

GB Electricity Demand – Realising the Resource

Workshop Report

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Sustainability *first* nationalgrid

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This document is a report by the organiser of a technical meeting set up as part of UKERC's research programme. It is believed to be an objective record of the meeting but has not been separately reviewed by the participants.

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Acronyms

GB – Great Britain
DSM – Demand side management
DECC – Department of Energy and Climate Change
Ofgem – Office of Gas and Electricity Markets
DUKES – Digest of UK Energy Statistics
DNOs – Distribution network operators
CAPEX – Capital Expenditure
OPEX – Operational Expenditure
LCNF – Low Carbon Network Fund
CLNR – Customer-Led Network Revolution
DSR – Demand-side response
EST – Energy Saving Trust
DG – Distributed generation
CHP – Combined heat and power
ROCs – Renewable obligations certificates
FITs – Feed in tariffs
PV – Photovoltaics
EMR – Energy market reform
EEDO – Energy Efficiency Deployment Office
UKERC – United Kingdom Energy Research Council

Overview

This workshop was convened in order to develop an understanding of the key commercial, regulatory, and policy "enablers and blockers" to active customer and consumer participation in GB electricity demand-side management. The event enabled the sharing of the latest research and thought on this subject. Discussions were facilitated and outcomes were developed, with the hope of supporting policy development and decision making in the future.

The workshop was structured around the following questions:

- What does electricity demand look like today?
- What could electricity demand look like in ten to fifteen years?
- What do market actors need from the electricity demand-side, and what is in it for them?
- How can the customer and consumer participate in the electricity demand-side? What's in it for them?
- Where does DG fit into the demand-side picture?

The final session was focused on current electricity demand-side policy development in process, and on the horizon, for DECC and Ofgem.

The following report details the discussion that occurred at the event, in order that the views of a range of key actors can be recorded and, it is hoped, taken into account in future policy.

To view the presentations and selected video podcasts from this workshop please [click here](#)

Welcome

Judith Ward, Sustainability First

Judith Ward welcomed contributors to the workshop, pointing out that the event was oversubscribed. An indication, she suggested, of growing interest in the subject.

Judith defined the terms of the discussion; its concern with electricity not energy, and how the event represented the culmination of two years' work to date on GB electricity demand by Sustainability First, as coordinated through their Smart Demand Forum. She outlined the economic and practical potential for positive changes to the GB electricity demand-side, which are possible at the current time whilst ensuring that consumers and customers remain at the core of energy demand concerns.

Judith went on to outline the day's aims:

- Take high level outputs, from a variety of researchers and organisations, and open them up to an audience to consider enablers and blockers *in practice*
- Identify key research areas and or areas of concern for the final year of the GB electricity demand project
- To bring together market actors, consumers, university colleagues, and others, concerned with this topic, and formulate how to feed findings into business and policy
- Identify the next steps for electricity demand-side in the next ten years.

Philip Lawton, National Grid

Philip suggested that there were two foundations on which GB electricity demand-side must build, that was the drive for efficiency, and the move toward low carbon electricity.

He pointed out that, within these changes; those running the grid are always looking for load variation and new sources of flexibility, which can hopefully be identified. Examples were given, such as the timing of battery charging when wind energy is plentiful, or time shifting according to grid capability. As such, Philip suggested that demand-side innovations would be key technologies in helping the grid continue to develop into a smarter infrastructure.

Session 1, GB Electricity Demand Side: Scene Setting

Chair: Jon Bird, Northern Powergrid

David Shipworth, UCL Energy Institute

David began by pointing out that there were a range of perspectives on what constituted demand-side management (DSM). He suggested we must clearly identify and define what we are trying to manage. One trap stands in the way of such an approach, that is, the limits of a singular disciplinary perspective. David outlined nine disciplinary categories, each with their own *thing* to manage. The question, he suggested, is how we can align these interests.

The key question, he suggested, was to come to understand what value system best could appeal to customers and consumers. There are lots of extant offers for consumer home energy management, but the cost of energy is not a key driver for LMC/UMC, they want convenience.

David outlined the range of academic theories which were in play, in conceptualising human behaviour. This ranges from neoclassical economics to more modern practice theory, which moves away from an individualist approach to behaviour, to an understanding of behaviour as practice. He suggested that, within this plurality of models, the attitudinal model is predominant. He concluded that a successful approach would be contingent on consideration of a range of understandings of human behaviour.

Serena Hesmondhalgh, Brattle Group

Serena described her five years' work on the subject of DSM, and outlined her current project seeking to identify where demand side policy and or investment strategies could get the most 'bang for its buck'.

She asked the audience, what do we really know about end-use electricity demand; In detail, for what, and when? Serena went on to suggest that productive analysis cannot account without detailed information on how demand is 'built up'. This is hampered by outdated data on electricity end-use. Accordingly, Serena has developed a data set with half hourly breakdowns of demand based on DUKES data, amongst others, and her own calculations. This data set allows for the identification of where there is most potential for demand side shifting and demand reduction.

Serena's model allowed for the identification of targeted policy at a household, commercial and industry level, and enacted to 2025 scenarios, business as usual (BAU) and a 'greenest' scenario. Both scenarios identified five key end-uses for potentially shift-able demand: and in total 10 GW of flexible demand was potentially achievable.

Discussion

Q. The ambition of the 10 GW figure was questioned, it was suggested that it was a very large amount of energy.

In response it was pointed out that the exercise was intended to identify from a technical standpoint, potential areas of demand worth concentrating on, rather than providing a precise figure as to forecast shift potential in practice.

It was suggested that, at the distribution level, flexibility offered a cheaper form of policy than current policy: Particularly when a further level of flexibility is offered by smart meters. Given this, the panel agreed that the question where most value from DSR might lie, needs more detailed analysis.

Q. The question of the timescale of DSM alongside the delivery of renewables was also raised. As the renewables sector, it was suggested, are keen to see demand side flexibility, as this fits with their agenda.

In response, the panel suggested that until we reach 20–25 per cent renewable output, actors do not need to consider renewable storage issues. Though, clearly, this is a concern, and the importance of synergies between the two broad policy approaches will need to be fully formulated.

Session 2, Panel Discussion: What demand side services do market actors want – and what is in it for them?

Chair: Judith Ward, Sustainability First

Lilian MacLeod, National Grid

Lilian outlined National Grid's role as an energy balancer. This involves balancing residual energy, as demand-side management is presently little used by suppliers. Lilian pointed out that less than five per cent of volume within the electricity market comes from demand side measures.

Lilian outlined a range of balancing services: alongside a range of demand side responses, which Lilian suggested might offer opportunities for the demand side to supply more capacity to the balancing marketplace in the future. She outlined that National Grid will continue to purchase balancing services, but compared with the wholesale market, the volumes will be comparatively low. She also outlined indicative prices available today to demand-side providers, in the Balancing Market. However, she stressed that it is expected that National Grid will require more balancing services from the demand side in the future. This left her to ask, whether there was a greater scope for true demand-side turn-down to play a greater role in the future.

Jon Bird, Northern Powergrid

Jon's key point was that for distribution networks, location was critical to the requirements that distribution network operators had of demand-side response. He suggested that this consideration must be held in place when Northern Powergrid addresses their aims: reducing the costs of managing the network; reducing peak or sustained demand, and maintaining system security. Jon pointed out that demand-side response is not just a climate change measure; it can assist the operation of the network today. Though, that being said, he suggested that low carbon technologies will offer a challenge to the grid operators.

Locational considerations can assist these goals; via a location-specific relation with customers and the formation of customer clusters. This will require location-specific incentives, and consideration of the role of time of use charges. But since any response from domestic customers had to be mediated through the electricity supplier, whose tariffs were not location-specific, this could limit participation. Aggregating responses to meet a location-specific outcome offers some difficulties because of the lower numbers. For example, it would be necessary to take account of the possibility of changes of supplier. Local capacity constraints could limit the

way in which demand side response is sold to other areas, and could mean that network operators would need to fall back on traditional reinforcement to allow customers to offer DSR elsewhere.

Northern Powergrid's approach is therefore to help customers to address their connection needs by exploring options and offering flexibility. They intend to build on their extant work with industrial and commercial users. Domestic customers entail more issues, such as buy-in, thus Northern Powergrid need to find ways to get customers to take part in DSM, other than via financial incentives. As such, a research funding proposal has been submitted to to the LCNF to meet this need.

Amanda Williams, British Gas

Amanda outlined trials of demand-side management initiatives in the North East of England (LCNF customer led Network Revolution project). She outlined the 'surprising' success which initial findings from the time of use trials were indicating. This success was encouraging in relation to British Gas' three main objectives; supplier balancing, aggregation, and meeting carbon targets. However, she suggested that, at the moment, many demand side management initiatives do not make commercial sense. The blockers to this are coming mainly from policy.

Faced with a range of blockers, Amanda suggested the need to focus on consumer engagement. This, in part, will involve raising awareness of DSM and Smart Grid capability. Thus, their research looked at how customers value non-financial benefits of DSM. For example, to what extent were consumers interested in wider benefits for the Grid's sake?

The Low Carbon Network Fund (LCNF) is beginning to look at non-financial consumer values, in relation to the implementation of actual DSM, and the Customer-Led Network Revolution (CLNR) trial, in which British Gas is partnered with Northern Powergrid, is revealing initial results. Though money saving is still the main aim of customer involvement, there was a broadly positive feeling in relation to a wider range of non-financial benefits. Alongside which, a 14 per cent reduction in peak time energy demand via shifting in response to a Toll tariff, and 3 per cent reduction in total demand, was indicated from initial trial findings.

Chris Welby, Good Energy

Chris set out two big changes in the move to a lower carbon electricity system. Firstly, more inflexible generation, which can be forecast but not induced, for example wind power. Secondly, generation will be more localised. DSM offers some means to compensate for these changes. Specific examples were given, such as the increasing unpredictability of consumers, owing to local generation or new loads, plus unpredictability of national generation.

In addition, energy companies may develop to distribute heat and power, rather than energy, as it is currently delivered in kWh. This service based model could be used to overcome the problem of energy 'on-demand' rather than 'when-available', which would otherwise be risked, under a predominantly low carbon system. How might this be achieved? Chris suggested that smart metering, a move beyond Economy Seven pricing, and the possible automation of energy use control could all offer significant savings. He suggested that this was a leap into the unknown, but that we need to take risks, rather than tweak the old industry model.

As such, Chris proposed advice for policy makers. Policy should not nanny the masses, but should protect the vulnerable; properly account for supply and demand costs; not look to a mass market approach, but to tailored tariffs; and seek to develop a relationship of mutual trust with consumers. In summary, those engaged in DSM, it was suggested, need to redefine the consumer, challenge old players, and think harder.

Discussion

Q. The panel were asked how they envisage the demand-side relationship between distribution network operators (DNOs) and suppliers. It was suggested that currently there are practical constraints and regulatory barriers to allow value-capture.

The panel agreed this was an issue. The solution was to formulate common interests. One way of doing this would be for more suppliers to be involved in discussions, and for a better understanding of customers to be developed. The more opportunities for discussion the better the outcomes will be. It was pointed out that National Grid and the DNOs were both looking to maximise value, but the current pressing concern is to develop a sharing model, and establishing what, in practice, we mean by sharing. The panel looked forward to more tangible outcomes.

Added to which, it was suggested that the industrial and commercial sectors had more direct involvement with DNOs, but that the domestic sector is more in the hand of suppliers. Thus system operator proposals would, to some extent, be limited to industrial and commercial sectors.

Q. The peak/off-peak price differential used in the CLNR study was queried, as was the wider question of price incentives for incumbent energy companies

It was confirmed that the modest differential was taken from pricing estimates for 2020, where peak price doubled (from the standard price). Off-peak price had a 20 per cent discount. It was further suggested that aggregation, particularly of domestic customers, is vital, as sometimes the price signal does not deliver results, as personal circumstance intervenes. Thus the need is to ensure that DSM delivers something to consumers, rather than dictates. Thus, the aim should be a sufficient reaction from a sufficient proportion of consumers.

In relation to incumbent energy suppliers it was suggested that the right price incentives were already in place. For DNOs, DSR is encouraged by the common regulatory treatment of the distribution networks CAPEX and OPEX, and this will be taken further in the next price control period. At the moment a carbon incentive is not included in DNOs' investment appraisals and so such decisions were taken on purely financial grounds.

Q. The question of data security and DSM automation as 'big-brother' was raised, in relation to the CLNR trial

In response, it was pointed out that this study was in fact predominantly behavioural. Those automated technologies used, were signed-up for voluntarily and terms and conditions formulated to ensure privacy. Qualitative research suggested that in fact consumers were not overly concerned with data privacy. It was further pointed out that the data was not live, so its security was perhaps less of a concern to consumers than other forms of personalised data.

Q. The way in which balancing mechanisms will work alongside the capacity mechanism was brought into question

It was suggested that balancing services *will* work alongside the capacity mechanism, though the exact mechanics are yet to be confirmed. The need is to clarify the baseline on which these services operate. Balancing services will have changed in four years' time.

Q. The question as to how peak demand be managed in a low carbon system was raised

Peak demand management is not cost reflective at the moment, it was suggested. So, there is a lot of work to be done in assuring it is. This, it was suggested, is a big unknown at the moment. Working groups at renewable suppliers are in process, and the indication is that peak pricing must be dynamic, and comfortable with some automation.

Session 3. Panel Discussion: How can the customer and consumer participate in the electrical demand-side – and what's in it for them?

Chair: David Shipworth, UCL Energy Institute

Industry Demand: Maria Pooley, Sustainability First

Maria pointed out the disparity between the scale of industrial energy demand and the minimal data on its end use. As such, a key aim of her research was to establish an indication of the technical potential of a range of industrial demand side responses. Her research indicated that industries which did not have a more than ten per cent energy cost to turnover ratio, tend to engage less in DSR, whereas energy intensive industries are actively involved.

Taking a survey of companies, a number of blockers were identified. Financially, it was suggested that the value on offer to a business to provide DSR services was an insufficient incentive, particularly in cases where power constituted a small proportion of total manufacturing or business costs. Some barriers are technologically inherent to the industry in question. For example some industrial processes are interruptible, whereas others are contingent on a continuous supply of energy. A further barrier is institutional limitations; businesses are risk adverse, thus unwilling to take on DSR/DSM risk.

Broadly the study suggested that blockers could be identified as insufficient additional prospective revenue from DSR measures. An issue connected to the price visibility of energy as factor of production. Contract lengths, for both supply of electricity and equipment lease were restrictive, as was a general lack of interest outside of energy intensive industries.

Jeremy Nicholson, Energy Intensive Users Group

Jeremy pointed out that, for some industries, electricity can be up to 70 per cent of production costs. And that for energy intensive industries as a whole, the average cost was 25 per cent. Thus, there is some clear interest in DSM from these groups.

As evident in the 1.5 GW TRIAD response work, already in action in the sector. However, he pointed out that involvement is highly industry specific, and can be constrained by health and safety constraints, the nature of the machinery in question, and the way in which long and short term price signals operate in relation to the internal dynamics of the industry.

So, there is a given baseline of demand, which cannot be resolved. But there are also some areas where innovation could occur, such as batch processing, peaking plant, and areas with electricity demand elasticity. In addition, lessons could be transferred from the energy intensive sector to less intensive industries, such as retail and the public sector. A final point was that the decline of heavy industry is not a positive thing, in relation to DSM, as such industries tend to be those able to offer effective demand response.

Household Demand: Gill Owen, Sustainability First

Gill stressed the importance of the customer. Work must look at available data, and technical solutions, whilst also attending to 'willingness'. For example in relation to space and water heating, a surprising number of people are still using 'on-peak' electricity. And sizeable proportions are not using heat storage systems. Added to which, the insulation gap is also a big challenge. Without addressing these, a new peak problem may be created by growth in electric heat.

Some contradictions exist. For example, for electric water heating systems, combination boilers may negate the benefit of water storage. People moving to combination boilers are therefore limiting heat pump provision with storage. Also, appliances offer some complexities, as wet appliances are often not used in peak periods, despite being the ones which consumers may be willing to shift the most. Thus there is a need to address this. Added to which EST data has shown that 50 per cent of lighting, in use, is still incandescent. Clearly then, the uptake of efficient appliances is not occurring at the rate and scale that was forecast.

It appears that there is less resistance from customers than would be expected, in relation to energy use automation. But consumer trust in energy companies is low. Thus, these, alongside data gaps, and slower than expected take-up of efficiency measures, needs to be fully addressed if households are expected to effectively and willingly buy-in to DSM.

Sophie Neuburg, Consumer Futures

Sophie asked the question, how would the value of reductions or loads shifting be passed back to consumers? The benefits of DSM would be contested, and forecasts have come up with different numbers according to the assumptions which they have used. As such Sophie wanted to raise the issue of fairness. The risk is that free-riders could exploit the benefits of DSM, or that consumers would not do well out of the extra costs and inconvenience which some DSM imply.

The question was therefore about how far shift-able load and peak demand correlate, and the effect that changes in these two demand profiles will effect consumers. She suggested that incentives will need to be significant to drive interest. In addition, she suggested that, despite media coverage, it was not yet clear how consumers were responding to automation.

The current evidence on consumer interest in differential tariffs, suggests that not many consumers are benefitting from the relatively simple Economy Seven system. Thus, time of use tariffs may further serve to alienate consumers, owing to a greater complexity. In addition, Sophie suggested that suppliers seem unable to offer detailed data even on Economy Seven uptake, so this will need to be improved if the efficacy of time-use pricing systems is to be objectively assessed.

Discussion

Q. Will Smart Meters overcome consumer free-rider and remuneration issues?

It was suggested that Smart technologies will not suddenly turn consumers into 'pro-sumers'. Remuneration will come through market and new retail tariffs, which smart meters will enable via efficient usage. In addition, it was added, those that take up smart meters may not be the consumers that need to be targeted, a self-selection bias may occur.

Q. Is fuel poverty still part of the equation?

Seemingly the scope and flexibility of the domestic sector, for DSM, are not great at the moment. So it was suggested that, in the short term, more should be done for low income households to assure that DSM does not have disproportionate distributional impacts on these householders.

Q. Time does not seem to have been addressed? Time of use pricing is one question, but seasonality is another.

The panel agreed that seasonality was important, and that time use pricing could not rely on simple models. Something more like dynamic pricing would be perhaps more effective. Seasonality will interact with technologies in unexpected ways. Seasonality has always been an issue, prices rise in winter in a market based system, and, without effective forms of storage, it cannot wholly be avoided. However, potential restrictive effects on industrial effectiveness, as a result of seasonal price rises could be a clear problem, requiring some redress.

Q. Is there anything we can do, in the short term, in relation to efficiency?

Some companies such as Onzo, the panel pointed out, offer non-financial incentives to time shifting. There are, it was suggested, 'nudge-ways' of encouraging consumers to shift their demand. Price is not the only motivator, though it is admittedly important.

Q. Distributors do not sometimes know when they are shifting from day to night, currently there appears to be no requirement that they do? To lose the radio teleswitch facility for storage heater would be a loss to DSM

It was agreed that some useful elements of the current RTS system may be lost. It is important that this is avoided, or that these are re-developed or integrated into the new system. The *Mail on Sunday* coverage of automation shows that DSM is not well understood, even amongst the media, thus it is important that we get smarter in our informing of others.

Session 4. Where does distributed generation fit into the electricity demand-side picture?

Chair: Catherine Mitchell , University of Exeter

Overview – Stephen Andrews, Lower Watts Consulting

Stephen presented his research on the potential contribution of distributed generation (DG) to DSM. DG has been defined and applied to a variety of technologies, but here Stephen was keen to define DG as 'anything not connected to the transmission network'. He suggested that existing data as to the capacity of DG was patchy; For example that provided by OFGEM, in relation to ROCS and FiTs. He suggested that we only guess how much standby generation is connected to the system. This data was virtually non-existent. Only data on commercial sector generation exists, and this suggests that it is less than 5 GW.

Stephen suggested that many treat DG as a problem, rather than an aid. His research suggested that this could be resolved if there was greater sharing of data between parties. DG contribution to demand side can occur broadly by three means, automatically, inadvertently, or intentionally, as metered energy – whose value is rewarded. Stephen suggested that, in some circumstances, there was the possibility of a natural correlation with demand. For example wind peaks as winter demand peaks, or CHP heating correlates with demand for hot water. Though he accepted these natural correlations may not coincide with the national peak. Stephen addressed the possibilities for DG from a wide range of sources, including energy from waste, landfill gas, fossil generation, and diesels, and the possibility of some reserves from renewables.

His key commercial conclusion was that you would need to pay a lot of money in order to compensate them for forgoing income from distributed generators Renewable Obligation Certificates (ROCs) or Feed in Tariffs (FITs). So his take home message was that the key blocker was a policy gap between low carbon policy and DG and DSM policy.

Smaller PV Units & Demand-Side Interaction, Syed Ahmed, Sustainability First

Syed suggested that small PV's interaction with DSM was more complex than might be imagined. He gave the example of the FiTs export meter, which are only fitted for installations of more than 30 kWh. Below that, they are not feasible, owing to cost. So, of the 350,000 plus FiT's installations, much generation is unmetered. There are also some clear regional disparities which present challenges. For example, the South West has a high uptake of PV and FiTs and the amount of PV energy concurrently entering the grid is causing 'headaches' for South West power distribution networks.

PV gets more complicated, Syed pointed out, when it displaces electricity brought to the site in question. In addition it can cause energy to be spilled, unmetered, into the grid. DECC has suggested this could be as much as 50 per cent of PV, but this is an estimate as all output from solar PV is presently not fully monitored. The Rwh output data captured under the FiT arrangements is quarterly, which may cause problems. Lack of detailed/granular knowledge of PV output may lead to imbalances between small PV producers, also spill recipients, and suppliers. The distribution network also has little understanding of the local spill pollution. Added to which, he argued the fact that the FiT arrangements and supply businesses are set up wholly separately. This means that neither know for certain what a given house is receiving or producing.

So Syed asked whether there might perhaps be some time of use elements to FiTs, as total UK energy demand is lowest when PV output is highest, during a sunny day. This may entail a FiT requiring storage onsite, in order to maximise on-site usage of PV. Another option would be a within-premises PV balancing tariff. A further idea was a community level postcode retail tariff, to ensure consumers absorb the spill.

Aggregator: Alistair Martin, Flexitricity

Alistair asked, whether demand response (DR) and DG were the same, or if they got in each other's way? He suggested that there was a clear overlap, but also much confusion. For example, DR could be 10 per cent diesel, or DR could be offered by CHP. A further confusion was that industrial and commercial energy users were leading the way in demand response, though at the same time, demand response was a challenge to industrial and commercial energy culture.

In terms of barriers, Alistair suggested that a supplier hub model does not work, as there are split incentives. He also pointed out that small commercial organisations do not have market access. A problem worsened by the lack of specific market structure design. As such, Alistair suggested that suppliers must be allowed to operate according to their own logics. Alongside which there was an urgent need for liquidity and access reforms in the market. A third point was that any future design of programmes needed representatives from both DR and DG in the room.

It was suggested that there were also perceptual barriers, as the achievements of DR aggregators had been marginalised, and they had unfairly be portrayed as middle men, and 'unlicensed ne'er do wells'. He suggested that their standing with suppliers may be adversely affected by the fact that suppliers are also generators.

As such it was suggested that, despite this, there were some clear DR and Flexible DG successes, but National Grid programmes were limited by technical constraints. So Alistair suggested that one tangible way to proceed would be to establish a similar program as the Low Carbon Networks Fund, but for suppliers.

Discussion

Q. It was asked whether it might possible for aggregators to be licensed like suppliers.

In response it was stated that on-going action at Greater London Authority may yield some change. But, at this stage, it is unclear whether this will make a difference. It was suggested that the sooner it was tested, the better. Another member of the panel pointed out that when Ofgem first began looking at this, it was clear that the site specificity of generation had to be a key part of changes to supplier arrangements, in order to fully capture the benefits of such a system.

Q. If it is not possible to make DG to work on industrial and commercial levels, how can we get it to work on household levels?

A member of the panel, in response, asked why a smart phone-like interface had not yet been developed for domestic energy production and consumption management. The same respondent also questioned the extent to which industrial and commercial organisations can engage with consumers, but at the same time, the respondent suggested that innovation may bring on changes in the domestic sector sooner.

Q. It was suggested that perhaps we are too quick to jump at financial incentives, as a sole means of inducing change. Community schemes, it was pointed out, get support without a commercial imperative. At the same time, large companies want to be involved with communities – so why can they not be involved?

A respondent suggested that community owned facilities are difficult to replicate in the UK, owing to planning law, as well as multiple industry barriers. So whilst agreeing that it would be great if community interest schemes could be shared with communities and businesses, the planning system will restrict this in practice.

Q. If PV 'spills' into the grid, unmeasured, why not encourage battery storage?

Some in the panel agreed, batteries did make sense especially in certain areas. One respondent pointed out that there was a large amount of demand for PV batteries, for example in Germany, where they have a subsidy on batteries. The respondent suggested that they could envisage this happening in the UK. A different take was that Germany was interested in batteries owing to the prevalence of PV creating too much capacity for the grid to handle. It was suggested that the concurrent need, in such a situation, to subsidise PV and subsidise batteries was the 'economics of a mad house'.

Q. How optimistic are the panel about the contribution and management of PV; considering the cost of installing PV in Germany, and the impact that FiTs and CFDs where going to have on demand side response?

One panel member suggested that the German system had recently resulted in consumers being paid to consume electricity, due to an oversupply. The panel also suggested that FiTs first objective, renewable energy will be met.

The Chair stated that when we thinking about the new DM system; it is tempting to think of the tools and solutions from the old system. The risk is that this perpetuates problems. A better idea, it was stated, was to generate new solutions.

Session 5. What are the current policies for electricity demand-side development – and how can we move forward for active customer participation?

Chair, Gill Owen – Sustainability First

Charlie Lewis, DECC

Charlie outlined, in relation to demand reduction, the government's fundamental focus on the efficient use of energy. He detailed the four-fold benefits of efficiency; reduced bills; economic growth; energy security; and the reduction of emissions. His presentation went on to describe the origins of the current policy, which emerged out of a White Paper on Electricity Market Reform (EMR). This exercise raised the question as to whether it was better to use less electricity, rather than generate more.

In order to test the cost effectiveness of a variety of policy measures, a marginal abatement cost-curve was developed, in order that cost to carbon dioxide abatement could be quantified in financial terms. The potential savings, taken as a whole, were a significant 90 TWhrs by 2020–2025. However, at the same time, it was clear that barriers to implementation existed, such as split incentives.

Charlie pointed out the fact that the government had issued a consultation, following the White Paper, in order to identify barriers and enablers that would facilitate efficiency saving policy proposals. Proposals ranged from financial incentives, informational campaigns, and the development of supplier obligations. DECC are in the process of analysing the responses to the consultation. DECC hope to publish their response on electricity demand reduction shortly.

Another key step, for this program, is to encourage demand side response. The plan, at this stage, is to ensure that DSR will be able to bid into the capacity market, alongside generation, meaning that DSR will contribute to the security of supply. Time frames are not clear at this stage, but will give enough time for primary legislative change.

Ben Smithers, Senior Economist, Ofgem

Ben outlined Ofgem's position on DSR. He suggested that DSR is different to many other things happening in the market. Different parties use DSR in different ways, and there is a wide range of products involved, which also add complexity. Thus Ofgem must consider how customers can benefit from potential value. In order to assure this, Ofgem, with help from others, must consider how settlement arrangements can be arranged to best deliver benefits.

In light of this, Ben drew attention to the Ofgem Consultation (open until 28th June, follow up in autumn 2013) which has been launched, on *Creating the Right Environment for Demand-Side Response*. The consultation intends to build knowledge as to the feasibility of DSR objectives, in relation to the organisation's wider goals, such as, in the longer term, the creation of a market environment which supports efficient system-wide use of DSR. So the consultation aim is to get a sense of the key challenges, and the way in which industry and Ofgem can coordinate more effectively.

Ben outlined some preconditions, which are necessary for DSR to be effectively implemented. First, industry parties must be confident in investing in DSR. Second, customers must come to understand the value of their consumption. Third, customers need access to information, and the ability to act on it. DSR could also be incentivised, if supply chain incentives could be improved; with improvements also to customer signalling, and investment potential.

Discussion:

Q. A question as to the perceived aggressive implementation timeline of the capacity market was raised, and it was asked what rules, in relation to demand, will be developed for wider industry.

The respondent suggested that no decision will be made before the conclusion of the consultation process. It was agreed that the capacity market was credible, but that doing everything with the right level of consultation was vital.

Q. Ofgem and DECC were asked to explain the relationship between demand response and demand reduction, and whether one policy instrument can do both?

A respondent suggested that there was a possible illustrative model from North America, where the capacity market does have a competing demand side response, efficiency standards and demand reduction policies. This suggests such a system is possible.

It was also suggested that clearly there is a link between these multiple policy aims; flexibility is related to demand reduction. But it was suggested that Ofgem and DECC must be careful not to duplicate each other's work. Though the consumer must be protected, and reduction comes into that, reductions targets also impose obligations.

Q. The question of who is looking after public interests, the public sector or markets, was asked

Both parties admitted that there are limits to, and failures within, the market. Thus their role was to offer both information, in order to ameliorate this, and also to offer consumer benefits and low cost energy, via some corrective policies.

Q. How do we prevent overlapping government policy?

It was accepted that there was a large amount of energy policy already in place. Thus new policy must account for the existing 'busy' framework. One way in which this is being managed is via the Energy Efficiency Deployment Office (EEDO), whose role is to coordinate policy within the complex framework, and between existing and affected departments.

Another point was raised in relation to data, and the way in which it might be curated and shared. It was suggested that funding bodies needed to think about the data that they assist in developing, in order that they might become universally available, in order that researchers and policy makers can better leverage value from that data.

Q. The panel were asked about non-financial motivation, and what they were doing to encourage it?

A respondent commended the strong behavioural literature and its range of interesting ideas, which had fed into the tone of the consultation document. Though it was suggested that within the non-financial space, it was not clear how much further government could go. It was suggested that there were no detailed answers to this question at this stage, but that they would be interested to hear of any. At the same time, the respondent suggested that time of use tariffs and greater levels of information on consumer and demand behaviours will be helpful. It was added, that there are many things which need to fall into place before market benefits/changes are implemented.

A second point was that there are clear signs that third parties are assisting consumers in navigating the market, and as such, some of these changes might come to affect companies.

And finally, it was suggested that better resolution data, could lead to potential much more reductions in demand. This was commended and encouraged.

Session 6. Key Enablers and Blockers, Roundtable and Working Groups – Plenary Feedback Session.

Chair, David Shipworth

Five themes were formulated throughout the day, as hexxie-notes were collected as and when attendees came up with a suitable question. These were collated and used to develop five major themes relating to enabling demand-side responses in the UK electricity system. The roundtable involved attendees self-selecting their theme of interest, and formulating an overview as to enablers and blockers within that theme. These were then presented and discussed by the group as a whole.

1. Economics and the Value Chain

- This group suggested in economic terms, there does not yet seem to be a problem for DSR to solve. There is sufficient capacity at present (generation, networks) to meet GB peak demands, and so price signals are not yet extreme; therefore it is not clear if price is prompting any change in demand. Moreover, value is not yet visible. Added to which, the wholesale market relies on the price signal, and this is not yet being articulated.
- It was suggested that Ofgem and DECC talk about effectiveness of demand response without looking at supply side capacity in the future, when intermittent generation is likely. Therefore, in the future, there may be 'missing' money to provide adequate capacity.
- One fear, articulated by the group, was that electricity market reform (EMR) might exacerbate this by dampening/suppressing scarcity prices which may prompt DSR.
- A further point was that it will be difficult to aggregate a range of changes across the energy system.
- The demand side needs the same amount of attention that has been placed on the supply side. This requires long term investment starting now, policy framework and an incentive structure which supports this.

2. Engineering and General Technical Challenges

- The group suggested that there are manifold problems in the remote control of energy demand, and not enough solutions. In relation to smart meters, it was suggested that these must be secure, and there is a risk that their security could be compromised by 'hacking'.

- Failures and maintenance issues must be avoided. This will, in part, be a result of the decisions made as to the level of control, and where it is located; locally or remotely. System robustness must be a consideration.
- Remote signalling control is an important concern, though it is feared that the response will be limited. Good technical standards are vital; this will ensure that there will be more in-house (domestic) energy intelligence.
- The energy infrastructure of housing will be different, and will need to incorporate local preference. One possible approach may be to offer building management systems, rather than remotely controlled systems. This could recognise priority areas in the country as a whole.
- The group suggested that these changes will take a long time, and so they abstained from putting a timeline on the process, but suggested that ASAP would be best for all involved.

3. Industry Skills and Capability

- The group suggested that they had focused on a potential lack of skills as a key block. It was a focus, as it connected all the players. The group suggested that it was not clear whose responsibility education and training should be: governments, tertiary educations, or the remit of a full educative programme?
- It was also pointed out that, it was not yet clear *what* skills would be necessary, though it was expected to involve a combination of planning and electronics, amongst other things.
- The value of undertaking such skills training will need to be assured, and will need to be backed up by consistent government policy. At the same time, it is important that older skills sets, and experience, are not lost.
- Thus, as a national issue, perhaps a Centre of Excellence could be established, or an Electrical Skills Forum established. The group suggested that there is a potentially wide range of good learning to be found.
- In terms of when, it was suggested that this educative process should have begun already. But that skills training must be run in parallel with other developments; i.e. assuring the necessary skill-sets are in place by 2020–22, and when smart meters are rolled out nationally.
- A further point about a lack of public awareness about DSM was raised, and it was suggested that promotion of such approaches needs to be carried out.

4. Consumer, Society, Community

- This group suggested that there was a difficulty in communicating the risk of energy shortages to the public as a whole. Thus it is vital to identify suitable high peak prices and/or methods to get the public on-board, these will need to be both top-down and bottom-up. One novel approach may be neighbourhood lobbying.
- In addition the central delivery of the smart meter programme may give the opportunity for national advertisements, regarding DSM, to be broadcast.
- The group suggested that trust is an issue, as consumers do not trust government or energy companies, to any great extent at the moment. One approach may be to leverage the support of local communities, in order to build trust.
- Another option would be to leave it to the market, and allow energy companies to manage everyone's energy.
- In terms of the timeline, it was suggested that trials must begin now. This will allow time for them to evolve into better customer engagement strategies.

5. Policy Regulation, Delivery, and Frameworks

- The group suggested that the market is not currently designed to accommodate DSR. For example, you need the right market, with the right market participants for the Smart Grid to work. The question, they suggested, is who should facilitate this accommodation.
- The group suggested that Ofgem must coordinate the current work, and UKERC's Meeting Place is vital in order to establish how DSR will be implemented. This must all fit within DECC's policy framework.
- How might market structure be corrected? The group suggested accurate data is vital, an audit which details what is occurring at the moment, and what is in implementation already, would be a good start. This would be facilitated by clear policy goals, which could then provide a focus for the players involved to target their activities.
- A key technological driver to successful policy and regulation is the effective use of data, which needs to be shared, and rendered interoperable. Data collection, it was suggested, is fundamental. Data sharing could enable the coordination of policies.
- This should be implemented as soon as possible. A roadmap would assist in monitoring progress.

Plenary Feedback

David Shipworth, UCL

David summarised the points made above. In conclusion he suggested that:

- In order for an improved demand side to be developed a considered approach to enabling practices needs to be undertaken. Whilst maintaining an approach which accounts for potential blocks to implementation. He gave an example. In relation to security, it is not only that smart systems need to be secure, but that they also need to be seen to be secure. This will ensure both data and consumer trust are generated at the same time.
- In addition, David suggested that the roundtable had shown that data will be critical to effect demand side development.
- The skills needed in order to collect, analyse and act upon this data are a vital developmental need.
- In conclusion, he suggested that he saw the process of implementation in a nexus between the use of data, and the maintenance of consumer trust.

Final thoughts, Judith Ward, Sustainability First

Judith reiterated that this was the third year of Sustainability First's demand side project. The outcomes of the roundtable discussion would feed into the last year of their work, and for this, she thanked the participants for their contributions. Judith quoted Isaac Newton, a former President of the Royal Society, when she stated that, progress is only achieved 'by seeing further by standing on the shoulders of giants', so she thanked the prior and on-going work of others, in contributing to the development of more effective demand-side measures. In conclusion, Judith said that today's workshop had revealed the burgeoning interest in demand-side, and that it was vital that all participants learn from what is happening on-the-ground, at the current time, so lessons can be learnt, and used to feed into policy in practical ways and to help formulate a clearer demand-side vision for the future.

APPENDIX A: Hexxie notes

GB Electricity Demand: Realising the Resource Hexxies

Session 1, GB Electricity Demand Side: Scene Setting

- Little contribution by heavy industry to peak demands -> demand in industry not the problem
- Locational aspects are key and will be the first drivers of need to do DSR
- Need to understand the supply side future variability to understand **when** might be best to deliver and **what** might be end use to focus on when that's needed
- When is DSR required 2020 -> or earlier? If later then why have DSR in Capacity Mechanism?
- Will the demand profile change? (with time, with region) as a result of policy
- Timescales: to achieve DSR by 2025 you will need to invest and plan from 2015 - don't underestimate timescales for deployment
- The Need: demand response is needed as soon as possible to help address grid constraints and curtailment of wind generation, notably in Scotland
- Will demand response compete with storage to provide flexibility? Current progress with each shows storage = very expensive vs. demand response = very hard to organize/enable
- Data on Appliance Level End-Use: 'smart' gives new opportunity for end-use appliance level data; but government regulator and research journals need to facilitate that
- Not necessarily **one** solution - different ones in different solutions
- Important to distinguish between reducing peaks or reducing overall demand
- Challenge in understanding what loads can be shiftable - limited data, which loads are peak loads? Can these be shifted
- It isn't just about dealing with intermittent generation. Need to think how it can address issues now (as Serena Hesmondhalgh presentation stated)
- Winter peak shifting from industry already occurs - not evident from graphics - lost in figures from winter commercials
- What is the overarching organizational framework which will bring together the different strands in an optimal way?
- What is the priority - reducing the cost in the system are reducing carbon emissions? Can we realize both - where are the conflicts? Where are the synergies?
- Scene setter highlighted potential = CULTURE CLASH
- Opt-in to demand side- even if invisible/in the background VS. opt-out from it just happening in background (by system operator)
- Difference between theoretical potential and what is practically realizable
- Domestic - is there an interesting difference between account holder, consumer, household etc

- In review of academic approaches to DSM, political science was missing; yet key issues (e.g. data protection/privacy) which loom large for consumers are highly political
- Demand profiles the **average** (or total) hides the variation at household level
- Does shifting **local** demand matter more re: **local** distributed production? Community energy/incentives?
- EV and Heat Pumps use lots of electricity – much greater incentive to engage
- The Need: we need flexible demand response not just because renewables is variable; but because some other forms of thermal generation are **inflexible** e.g. nuclear, also coal
- Surely someone needs to pay attention to seasonal variation in DEMAND. End use practices are **not** the same all through the year
- Insufficient focus on wholesale markets!
- Maximum value delivered if Demand Side responds to system conditions – frequency or signal from system operator
- If smart meters are the biggest enablers, how does policy delay impact on future of DSM?
- A key question for me is: do we need to have demand–side management for households and their appliances? There must be tremendous potential to shift demand using electric vehicles and industry – so why bother trying to engage consumers to load–shift their washing machines
- Importance of getting more electricity usage data: we need data to analyse/assess policy regulatory options for future DSR
- Flexibility – where’s the impetus? Bottom up: addressing local network constraints OR top down: aggregated, monetized national products OR if both: how do they meet in the middle?
- Important note: it is dangerous to use Dukes data over last few years to extrapolate the future: (1) we have been in recession since 2008; (2) manufacturing industry has been discouraged for last 15 years in favour of financial services and this is unlikely to continue; (3) easy energy efficiency have now been achieved
- Distinction between residential, sme, commercial, industry is artificial – people work in one space and live in another – Join the Dots
- Another option: to regulate that domestic appliances must be ‘smart’ enabled. Points: (1) model is frequently responsive cooling units mandated by EU; (2) need agreed smart appliance standards across EU; (3) will automate DSR as much as possible; (4) likely to deliver the maximum DSR
- How is society being engaged in the potential options for DSR – which they will be expected to provide?
- Focusing on ‘the consumer’ is probably a mistake if you are actually interested in changing patterns of DEMAND
- Brattle Group – demand forecasting: a clear split was shown between IxC and Domestic. Where do SME businesses feature in the model and in 2025, 2050 plans?

- ‘Where do we get most value from our bucks’ – But: who are “we” and what are “we” spending?
- Serenea Hesmondhalgh presentation: lighting offers a major energy efficiency opportunity at peak (so not shift, but reduce)
- UCL Shipworth: DC seems to be seen as a problem (wind, solar) – not a solution – affluent middle class most of interest but hardest to reach – but they maybe the one to install solar etc and have smart appliances
- 117k HH sites are both commercial and industrial (val of sites is more commercial/e.g. 1500 McDonalds!) – need to simplify road map e.g. to remove uncertainty for investors – storage vs. DSR, DSR rewards
- Brattle group presentation: PV, which may more morning peak – more flexibility from cheaper demand side make bring forward timescale of DE integration
- To Serena Hesmondhalgh: the data analysis stops short of understanding DEMAND. Future end users are assumed to be the same as those of today!
- Whole systems approach needed – supply/storage/demand
- Optimizing energy cost should be the primary focus of DSR (and distributed resources generally) just like it is and in the wider electricity system. Networks should be a secondary concern acting as a reactive enabler. Networks should not and cannot be the proactive driver of change at the distributed level
- Difference between consumer and customer?
- Industry isn’t the ‘problem’ i.e. does not cause swing; industrial data is readily available in the HH Market
- A commercial framework that enables the capturing of value from distributed resources is the key to unlocking their benefits. This would allow market forces to progress development. Just like the centralized system has the wholesale market, so the decentralized system needs a decentralized market
- Sustainable and long term development of DSR requires those providing it to get the value they create (either through optimizing on energy cost or providing services to the market)
- How do new entrants/innovations access/influence policy-makers and regulators given: (1) importance of regulatory policy framework; (2) powerful incumbents
- Middle class use most energy – but least concerned by the price! How then to make energy saving ‘cool’ or ‘must have’ e.g. like Toyota prius growth!
- We need to make the role out of smart meters a positive to get customers engaged
- Customer engagement is crucial! Needs to be as simple as possible to customer
- Storage seems obvious enabler – especially to support renewable generation. But have we developed cheap/easy/flexible storage options?
- Too much focus on residential – need to start with industry

- DSM: this is a change in culture – need maximum time – in–spite of medium time scale, good – 10 – 15 is years needs to start now!
- Serena mentioned 27 million customers – is that 25m domestic – 2m non–domestic? Is there a better breakdown of these elec customers?
- What happens to Serena’s industrial demand curves if you take out the say 100 biggest industrial users?
- What did Serena Hesmondhalgh’s demand analysis assume about the impacts of changing end user efficiencies?
- How to translate papers on demand side management that is understood and is of benefit to public engagement: (1) what’s in it for me to bother? (2) high level figures on savings by implementing security
- How to bring together and showcase technologies to support DSR with research and policy development?
- Barriers/enablers:
 - Currently lack of flexible demand–future HP storage?
 - Lack of incentives for industry parties
 - Technology – conventional meters, SMIP current spec
 - Customer engagement – need for education/automation
 - Data privacy – concerns overstated?
 - Policy uncertainty – carbon agenda
 - Lack of policy coordination e.g. SMIP, OLEV, EMR, IRMR
- Is there a mechanism in place for DNOs to access the consumer? Priority of access? Communication protocols?
- How useful are DECC 2050 pathways in relation to DSR?
- The timescale issue raised by Zoltan of R.UK is important – R110–EDI set for next 7 years
- If ‘biggest’ bang for the buck! If moving from peak –> DNO/supplier customer relationships must change (DNO more involved?)
- Biggest bang for your buck already quantified = avoided investment in generation and networks for demand peaks (DECC/Poyry 2010)
- Mass EU Battery charging and discharging would seem to have great potential for automated domestic sector DSM, so projections of potential presumably depend on assumptions about EU roll out/take up (which is partly policy dependent)
- Do we have models and estimation of how much demand side response could impact on energy efficiency/renewable energy uptake?
- What is the priority focus? Power/energy/more effective use of renewables? Where will the biggest impact be achieved?
- Is there evidence that demand shifting is easier to achieve among industrial/commercial customers than domestic?
- Serena stated that lighting is not flexible. Is this true? It would be possible to gracefully degrade lighting demand
- Where do we get most value from DSR? Industry, domestic, commercial?

Session 2 What demand side services do market actors want – and what is in it for them?

- How much energy do consumers actually ‘need’ – where does this ‘need’ come from and how does it change? Who is discussing this topic?
- How might non-financial incentive be reflected to customers?
- Focus on evening peak is wrong. Needs focus on margin between demand and available generation
- Shifting demand invariably involves some change to services provided – expectation management?
- To move forward the discussion on how much of the IOGW domestic resource for DSR may be realized, we need to establish the value and cost of it
- Payments for DSR need to be cost reflective
- What are conclusions of demand analysis? High level analysis needed. Different level for different purposes vs individual companies need individual details
- Aims: promote efficient use, CLMR – selection bias?
- Good to hear positive results from British Gas toll trial. Maybe there is hope re: consumer engagement! (but as ever, Daily Mail response not helpful)
- Will dynamic pricing be too complex a step for residential consumers?
- ‘Load limited tariffs’ – perhaps the benefit comes from linking to large (and new) energy uses (EU, ASHP)
- What are the relative benefits of DSR for system balancing and grids?
- How can consumers play a role in storage?
- Are suppliers the best placed organisations to reach on consumer engagement? Alone?
- On toll pricing, it seems there is a risk that peak pricing becomes just a way of charging customers more, which may result in those who are least able to shift demand being penalized. There is also a question as to whether discounts during off-peak periods will benefit consumers enough to compensate for the peak pricing.
- Does government recognize the carbon benefits of DSM? Important as average grid intensity decrease but peaking with high carbon intensity
- How much demand response is really left when you have maxed demand reduction?
- TOU Tariffs vs “tariff simplification”
- Vision: will government/ofgem/industry agree strategic priorities and roles? Or will it be a ‘don’t pick winners’/’competitive markets will deliver’ approach
- Why no exposure to Triad Reduction Actions
- What about Red Band (DNU) and Triad Demand Reduction (not diesel generators)
- What is the default YOA permitted to 3 bed domestic household – could these be tiered?

- Interesting to see the LOW representation at this event of ICT companies – their involvement is crucial but they tend to feel shut out
- Government understanding of the complexity
- The 4–8pm peak: the idea of imposing peak pricing for this period would immediately draw protest from families with children under 10 or so, as it is simply harder for them to shift electricity use from this period. Politically tricky, sets the principle of cost reflexivity and efficiency against that of socializing cost
- Bespoke tariffs = profiling and restricting customer choices? As in mobile phone industry?
- Monthly DD has removed customer awareness of cost of energy – should suppliers produce, graphically assumed monthly profiles vs. actuals
- How will DNOs manage fault restoration for managed loads that are restored at full demand? Even a short outage will switch off load controls and renewables and domestic loads
- How will NG account for DSM of other actors e.g. DNO, suppliers?
- If DSM is not going to be implemented until late 2020s do we have roadmaps developed to ensure we are thinking towards late 2020s – what are the tech challenges, social challenges etc
- How engage customers? (1) role price; (2) non financial incentives; (3) segmentation; (4) innovation in terms of offers, need ‘game changers’
- Should networks have a direct relationship with customers? What would be needed to make this happen?
- Do not underestimate privacy issues – very low awareness now BUT could change very quickly with adverse media
- Today’s customers vs. future customers – lifestyle, demographics, technical ability
- Localization would make it easy for consumers to understand pricing based on renewable generation i.e. if its windy here – why is price more expensive?
- Complexity – right incentives? How do they do it elsewhere? (sicily)
- Studying relationships between parts of supply industry and ID optimums
- Energy management systems too complex for domestic customers?
- Any gender differences in approach to energy shifting?
- NGC: most non BM demand from Fossil generation therefore carbon implication; multiple purchasers of DSRs; Suppliers NG (need market) and DNO’s
- Non-financial benefits of DSR to customers – how can we best leverage it?
- How will we coordinate use of DSR by different market players?? DNOs, GRID
- In future DNOs, NG, others will ALL use DSR. How will CO MMS work for this – need to keep customer clarity and central coordination?
- DSR in National Grid’s balancing services – should we identify and favour? DSR over e.g. diesel generation?
- Who, across the whole system, stands to make most money from shifts in the timing of energy use?

- Why are cooking and washing more malleable (in timing) than other practices?
- Consumer Engagement: before you introduce DSM to consumers, how do you get their trust in the industry? Biggest barrier to DSM!!
- Most trials to date have struggled to get a significant level of customers engaged to date
- Smart metering will not deliver the benefits if industry players are prevented from getting the most valuable data!
- Not clear the Ofgem consumer challenge panel should be seen as representative of what the majority of consumers will respond to – they are not necessarily typical consumers?
- Value will evolve over time: decrease local constraint management and decreased system balancing; boundary between DNO and generators/suppliers needs to be clarified: DNO → SO
- DSR: some form(s) of storage is key → incentives
- Pricing: post code lottery – house prices/rents vary; rates vary; why not?
- Good Energy's contention that we stop thinking about evening peaks and instead think of when wind and solar generating is key exemplar of difference in priorities between renewable generation, and networks for whom peaks are still crucial. These different priorities need to be managed, maybe governed
- Is government/regulator nimble and bold enough to remove barriers? In a suitable timescale?
- "Protect the vulnerable; don't nanny the masses" – Agree. However, government definition of vulnerable covers ~70% of households. Old problem of identification becomes more important
- Experience: people aren't that bothered even about shifting supplier, let alone shifting their demand!
- How do we set up a way to get all market participants and consumers together to develop a DSR market?
- Risks to DSM: conflicting objectives of market participants i.e. supply and DNO
- Local customers, high energy production, low demand – location is BIG issue
- Who controls the signals, suppliers or DNO? Needs to be sorted out otherwise consumer confidence will be too low to recover
- Jon Bird states that domestic customers installing low carbon tech CHP/PV etc. are not currently charging for reinforcement costs. Current evidence would show otherwise, in certain cases where customers are being changed. There is a short term need to address this between now and ED1 when these costs will be socialized. It is potential causing location specific barriers to low carbon led take up
- Cost reflectively – will mean winners and losers → can be dealt with cost signals?

- How far can we take cost reflectivity in terms of (a) public/political acceptability and (b) consumers' ability to engage?
- DSR Smart Homes – automation and storage is key – need customer incentives? Green deal?
- The Need: Ofgem have identified low generation margins over next few years. Where is the debate for DSR to address this in the short-term and before smart metering is rolled out in domestic sector?
- What are the current thoughts on locational charging? Transmission, distribution – particularly DECC/Ofgem
- Question: are all distribution businesses offering flexible connection agreements?
- Relationships between industry segments
- DSM or DSR: assumes customer (especially domestic) has the information in a suitable form and the controls to 'adjust' their use – facility must include ability to 'automate' the control in line with their needs
- 'Consumer in control' – very important especially to cover unsuspected emergency needs/use
- To which end users is the 14% reduction attributed? This is a key unanswered question
- What are emissions savings (or penalties) directly from timeshifting? How well do we have marginal grid emissions intensity characterized at present, and what do we anticipate in the future?
- 27 million bespoke contracts? Unworkable
- National Grid's role in DSR within the Capacity Mechanism? NGT unlikely to be buying DSR in STOR as it can be called via CM
- Storage, Storage, Storage. Still not enough being said about how to research new technology, and promote take up.
- How to evaluate benefits of energy storage at Domestic, Local or National level. In particular how far could it reduce problems of unbalanced supply and demand, and avoid need for complex demand management?
- This event brings together enlightened people and a lot of knowledge in the area of DSM which represents a 'skewed' view, what about running a similar event with different communities to get a real life consumer perspective?
- The technology strategy board funded a number of feasibility studies in the area of smart power and demand side, focusing on innovation with SMEs – an event to showcase this being held on the 17th July in London
- STOR: as time goes on, the amount of CO₂ from STOR will increase if this is based on diesel generation. Can this be reflected in the price of STOR in a better way – i.e. in the contract for difference mechanism?
- Customer Engagement: what percentage of electricity use do customers have direct control of?
 - Heating is normally on timer and difficult for consumer to adjust
 - Fridges are automatic
 - TVs transmit programs at certain times

- Hot water is on timer
- Policy option: allow DNOs to bill domestic customers directly and not through suppliers. This means DSR (and indeed PV) can be supplied through DNO with no involvement with suppliers
- If the uncertainty of consumers changing supplier at 30 days' notice is a challenge – then what is the challenge of customers changing suppliers at one of two days' notice?
- Demand Response achieved by back up generation is a really telling statement – that really is delivering one benefit of network reliability
- Managing demand in negotiating at connection is an interesting challenge – are they also negotiating for the future tenants? How strategic can this be?
- At what stage (levels) does DSM truly have measureable impact on load? (Reduction in the use of fossil fuels)
- Need for DSM may be caused by Renewable DC, but then DNO has to reinforce network to allow NG to procure balancing services? Caught in middle
- Onzo Energy Reports, the US are provided to customers – they include a 'grid watch' section which gives customers a smiley face if taken behaviour that positive in terms of load shifting...doing the right thing has an impact and useful driver not just price!
- How important is the actual price to motivate customers? E.g. Ireland Trial showed that customer responded more to the price trigger than the amount...
- Ofgem consultation not focusing on where value is for consumers...danger in too much focus on signalling (and therefore potentially segmentation and mis-selling) rather than first establishing where the value is and how it is realized
- Triad response: clear pricing/big savings; time of day specific; location specific = BEST PRACTICE?
- BG. CLNP Trial: are BG using a genuine tariff that would stand up in Business as Usual? What magnitude of saving will the average participant receive?
- Doubling peak tariffs is not a small differential
- Need for 'Market Makers' in DSR to stabilise prices where appropriate
- Should dynamic pricing be suitable/available/marketed to very vulnerable customers given the risk?
- Is there any evidence of consumer behaviour change from non-financial incentives? Are they sustainable?
- Good Energy: some suppliers are providing price guarantees if customer goes onto a ToU pilot and ends up worse off at the end they only change them what they would have on the standard tariff. Safety net – consumer groups welcome this
- More from energy provision to service provision: appetite from industry? Return to centralisation of service (CEB)?

- Could we be surprised by how much DSR comes on?! (once capacity mech in place) i.e. do we have a good price understanding
- How much DSR is currently purchased by local grid operators (DNOs)?
- Which demand sources have the largest potential for DSR? What is the industry vs residential comparison?
- There's been lots of focus on peak shifting – what about actual demand reduction as we move forward?
- 4 different speakers with different goals for DSR – How can an overarching purpose and aim be created to bring these together?
- Unclear how much people are willing to forgo control of their appliances
- The distinction between DSR and storage gets blurred in the case of EV battery charging/discharging and time shifting if not water
- Tension between DR and DSR?
- Need to understand that requirements for DSR will increase over time (now it is about DNO local peaks; it is only much later that wind may be the predominant driver of value for DSR) and therefore SC will require trials
- How to reconcile the different positions/needs for DSR of suppliers, distributors, transmission and generators?
- How do patterns of domestic demand vary with location? Would balancing supply/demand mean encouraging people to move house to a 'better' (in terms of electricity supply) area?
- Exactly which end uses might be modified/re-timed? Does this vary across social groups? Don't talk of consumers as one population
- How to manufacture and sell 'negumption'? (i.e. non-consumption)
- How much flexibility is there in DEMAND? How could flexibility be measured?
- It doesn't have to be a price signal through tariffs to get a location specific DSR response
- "Protect the vulnerable but don't nanny the masses" – Agree!
- Interaction between storage + DSR and optimisation of the combination relatively unexplored. Whether storage is large scale national or small scale domestic, how big implications for whole energy value chain
- DSR will be a shared service. Styles and incentives will likely vary so who will regulate or monitor if across suppliers/DNOs?
- DSR should be facilitated on local level by DNO to alleviate constraints/demand, now range of suppliers needs a rapid change to model of supplier first...
- Interesting concept of reinforcing to enable max local customer DSR, keen to see costs/benefits
- Consumer engagement for suppliers – real results needed – others need joined-up dissemination key
- Fascinating insight into CLNR project and British Gas' ToU work, including behaviour change
- Good separation of types of consumer DSR (on demand, when available, etc.)
- Good Energy's barriers are spot on!

- What is the critical mass of customers in DSR needed? And at what moment is the cost of an additional DSR user bigger than the additional value? Will there be then discrimination?
- Who makes the 'peaks'? The customers? The suppliers? The type of generation? What customers are doing/shared conversations/timing
- "True" demand and "false" demand? Actually why should the lights stay on? Which lights? How many lights? All lights?
- Possible demand-side services are already being (or soon will be) shaped by technological development and manufacturing interests – and decisions on standards
- What was the variance in reduction in CLNR ToU trial? Show me the confidence intervals!
- It's not the 'communication/messages' that need fixing re DSR – it's understanding what demand is that matters (FIRST!)
- What do special 'opt-in' trials really tell you about customer engagement (re CLNR) – these are not 'normal' and definitely not the hard to reach high consumers
- So customers are a 'flexible sink' to be sold on? To offer DSR services to others?
- How to join up research to commercialisation through innovation, perhaps a staged approach (research → development → application → product/service)
- Privacy: Daily Mail scaremongering aside, how aware are consumers regarding one level/resolution of information collected and how it might be used – need to know why is there this initial ambivalence
- Need to make payments for low carbon generation cost reflective? Is this an example of a potential clash between carbon goals and cost reduction goals or can we align them?
- Different methods to provoke consumer change – not simply carrot/stick – keen to develop
- Different drivers for different classes – classifications? Effective targeting
- Future load profiles – could massively alter if control of appliances/EVs improves...
- Customer incentives for DSM – link benefits to consumers' carbon costs e.g. long-haul flights
- Time to stop categorising backup generation as a demand-side service?
- Lots of talk about how regulation is a barrier – how can it be an enabler?
- The Energy Supplier Obligation on retail energy suppliers could incentivise consumer take up/purchase of DSR appliances
- Manufacturers of appliances need to be engaged in demand reduction considerations – new consumer propositions?
- Selling on 'on-called' DSR – What are the systems, mechanisms and who would own and operate these? Who owns relationship?
- Scope for contribution of Building Energy System Mgt. response?
- How to avoid double counting of DSR potential in projections?

- Jon Bird: 'need to reinforce in particular location to enable consumer to provide letter value DSR' → what sort of timescales are you thinking of?
- Who is holding the ring to make sure long term 'public interest' is served overall, given the range of commercial interests involved won't necessarily serve it
- Load limiting tariffs are a negative press story waiting to happen
- Markets evolve and can ramp up quickly – how will regulation keep up to ensure it doesn't act as a barrier?
- Ideas about engaging consumers remains incremental, dividing loads into shiftable etc.
- Obviously, in homes, there are people, families, lifestyles (etc.) and not simple, controllable uncontrollable loads
- Apart from asking what are customers willing to do, we need to ask what CAN they do?
- What is the value of disruption costs?
- DNO, National Grid, Energy Supplier relationships needs further investigation – who has priority of DSM?
- What would be needed to enable DNOs to establish load limited services to domestic customers?
- Can particular DSR services be 'sold' to more than one customer (supplier, DNO)? 16 not how to prioritise – where will most costs be reduced
- Is data privacy an issue of concern to customers or is it a red herring?
- Where will biggest drivers for demand response be derived? Will first movers set a scene that shapes future markets?
- Hypothesis: regulation of natural monopoly activity may stimulate networks and system. Operators to drive demand response sooner than market forces prompt energy suppliers. Will this shape the market?
- How will the role of the National Grid change if we move to a more distributed environment? How can DNOs engage customers in DSR without direct access to customers?
- How do other countries do DSR/DSM – we could potentially learn a lot and progress more rapidly
- Education of customers: national campaigns required – not supplier marketing! No one trusts them, no one will listen
- Astounding to hear national grid as a small, niche player! They are market maker and currently largest purchaser!
- DNO challenge is of a local nature – defer reinforcement costs
- Having lots of EU's seems optimistic – take up is currently slow and not being driven by higher conventional fuel costs
- How do we ensure cost reflectivity up and down the supply/value chain? Is this required for better incentives?
- There is NO regulation that prevents a direct relationship between DNOs and domestic customers!!

- Are Ofgem to introduce customers charges (domestic) when introducing low carbon technologies → where is this being recommended?
- Does NCEC have a carbon priority when it bags reserve services like STOR etc.
- Barriers/Enablers:
 - EU rule – storage investment, EU ‘influence’
 - Cultural constraints in network compares
 - Mandated response/control? DR insulation! Lighting
 - Privacy rules in SMIP!
 - Conflicting policy objectives – RMR/EED
 - Lack of understanding different customer types
 - Privacy concerns overstated
 - Consumer – lack of trust in suppliers
- Why and when will we need a distribution system operator?
- What non-financial incentives for DSM have evidence of success?
- Trial transmission charges means we are already seeing reductions in winter peak loads from large T-connected users
- Which challenge do you want to address with DSR?
- Peak cutting-network management?
- Responding to intermittent power sources?
- Gender differences – female vs male influences
- Data ownership – is this a barrier?
- Reducing peak and demand reduces the benefits of running conventional peak and baseload generation: could lead to security of supply issues? Mothballing of gas plants; negative wholesale prices?
- Need far more robust CBA of DSR against changes in product standards. Should lighting be written off as a way of getting further energy saving?
- Role of community solutions? Local councils self-contained ESCOs? Energy islands? Positive or negative?

Session 3. Panel Discussion: How can the customer and consumer participate in the electrical demand-side – and what's in it for them?

- Solutions: are we going ‘back’ to storage heating? Is it palatable form of heating?
- What is the demographic of the current 4 million users of economy 7? Is it historical?
- Barrier: lack of DNO awareness of I&C triad contracts
- Conflict between supplier competition/simplifying tariffs vs. granularity in tariffs to give “time of day signals”
- How many GW of DSR could maintain 4 day (e.g.) response, and thus be able to bid into capacity mechanism?
- Has anyone mapped out what the energy intensive industry sector might look like through to 2025? This may help with understanding overall potential in the future

- Will greater cost–reflection mean that subsidy to households from industry might unwind? So, will households pay more?
- Incentives to consumers should not be locked into being delivered using tariffs or existing NW charges. The opportunity to be innovative and change customers perception about energy should be seized
- DSR unlikely to bring bill reduction for consumers, but to dampen increases. This is a hard sell
- ‘Enablers’ – I see that it is more than just revenge of price!! Corporate and social responsibility cannot be forgotten
- How prepared is industry (that has not previously participated in DSR) to bid into the capacity mechanism?
- Age of control is over! What is the consumer proposition?
- Given people chance to innovate – introduce peak hour price premium and reduce non–peak so cost neutral if they do nothing. But if they switch demand they gain!
- We need to learn from lessons of E7 and Radio T/SW
- Consumers need help – don’t trust utilities to advise them. So, we need new community based support groups to encourage peak shift (and all energy saving)
- How do we convey the potential socialised benefits to consumers?
- Household demand: if value of demand–side is locational – then some households will be more ‘valuable’ than others
- Elaborate on whether heat purps are good technologies for DSR!
- Energy efficiency should be considered carefully before any other consumer measures. Rewarding the consumer for DSR will be enabled by market and regulatory mechanisms
- Is true cost–reflectiveness really achievable? Are there any precedents in other markets – I’m struggling to think of any
- RESPONSE:
 - How can we encourage sustained response from residential consumers? (so they continue to engage over the long term, not just the short term)
 - How can we improve the evidence–base for DSR? (looking at international experiences and understanding context)
 - How can we include and design locational pricing? And seasonal pricing?
 - In the short–term should we concentrate in developing policies to encourage commercial demand shifting?
- TARIFFS:
 - What impact will the Government’s plans to reduce the number of tariffs to 4 have on the wider development of residential time–of–use tariffs?
 - Need to know how many customers are actually on Economy 7 Tariffs (not just those with Economy 7 Metres)

- Is there anything that can be done in the interim before smart metres are fully rolled out (2019) regarding encouraging residential demand shifting (through tariffs)? (no demand reduction)
- Not dump all the 'old' stuff? → storage heaters, hot water cylinders, teleswitch
- Data centres? Significant and growing demand
- Rebound? Carbon vs energy efficiency
- Risks re: consumers benefits – how fair? They could benefit the most but they cannot due to circumstances?
- Industry focused on: Triad, STOR, Freq resp, Voluntary LM, now DNO resp. How can this be extended?
- Enablers: ability of commercial/office/public sector to offer DSR to offset early evening peak (and high wind during day)
- Impacts of domestic load shifting: if use wet appliances off peak, could this impact on increases in overall demand, with people using tumble driers etc. to dry clothes washed at non-standard times?
- Barrier: high intensive industries might not like to reveal their electricity costs/usage as those could be attributed to their processes
- Cost reflective approach but UK regulatory framework drives 'socialisation' of cost
- We can't always assume that the aggregators are not the suppliers, and how do you regulate that?
- What time periods do we want to shift out? Hours, days months?
- Which customers are we aiming at?
- Lots of talk about working with existing markets...radical change will not come from tweaks
- What is the objective energy efficiency? Load reduction? Energy management? This should inform what model is used to provide DSR
- Role for local collective action? E.g. whole street/ e.g. bulk buying/consumer coops?
- Smart metres are a key enabler to domestic DSR but plenty of other challenges to confront
- How much scope for DSR if we become ultra-efficient?
- See business parks/ MULTI-SITE: are there also opportunities for multi-site companies to aggregate load themselves? How does this fit with local stress? Presumably they could manage in aggregate and at location and balance there to offer services at different levels
- Carbon cost of margin
- Supply side measures aren't subject to cost effective constraints, why should demand side?
- Cost effectiveness – but what costs? Wholesale models are not currently a good guide

- Customer issues: when will these bite? What is the right balance between empowering and protecting consumers? Seasonal pricing? How will a customer deal with multiple parties? Domestic vs. larger costs
- It is very difficult to get away from quite ingrained terms. “Peak” – there is still a peak but in future it may not be a static one; “response” should not always be off
- Two key levers for change: financial, mandatory → what is role of latter and targeted at who (not just consumers) e.g. suppliers, networks, builders, manufacturers
- Education of energy consumers is key (decarbonisation, prices increase) → who should be responsible
- Sophie’s comment to ‘beware international comparisons’. There are many trials and evidence of business as usual around the world that provide DR that is more advanced than the UK. So what CAN we learn from the rest of the world?
- With the demise of large manufacturers in the UK, how do we engage medium size companies in the UK? How do we reward aggregators?
- Heat pumps are thermodynamically most efficient when the hot water has the lowest temperature. How do we use this water for retrofitting homes? Could this water be used as local storage for DSR?
- Business Parks/Industry: are there different opportunities for Business Park type arrangements where collectively the ‘park’ could offer the demand but ‘protect’ the consumer companies? A sort of business park aggregator – but particularly valuable to a network as it is local specific
- Too much focus on pricing? Are households national consumers of electricity – maybe the bill payer is, but other residents?
- DECC paper suggests potential for electrical efficiency biggest in I & C sector
- I&C DSR: target batch processes and provide maximum advance notice
- What is the optimum size of a storage heater in an age where the majority of power comes from renewables and local base load is removed?
- What is the relationship between electricity demand reduction and DSR?
- From energy intensive industries to multi-site operations. Start the conversation with energy efficiency advice to engage customers
- Domestic need half-hourly settlement in addition to smart metering
- The question which needs to be addressed is whether all of this can come from market or whether we need a more managed transition/strategic framework forward?
- Remember that the energy benefits of a smarter energy system could lie far more in identification of energy wastage, then in dynamic demand side management
- Who should have the benefit? Individual, everyone? Is that right?
- Can anything be learned from I&C sector which can be used in the domestic sector?
- What has the most value, benefit: energy efficiency or demand side response

- How do you engage the average domestic consumer? Is a price signal enough?
- Real risk that DSR benefits the 'able to participate' – like FiTs – would essentially be a regressive taxation system (at expense of 'unable' e.g. tenants etc)
- We need historical data to show how energy use and time use (household) interact to get any sense of temporal flexibility and how such patterns change
- Media: what are the stories? What are we collectively doing about them? Demand shifting; wind curtailment; grid infrastructure; idling capacity mechanism plant?
- Engagement: where is DECC's 'Energy Challenge' and National Grid's 'Powering Britain's Future' campaign on developing system needs?
- Presumption that consumers are the locus point for response. What about infrastructures of demand e.g. heat settings, norms, habits, work hours, travel practices, co-ordinated habits etc?
- Price response is variable and context dependent in households too → average price elasticity tells vs nothing
- A lot of consumers are already 'free riding' on standard tariffs. They are the high consumers
- Why is 'price response' the only lever/incentive we are talking about!?
- What's the scope for seasonal shifting of practices not only day-time of use?
- "If customers not willing to participate, no demand side" – NOT TRUE!
- How do different industrial sectors come to have the types of "kit" they do (in terms of elec use/sensitivity). How does this vary and change within and between sectors?
- A single unit price will simplify tariffs for household consumers so that they can easily identify the best deal for them. It will also allow ToU tariff rates to be presented clearly on a series of unit rates. Currently tariff complexity prevents engagement, and the TCR prompt will be limited in improving this, it is particularly difficult to see how TCR approach for ToU would be clear for consumers
- Managing transition from storage heaters is key – DO NOT DECOMMISSION R7s IF SMART METERS CAN'T DO LOAD CONTROL
- Need to develop a strong engagement strategy for mass consumer participation (or benefits will be minimal)
- Cost reflexivity (fair pricing) vs. equity (if low income not on new tariffs)?
- Social implications need more consideration
- Can heat pumps really provide DSR?
- Can DSR really offer capacity to help a 4-day wind low?
- Domestic Smart Meters: only a 1st step – more import to energy response is quality of IHD and other access to smart metre data/tariffs via customer access device "CAD"

- Do we need to see DSR and e.g. smart metres as more of a walk that takes (a long) time with numbers joining than something instantaneous i.e. peer examples, pilots etc. where benefits are demonstrable!!
- We've said hardly anything about voluntary (i.e. non-remunerated) demand response. If people can give blood in response to appeals, why not reduce demand?
- Will businesses take on the investment risk of changing processes to deliver DSR if there is so much uncertainty of value?
- Will electric vehicles and heat pumps be a help or a hindrance?
- Unwinding cross-subsidies via smart meters needs addressing!
- Smart meters are a necessary but not sufficient pre-requisite. Consumers will still be diverse
- Different approaches to evaluating benefits tell you something about the benefits – not obvious you gain from a united approach
- What is 'appropriate' consumer protection? More specifics please
- On consumer engagement – is anyone else concerned about the X year gap between when the consumer gets the smart meter 'enabling' hardware and when they're likely to significantly benefit from it? Late 2020's mentioned today, by then will the hardware still be in use?
- We need more emphasis on energy efficiency, which has bigger effect on peak demand than switching
- The majority of customers will not understand or are interested!! Far too complicated!
- Data will become more important in energy management – will this drive a new market to evolve?
- People replace appliances infrequently, will smart grids evolve faster than the pace of appliance replacement cycle
- How are HPs being taken up in commercial premises? Is this with regard (physically/institutionally) for DSR now or in the future?
- How much account is being taken of path dependence in relation to average life cycle of household appliances?
- Why is heating 'not shiftable' its changed radically over 100 years?
- People are willing to accept freeloaders in other areas of life i.e. recycling (waste changes), NHS (national insurance) however in these areas the service is not seen as for profit as the interface with the customer is a public service. Energy is seen as a 'public gd' by many so ppl might be willing to accept impositions and freeloaders in name of good of the country, however issue of profiteering needs to be tackled. Probably need other intermediaries involved
- Is the local government and communities department being lifted into energy policy developments and informed how it can be a means of educating consumers via local authority bodies
- How about ranking household appliances against (a) potential for timeshifting/demand reduction (b) average time before replacement

- Changing the timing of end use practices does NOT depend on smart meters, it is already happening! The timing of a practice is not natural
- How would the geography of electricity capacity map on to the geography of the present housing market? Social inequality
- Benefits of DSR: should be shared between suppliers, DNO's and consumers; every market participant should have the opportunity to share benefits!; consumers provide a lot of information about their lifestyle already – phones, shopping, banking, using twitter, travel etc. i.e. enables your location to be identified
- To be cost reflective we need dynamic pricing as well as dynamic timing in tariffs
- Where is domestic cooling in all this? Heat pumps in reverse? 22 degrees celcius, let's go for 18 in winter! + natural cooling
- There is a tension between customers knowing when off-peak periods will be and the need for DSR to be dynamic
- Industry participation in Demand Side: given the exemption from various elements of energy price, CPS, EMR CCC etc. why should they bother?
- Conflict with lower industrial prices (to compete internationally) and responding to full electricity price signals
- If we continue to have FIT and CfD not time differentiated then electricity price will be flat and NG will have to ramp up
- If the government is not committed to decarbonisation of the energy sector, why should we be pursuing EV, HP installation in what might still be a fossil fuelled generation sector
- Operating a low demand grid vs. operating a high demand grid = steering a minesweeper vs. steering an aircraft carrier?

Session 4. Where does distributed generation fit into the electricity demand-side picture?

- Is there a need for a local balancing or energy market?
- How can diesel generated electricity possibly be defined as 'Demand Response'?
- Alistair...what's a hub-hub?
- Who should be the curator of the data system needs? DNOs? Give them a bigger role
- Barrier: market structure/government support needs to be more cost reflective
- Distinguishing between DG and diesel DG
- Nomenclature: DSM vs. DSR = the industry needs to define what they mean by these terms. Going back 5 years DSM was anything that effected demand on the Distribution Network. DSR was a subject of this and primarily related to I&C triad and STOR activity. ToU is DSM unless real-time dynamic with automation

- We need to know what people do with energy during the day to understand what spills from PV and why and how to adjust this via storage etc?
- Aggregators: Alastair Martin stated that aggregators are not always best thought of, not all behave the same and they will reap what they sow
- Just because aggregators are newer on the scene than suppliers they should not be frowned upon/treated with disdain – they are a mechanism that is forming the future of the energy world
- Believe CHP flexibility available will decrease in future due to change in policy landscape (loss of LECs to CHP)
- The total system must be very ‘fat’ and accommodating to persist at all with all this present complexity/conflicting interests
- Market access for aggregators – is there enough?
- Will batteries in EVs be eligible for subsidy?
- ‘Wash when it’s windy’ – would people (or some people) be motivated by messages like this?
- Clear definitions for distributed generations are needed to ensure that the correct signals and goals can be developed
- How to link to industry who are developing solutions in demand response
- Are the details of the Capacity Market sufficient to help kickstart the market for DSR? 1 year is arguably not enough time for DSR aggregators to get ready for actions on DSR – thus hindering the potential DSR market in the short and subsequently, long term
- What type of storage should be allowed under fit for PV? Batteries →limited life; hot water storage; other e.g. flywheels, hydrogen generation
- How should batteries in PV systems be used to stabilise the grid? E.g. frequency aware batteries?
- Distributed generation:
 - We currently do not know how many distributed generation units are installed in the UK, a review needs to be done with a centralised database
 - We need a review of the carbon implications of distributed generation
 - What is the maximum amount of solar PV capacity that can be installed in the UK before networks need to be upgraded?
 - Should we introduce feed-in tariffs for small-scale storage?
- Alastair: what market model should replace the supplier limb? How does DG get joined up with demand-side policy measures?
- LCNF funding for suppliers for aggregators
- PV and battery requirement – this seemed to imply imposing a global solution to deal with local hot spots
- What about hydrogen production/storage for PV
- PV problems seem to arise from form of support so why not change that? Can aggregation work in installed systems?
- Need to consider the intangible benefits of domestic solar – massive increase in acceptance of renewable tech and acknowledgement of intermittency

- Are the barriers to DG as big as are made out – clearly aggregators are in the market so there must be an opportunity

Sessions 5: What are the current policies for electricity demand-side development – and how can we move forward for active customer & Session 6. Key Enablers and Blockers, Roundtable and Working Groups – Plenary Feedback Session.

This session contains mostly Hexxies from Sessions 5 however participants were able to add to their Hexxies whilst final feedback was presented during session 6.

- RMR will dissuade suppliers from offering ToU tariffs as part of their 4 schemes
- Regulation or market? ENSTOE (European Network Regulators) wants to mandate performance of DG and White goods to give frequency response DSR rather than pay for it
- DSR may be needed quickly given that EMR has been delayed and if the capacity mkt docs get buy-in by generation
- Despite DSM/DSR discussions, for many years – policy work on this issue has only started recently – and really because it became an ‘add-on’ to the EMR!
- Is there a clear industry group liaising with Ofgem & DECC on DSM/DSR?
- ‘Demand Response is a tool not the goal’ – this seems sound, therefore need to incentivise the goal and allow the tool to be used, want to be careful about encouraging the tool for its own sake
- DECC electricity demand reduction – shouldn’t we prioritise Time Of Use – for electricity demand reduction – as well as for DSR?? For cost efficiency and for carbon
- Economics has to fail first! Hopefully not but...difficult to solve tomorrow’s issues. But we don’t want to solve today’s issues, in 10 years’ time
- Policy changes and instability discourage long-term, sustainable planning for suppliers and 3rd parties
- What is the impact of DSM on security of supply?
- Back up diesel is easy pickings and doesn’t impact I&C core processes. Why isn’t the I&C market falling over themselves to sign up with flexitricity?
- Ofgem needs to reform tariffs so that consumers can play their allocated role in the market in driving competition NOW. Before the extra complexities of DSR are introduced for domestic consumers. RMR is unlikely to achieve the simplification and clarity needed
- POLICY:
 - How do policies for demand reduction and demand response integrate?

- How do we prevent policies overlapping?
- Do we really need new policies for demand reduction? Is it better to adapt current policies (Green Deal/Eco/etc.) instead?
 - However, could there be a need for an Energy Efficiency FIT or Supplier obligation for SMEs?
- How do we improve the evidence base for DSM policy implementation and evaluation (not modelled, but actual)?
- Central Delivery Body for smart meters needs to have a remit to engage public on energy (and coming changes in energy) more broadly (including DSR) not just smart meter rollout
- Will capacity market help bring forward DSR? Requiring year round 100% availability will discriminate against DSR compared to flexible gas plant
- Why can't we "turn the lights out" (perhaps as a simulation!) to show people how important getting the right energy mix and DSR is, and that if we don't get it right, it will happen for real
- Have you considered the need for a duplex market: (1) electricity; (2) load under particular conditions
- Significant overlap between capacity mechanism and smarter markets. Real risk that former may reduce need for latter, though both may be implemented/worked on simultaneously
- Risk that we build a DSR market but the economic incentives aren't (e.g. small peak/off peak differential) result is wasted investment
- I wish innovation here (in energy) was radical and not incremental, we need to see disruptive solutions that will give rise to change
- Is DECC prioritising DSR sufficiently in policy making and thinking, or are they leaving it all to Ofgem for now?
- RIIO ED-1 needs to clarify boundary between DNO and suppliers, otherwise ambiguity will inhibit innovation as DNO's are risk adverse
- Next time please allow more time for ad hoc discussions – that what we're here for! Well, ½ the reason
- Customers will need to be able to compare new offers – to do that they need:
 - Access to data – suitable granularity
 - Tools e.g. price comparison sites which show deals
- Ofgem needs to review protections framework e.g. around info provision, sales and marketing, also product standards = trust; consumers selected the right deal
- Need to recognise NOT all consumers will be able to benefit, even IF willing to – what happens to them?
- DSR – Big Question is: is industry joined up in its approach? However, a more fundamental question is: are DECC and Ofgem joined up in their approach?
- Turning demand into a product is even more amazing than providing the emperor with new clothes. Just how did we get to this point?
- IHDs should be ToU ready

APPENDIX B: Programme

09:00 Arrival refreshments

09:30 Welcome and Introduction: Judith Ward, Sustainability First

09:40 Session 1: GB Electricity Demand–Side: Scene Setting

Chair: Jon Bird, Northern Powergrid

- What do we mean by demand–side management?

David Shipworth, UCL Energy Institute.

- What will electricity demand look like in the next decade?

Serena Hesmondhalgh, Brattle Group

10:10 Session 2: Panel Discussion: What demand side services do market actors want – and what’s in it for them? What role for time–related pricing?

Chair: Judith Ward, Sustainability First

- Lilian MacLeod, National Grid
- Jon Bird, Northern Powergrid
- Amanda Williams, British Gas
- Chris Welby, Good Energy

11:00 Discussion: enablers and blockers

11:30 Refreshments

11:50 Session 3: Panel Discussion: How can the customer and consumer participate in the electricity demand–side – and what’s in it for them?

Chair: David Shipworth, UCL Energy Institute

- Industry Demand: Maria Pooley, Sustainability First; Jeremy Nicholson, Energy Intensive Users Group
- Household Demand: Gill Owen, Sustainability First; Sophie Neuburg, Consumer Futures

12:40 Discussion: enablers and blockers

13:10 Light Lunch & Refreshments

14:00 Session 4: Where does distributed generation fit into the electricity demand-side picture?

Chair: Catherine Mitchell, University of Exeter

- Overview – Stephen Andrews, Lower Watts Consulting
- Smaller PV Units & Demand-Side Interaction – Syed Ahmed, Sustainability First
- Aggregator: Alastair Martin, Flexitricity

14:30 Discussion: enablers and blockers

15.00 Refreshments

15:20 Session 5: What are the current policies for electricity demand-side development – and how can we move forward for active customer participation?

Chair: Gill Owen, Sustainability First

- Current Policy for Enabling DSR and Electricity Demand Reduction: Charlie Lewis, DECC
- Routes to Market for Demand Side Response: Ben Smithers, Ofgem

16:15 Session 6: Key Enablers and Blockers: Round table working groups and next steps

17:00 Plenary feedback

Chair: David Shipworth UCL

17:30 Final thoughts and close: Judith Ward, Sustainability First

UK Energy Research Centre and the Meeting Place

The UK Energy Research Centre carries out world-class research into sustainable future energy systems. It is the hub of UK energy research and the gateway between the UK and the international energy research communities. Our interdisciplinary, whole systems research informs UK policy development and research strategy. The Centre was established in 2004 and is funded by the Research Council's Energy Programme. A key supporting function of UKERC is the Meeting Place, based at Oxford University, which aims to bring together members of the UK energy community and overseas experts from different disciplines, to learn, identify problems, develop solutions and further the development of a sustainable energy system.

Sustainability First

Sustainability First is a UK environmental think-tank with a focus on practical policy development in the areas of sustainable energy, waste and water. Since 2006 Sustainability First has produced a number of multi-sponsor studies on GB household smart energy meters, and brings significant knowledge and insight in the field of energy efficiency, smart metering, smart energy tariffs and demand response.

Sustainability First is currently leading a major three-year multi-sponsor project (to 2014) '**GB Electricity Demand – *realising the resource***' to evaluate GB electricity demand-side resource across all sectors of the economy. The project and its outputs are co-ordinated via a multi-partner **Smart Demand Forum**. The forum includes the project sponsors^[1], plus four major UK consumer bodies and representatives of DECC and Ofgem. The project is highly practical and aims to understand the major consumer, customer, commercial, regulatory and policy issues for development of an active GB electricity demand-side over the next 10–15 years. Published papers are available on the Sustainability First website www.sustainabilityfirst.org.uk (seven project papers published to date)

^[1] BEAMA, Vodaphone, Consumer Focus, British Gas, EDF Energy, Elexon, E-Meter (a Siemens business), E.ON UK, National Grid, Northern Powergrid, Ofgem, Scottish Power Energy Networks, UK Power Networks.

National Grid

National Grid owns and operates the high voltage electricity transmission system in England and Wales and, as National Electricity Transmission System Operator (NETSO); National Grid operates the Scottish and Offshore high voltage transmission system. National Grid also owns and operates the gas transmission system throughout Great Britain and through its low pressure gas distribution business distributes gas in the heart of England to approximately eleven million businesses, schools and homes. In the UK, National Grid's primary duties under the Electricity and Gas Acts are to develop and maintain efficient networks and also facilitate competition in the generation and supply of electricity and the supply of gas. National Grid activities include the residual balancing in close to real time of the electricity and gas markets.

Workshop Steering Committee

Judith Ward, Sustainability First
Dr Gill Owen, Sustainability First/UCL
Lilian MacLeod, National Grid
Amanda Williams, British Gas
Zoe McLeod, Consumer Focus
Prof Catherine Mitchell, University of Exeter
David Holtum, EPSRC
David Shipworth, UCL
Jon Bird, Northern Powergrid
Tim Churchouse, UKERC Meeting Place
Jennifer Pate, UKERC Meeting Place

APPENDIX C: Attendee list

First Name	Last Name	Company
Dana	Abi Ghanem	University of Manchester
Constance	Agyeman	NESTA
Syed	Ahmed	Sustainability First
Ben	Anderson	Energy & Climate Change
Justin	Andrews	Elexon
Stephen	Andrews	Lower Watts
Elena	Ares	ECC Committee
Neil	Barnes	Ofgem
Sara	Bell	Sustainability First
Paul	Bircham	Electricity North West
Jon	Bird	Northern Powergrid
John	Broderick	University of Manchester
Mark	Brown	Energy Efficiency Partnership for Buildings
Alistair	Brown	SSE
Jane	Burston	National Physical Laboratory
Ted	Cantle	Sustainability First
Jim	Cardwell	Northern Powergrid
Phil	Coker	University of Reading
Ute	Collier	Committee on Climate Change
Adam	Cooper	Ofgem
Matt	Cullen	E-ON
Sarah	Darby	Oxford University
Sharon	Darcy	Sustainability First
Emily	Darian	Which?
Sarah	Deasley	Frontier Economics
Tom	Edwards	Cornwall Energy
Nick	Eyre	University of Oxford
Xander	Fare	SmartGrid GB
Yselkla	Farmer	BEAMA
Steven	Firth	University of Loughborough
Maxine	Frerk	Ofgem
Aaron	Goater	POST
Maria	Gradillas	Imperial College London
Dora	Guzeleva	Ofgem
Michael	Harrison	DECC
Richard	Hartshorn	SSE
Serena	Hesmondhalgh	Brattle Group
Christine	Hirsch	DECC
Marina	Hod	KiWi Power

First Name	Last Name	Company
David	Holtum	EPSRC
Christian	Inglis	Technology Strategy Board
Malcolm	Keay	Oxford Institute for Energy Studies
Tabish	Khan	British Gas
Matthew	Knight	Energy Saving Trust
Phil	Lawton	National Grid
Zoe	Leader	WWF
Charlie	Lewis	DECC
Ian	Llewellyn	DECC
Matthew	Lockwood	University of Exeter
Ron	Loveland	Welsh Government
Jane	Lucy	Metric Digital
Alastair	Manson	Engage Consulting
Alastair	Martin	Flexitricity
Lilian	MacLeod	National Grid
Christoph	Mazur	POST
Zoe	Mcleod	Consumer Futures
Sacha	Meckler	Wipro
Alison	Meldrum	Tata Steel
Luanne	Middleton	ECC Committee
Catherine	Mitchell	University of Exeter
Sophie	Neuburg	Consumer Futures
Jeremy	Nicholson	EIUG
Euan	Norris	Scottish Power Energy Networks
Derek	Osborn	Sustainability First
Gill	Owen	Sustainability First
Jason	Palmer	Cambridge Architectural Research
Mike	Patterson	PassivSystems
Peter	Pearson	Cardiff University
Andrew	Perry	DNV KEMA
Rebekah	Phillips	Green Alliance
Maria	Pooley	Sustainability First
Gareth	Powells	University of Durham
Alastair	Ramsay	BEAMA/Legrand
Simon	Roberts	Centre for Sustainable Energy
Josh	Robson	Energy UK
Simon	Russell	EIUG/Tata Steel
Sarah	Samuel	DECC
Brian	Shewan	SSE
David	Shipworth	UCL Energy Institute
Elizabeth	Shove	Lancaster University
Ben	Smithers	Ofgem

First Name	Last Name	Company
Duncan	Southgate	Siemens
Gary	Swandells	Western Power Distribution
Claire	Thornhill	Frontier Economics
Tim	Tutton	Imperial College London
Dan	Van der horst	University of Edinburgh
Alan	Walker	Royal Academy of Engineering
Judith	Ward	Sustainability First
Robin	Wardle	University of Durham
Peter	Warren	UCL Energy Institute
Chris	Welby	Good Energy
Mike	Weston	UKERC
Felix	Wight	Community Energy Scotland
Mike	Wilks	Poyry Management Consulting
Amanda	Williams	Centrica
Zoltan	Zavody	Renewable UK