Take a walk on the demand-side

Making electricity demand side response work for domestic and small business consumers

August 2014

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Acknowledgements

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Citizens Advice would like to thank the stakeholders whose input into earlier drafts has been very useful, although the paper does not necessarily reflect their views: Tabish Khan from British Gas, Chiara Redaelli and Bart Schoonbaert from Ofgem and Judith Ward from Sustainability First.

Summary

In at least one respect, the way most of us buy electricity is at present relatively simple: we use it, energy companies undertake to provide it, and a behind-the-scenes mechanism of generation, trading and balancing in the market intervenes to ensure that moment by moment supply matches demand.

However, this could be changing. Already, many larger industrial and commercial energy users, and some households, take part in schemes where the price of electricity changes depending on when it is used. This can help reduce the strain on the system at peak times and shift usage to when there is spare capacity. Over the next few years, the smart meter roll-out and other technical developments will mean these schemes spread and develop, while at the same time growing pressures on the electricity system may make it increasingly valuable to be able to shape demand so that it matches supply. More schemes will emerge and more people will get involved, so that by 2020 (and even more so by 2030) it is likely that a significant portion of domestic and small business electricity consumers will be taking part in what is known as Demand Side Response, or DSR.

DSR innovation has the potential to deliver real benefits to consumers. If it allows efficiency savings to be made in the electricity system, then those savings should in due course lead to downwards pressure on bills. It could also lead to a more secure and lower carbon supply of energy, enabling greater exploitation of renewable energy sources and less reliance on the fossil fuels that generators fall back on at peak times.

But moving from a regime where consumers use the electricity they need when they need it and know what they can expect to pay, to one where they can play an active role helping energy companies balance the system, is not without risks. Citizens Advice wants to see energy policy that is **affordable**, **accessible**, **safe** and **fair**. This report asks four questions:

- Introduction: how can the potential of DSR be realised to make electricity bills more **affordable** for all?
- Chapter 1: DSR will tend to be a complex offer and there may be many different DSR-based products and services. How can DSR be made simple and clear enough to be **accessible** to ordinary consumers?
- Chapter 2: any DSR scheme will throw up new issues and take consumers into uncharted territory, so what consumer protections will need to be updated or introduced to ensure it is **safe**?
- Chapter 3: if and when DSR generates savings, how can it be ensured that these are passed through to consumers and distributed in a **fair** way, with a benefit to all bill payers as well as those participating directly?

As DSR gathers momentum, answering these questions will ensure that it can contribute to an effective, low cost energy supply, rather than becoming an added headache for domestic and small business consumers.

Vision and priorities

We are in the very early days of DSR in the domestic and small business market. DSR will pass one milestone with the start of the mass smart meter roll-out at the end of 2015, and another if and when changes in the market arrangements mean that the usage of small consumers is charged for on a half-hourly basis. Even so, it remains possible that it will never take off on a significant scale, but the likelihood is that it will have a significant impact on consumers in the near future that at this point cannot be ignored.

In the best case scenario, this application of smart grid technology could save consumers hundreds of millions of pounds by 2030. But recent experience in the energy market provides a warning that the development of such a complex concept as DSR should be handled with caution. Getting it right will make DSR a valuable resource, but getting it wrong could expose consumers to chronic confusion, poor service and unfair costs.

To ensure that its development from this point on makes DSR work for domestic and small business consumers, this report makes 12 recommendations, listed on the next page. Running through all of these, there are three messages that policy makers, regulators and energy companies should hear ***now****:*

1. **Information provision and the comparability of DSR offers will be key and more work is needed to provide consumers with the tools they need in order to make a choice.**

2. **When it comes to the risks presented by DSR, attitudes of 'wait and see' or 'buyer beware' will not be enough. Proactive protections need to be put in place to safeguard consumers from financial or other detriment.**

3. **The impact on different vulnerable consumer groups needs to be considered, first to ensure that they are not negatively affected by DSR, and second to empower them to share in its benefits.**

Recommendations

Industry parties with the support of Ofgem should:

- be active and thorough in sharing consumer-related findings from trials of DSR, and in due course Ofgem should take the lead in ensuring these are collated and disseminated appropriately (recommendation **1**).
- work together to agree on a phased introduction of DSR offers (recommendation **2**).
- commit to consult with Ofgem and Citizens Advice before introducing any new scheme involving direct control of consumers' appliances, as with load limiting (recommendation **5**).
- investigate feasible models for limiting financial liability for DSR participants (recommendation **8**).
- explore forms of DSR with clear and immediate benefits to consumers based on existing thermal storage and energy efficiency initiatives (recommendation **11**).

Ofgem should:

- in the course of reviewing the RMR, seek innovative solutions to ensure its measures are adapted not relaxed to accommodate DSR. The tariff information label, 'cheapest relevant tariff' system and tariff cap should all be preserved (recommendation **3**).
- work together with other stakeholders to adapt the Tariff Comparison Rate to time-of-use tariffs and consider what other steps might aid comparison between DSR offers, such as standardising time bands (recommendation **4**).
- implement an accreditation scheme for third party DSR providers and consider a framework for accountability when multiple parties are involved in a consumer's DSR (recommendation **7**).
- ensure consumers are not locked into DSR schemes by bundled appliance offers or interoperability issues (recommendation **9**).
- complete a distributional impact assessment of DSR to examine what measures are needed for vulnerable consumers groups engaging in DSR (recommendation **10**).
- in future monitor the impact of DSR for non-participating consumers and consider a requirement that suppliers maintain at least one non-ToU evergreen tariff (recommendation **12**).

Government should:

- implement product standards that ensure that any automated appliance is safety tested, has an easy to use, free override and is clearly labelled with running costs and an estimate of possible savings (recommendation **6**).

Introduction: will DSR mean affordable bills?

What is DSR?

The majority of consumers may never need to learn the phrase Demand Side Response (DSR), but there is already a substantial body of research, trials and policy dedicated to how they might take part in it. It is defined by Ofgem as 'customers responding to a signal to change the amount of energy they consume from the grid at a particular time',[1] and its basic purpose is to inject a degree of flexibility into the electricity system.[2] Maintaining a grid that can provide the electricity the country needs at any given time is a growing challenge, so introducing some control over the contour of demand over time takes a little of the pressure off the parties responsible for supply.

DSR already happens. Research carried out by our predecessor body Consumer Focus found that in the region of 13 per cent of domestic electricity consumers in the UK are already on some form of Time of Use (ToU) tariff, the most common being Economy 7, which dates back to the 1970s.[3] Many larger industrial and commercial consumers, many of whom are very high power users, have put arrangements in place for more complex ToU systems. The principle of shifting usage to when there is more availability is already in place in these schemes, as is a basic price signal mechanism by which it operates. However, there are now two related new developments that are likely to make DSR more widespread, more effective and potentially more complicated:

- Between 2015 and 2020, the Government-backed roll-out of smart meters will take place. These meters will provide consumers and energy companies with a wide range of new functionality, but most important to DSR is that they will record usage in half hour chunks, so for the first time it will be possible to see (with the consumer's consent) roughly at what time of day a unit of electricity was used and in theory charge accordingly. The accompanying free in-home displays will also be able to display the prices that a ToU tariff is based on.
- Ambitious carbon reduction targets, growing risks to energy security and the anticipated increase in electric heat and transport and distributed generation in coming years are expected to put greater strain on the supply of electricity, making future efficiency gains from DSR more attractive.

Therefore, though DSR is not a new concept, it is likely to take new forms and reach new consumer groups over the next few years. The usage of industrial and commercial DSR may intensify, but at the same time, DSR on a smaller scale may start to become more widespread. *This is the focus of this paper and, unless otherwise stated, DSR refers to DSR services for domestic or small business consumers.*

[1] Ofgem (2013), Creating the right environment for demand side response: next steps
[2] In theory DSR would also be applicable to gas, but because gas is more easily storable there would be less advantage in it. At the present time DSR looks likely to only concern electricity.
[3] Consumer Focus (2012), From devotees to the disengaged: A summary of research into energy consumers' experiences of Time of Use tariffs and Consumer Focus's recommendations

What is DSR for?

DSR could have a range of applications as a cost-saving tool to be employed by suppliers, network operators or the National Grid (in its role of System Operator, ensuring that electricity supply balances demand at any given time). These parties would have various specific uses for DSR services, some of which might align technically and commercially with each other, others which would clash. Several bodies are currently researching how these technical and commercial priorities weigh up against each other and therefore how DSR can best be used and commercially organised.[4] From the consumer perspective, the majority of these uses are likely to appear broadly similar, though with variation in some respects such as when and how often the signal to shift usage comes, and from whom.

The positive outcomes for the electricity system could include:

- Less need to switch on expensive and carbon-intensive back-up power plants at peak times.
- Less need to build new power plants.
- Less need to reinforce or extend existing distribution networks.
- Better outage management when a network fails.
- Easier connection and use of small-scale, intermittent renewable energy sources like wind farms.
- More efficient balancing of the grid on a local and national level.

What does it mean for consumers?

If DSR can produce at least some of the above outcomes, it should help to create an electricity system that is more sustainable, more secure and more affordable. However, since DSR is one of a range of options to achieve sustainability and security, its impact on consumers can be expressed as a downwards pressure on bills (at a time when overall they are expected to rise) relative to alternative solutions. In addition, measures and appliances introduced to shift inefficient use of energy should have the additional effect of reducing overall energy use, together with concurrent rising energy efficiency standards for products, so there should be a synergy between demand response and demand reduction.

If any, the overall financial benefit from DSR is hard to predict, and depends a great deal on how DSR is managed at this early stage. According to one model commissioned by DECC, savings from DSR between 2025 and 2030 are likely amount to roughly £10 per household per year if evenly shared.[5] Alternatively, if not shared, and under the most favourable conditions, participants could benefit from in the region of £90 per year. Potential savings from DSR are therefore meaningful but at the household level by no

[4] Including Sustainability First (in particular paper 12, The household electricity demand-side & participation in the GB electricity markets), the Smart Grid Forum run jointly by DECC and Ofgem, and Elexon (in a report commissioned from Frontier Economics).
[5] Redpoint/Baringa/Element (2012), Electricity System Analysis – future system benefits from selected DSR scenarios

means enormous. They are smaller than what can be achieved through fabric, lighting and appliance efficiency measures, though the two are not exclusive and may be mutually reinforcing. There are in addition a number of unanswered questions about the benefits from DSR:

- How much of the savings will be passed through to consumers and how much swallowed up by the supply chain?
- If they are passed through, who will benefit? It is unlikely they will be evenly distributed, since consumers who participate directly in DSR will receive a larger reward than those who do not (which will itself be hard to quantify).
- When will consumers feel the benefit? While the saving is expected to increase over time, it will start very low, and might still be very small even by 2020.

Even if the net effect is a reduction in bills, DSR could mean that some participating consumers (or possibly even non-participating consumers) end up paying more, depending on the way incentives are structured and the clarity of DSR offers. Trials have shown this is a real risk. For example, a recent project to study ToU tariffs conducted by British Gas and Northern Powergrid found that while 60 per cent of participants benefited, the other 40 per cent paid more than they would have done otherwise.[6] Nor is this creation of winners and losers limited to trials or to the short term. Recent experience has shown that losers from DSR can get stuck that way. Of consumers with Economy 7, 38 per cent were recently found not to have a storage heater or run any of their appliances at night, therefore paying more than they need to, to the advantage of no one but the energy companies.[7] It will be important to guard against this kind of failure in any DSR system.

Substantial savings are likely to only be possible if a significant proportion of consumers adopt new behaviour, which could take a variety of forms. For some consumers shifting their electricity usage will never be an attractive proposition, either because they do not have the flexibility of load required or because the inconvenience and uncertainty are too great. However, given a suitable incentive, others might explore options including:

- Altering their routines to manually shift usage away from peak periods, for example by running the dishwasher or washing machine at night or delaying watching TV until later in the evening. In one survey, 66 per cent of respondents said they would be willing to delay starting the washing machine until after 9pm and 17 per cent would delay watching TV; by contrast, less than 1 per cent would be willing to delay cooking.[8]
- Using time controls to automate the switching of use away from peak times. Whilst not suitable for cooking, computer or TV use, controls are already widely available on white goods and timers can be applied for use with a wide range of other appliances such as smartphones and tablets, cordless vacuum cleaners, or indeed any other

[6] Customer-Led Network Revolution (2014), Progress Report 7
[7] Consumer Focus (2012), From devotees to the disengaged: A summary of research into energy consumers' experiences of Time of Use tariffs and Consumer Focus's recommendations
[8] ESRC Electricity Policy Research Group (2011), 2010 EPRG Public Opinion Survey: Policy preferences and energy saving measures

rechargeable device. In future, charging of electric car batteries might also be suitable for automation, subject to technical minimum supply requirements.

- Using a storage heater and/or good household insulation to store up heat in advance of the peak evening period. This option would be open to the approximately one in ten UK households that use electric heating,[9] although advances in storage heater technology and significant improvement in the uptake of insulation would be needed, since satisfaction with storage heaters currently tends to be around 20 percentage points lower than for gas central heating.[10] These advances may come in the next few years and the possible uptake of highly efficient electric heat pumps may also make load shifting more feasible in this area, if combined with insulation and storage.
- Using off-peak power to heat hot water, though the increase in combination boilers and pressure on domestic space is reducing the number of hot water cylinders in people's houses.[11]
- Installing thermal insulation, heating systems, energy efficient lighting and appliances that can reduce use at peak times, with the added advantage of reducing consumer bills and carbon emissions throughout the day.

Assuming that consumers are willing to shift a certain part of their usage and have the ability to, the next question is how they receive a signal to do so from the supplier (or whichever other party might enter a contract for DSR). The pros and cons of various systems are discussed elsewhere,[12] and over the next few years several might coexist in the market, although some options that have been posited might be judged to expose consumers to too much risk to be practicable. In summary, a DSR arrangement could be based on:

- Price signal – load shifting could be incentivised by a ToU tariff. This could be:
  - Static, with fixed time bands each with a different price level.
  - Dynamic, with prices fluctuating according to conditions (though in practice this may be too complex to work without household automation).
  - Critical peak pricing, with particularly high cost during certain occasional periods, most likely following a network fault.[13]
- Load limiting – rather than paying more for electricity at peak times, consumers could receive a financial reward if they agreed not to go above a certain usage during these times, and smart meter technology would be able to enforce this by temporarily disconnecting the supply if they exceeded this.[14] Inevitably any DSR contract based

[9] The proportion of electrically heated households is higher in some parts of the UK, such as Scotland, meaning that there could be greater scope for DSR in these areas. The greater proportion of off-gas households in some of these areas means that fewer are replacing water cylinders with combination boilers, creating further opportunities for storage.
[10] Consumer Focus (2012), From devotees to the disengaged: A summary of research into energy consumers' experiences of Time of Use tariffs and Consumer Focus's recommendations
[11] Sustainability First (2012), What demand side services could household customers offer?
[12] Smart Grid Forum Work Stream Six (2014), interim report on options, and more generally, THINK (2013), Shift, Not Drift: Towards active demand response and beyond, chapter 2
[13] Various variations on these price signal-based systems might be possible, for example by offering a rebate for avoided usage at a certain time or having separate contracts for flexibility and overall usage.
[14] Load limiting in this sense, of disconnecting supply to a premise if a certain power limit is exceeded, should not be confused with 'trickle flow' or 'trickle disconnection', also sometimes referred to as load limiting, where usage is constrained but not cut off altogether as an alternative to disconnection.

on load limiting would impose a serious reduction in consumer control which could have unforeseen consequences, so this option should be considered with caution.
- Direct control – automation could facilitate either price-based or load limiting-based solutions, but it could also work independently if consumers were willing to allow their appliances to be externally controlled. This could either be remunerated as a direct payment or with a cheaper tariff, and/or, in theory, it could be mandated for certain appliance types such as electric vehicles. Again, this option needs to be treated with caution.

Any of these options could be implemented by a contract with a supplier, but equally they might be realised through a contract with another party, most likely the local Distribution Network Operator (DNO) or an aggregator. This aggregator, or another party acting as an aggregator, would enter into contracts with a large number of consumers for their DSR so as to be able to coordinate their response and sell the net effect on to another party in the energy market. The exact nature of the contract type and the parties involved would be likely to be determined by the type of DSR and the use to which it was being put.

Of course, DSR might take other forms, as yet not thought of. These will continue to develop over the next years and beyond. What is clear is that on the other hand DSR *may* create substantial savings that make electricity more affordable in years to come, while on the other it *may* radically change the experience of buying electricity for many consumers. This is why it is vital at this early stage to consider how DSR can be made to work for consumers.

DSR for small businesses

It should be noted that DSR will be available for small businesses as well as domestic consumers, and many of the risks and issues they face will be broadly similar. DECC's smart meter roll-out impact assessment assumes the same 20 per cent take-up of ToU tariffs among small businesses as for domestic consumers.[15] There is arguably some reason to think that businesses may be slightly slower to take up DSR: for example, a relatively small proportion of many small businesses' revenue is spent on energy bills and some are less energy conscious, so that of those that have detailed access to their consumption data because of smart meters, only 40 per cent have ever checked it.[16]

Nonetheless, it is essential that the needs of small businesses in the DSR market are considered. This paper focuses on those issues that are common to domestic and small business consumers, but in future it will be important to monitor specifically small business experience as well.

[15] DECC (2014), Smart meter roll-out for the domestic and small and medium non-domestic sectors (GB)
[16] Consumer Futures (2013), A smart business?: Small and micro-businesses' experiences of smart meters

1. An accessible market for DSR

DSR is complicated, and too much complexity in the energy market is a problem for consumers. In 2013 Ofgem completed their Retail Market Review (RMR) with the aim of making the market simpler, clearer and fairer, introducing a raft of measures designed to help consumers understand and compare between energy tariffs. Not all of these measures will work smoothly with DSR, and the new areas of complexity it entails could risk undoing many advances that have been made.

Valuable work is underway in this area from a number of groups. The Smart Grid Vision and Routemap published earlier this year by DECC/Ofgem's Smart Grid Forum considered what has been done so far and what remains to be done to enable customer participation in DSR. [17] Work is being taken forwards within the Smart Grid Forum as well as internally by Ofgem, and valuable contributions have been made by other bodies such as Smart Grid GB,[18] Sustainability First[19] and THINK.[20] A range of relevant trials have been completed or are being carried out through the Low Carbon Network Fund (LCNF) and other schemes. What is now needed, in addition to the 'understanding about factors which influence consumer behaviour' identified in the Vision and Routemap, are provisions to ensure that DSR is understandable and accessible, so consumers can make up their own minds.

For DSR to be accessible, any offers will need to be accompanied by clear and comparable information. Work is needed on how this is assured. Consideration should be given to how existing rules on clarity and accessibility can be updated, and whether some offers, even if they work technically and financially, will lead back to confusion and uncertainty for consumers.

What if...

I've heard from a neighbour about their 'time-of-use' tariff, which they say is saving them money, so I decide to look into it myself. I search the internet for 'time of use electricity', but all that comes up is a mass of American sites and incomprehensible graphs. I notice that my current supplier is advertising something called a critical peak pricing scheme, and though it's not clear from the tariff details what it will cost or how it will work, it sounds like it's probably the same as what my neighbour has so I sign up. I have a large family at home so while I could probably adapt my energy usage a little, I can't make major reductions at short notice. What will be needed to ensure I know whether I will be better off on a DSR product or service and which is the right one for my family?

[17] Smart Grid Forum (2014), Smart Grid Vision and Routemap
[18] Smart Grid GB (2013), Smart Grid: A great consumer opportunity
[19] Sustainability First (2014), The household electricity demand-side & participation in the GB electricity markets
[20] THINK (2013), Shift, Not Drift: Towards active demand response and beyond

Information and engagement

With the exception of Economy 7 or Economy 10 tariffs, DSR is so far a little known and understood concept among UK domestic and small business consumers. Yet once sufficient numbers of smart meters are installed there will be nothing stopping energy companies from offering DSR tariffs or other schemes.[21] It therefore seems likely that for many consumers, the first they hear of DSR will be from an advertisement or perhaps a news story.

DSR will not be a centrally planned and co-ordinated project. It will be taken forwards (if at all) by suppliers and other energy companies, possibly offering a wide variety of DSR related schemes, all trying to make their individual offer or offers as appealing as possible. It is possible that energy companies will seek to work with public or third sector organisations to engage consumers in DSR, though of course these organisations would have to be satisfied about the risks and benefits before taking part.

Consumers may benefit from this variety and choice, but there are a number of areas where there might be room for confusion. Consumers considering whether to take part would benefit from a more objective source of information to clarify some basic points such as:

- How DSR works and what the benefits are.
- The range of DSR options available, and guidance on which kind might suit consumers according to their situation.
- Ideas for how to shift usage, and linked to this, approximate potential benefit of doing so.
- The risks of signing up to a DSR scheme.
- Consumer rights regarding DSR.
- A guide to what further information and resources are available.

There may be a connection here with the kind of information provided by Smart Energy GB (formerly the Smart Meter Central Delivery Body), whose role is to promote consumer engagement with the smart meter roll-out. In Smart Energy GB's consumer engagement plan the introduction in due course of more ToU tariffs is already mentioned as one among several medium to long term benefits of the smart meter roll-out.[22] At this early stage this seems wise, and DECC has stated in its Smart Meter Consumer Engagement Strategy that Smart Energy GB could take a more active role in promoting DSR in future.[23] If this comes about, it is important that information should be clear and objective, without promoting DSR unduly.

Ofgem have already begun to provide guidance to consumers on DSR. They have compiled a factsheet which usefully sets out the background to DSR, but this will need to

[21] One example of a DSR-type tariff that has already been made available on a trial basis is British Gas's Free Saturdays.
[22] SMCDB (2013), Consumer engagement plan for smart meter roll out
[23] DECC (2012), Smart Metering Implementation Programme: Government Response to the Consultation on the Consumer Engagement Strategy

be updated once the regulatory regime is established – following the review of the RMR scheduled for 2017, if not before – and the first wave of offers has started to emerge.[24]

A unified, thought-through approach is needed to the specific communication challenges posed by DSR. Ofgem, energy companies, consumer groups, charities and local authorities should work together to capitalise on the body of work already available in this area. Smart Grid GB for example has drawn on international experience and comparisons from other sectors to compile a list of suggestions for a ToU tariff communication strategy,[25] while in 2012 Oswald Consultancy – to take one example among many – trialled a scheme called The Generation Game in which participants competed to see who could shift the most of their peak load.[26] Out of these projects best practice needs to be identified and shared.

The methodology for disseminating information about DSR, as well as the information itself, should be grounded in research and trials. Several projects currently being funded by the Low Carbon Networks Fund (LCNF) have gained experience of introducing DSR to consumers which can be very valuable. At present, though, it is difficult to compare across these trials or locate particular findings, due to a lack of a unified summary. A recent paper by Element Energy for DECC and DEFRA has made a good start in bringing together a number of trials and simulations that analyse consumer response to ToU price signals.[27] More work of this kind is needed, to bring together findings from the LCNF in areas such as:

- Best practice for consumer engagement and continued communications.
- Understanding the winners and losers in different consumer segments.
- The level of savings available and behaviour changes required.
- Appliances and devices needed to effect that change, and their costs.
- Unforeseen problems and opportunities.

Each of the larger LCNF projects is working in collaboration with a team of researchers from a university, who are responsible for producing a close-down report. These reports have the potential to make a great contribution to policy in this area and the material that appeared so far has been highly useful. It is vital that the future reports are thoroughly completed and actively disseminated. If these outputs are mapped to make them accessible and comparable, then the projects will be a strong basis for future work.

Recommendation 1: industry parties should be active and thorough in sharing consumer-related findings from trials of DSR, and in due course Ofgem should take the lead in ensuring these are collated and disseminated appropriately.

This should be complemented on a more strategic level by consideration on Ofgem's part of the potential of a phased introduction of DSR. Industry parties will justifiably be keen to have freedom to innovate, but introducing too much complexity in too short a time might

[24] Ofgem (2013), How managing your energy use could help you
[25] Smart Grid GB (2013), Smart Grid: A great consumer opportunity
[26] See website here.
[27] Element Energy (2014), Further Analysis of Data from the Household Electricity Usage Study: Electricity Price Signals and Demand Response

not give the best results. Industry groups should continue to work together through the Smart Grid Forum to agree which form of DSR has most immediate potential for shared benefit, and which could be left until later. Starting with simple two or three band static ToU tariffs before considering more diverse offers is likely to create a more engaged and empowered consumer base in the long term.

This is the course that the market would be likely to follow in any case. However, if no action is take then a minority of unusual DSR offers might introduce greater complexity simply to grab attention. Agreeing a shared strategy would save consumers this unnecessary confusion, while new and innovative options could still be explored on a small scale trial basis before being introduced nationally. Such a strategy could be agreed between industry parties or formalised by the regulator, but in either case this approach would make DSR more graspable and less overwhelming for consumers.

Recommendation 2: industry parties and Ofgem should work together to agree on a phased introduction of DSR offers.

Clarity of DSR offers

Once consumers reach the point of considering specific DSR offers, there will be a range of issues around information provision for specific tariffs and offers. Consumers will need a framework in place to ensure that clear and comprehensive information is provided at the point of sale and subsequently on bills. The nature of the information required would vary between types of DSR: the details needed to explain a critical peak pricing system, for example, would be different from the case of static ToU, so regulation needs to be flexible enough to cover both. Many of the current provisions were set by the RMR, which Ofgem have announced will be reviewed in 2017 at the latest, so it is worth looking ahead to how RMR measures will need to be implemented to make DSR more accessible.

Current rules in Ofgem's Standard Conditions of Electricity Supply Licence place a number of obligations on suppliers to make their tariff offers clear and comprehensible. These include:

- Before entering into a contract, to provide the consumer with an estimate in writing of the annual cost based on their usage (condition 25).
- To include a Tariff Information Label on each bill which clearly displays details including unit cost and estimated annual cost (condition 31B, new in the RMR).
- To inform the consumer on each bill if he or she could pay less on another tariff that the supplier offers (condition 31A, new in the RMR).

These rules should apply to DSR as far as possible, even though this might raise certain complications. For example, calculating an estimate of an annual bill from a DSR offer in advance will be hard, since it would depend on how the consumer's behaviour changed. However, if a methodology could be agreed on, this could offer a valuable tool in comparing DSR and non-DSR tariffs. Some adaptations to the rules would be appropriate, such as, in addition to the above details on the financial cost, the inclusion of

an explanation that some potentially inconvenient behaviour change will be required in order to make a saving.

The licence conditions also state that calculation of the cheapest available tariff should be based on 'consideration of both Time of Use Tariffs for which appropriate consumption data is available and Non-Time of Use Tariffs'. The inclusion of ToU tariffs in this wording is welcome, but the operation of this rule will need to be carefully worked out as more consumption data becomes available. In particular, although consumers should always be informed if a non-ToU option would be cheaper than their ToU tariff, non-ToU customers should not necessarily be encouraged to move to ToU, as this might be unsuitable for them in other ways.

Another RMR reform that might be hard to reconcile with DSR is the imposition of a tariff cap, so that each supplier will only be able to offer four tariffs, or 'four tariffs per customer'. In fact, so as not to place a barrier to ToU tariff innovation, it appears that the reforms actually allows for up to 20 tariffs per supplier, with four in each of five categories:

- Tariffs with a single unit rate, single period of time.
- Other time ToU tariffs (not captured in the other categories).
- Tariffs with two unit rates, two periods of time.
- Tariffs with two or three unit rates, up to three periods of time.
- Dynamic teleswitching tariffs.[28]

Ofgem's FAQ on this subject states that 'the key point is that once a customer has chosen a payment method and meter type, they will face no more than four core gas tariffs and four electricity tariffs.'[29] This is slightly misleading. The reforms actually propose four tariffs per 'meter type *or mode*,' and since a smart meter can be switched between modes (single-band, two-band etc.) remotely by the supplier, it would appear that any consumer with a smart meter installed can effectively still be offered up to 20 tariffs. If this is the case, the cap may need to be tightened. Consumers might benefit from being able to compare multiple offers between several modes, but this should be considered within the terms of the cap.

In response to a recent consultation, Ofgem have also stated that they would consider further derogations from the tariff cap to allow 'pilot schemes for innovative products linked to smart metering.'[30] When considering applications for derogations, however, Ofgem should weigh up the risk of confusion in the broader market that even trial tariffs could cause. This is in line with the recommendation made by the European Commission project THINK for contract 'harmonisation', meaning that any DSR contracts should be assimilated into one of a limited number of groups to make the market more navigable.[31]

In future DSR offers might in some circumstances be the subject of a separate contract from the main tariff, for example if, as has been hypothetically suggested, distribution charges were charged separately from the main bill and the consumer had a contract

[28] Ofgem (2013), The Retail Market Review – final domestic proposals
[29] Ofgem online FAQ
[30] Ofgem (2013), Creating the right environment for demand side response: next steps
[31] THINK (2013), Shift, Not Drift: Towards active demand response and beyond

directly with their DNO. Many objections might be raised to this kind of arrangement. A major problem would be that if this new arrangement was be mandated it might effectively force consumers into DSR, while if optional consumers would find themselves in the position of having to choose two separate tariffs and deal with two parties. Further investigation of the risks involved is required, but as a minimum, the same standards of clarity and information provision should be applied to this kind of contract as to any traditional supply contract.

Recommendation 3: in the course of reviewing the RMR, Ofgem should seek innovative solutions to ensure its measures are adapted not relaxed to accommodate DSR. The tariff information label, 'cheapest relevant tariff' system and tariff cap should all be preserved.

Comparing offers

In addition to ensuring that clear information is provided with DSR offers and that the number of possible tariffs does not become overwhelming, it should be made as easy as possible to compare offers. If rival DSR offers are not comparable, competition will not function effectively in setting a price for a given shift of usage, causing individual consumers to lose out and potentially stalling the development of the DSR market.

As mentioned above, previous experience has shown that poor comparability causes consumers not only to potentially miss out on the best DSR option, but to end up with a deal that is worse than no DSR:

- Early headline findings from British Gas/Northern Powergrid's Customer-Led Network Revolution project have shown that of the c.600 consumers who chose to take part in a representative ToU trial, 40 per cent paid more than on a standard tariff.[32] These consumers were reimbursed by the trial organisers, but the fact that they had taken part hoping to save money but not done so shows the difficulty of knowing if DSR will be suitable.
- Among consumers on Economy 7 tariffs, 38 per cent do not have storage heaters or use any appliances particularly at off-peak times, meaning that they are likely to be paying significantly more than on standard tariffs. This is exacerbated by the lack of clarity with many Economy 7 tariffs about how much of a consumer's usage would need to fall into the off-peak hours in order to make a saving – a figure which varies from 15 per cent to 45 per cent between different suppliers – and even what those off-peak hours are.[33]

One obstacle to comparing DSR offers will be the range of possible variables. These might include:

- Prices – these will differ according to multiple time bands, or change in real time.

[32] Customer-Led Network Revolution (2014), Progress Report 7
[33] Consumer Focus (2012), From devotees to the disengaged: A summary of research into energy consumers' experiences of Time of Use tariffs and Consumer Focus's recommendations

- Time bands – different static ToU tariffs may offer different numbers of band, and different times to switch between them.
- Signal mechanism – DSR could be based on delivery of a price signal or a system involving load limiting or direct control of the consumer's appliances (see introduction).
- Offering party – as well as suppliers, contracts for DSR might be offered by other parties including aggregators or DNOs.
- Financial reward type – could be by various means including a cheaper or variable tariff, direct payments or rebates.
- Links with equipment – some DSR offers may come with some kind of smart appliance or related gadget included, while others may depend on or be facilitated by having suitable equipment already.
- Collective action – some tariffs may be negotiated on behalf of a group of residents, for example housing associations.

In addition to the above the decision might be influenced by other variables that the consumer does not control such as location, particularly if the degree of regional variation already contained in network charges was increased to facilitate DSR.

Given the range of options, one approach would be to focus at first on making static ToU tariffs as comparable, engaging and rewarding as possible. Comparison could be based on the Tariff Comparison Rate (TCR) that Ofgem introduced as part of the RMR, and Ofgem have stated their intention to develop the TCR to accommodate ToU tariffs: this project should be taken forwards urgently.[34] It is also possible that other parties such as price comparison websites or energy companies might decide to develop their own DSR comparison tools, but it is unlikely that this will take place until the market is commercially viable.

Once consumer trust and the commercial case is developed, more diverse options may be suitable for introduction to the market, or may be ruled out as too difficult for consumers to interpret and compare.

Unfortunately, it is not clear that the TCR will ever be fully applicable to ToU. The TCR combines a tariff's unit price and other associated costs to assign an approximate price in p/kWh. With a ToU tariff, even if each time band was assigned its own TCR, it would be unclear firstly how much usage would be likely to fall into each band, and secondly how to factor in the non-financial cost of shifting usage. To overcome these obstacles it may be necessary to consider other, more flexible solutions.

As a starting point for new solutions, it may be worth looking to other sectors and/or abroad. For example, one model could be the Energy Calculator developed by the Ontario Energy Board, which allows consumers to compare three-band ToU offers on the basis of how much of their usage falls into each band.

[34] Ofgem (2013), Creating the right environment for demand side response: next steps

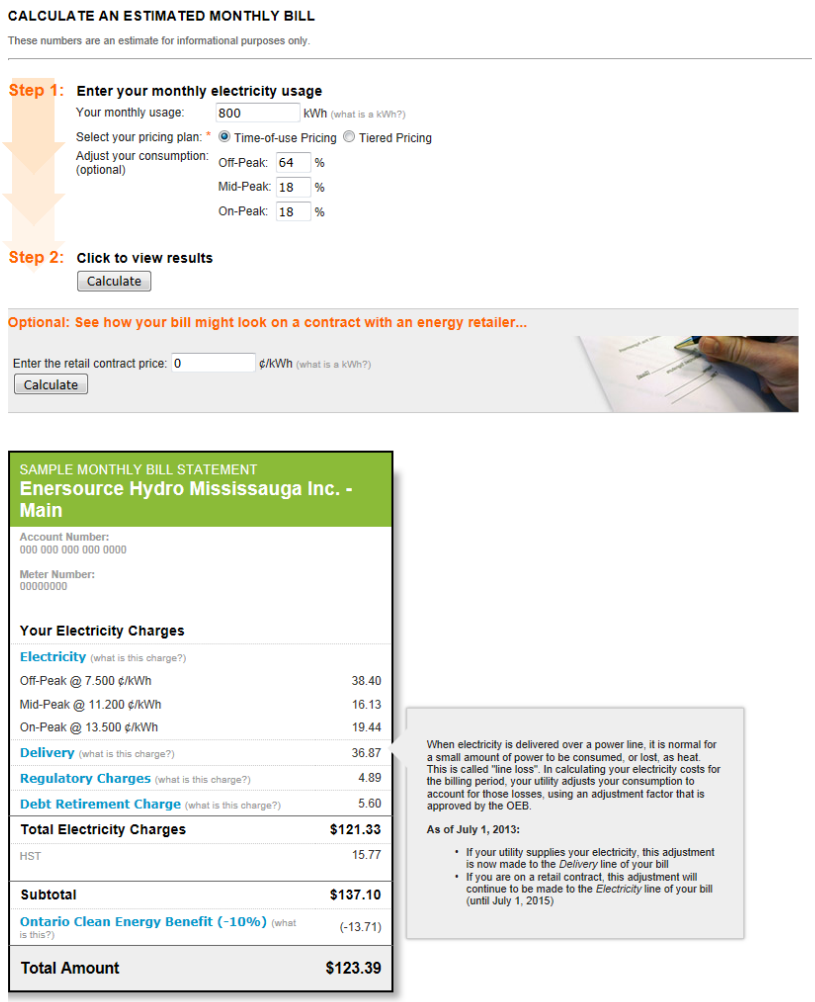

Figure 1: screenshot of the Ontario Energy Calculator

This is certainly a useful tool, but it makes a number of assumptions, notably that:

- All available tariffs have the same time bands, though different prices (as is the case in Ontario, where they are centrally set for each summer and winter period by the energy board).
- The consumer's future usage is either known or reasonably easy to estimate.

Both assumptions would be a stumbling block to GB consumers. But in fact, they point towards two steps that could improve comparability. The first would be to follow the Ontario model in standardising time bands, at least during an initial phase. This would only allow for certain uses for DSR, since others would require a finer degree of control, and it might be necessary to make use of smart meters' randomised timing capability element to avoid ramp-up problems (when a switch from a high to a low price leads many consumers to increase their usage at the same time, creating a spike). It would be possible to establish one set of time bands for tariffs with two rates and another for three, or there could be a few options for each. Standardising time bands in this way would make ToU tariffs far easier to compare.

The second assumption made by Ontario Energy Calculator is that consumers know and understand their usage. This highlights the importance of all consumers having free access to their usage data in a form that is easy to understand and share. Energy Service Companies (ESCos) might in future play a part in helping consumers compare between DSR offers, so it is essential that consumers are able to share their data easily when they choose to.

Standard time bands and freely available data would allow consumers to use an Energy Calculator-type tool to work out how much a given ToU tariff would cost them, but only assuming no shift in their usage. Consumers should also be able to interpret what a given shift in usage would practically mean for them, both in terms of the behavioural change it would require and the saving it could be expected to generate. Options for how to build this into a comparison tool need to be further investigated, but might include:

- Providing intuitive examples of how load shifting has worked for others, which would both give consumers ideas about how to change their behaviour and help them work out if they would be suitable participants.
- Adding figures to the Tariff Information Label to show what proportion of usage would need to fall into each time band in order to make a saving relative to the cheapest standard tariff.
- Adding descriptions to tariffs about the kind of consumer profile most likely to benefit ('do you run your tumble drier in the evening? Do you own an electric car?' etc.).
- Giving consumers the ability to 'try before they buy' by trialling a DSR offer for a fixed period with no commitment or liability.

To make use of practical experience, learning from innovation trials could aid understanding of the role of behaviour in tariff selection. This could either be from existing trials, or through the testing of a conceptual comparison site on consumers who have participated in ToU trials and therefore already have a basic understanding of ToU tariffs. Trial data could help shape how a comparison site would combine that consumer understanding with smart meter data to enable comparison.

Recommendation 4: Ofgem, industry parties, price comparison sites and other stakeholders should work together to adapt the Tariff Comparison Rate to time-of-use tariffs and consider what other steps might aid comparison between DSR offers, such as standardising time bands.

2. Safe DSR protections

By its nature, DSR may introduce certain risks. Consumers' behaviour change, new incentive mechanisms, and the new arrangements needed to make these possible could all throw up unforeseen problems. To allow consumers to engage in DSR with confidence, some existing protections will become even more important. Others may need to be adapted in a DSR world, or new ones may need to be introduced to cover new issues. Putting in place strong, clear protections will help build a DSR system that works better for all parties.

Various automation and potentially load-shifting offers are already in operation, some old, such as Economy 7 and Radio Teleswitching (RTS), others relatively new, such as the smart thermostats offered by Nest, British Gas's Hive and SSE's Connect. The risks posed in this area are therefore not without precedent, and in many cases consumers have benefited from these offers under current protections. However, if and when DSR becomes more complex and more widespread, new protections must respond to the fact that consumers will be exposed to new kinds of risk: of financial loss, loss of control, loss of accountability or loss of choice. A buyer beware approach will not be enough.

Protections might include discouraging some forms of DSR scheme, while others will need new rules around them. Areas posing new regulatory challenges will include automation and the role of third party service providers. The financial risks consumers could be exposed may require some limits on liability, while current arrangements on switching and operability may need to be tightened.

What if...

…to try to save money, I sign up for a time-of-use tariff with my supplier that comes with a 'free' new fridge, washing machine and dishwasher which can be controlled remotely. At first the arrangement goes well and I make a saving, until my fridge is turned off and fails to turn on again. I don't realise until some of its contents have gone off. I want to claim compensation from the supplier, but they say it is not their responsibility and pass me on to the appliance manufacturer. At the same time, I now want to leave the tariff and revert to a non-time-of-use tariff with no automation, but my supplier tells me I would have to pay a large exit fee that I cannot afford. What protections would be needed to make DSR safe from my point of view?

Automation and load limiting

DSR offers that are based on a ToU tariff could lead to confusion or higher bills, but the problems they might cause are at least reasonably predictable and limited, and can be mitigated. It may be harder to introduce protections that are adequate for schemes based not on price but on active intervention by the energy company. These schemes could take the form of:

- Load limiting – smart meters have the ability to restrict the maximum load allowed to flow through them, and to disable supply until further notice if this is exceeded. In the context of DSR, this could be used to ensure that participants did not exceed a given usage during peak times.
- Direct control – smart meters and smart appliance technology may make it possible for energy companies to control a consumer's household appliances remotely, for example by turning down a fridge or freezer at a time of high demand. This is in some ways similar to existing heating systems with inbuilt Radio Teleswitching (RTS), but could work on an individual appliance basis rather than having a single centralised switch for the scheme.

With the exception of RTS schemes, these options are so far only being explored on a trial basis in this country, and suppliers have committed to consult with Ofgem and Citizens Advice before introducing any load limiting scheme.[35] This is welcome, since any move to take control of their electricity usage away from consumers would potentially be a major concern. No load limiting trials on a large scale have yet been proposed, but if and when they are they will need to be closely monitored to ensure, for example, that it is sufficiently easy for consumers to reactivate the supply through their smart meter once it has been cut off by exceeding the limit.

Participation in these schemes would be voluntary. But if a large financial incentive was on offer, as there would need to be, consumers might be tempted to enter into them even if not well suited. The RTS model is tried and tested, but a cap or automatic control of more time-sensitive appliances could be highly disruptive, albeit only on an infrequent basis. It could be hard for consumers to fully grasp the potential consequences of direct control, or to differentiate between the impact of control on different appliances, at the point of signing up for them. This might result in severe unintended consequences, in particular if these schemes compromised heating in the homes of older people or people who were unwell, or interfered with the operation of in-home medical equipment.

Recommendation 5: suppliers should commit to consult with Ofgem and Citizens Advice before introducing any new scheme involving direct control of consumers' appliances, as with load limiting.

Direct control of appliances by an energy company would be one form of automation. Slightly more attractive to consumers might be the option to set the controls on their smart appliances themselves. In this way automation could, for example, start a dishwasher cycle in the middle of the day or at night, whenever electricity was most freely

[35] Ofgem (2012), letter on review of developments with the use of load limiting functionality

available. However, automation in any form will pose serious questions in terms of risk, accountability and control.

Automation has the potential to become a major pressure point for public opinion and consumer anxieties. Already, even though it has hardly been put into effect, 40 per cent of consumers say they felt negatively (fairly or very) about automation, though views differed with different appliance types, with automation of fridges and freezers being the most unpopular and automation of wet goods more acceptable.[36] In this context, it is unsurprising that the proposal by the European Network of Transmission System Operators for Electricity (ENTSO-E) that functionality for frequency response, a specialised form of DSR, could be mandated for all 'temperature controlled devices' including fridges, freezers and hot water heating, gave rise to the headline shown right.[37] If strong protections are not put in place around automation there may be a risk of this kind of backlash in consumer opinion on a larger scale.

£5000 TO BE WON IN THE MAIL LOTTERY
The Mail ON SUNDAY
FREE INSIDE
This superb new culture & celebrity magazine in your bigger better value Mail on Sunday Still only £1.50
EVENT
Benedict BLASTS OFF
PLUS Fast Diet Delicious recipes
2 FOR 1 All-inclusive Sandals holidays
BIG BROTHER TO SWITCH OFF YOUR FRIDGE
Computer chips will take control of home appliances when energy is low
Power giants to make millions – but you must pay for 'sinister' technology

Figure 2: The Daily Mail, 27 April 2013

Automation could perhaps enable a significant layer of efficiency savings, but the benefit to consumers is still to be proven.[38] It is also unclear what level of financial incentive would need to be embedded in a tariff to overcome consumer concerns about automation and direct control, what unintended consequences may result (such as the impact of noisy appliances in properties with poor sound insulation, for example), and whether the level of shifting will be sufficient to deliver the savings across the supply chain and consumer base necessary to make such a move worthwhile.

It is of concern that automation seems to be at risk of falling between two sections of Ofgem's current work. A consultation decision published in December 2013 stated that 'the Consumer Empowerment and Protection project will consider the appropriate protection for automation for small non-domestic and domestic consumers',[39] but the Consumer Empowerment and Protection in Smarter Markets consultation document from the same month, setting out this project's proposed work plan, makes no mention of automation.[40] One approach to the problem would be to open a work stream on automation similar to Ofgem's existing Third Party Intermediaries Programme which is dealing with Energy Service Companies (ESCos).

A key protection will be the provision of an override function that is easy to identify and use, and can be used at the consumer's discretion without incurring a financial penalty other than forgoing the incentive to use off-peak power. Automating without an override function or with one that the user might feel unable to activate would not only be very off-

[36] UKERC (2013), Transforming the UK Energy System – Public values, attitudes and acceptability
[37] ENTSO-E (2012), Network Code on Demand Connection
[38] Sustainability First (2013), Electricity demand and household consumer issues
[39] Ofgem (2013), Creating the right environment for demand side response: next steps
[40] Ofgem (2013), Consumer Empowerment and Protection in Smarter Markets

putting for consumers, but could also in some cases pose serious risks to health and wellbeing, as discussed above.

An objection might be raised that this will limit the effectiveness of automation, but the essential principle is that automation should be a tool to help consumers shift their usage if they wish to do so, not a way of forcing them to. The majority of automation should take place when consumers are unaware of it, but it is not yet fully understood how noticeable or disruptive automation might be. Any future models of DSR that incorporate automated load shift should work on the basis that consumers can choose to override it.

Accessibility testing should be carried out to set a minimum standard of usability for the override switch in terms of placement, design and accompanying information, similar to the usability assessment of in-home displays performed by our predecessor body Consumer Focus.[41] It should in addition be considered whether it is inappropriate to apply automation to certain consumer segments, to certain appliances, or to households with certain appliances.

DECC have also raised the health and safety risk that automation could pose, quoting a home safety expert from the Chief Fire Officers' Association: 'Every year we have numerous fires caused by dishwashers, washing machines and tumble driers. We would strongly advise people not to put them on when they go to bed, or before they leave the house.'[42]

A key area of regulation of smart appliances will be labelling, to help consumers weigh up the complicated financial decision involved in buying one. In combination with the right tariff or scheme, a smart appliance could generate substantial savings over its lifetime, but this will be hard to predict accurately. Researchers have estimated that at present adding smart capability could save as little as £10 in an appliance's lifetime, but by 2030 this could increase to £500.[43] This information needs to be conveyed to the consumer and this could be done much more clearly if, as previously recommended by Consumer Focus, product energy labels included an appliance's running costs.[44] In the case of smart appliances, a rough guide to expected savings could be added.

Recommendation 6: product standards should ensure that any automated appliance is safety tested, has an easy to use, free override and is clearly labelled with running costs and an estimate of possible savings.

Energy services

Like automation, Energy Service Companies (ESCos) may come to play an increasingly important role in helping consumers engage with DSR. On the larger industrial and

[41] Consumer Focus (2011), Getting to grips with smart displays
[42] DECC/DEFRA (2014), Powering the Nation 2: Electricity use in homes, and how to reduce it
[43] IEEEE (2013), Economic and Environmental Benefits of Dynamic Demand in Providing Frequency Regulation
[44] Consumer Focus (2012), Under the Influence?: Consumer attitudes to buying appliances and energy labels

commercial scale, several ESCos already participate by aggregating consumers' DSR actions, interpreting their data and advising on the best options. If the market for these services expanded to the domestic and small business level, consumers could benefit from a similar deal.

Our full views regarding the regulation of ESCos are set out in the response to Ofgem's consultation on third party intermediaries by our predecessor body Consumer Futures, which explains that 'our preference is for an Ofgem-run accreditation scheme for TPIs accompanied by a new licence requirement on suppliers that obliges them to only deal with accredited providers'.[45] The accreditation scheme should be linked, at least in terms of branding, to a single badge of trust for energy efficient appliances and housing, to enable clear consumer messaging on who to trust.

The combined factors of ESCos and automation playing an increasing part in DSR may pose a risk to accountability, if consumers entering into arrangements with multiple parties for their DSR services. Clear lines of accountability need to be drawn in these situations, from a legal, operational and communications perspective. If for example a smart appliance manufacturer provides a fridge through partnership with a supplier, and it is automated by an aggregator according to calls for DSR from a DNO, then:

- It should be clear to the consumer who to contact in the event of a malfunction or billing query. There should ideally be a single point of contact rather than different ones depending on the nature of the problem, and this should be advertised from an early stage of the arrangement.
- It should be agreed between all parties who will be responsible for each eventuality of fault repair and maintenance, and DECC, Ofgem, consumer groups and potentially other regulators (such as Ofcom or the Information Commissioner) should be responsible for stress testing this accountability and ensuring that there are no cracks.
- There may be a legal question of liability if, for example, an error somewhere along the chain leads the fridge to be turned up instead of down when prices are high, to be turned off and not turned on again, or to have its life shortened.

It is impossible to foresee the full range of complex contractual situations that may arise. The regulator will need to consider in detail the balance of costs and benefits, and the risks and opportunities for all parties. This is preferable to leaving a system to develop that might later take much longer to untangle at a later stage, at a cost to consumers.

Recommendation 7: Ofgem should implement an accreditation scheme for third party DSR providers and consider a framework for accountability when multiple parties are involved in a consumer's DSR.

[45] Consumer Futures (2013), Response to Third Party Intermediaries: exploration of market issues and options consultation.

Limits on liability

Alongside the most basic risks of DSR – that consumers could be left without an electricity supply, without control over their own appliances or without accountability from their service providers – some forms of DSR might also expose consumers to high financial risk. In theory, DSR should lead to lower bills not higher, since the principle is to reward load shifting rather than penalise the status quo. However, most price-based systems would bring a risk that participating consumers who failed to shift their load sufficiently would in fact end up paying more than they would otherwise. This has already been seen with the experience of the 38 per cent of consumers on Economy 7 with no way to benefit from it, and the 40 per cent of participants in the Consumer-Led Network Revolution ToU trial who paid more than with a standard tariff.[46]

However, given that DSR is supposed to save money in the system overall, why should some consumers have to pay more for it? In theory, it should not be necessary for DSR schemes to create winners and losers among its participants (though there could be a knock-on effect on non-participants, discussed below). If 'winners' are those who are rewarded for successfully providing response, then the value of the reward should be covered by the value created by the response, a win-win situation. Some trials have been designed to be 'revenue neutral', meaning that some participants are charged more to balance the loss of revenue from those who save,[47] but if DSR is effective in creating cost savings then revenue neutrality in this limited sense should no longer be necessary. Therefore, it should be possible to seek innovative protection measures to limit the financial liability faced by participants who fail to shift their load sufficiently.

This would be particularly needed in any scheme based on critical peak pricing, in which a particularly high cost would apply during certain occasional periods, for example following a network fault or during a winter evening peak. This would mean that consumers who could not respond to the signal, or failed to notice it, would be liable to pay an extremely high cost. Consumers might enter into this kind of agreement without fully understanding the risk or considering the potentially unlimited liability they could face. The gains that could be shared from this kind of scheme (as opposed to another DSR offer) would have to be very great to justify this kind of risk.

Options for limiting liability are diverse, but could include:

- Capping bills, and possibly shifting consumers to a different tariff if the cap is exceeded.
- Setting a maximum differential between high and low prices rates.
- Introducing financial incentives at peak times as a rebate rather than a charge.
- Having a contract for flexibility separate from the main supply contract, so that the consumer is rewarded for their response relative to a baseline load.

[46] Consumer Focus (2012), From devotees to the disengaged: A summary of research into energy consumers' experiences of Time of Use tariffs and Consumer Focus's recommendations; Customer-Led Network Revolution (2014), Progress Report 7

[47] For example the Electricity Smart Metering Customer Behaviour Trials carried out by the Commission for Energy Regulation in Ireland.

- 'Shadow billing', as in the ToU trial in the Customer-Led Network Revolution, where consumers in effect pay either a ToU rate or a non-ToU rate in each period, whichever is lower.[48]

Recommendation 8: industry and Ofgem should investigate feasible models for limiting financial liability for DSR participants.

Switching and interoperability

The ability to switch easily between tariffs will be particularly important to the effective operation of a DSR market because consumers will need to have the ability to explore the unknown territory of new kinds of tariff freely and with confidence. The roll-out of smart meters should in fact make switching easier than ever before. However, the new complexities of DSR could pose barriers to switching, whether on a technical or a commercial basis, which need to be mitigated.

It is worrying that suppliers (or whichever party is making a DSR offer) could in fact have an incentive to make switching difficult, since this would secure a shift in load even if contrary to consumers' preferences. It is essential that consumers are able to experiment so as to test out how much a given behaviour change is worth to them. If locked in to a tariff they might end up having to shift usage even if they decide the resultant savings are not worth it – which would benefit the supplier, but be a detriment to the consumer and to DSR's reputation in the long term.

There is a still a risk that some smart appliances might not be fully interoperable. Because the exact design of the Home Area Network (HAN) is not specified in the first version of the Smart Metering Equipment Technical Specifications (SMETS1), it may be the case that some appliances which connect to it will work with the SMETS1 smart meters installed by some suppliers but not by others. This might mean that a consumer who had invested in an expensive smart appliance that only worked with their current supplier's SMETS1 smart meter could be left feeling they are unable to switch. Likewise, if a smart appliance was controlled not through the standard smart metering communication network but through broadband (connecting to the smart meter through a Consumer Access Device (CAD)) then it would be possible for this appliance to be made compatible with the systems of only one supplier, again impeding switching. Product regulation might play a part in ensuring smart appliances are as fully interoperable as possible, and that any possible lack of interoperability is made clear at the point of sale, for example by a 'smart grid ready' logo or similar.

The potential involvement of ESCos may add a new element of complexity to switching. In future there may need to be a parallel consideration of switching between ESCos. In the shorter term, however, ESCos may need to enter into agreements with suppliers in order to gain the necessary access to a consumer's smart meter (because current security arrangements make it impossible for anyone except the supplier to access the appliance automation functionality built into smart meters). A consumer must be able to

[48] Customer-Led Network Revolution (2014), Progress Report 7

switch supplier but keep the same ESCo, which would require one supplier to transfer the ESCo contract smoothly to the other.

A further barrier to switching might be posed if in future energy companies offer some form of equipment (appliances, monitors, controls etc.) with their tariff or service, to be paid for on a similar principle to the Green Deal's 'golden rule' – that is, using some or all of the savings attributable to that equipment. This model would have certain advantages, in that it would overcome the barrier of the upfront cost of DSR-ready appliances and devices.

However, in addition to practical difficulties around estimating savings in advance, attributing them during the payback period and preventing mis-selling, this might lock consumers in to a tariff for an unacceptable period. In the Green Deal the 'golden rule' is based on the concept that the customer never loses out because payments are offset against savings, and consumers can continue to pay off the debt if they switch energy provider because they will continue to make savings. In the context of DSR-ready appliances, on the other hand, the savings might be dependent on a ToU tariff, possibly of a kind that only one supplier offered, and therefore there would be no means of paying off the debt if the consumer switched.

It should also be considered that the Standard Licence Conditions require that any bundled offer available to one consumer must be available to all, which would mean that suppliers could effectively be in the position of offering expensive products to consumers with no guarantee they would be able to benefit from them or be able to pay.[49]

Recommendation 9: Ofgem should ensure consumers are not locked into DSR schemes by bundled appliance offers or interoperability issues.

[49] Licence condition 22B

3. Fair distribution of benefits

If successfully implemented, DSR could create significant efficiency savings in the electricity system. One question this raises is how will these be passed through to consumers in a fair and equitable way? Those consumers who take part directly in DSR can expect to be rewarded for the efforts they make to change their behaviour, but initially at least this is likely only to constitute a minority of more engaged consumers. If savings are never passed beyond this group and the energy companies, DSR could lead to a two-tier electricity market, where those with the time and resources to take part pay less and the rest end up paying more.

In terms of timescale, the distributional impact of DSR will probably be slower to unfold than the establishment of measures to ensure that it is accessible and safe. It may be several years before the effect of DSR is felt on a national scale, and therefore before it could have serious implications for the fairness of the energy market. Issues of accessibility and protection from risk, on the other hand, will be relevant on an individual scale as soon as DSR offers become available. Nonetheless, it is essential that policy makers and industry look ahead now to consider what the medium-term distributional effects of DSR might be.

Valuable work is already being done on distributional impact of DSR and the channels through which savings will find their way back to consumers, by the Smart Grids Forum and others. This work should be carried through and the conclusions it reaches should be a cornerstone of DSR policy, if DSR is to become not just a viable business model but actually beneficial to society. Furthermore, consideration should be given not only to consumers who take part in DSR but also to the unintended consequences it could have for those who do not.

What if...

…I am an older person with poor health who is generally house-bound. I can make few changes to how much electricity I use, or how I use it. I hear on the news that other people are paying lower prices through new schemes and technology, but my bills keep going up. I already spend a lot on energy because my house is not connected to the gas mains, and now it is being suggested that I should pay even more to reflect my network charges and Government-imposed levies. I have called my supplier to complain, but their only suggestion was that I move to a time-of-use tariff. How can the impact of DSR be made fair to me?

Distributional impact of DSR

In its latest impact assessment of the smart meter roll-out, DECC estimates that 20 per cent of consumers might be on some form of DSR tariff by 2020.[50] There is necessarily a wide margin for error in this estimate, and DECC do not make any prediction on the demographic, but from past experience it appears likely that these early adopters of DSR will be disproportionately constituted of more engaged consumers. Those who are better equipped to engage with complex tariff choices, have higher demand and more flexibility to change their demand habits, and are more likely to have the disposable income to buy smart appliances will be more likely to try and to benefit from DSR.

Evidence is already emerging on this effect. A report from one of the largest consumer trials of DSR found that 'higher income groups are more flexible than lower income groups – with high-income groups consistently reducing evening peak consumption more than medium-income groups and in turn, medium groups reducing their peak consumption by more than low-income groups.'[51] On the other hand, research in the US has suggested that low-income consumers will actually be better placed to benefit from ToU because of their flatter load profile.[52] Even if this is the case, however, there is a risk that this group might be less keen to experiment with DSR so a small engaged minority might gain at the expense of those who are not early adopters.

To explore this further, a thorough distributional analysis of the impacts of DSR should be completed. Work on this has already been begun by the Centre for Sustainable Energy's recent report to Ofgem on the possible impact of ToU tariffs, but this assessment does not consider social characteristics or behavioural trends.[53] The data on which the report is based, from the Energy Demand Research Project, would be sufficient to at least begin an analysis of these questions using postcode level classification.

When considering how to make DSR more equitable, it may be useful to look at the situation in countries where the smart grid is further developed. In the US, for instance, the Smart Grids Consumer Collaborative has recently published a report on the smart grid's impact on low income consumers. The findings were that those with low incomes received substantially less benefit from the smart grid and associated offers, due to:

- A lack of educational outreach.
- Too much reliance on engagement through the internet, which not all consumers are happy to use or have access to.
- Too little consideration to the disproportionately high number of low income consumers (here as in the US) in rented accommodation, which may impede them from adopting the energy efficient products or services that might be a part of some DSR offers.
- Too little engagement with older people.[54]

[50] DECC (2014), Smart meter roll-out for the domestic and small and medium non-domestic sectors (GB)
[51] Customer-Led Network Revolution (2014), Durham University Social Science Research
[52] Institute for Electric Efficiency (2010), The Impact of Dynamic Pricing on Low Income Customers
[53] CSE (2014), Investigating the potential impacts of Time of Use tariffs on domestic electricity customers
[54] Smart Grid Consumer Collaborative (2014), Spotlight on low-income consumers II

The report calls for 'a two-pronged approach to bringing low income consumers into the new world of energy efficiency technology, one for the more digitally/technologically savvy and another for often older, "analog" consumers who can and will not be reached in the same way as the majority of those in younger age groups.' It also calls for greater efforts to be made to empower people living in rented accommodation to take control of their usage through DSR, particularly relevant in the light of the increasing number of consumers living in insecure rented accommodation in this country.

The first priority for vulnerable consumers is to ensure that they are protected from unsuitable DSR offers, but secondary to this is enabling different groups of vulnerable consumers to take advantage of DSR if it is shown to be beneficial. The former is a more immediate concern, while the latter should be developed over the next few years if the value of DSR is proven. In due course, it might be appropriate for particular strategies on engagement, information and the details of DSR schemes to be adapted to accommodate the different needs of groups including:

- Older people.
- Low-income and fuel poor households.
- People with disabilities.
- People who do not use the internet.
- People who speak little or no English.
- Renters.
- Families with young children.

The first step will be to analyse how these groups are affected by DSR. Trials such as UK Power Networks' forthcoming Vulnerable Customers and Energy Efficiency project will be useful in this respect,[55] but more research and development funding may be needed in this area. Through research and targeted regulation, first and foremost, vulnerable consumers should not be made be worse off by DSR, but they should also be empowered to participate if benefits are proven.

Recommendation 10: Ofgem should complete a distributional impact assessment of DSR to examine what measures are needed for vulnerable consumers groups engaging in DSR.

Delivering benefits

If and when savings are made from DSR, these savings should be passed back to consumers. But the commercial details of how this will work are hard to foresee, and it is unclear when savings would start to appear, what their scale would be, and how they would be split between those consumers who were directly rewarded for participating in DSR and those who were not.

This process will operate differently depending on which party turns out to be best placed to realise DSR's potential savings.

[55] UK Power Networks (2014), Vulnerable Customers and Energy Efficiency overview

- If it is suppliers, competition should mean that savings would be passed through as cheaper tariffs, but there is no guarantee that this would extend beyond the participants – who in any case would need rebalanced tariffs to incentivise their behaviour change in the first place. One account would be that in a supplier-led version of DSR, savings in the wholesale price of energy would be used to incentivise participants while savings from avoided generation costs would be passed to all customers, but these assumptions are still to be tested.
- If it is networks or the system operator, savings should be captured by the price control, but it is unclear whether they would be passed through in the current or the next price control period, nor what would set an appropriate margin for the networks. A price signal would still be needed for participating consumers. Avoided costs might be highly regionally specific, but it would be unfair if this accentuated a postcode lottery for network charges.

Work is being carried out by the Smart Grid Forum and others to understand how these savings will be distributed in practice, and modifications may be needed to future price controls or market arrangements in order to optimise the outcome.

In the short term, one area where it may be possible to realise benefits is in ensuring that consumers who are already on some form of ToU scheme such as Economy 7 or RTS are provided with effective and well-designed routes to transition into next-generation DSR if they wish to. Many of these schemes are out-dated and inefficient, and consumers who already have the capacity to store heat or hot water, and are already accustomed to the principle of DSR, may be particularly well-placed to benefit from new smart schemes. Further work is needed to explore the scope for transition and updating in these areas.

There are important also dependencies between the benefits from DSR and other policy on energy efficiency. Both the effectiveness and the fairness of DSR will be much greater if combined with improved measures on demand reduction. One of the main forms of DSR action open to consumers is shifting heating times, but this is only feasible where heat can be stored in the form of thermal mass in storage heaters, well-insulated homes or hot water storage. It is also essential that consumers have a fully functioning set of heating controls. Situating DSR in a broader policy context that also includes improved insulation, better appliance efficiency, better heating controls and improved trust of energy companies will maximise benefits and ensure that all consumers are better placed to take part.

Recommendation 11: industry parties should explore forms of DSR with clear and immediate benefits to consumers based on existing thermal storage and energy efficiency initiatives.

Left-behind consumers

In the near future, new forms of DSR may only appeal to a minority of consumers but it could have wider implications for the majority. Some may be positive, such as lower bills if the cost of investment in peak generation capacity is avoided. At the same time, system changes triggered by DSR could lead to more variable, unpredictable prices, and change even non-participating consumers' relationships with energy companies.

3. Fair distribution of benefits

One potential consequence of DSR arrangements might be the introduction of greater cost reflectivity in electricity pricing for all consumers (instead of the specific cost reflectivity contained in a ToU tariff). This would have high cost in terms of fairness, since any increase in reflectivity is likely to come at the expense of socialisation of costs. For example, it has been suggested that in future some or all of the network cost element of an electricity bill could be passed through to the consumer, rather than being spread evenly between consumers in a given area as at present. If this happened, the regional disparity in the cost of electricity, which exists already, could be greatly increased. Consumers in remote rural areas are already penalised by often being off-gas and often having houses that are harder to heat, and any measure that increased cost reflectivity across the board would exacerbate this inequality. Other proposals would see the cost of government levies being placed disproportionately on on-peak times, but this should not be allowed to lead to all consumers being effectively forced to participate in DSR.

Even if price reflectivity was introduced through voluntary schemes, non-participating consumers could be adversely affected. Those who can save money by switching to more cost-reflective tariffs would clearly be likely to do so in disproportionate numbers.[56] In the short term, if households who switch to ToU tariffs on average save money by doing so, the supplier is likely to face a loss of revenue unless they balance it by increasing their margins on those households not on ToU tariffs – which they might feel they can do with impunity, since these are more likely to be 'sticky' customers. In the long term, efficiency savings from DSR should cover this loss of revenue, but it is not known how long this will take, nor how the consumers who have lost out by it can be reimbursed. Even an opt-in system of greater price reflectivity would therefore have a potential 'see-saw' effect for those who do not opt in, which must be considered by policy makers.

Apart from financial considerations, there is also a more general risk that if DSR turns out to be valuable to suppliers, they will have more incentive to attract and keep customers who are willing to participate. Customers who remain on non-ToU tariffs may end up with second-class customer service, or be offered less attractive tariffs to encourage them to take part in DSR. There should be no possibility of DSR creating a two-tier electricity system, and Ofgem should guard against declining standards of service for non-participants.

Although suppliers may emerge who are DSR specialists, a supplier removing all of its non-DSR tariffs might be problematic. This could result in consumers feeling forced into DSR. It would also remove a useful point of comparison: so long as a supplier offers at least one 'normal', flat-rate, evergreen tariff, that tariff could be benchmark against which consumers can could compare both the DSR offers and other suppliers. It would also mean that consumers coming to the end of a fixed term DSR tariff could not be rolled onto another with different time bands, for example. Therefore it might be advantageous to require all suppliers to offer at least one non-ToU tariff.

Recommendation 12: Ofgem should in future monitor the impact of DSR for non-participating consumers and consider a requirement that suppliers maintain at least one non-ToU evergreen tariff.

[56] Sustainability First have modelled this in their paper Electricity demand and household consumer issues.

Glossary

Automation (of appliances or heating systems)	When an appliance or system is controlled (either by a timer, or remotely by a third party such as a supplier or network) to turn on and off at certain times without intervention by the consumer.
Auxiliary Load Control Switch (ALCS)	A switch built into a smart meter that can be connected to an ordinary appliance or a heating system to switch it on and off remotely.
Critical peak pricing	A type of demand-side response signal in which energy prices are particularly high for a short period to encourage a steep reduction in demand for that period.
Demand side response (DSR)	Customers responding to a signal to change the amount of energy they consume from the grid at a particular time.
Distributed generation	Electricity generation that is smaller-scale, and connected to the distribution network. It often takes the form of renewable generation.
Distribution Network Operator (DNO)	A company licenced to own and operate the gas or electricity distribution network which connects consumers to the National Grid. These operate as a regulated monopoly subject to a price control.
Dynamic time-of-use tariff	A demand-side response tariff in which the time bands and their associated prices change from one day to the next, sometimes in line with real-time data. This is as distinct from static ToU tariff.
Energy Services Company (ESCo)	A company that helps consumers manage their energy, which could include finding the best deal, installing and managing smart appliances or aggregating demand-side response actions with other consumers.
Frequency response	Short-term demand-side response services used by the transmission network to keep the frequency of the grid at the required 50Hz.
Load limiting	A restriction placed on the flow or amount of electricity allowed to a consumer, which can be set by a smart meter.
Load shifting	Movement of electricity demand from one time period to another.
Low Carbon Networks Fund (LCNF)	Funding available to electricity distribution networks through the current network price control, DCPR5, to be used to try out new technology, operating and commercial arrangements.
Network price control	The regulatory framework governing the agreement between an electricity (or gas) network and the regulator Ofgem, detailing how much the network can spend over a certain number of years, and what it must achieve through that

	spending.
Off-peak period	A period during a day, a week, or a year in which there is particularly low demand for electricity.
Peak demand	Electricity demand during the peak period. Or, the level of demand at the point (usually within a day) when it is at its very highest.
Peak period	The period(s) in a day during which electricity demand is higher than usual. For domestic consumers in the UK this is in the early morning and early evening.
Radio teleswitching (RTS)	Remote control by the electricity network of consumers' heating systems, to aid balancing and efficient use of network capacity, and help consumers to take advantage of off-peak electricity.
Retail Market Review (RMR)	A review launched by Ofgem in 2010 to encourage and equip consumers to engage effectively so they can get the best deal from the energy market.
Smart Grid Forum	A forum which brings together experts in the development of UK smart grids to help shape UK Government and regulator thinking in this area. It is chaired jointly by DECC and Ofgem.
Smart appliance	An appliance which can respond to remote signals to switch on or off or be turned up and down, in response to pre-set conditions or an external signal.
Smart meter	This is an umbrella term referring to advanced electricity and gas meters with a variety of additional functions. A smart meter can be read by a supplier without the need to visit the consumer's home.
Static time-of-use tariff	A demand-side response tariff in which the time bands and their associated prices are consistent from one day to the next (for instance under the Economy 7 tariff, in which electricity is cheaper during the same hours every night).
System operator	The party responsible for managing the security of the power supply and co-ordinating supply and demand. In the UK this role is played by National Grid Electricity Transmission Plc.

Aims and principles

The Citizens Advice service provides free, independent, confidential and impartial advice to everyone on their rights and responsibilities. It values diversity, promotes equality and challenges discrimination.

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