional work needed to explore the role of third parties in helping customers to access and assess demand-side response offerings?

4. Conclusion and next steps

4.1. We have highlighted a range of key challenges that will need to be addressed in order to achieve our longer-term objective of creating the right environment for demand-side response. Our initial view is that there are several areas where the preconditions for meeting our longer-term objective are not met and that some inherent characteristics of current arrangements are therefore likely to hold back development of demand-side response.

4.2. In the shorter-term, incremental change to current arrangements offers some scope to improve industry incentives to use demand-side response. Indeed, Ofgem is already exploring some such changes and we would welcome action by industry to address specific barriers to market development. However, it is not clear an incremental adaptation of current arrangements would be sufficient in the longer term. More significant reforms might therefore be needed in due course to meet these three essential preconditions.

4.3. We have identified three challenges that will need to be addressed as a matter of priority. These challenges could dictate the pace of market development, whereas the other challenges we identify will generally materialise once further market development takes place. They focus on improving incentives for industry parties to use demand-side response and on ensuring that regulatory and commercial arrangements complement these incentives to deliver the required investment:

- Revealing the value of demand-side response across the system. The right incentives for parties across the supply chain to use demand-side response can encourage them to use it when it is cost-effective to do so, even today. Ofgem is already taking steps to improve incentives for demand-side response, including with our EBSCR and Smarter Markets work on settlement reform.
- Making demand-side response more secure, so that industry parties can be confident they can recoup investment needed to deliver demand-side response. We have identified constraints in current arrangements, suggesting that further work needs to done to examine how these investments can be supported. For example, further work could explore whether monitoring and verification arrangements can make revenue streams from demand-side response more secure – improving its investment potential.
- Improving signals to customers. Customers will not provide demand-side response unless signals communicate its value to them. Current arrangements to not appear to transmit these signals effectively. Further work is therefore needed, to explore what new routes to market might look like. We welcome work in Workstream 6 of the Smart Grids Forum and through the LCN Fund that is beginning to do so.

4.4. Table 6 summarises the key challenges that we have identified across the three preconditions in chapter 3, together with an initial view of how urgently each of these challenges will need to be addressed.

Table 6: Challenges and priorities for market development by precondition

Challenge	Priority for market development
Precondition 1: Industry parties need to be confident that there is value for them in demand-side response to justify the investment	
Revealing the value in the system	High. Important to unlock incentives that will help realise potential even today. Work is underway to improve industry incentives for demand-side response and to examine now hew regulatory and commercial arrangements can help facilitate smart grids, which can help to stimulate more demand-side response where it is cost-effective.
Making demand-side response securable	High. Important to provide industry parties with sufficient certainty that demand-side response can be a reliable alternative to generation and network investment. Industry parties are already addressing this issue through research and trials exploring
Clarifying interactions between industry parties	Moderate. Important, but not urgent until cross-supply chain impacts are more material and there are better incentives across the supply chain to use demand-side response. Some work underway to explore instances of interactions.
Precondition 2: The value of demand-side response services needs to be effectively signalled to customers	
Improving signals to customers	High. Important to unlock incentives that will help realise greater potential even within existing arrangements. Better incentives to use demand-side response will stimulate industry parties to improve signals to customers.
Clarifying cross-party impacts	Moderate. Important, but medium term as demand-side response becomes more material and incentives improved. Industry will have greater incentives to address these impacts if incentives are improved and volumes increase.
Customer protection with more cost-reflective charges	Moderate. Important but longer term. Customers could have a wide range of demand-side response products available to them. Many of these products could create winners and losers, or allow customers to choose different levels of service. This could raise questions over the acceptability of a potentially wider range of customer outcomes in the market.
Precondition 3: Customers need to be aware of the opportunities to provide demand-side response, able to readily to access information on options and able to act.	
Awareness of the demand-side response opportunity	Moderate. Important but longer term. This will be a challenge for industry to address as incentives to use demand-side response improve. Parties will need to inform, educate and persuade customers of the benefits of these products for them to become mainstream.
Accessing and assessing the options	Moderate. Important but longer term. A market to help customers access and assess options already exists. This can play a key role in helping customers to engage. More sophisticated tariffs and offerings for smaller customers will take time to develop. When they do, arrangements will need to support advice for smaller customers.
Acting to provide demand-side response	Moderate. Important but longer term. Customers can act themselves to change the level of their consumption, or they can choose some form of automation to help them realise the benefits of providing demand-side

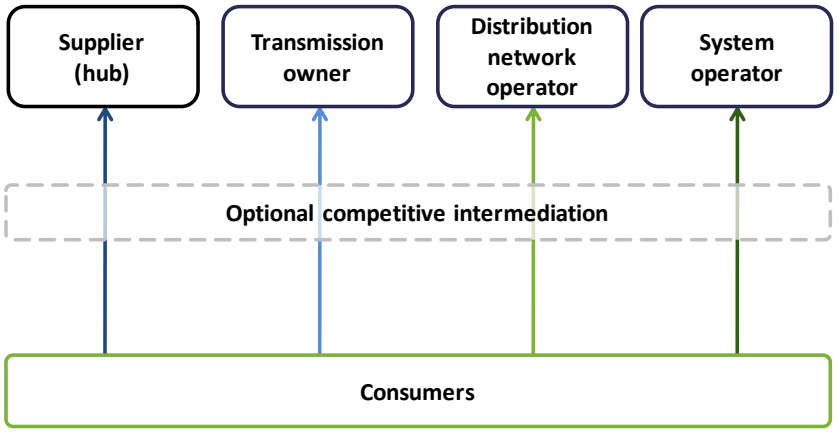
	response. Few customers are currently offered automated services that are externally controlled.[66]

4.5. Given the potentially significant nature of reforms, we wish to gather views from a wide range of stakeholders on the key challenges and timescales for addressing them before taking any further steps on what these reforms might look like.

4.6. To inform views we outline below two potential future models for transacting around demand-side response. These indicative examples give a flavour of what reform to current arrangements would entail and how it could influence the structure of the market around demand-side response and the nature of customer interactions that each would require.

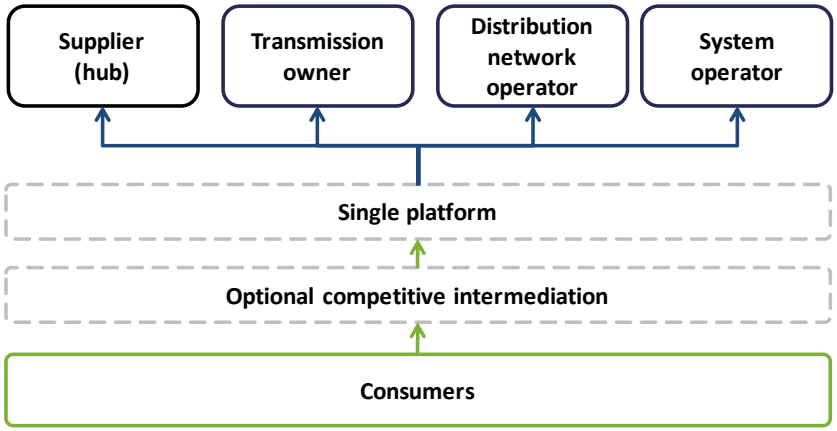
4.7. In the first, customers contract directly with parties across the supply chain (Figure 3). In the second, a platform provides a single counterparty for customer transactions around demand-side response (Figure 4). Intermediation could help customers to navigate the market in each case, as it does in today's market.

Figure 3: Direct customer relationships across the supply chain



[66] Excepting those who have Dynamically Teleswitched heating controls.

Figure 4: A single point of customer contracting across the supply chain



4.8. There are of course a range of other models and variations to be considered, including for different customer segments. We have included these illustrations to stimulate debate and better inform how work on future arrangements should be taken forward, not to determine whether the high-level arrangements outlined here should be developed.

4.9. Some work has already begun to progress thinking in this area. For example, Workstream 6 of the Smart Grids Forum will examine potential future models for DNOs to engage customers with smart grids, along with options for commercial and regulatory arrangements, aiming to maximise the value of smart grid solutions across the value chain. This consultation will feed into this work and inform any wider work that may be required.

Consultation questions

Question 9: Are there additional preconditions for delivering the right environment for demand-side response? If so, please explain what these are and why they are important, as well as attaching a priority relative to those challenges we have already identified.

Question 10: Do you agree with the priority and timing we have attached to addressing each of the key challenges identified above?

Next steps

4.10. This consultation is designed to identify the key challenges that regulatory and commercial arrangements will need to overcome, to support efficient use of demand-side response across the supply chain. This will help us to identify any gaps in current work across Ofgem, industry and government. We welcome your views on the initial conclusions we have drawn in this consultation.

4.11. Ofgem is already examining incremental changes to regulatory arrangements that could help to incentivise industry parties to use demand-side response. Nonetheless, we welcome work by industry to further explore the development of regulatory or commercial arrangements for demand-side response, to address the

challenges we have identified. We therefore also want to hear your views on the role Ofgem could usefully play in overseeing or coordinating any such development, monitoring this develop against our longer-term objective or delivering non-incremental reforms to regulatory arrangements.

4.12. We will publish our response to your views in Autumn 2013. We may conclude that there is no need, or it is not the right time, for Ofgem to initiate further work in this area. Alternatively, we may identify clear opportunities for Ofgem to explore additional changes to regulatory arrangements over and above what is already being done, or to support industry development of new commercial arrangements. If future work leads to specific policy proposals, we would subsequently consult on the nature of any proposed reforms as well as when and how best to implement them to ultimately meet our longer term objective for demand-side response.

4.13. As our work moves forward we are committed to continuing and extending our engagement with stakeholders. We will be presenting our work to various industry groups (eg Smart Grids Forum and the Smart Demand Forum). At each of these fora we wish to stimulate debate and encourage responses to this consultation. We will also consider whether a bespoke event would be helpful for advancing the debate.

4.14. If you have an event or forum at which your colleagues and stakeholders could usefully hear about our work, please contact us at smartermarkets@ofgem.gov.uk. We want to hear from the widest possible range of stakeholders.

Appendices

Index

Appendix 1 - Consultation Response and Questions

1.1. We would like to hear the views of interested parties in relation to any of the issues set out in this document. We would especially welcome responses to the specific questions which we have set out at within the document and which are replicated below.

1.2. Responses should be received by Friday 28 June 2013 and should be sent to:

Smartermarkets@ofgem.gov.uk
Smarter Markets
Ofgem, 9 Millbank, SW1P 3GE

1.3. Unless marked confidential, all responses will be published by placing them in Ofgem's library and on its website www.ofgem.gov.uk. Respondents may request that their response is kept confidential. Ofgem shall respect this request, subject to any obligations to disclose information, for example, under the Freedom of Information Act 2000 or the Environmental Information Regulations 2004.

1.4. Respondents who wish to have their responses remain confidential should clearly mark the document/s to that effect and include the reasons for confidentiality. It would be helpful if responses could be submitted both electronically and in writing. Respondents are asked to put any confidential material in the appendices to their responses.

1.5. Any questions on this document should, in the first instance, be directed to:

Ben Smithers
Energy Market Monitoring and Analysis
Ofgem
9 Millbank
SW1P 3GE

Precondition 1

Question 1: Are there any additional key challenges associated with revealing the value of demand-side response across the system? If so, please identify and explain these challenges.

Question 2: Can current regulatory and commercial arrangements provide the means to secure demand-side response being delivered? If not, what will regulatory and commercial arrangements need to deliver in future?

Question 3: Is current work on improving clarity around interactions between industry parties sufficient? If not, what further work is needed to provide this clarity?

Precondition 2

Question 4: Are there any additional key challenges associated with effectively signalling the value of demand-side response to consumers? If so, please identify and explain these challenges.

Question 5: Do you agree that signals to customers need to improve in order for customers to realise the full value of demand-side response? Does improving these signals require incremental adaptation of current arrangements, or a new set of arrangements?

Question 6: To what extent can current or new arrangements better accommodate cross-party impacts resulting from the use of demand-side response?

Precondition 3

Question 7: Are there any additional key challenges associated with customer awareness and access to opportunities around demand-side response? If so please identify and explain these challenges.

Question 8: Is any additional work needed to explore the role of third parties in helping customers to access and assess demand-side response offerings?

Conclusion

Question 9: Are there additional preconditions for delivering the right environment for demand-side response? If so, please explain what these are and why they are important, as well as attaching a priority relative to those challenges we have already identified.

Question 10: Do you agree with the priority and timing we have attached to addresing each of the key challenges identified above?

Appendix 2 - LCN Fund projects and demand-side response

1.1. The table below outlines the second tier LCN Fund projects that explore, among other things, how DNOs and their project partners can facilitate the take up of demand-side response for distribution network purposes. We will be monitoring the learning emerging from these projects and expect DNOs to outline how learning from LCN Fund projects has been embedded into their core business as part of their RIIO-ED1 business plans. More information on the learning from these projects is available on the Ofgem website.[67]

[67] http://www.ofgem.gov.uk/Networks/ElecDist/lcnf/stlcnp/Pages/stp.aspx

Table A2.1: LCN Fund projects that are considering demand-side response

Customer-Led Network Revolution	An integrated trial looking at how a combination of smart network technologies and flexible customer demand response can reduce the network costs associated with the mass take up of low carbon technologies. The project trials the impact of distribution use of system (DUoS) price signals on domestic and SME consumption through a number of innovative time of use, restricted hours and direct control tariffs, which are provided through suppliers. It also investigates the potential of industrial and commercial demand-side response to reduce network costs.
Low Carbon London	This project seeks to extract network learning from a variety of separate trials across the inner and outer London area. These include new commercial arrangements including time of use DUoS tariffs with domestic customers and demand response trials with industrial and commercial customers.
BRISTOL	This trials the use of in-home battery storage to provide benefits to customers and aid the DNO with network management. The customer will be provided with a variable tariff to encourage electricity use at times of high PV generation and to use electricity stored by the battery when the network is heavily loaded. The DNO will be able to communicate with the battery to charge and discharge it to help with network management.
Capacity to Customers	This will develop and trial demand response contracts which will reduce the consumption of contracted customers on the relevant circuits following system faults, allowing the DNO to get all customers back online as quickly as possible. New connections customers will also be offered the option to sign up to a managed contract for a reduced connection charge.
FALCON	FALCON will trial a range of technical and commercial methods, including commercial agreements with industrial and commercial customers who have the ability to control appreciable amounts of load in relatively short periods of time.
New Thames Valley Vision	This is a large project which is primarily focussed on developing a tool to help forecast where low carbon technologies might connect to the network. Amongst other things the project will investigate how automated demand response in commercial premises can provide network benefits.
Innovation Squared	This will trial automated control of electric vehicle charging, where a substation monitor will control "active sockets" in customer premises to ensure clusters of electric vehicles will not overload the network.
CLASS	This project aims to explore the relationship between voltage and demand. The project will seek to use existing network assets in an innovative way to vary the voltage on the network to alter the demand over a specific area. By reducing the voltage across the network, demand would be reduced. Reducing peak demand in this manner should make better use of existing network infrastructure, potentially avoiding or deferring network reinforcement.

Appendix 3 - Glossary

A

Aggregator

A third party intermediary specialising in coordinating or aggregating demand response from individual customers to better meet industry parties' technical requirements for specific routes to market.

B

Balancing Services

The SO supplements the Balancing Mechanism with forward contracts for a range of Balancing Services. The SO will enter into these agreements where it believes that it cannot source the service through the Balancing Mechanism, or it wished to reduce the costs of Balancing Mechanism actions by guaranteeing the available of certain units.

C

Capacity Market

A mechanism to provide security of electricity supply by incentivising sufficient capacity to be delivered when needed.

D

Demand-side response

Changes in energy use by consumers at particular times in response to a signal, such as a price.

Distribution Network Operator (DNO)

A DNO is a company which operates the electricity distribution network which includes all parts of the network from 132kV down to 230V in England and Wales. In Scotland 132kV is considered to be a part of transmission rather than distribution so their operation is not included in the DNOs' activities.

Distribution charging or Distribution Use of System (DUoS) Charging

The charges paid by electricity suppliers to network operators for the use of the electricity system. These charges are either socialised across customers or passed through directly to the customer depending on their size.

E

Electricity Market Reform (EMR)

The Government-led Electricity Market Reform Project aims to develop and deliver a new market framework that will ensure secure, low carbon and affordable electricity supplies.

Energy Imbalance

Energy imbalances are differences between the total level of demand and the total level of generation on the system within the half hour balancing period. The cash-out price aims to reflect the price of actions taken to solve energy imbalances, rather than those taken to solve system imbalances.

Energy Imbalance prices (or cash-out prices)

Energy imbalance prices are applied to parties for their imbalances in each half-hour period. System Buy Price (SBP) is charged for short contracted positions. System Sell Price (SSP) is paid for long contracted positions.

F

Fast Reserve

Fast Reserve is a balancing service that provides the rapid and reliable delivery of active power through an increased output from generation or a reduction in consumption from demand sources, following receipt of an electronic despatch instruction from the SO.

Frequency Response

Frequency Response is a type of balancing service procured by the SO to ensure that system frequency is maintained within the limits specified in the 'Electricity Supply Regulations', i.e. ±1% of nominal system frequency (50.00Hz) save in abnormal or exceptional circumstances. The SO controls System Frequency through three separate Balancing Services; Mandatory Frequency Response, Firm Frequency Response and Frequency Control by Demand Management.

G

Gate closure

The point in time by which all Contract Notifications and Final Physical Notifications must be submitted for each settlement period. Parties should not change their positions other than through instruction by the SO after gate closure. It is currently set at one before the start of the relevant settlement period.

L

Low Carbon Network (LCN) Fund

As part of the electricity distribution price control arrangements that run from 1 April 2010 to 31 March 2015, Ofgem established the Low Carbon Networks Fund. The Fund allows up to £500m support to projects sponsored by the DNOs to try out new technology, operating and commercial arrangements. The objective of the projects is to help all DNOs understand what they need to do to provide security of supply at value for money as Great Britain moves to a low-carbon economy.

R

RIIO-ED1

The next electricity distribution price control which will set the outputs that the 14 electricity DNOs need to deliver for their consumers and the associated revenues they are allowed to collect for the eight-year period from 1 April 2015 to 31 March 2023.

S

Short Term Operating Reserve (STOR)

A contracted balancing service for the provision of additional active power from generation and/or demand reduction when instructed by the SO. The SO makes two kinds of payments for the use of STOR, availability payments and utilisation payments.

Smart Grid Forum

DECC/ Ofgem coordinated group which looks at the services and functionalities that networks will be required to offer as we move towards a low carbon energy sector. Work stream 6 of the Smart Grid Forum brings together stakeholders to investigate the commercial and regulatory challenges of implementing the smart grid solutions.

System Operator (SO)

The entity charged with operating the GB high voltage electricity transmission system, currently National Grid Electricity Transmission (NGET).

T

Time-of-use tariffs

Energy tariffs that charge different prices at different times of the day, week, month or year.

Transmission Owner

Regional monopolies that own and maintain the electricity transmission assets. NGET for England, Scottish Power Transmission Limited (SPTL) for southern Scotland, and Scottish Hydro-Electric Transmission Limited (SHETL) for northern Scotland.

Transmission Use of System (TNUoS) charges

Charges paid by generators and suppliers directly connected to the electricity transmission grid for use of the transmission network.

Appendix 4 - Feedback Questionnaire

1.1. Ofgem considers that consultation is at the heart of good policy development. We are keen to consider any comments or complaints about the manner in which this consultation has been conducted. In any case we would be keen to get your answers to the following questions:

1. Do you have any comments about the overall process, which was adopted for this consultation?
2. Do you have any comments about the overall tone and content of the report?
3. Was the report easy to read and understand, could it have been better written?
4. To what extent did the report's conclusions provide a balanced view?
5. To what extent did the report make reasoned recommendations for improvement?
6. Do you have any further comments?

1.2. Please send your comments to:

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