Sustainability First

Response to Ofgem Consultation response 64/13.

Creating the right environment for demand-side response .

Sustainability First

1. Sustainability *First* is a small environment think-tank and charity. It undertakes research, publishes policy and discussion papers, organises workshops and high level seminars to promote new thinking on sustainability.

2. Since 2006, Sustainability First has undertaken a series of multi-sponsor studies on GB household smart energy meters. These studies have served to develop knowledge and insight in the fields of energy efficiency, smart metering, smart energy tariffs and demand response.

GB Electricity Demand project – *realising the resource*

3. Sustainability First began a major multi-sponsor three-year project in April 2011 on GB Electricity Demand. The project was supported in its first year under one of the Low Carbon Network fund projects[1] and thereafter for a further two years via a multi-sponsor group[2].

4. The project aims to understand the GB electricity demand-side resource - across all sectors of the economy. We are evaluating both the scope for (1) demand reduction and (2) demand response – including the demand-side role of distributed generation. We are looking to understand the economic value of this resource - to both customers and market actors – over a 10-15 year horizon.

5. The project has a strong practical focus on customer, consumer, commercial, regulatory and policy issues, informed by the experience of our project partners. The project is co-

[1] Northern Powergrid's Customer-Led Network Revolution project.

[2] Northern Powergrid, Scottish Power Energy Networks, UK Power Networks, National Grid, British Gas, E.ON UK, EDF-Energy, Vodafone, E-Meter Siemens, Elexon, BEAMA, Ofgem, Consumer Futures.

ordinated via a Smart Demand Forum, comprising our sponsors, major consumer bodies[3] as well as colleagues from Ofgem and DECC.

6. Project papers completed so far are published at 'GB Electricity Demand' on www.sustainabilityfirst.org.uk.

7. This consultation response to Ofgem reflects the views of Sustainability First, and not those of our project sponsor group or of the Smart Demand Forum.

Ofgem Consultation on Electricity Demand Reduction

8. Sustainability First very much welcomes the Ofgem initiative to consider electricity DSR. This is central both to promote system-wide cost-efficiency and, in the long-run, in delivering cost-savings to customers.

9. The consultation does not address electricity demand reduction. Just to note that electricity demand reduction remains especially important - both for larger electricity users and / or for the fuel-poor with inflexible demand, and for whom industry levies on end-bills may prove particularly onerous.

10. Answers to the consultation questions are based on the research carried out for our three-year GB Electricity Demand project. A full list of project papers to date on which this consultation response draws, are listed in Annex A.

[3] Consumer Futures ; National Energy Action; Which? ; Energy Intensive Users Group

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

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

The work of the GB Electricity Demand project has identified **a number of key gaps** which presently make it hard to reveal the value of DSR across the electricity system. We note some of these below.

- Our Sustainability First Paper 4 : **'What demand-side services can provide value to the electricity sector'** made a basic attempt to address the question of DSR value, including the value of flexibility and likely cost-savings, through the GB value chain. We found both a lack of basic available information and considerable complexity in trying systematically to attribute potential cost-savings from DSR to different parts of the value chain eg to assess the fixed and variable cost-savings enabled by DSR, attributable to different kinds of avoided generaton and / or avoided network investment – both short-run and long-run[4]. The relative materiality of potential cost-savings from avoided investment achieved by DSR at different times of day and at different times of year in the GB market is therefore not well understood. A systematic analysis of these values would help to improve the general understanding of how GB markets in DSR might develop in the future – and where regulatory and policy priorities might best be focused. This has led us to conclude that DECC, Ofgem and others may wish to consider how best to plug this gap – and perhaps to consider developing a more systematic approach to **a 'consensus' framework by which to analyse and evaluate the value of likely avoided-costs (i.e cost-savings) and the costs of DSR in the GB system – and when any savings identified may become available / realisable in practice**. This might be along the lines of the Smart Grids Evaluation Framework commissioned for the DECC / Ofgem Smart Grid Forum[5].

- Further, Sustainability First Paper 8 : **'Electricity Demand and Household Consumer Issues'** explores the lack of systematic analysis of the *costs* likely to be directly associated with DSR. We reviewed a number of key reports to identify costs and benefits of demand response. Although benefits have been modelled[6], apart from some work by Ofgem (July 2010), no-one seems to have attempted a systematic quantification of the

[4] The Redpoint, Baringa Element Energy modelling for the DECC Electricity System Policy (August 2012) has since made an initial contribution on this.

[5] 'A framework for the evaluation of smart grids. A report prepared for Ofgem'. March 2012. Frontier Economics and EA Technology.

[6] Eg. Redpoint, Baringa & Element Energy for DECC. August 2012.

costs including the transaction costs of DSR through the value chain. Most reports say very little about costs. This seems to be because costs are considered hard to quantify and also because it is assumed that some costs are being incurred anyway (e.g. smart meters) and therefore should not be attributed to demand response. DSR costs may arise to : customers (I&C, households), suppliers, network operators, the system operator and the settlement-system. A robust estimate of the *costs* of introducing DSR in different parts of the value chain would almost certainly form a basic input to the kind of evaluation framework suggested above.

- Other important 'knowledge gaps' which will help to improve general understanding about the costs and benefits of DSR through the value chain are :

  - **Value of Lost Load** – We are pleased to note that work is now in hand on trying to establish a range of likely values which different customers may place on a firm and reliable electricity supply (by DECC for the capacity mechanism and by Ofgem for the Significant Code Review). Up until now, this has been a significant gap in piecing-together the jigsaw of DSR values.

  - **Locational Value of DSM through the value-chain** - the value of DSM may vary significantly dependent on where the 'manageable' load or distributed generation is physically located in the electricity system. While DSM *at particular locations* can support avoided network investment (both transmission and distribution) and may reduce losses, location can also be material in Balancing Services too. Collective and community schemes involving DSM may also bring a potential value at particular locations, especially in the lower voltage distribution networks. Although some cross-industry charges already incorporate some form of locational signal with respect to load, this is not necessarily universal (e.g. DUOS). Nor is the value of location signalled in a consistent or integrated way through the value chain.

  - **DSR price discovery, visibility and transparency** – In paper 4, it was also not easy to relate prospective supply-side savings from DSR to the prices which are presently offered (or might be offered in the future) to customers for their DSR services. It would seem that both market actors and consumers stand to benefit from more concerted DSR price discovery, visibility and transparency across the value chain. Demand-side prices are beginning to become more visible in Balancing. Some LCNF trials are also beginning to reveal 'price-points' for some DSR services in the distribution networks – for example for pre- and post-fault 'insurance' services from DSR. The capacity market should also start to bring greater transparency to the value associated with DSR in the wholesale markets – in particular how this value relates to the avoided costs of new entry for open cycle gas turbine plant (ie avoided peaking plant). How in the end such prices become visible and transparent through the value full chain – i.e. the value of different DSR products in different timescales to different market actors - and how that value is then shared in a transparent way with consumers – will eventually support development of a full and active GB demand-side.

Experiments with local auctions and / or electronic DSM exchanges or trading platforms may help to kick-start the process of the wider development of 'DSR tariffs' and transparent prices.

- **Distributed generation –** Sustainability First Paper 6 : **'What demand-side services does distributed generation bring to the electricity system'** found that there is no clear view of GB distributed generation capability, its location and 'despatchability'. A more comprehensive distributed generation data-base would be a helpful step in establishing the likely contribution distributed generation may make to the demand-side[7].

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

Improved knowledge and insight gained from addressing some of the 'gaps' noted in the DSR 'jigsaw' noted above, should help to :

- Build a consensus and enable articulation for the first time **of a longer-term GB DSR 'vision' and likely route-map**. In effect, to develop a clearer picture of how the demand-side will interact with the supply side through the full value chain against a time-line.

- Improve understanding of where :

  - There may be material value available from DSR or DSM - but where incentives or responsibilities to realise that value in certain parts of the market are especially weak (for example, with respect to : the wholesale markets ; households ; a particular location).

  - The most *cost-efficient* and / or *realisable* sources of DSR sit in the value chain.

  - It may be more *cost-efficient* to pursue supply-side solutions (investment in generation, networks) to ensure an electricity supply which is secure and reliable.

  - Responsibilities or incentives to realise value from cost-efficient DSR in different parts of the market are especially weak – eg with respect to households – albeit there may be material value (eg in a household TRIAD, CPP etc).

  - New roles, new activities or new investment could facilitate cost-efficient DSR – but where current arrangements do not allow for or actively support this.

[7] In tandem with more work to examine the carbon implications of DG providing demand-side services.

- New 'horizontal' measures or cross-market incentives may be needed to co-ordinate and release DSR value across the value chain – and / or where such measures might be 'unfunded' or without a revenue potential stream in the market at present – in order to incentivise DSR where that would nevertheless be cost-efficient.

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

A number of industry groups are usefully starting to discuss likely industry party interactions – in particular the likely technical requirements and specifications which they seek from DSR services in the long-run - and any over-laps or conflicts from their point of view. This is doubtless a helpful initial step.

However, in the long-run, for an active demand-side to develop, end-users, including communities, will need some form of price visibility and price transparency for the DSR services they as customers / end-users might provide, right through the value chain. In an ideal world, it would in the end be for customers *to choose* (or at least be supported in making an informed choice) as to which parts of the market they might wish to offer their DSR service and how – rather than for market actors largely to determine these questions largely amongst themselves[8]. (Also, see points on price visibility for Question 1above).

[8] For an insightful paper on this, see : 'Shift, not drift : Towards Active Demand Response and Beyond'. THINK Topic 11. European University Institute. Florence. June 2013. http//www.think.eui.eu

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

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

See points on question 1 above regarding the need for visible pricing / 'price-points' to start to emerge for different DSR services and products in different parts of the value chain. As noted, for this to happen, progress will also be needed on improving understanding of :

- Value of costs and benefits of DSR and DSM through the value chain.
- Value of Lost Load.
- Locational Value of DSR in the value-chain
- Practical ways to achieve an element of DSR price discovery, visibility and transparency (auctions, exchanges, published / transparent tariffs).

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

- **Data - Access to data from trials and from smart meters will help to improve knowledge of how electricity is used.** This in turn this will allow for development of better signals and targeted incentives to customers to support customer participation and engagement in DSR. Detailed knowledge of GB electricity end-use is presently very limited[9].

  Subject to satisfactory safeguards – especially on privacy and security – end-use data, especially at appliance-level, will offer valuable new insights on how different customer groups use electricity at different times-of-day / year. **Such new data can help unlock many different ways for market actors to match their technical needs with the load which customers are able to offer on the demand-side by helping :**

  - Understand which loads may offer most potential DSR and DSM **flexibility value** in the system.
  - Understand *realistic* demand-side potential
  - Target particular end-uses – for both load management (and for demand reduction).
  - Target particular customer groups
  - Target particular appliances (EVs, HPs).

[9] See Sustainability First. DECC Electricity Demand Data Sources – Summary Note by Richard Hoggett. University of Exeter. March 2012.

- **Cost reflection** – time-varying retail pricing will become increasingly important in signalling to customers when it is cost efficient to shift, to reduce or to increase their electricity use. Our Paper 7 explored why it was important for the economic and operational efficiency of the electricity system (and also for carbon) to look more towards more *time-related retail incentives* to try to encourage a closer match between customer demand and electricity system costs. So, to try to incentivise a better match of customer-load and generation output at both high and low-cost periods in the day (and, conversely, for PV output to be better incentivised to match load more closely if possible).

  It will be feasible to incorporate more cost-reflection in cross-industry charges (eg DUOS network charges for suppliers at low-voltages – eg time-bands, capacity, location) to incentivise *other* actors in the value chain - such as suppliers - to start in turn to reflect sharper signals in *retail* prices to their own customers. In the long-run, as with half-hourly customers now, more cost-reflective network charges could eventually become a separate, transparent and direct pass-through, from suppliers to customers. Distribution networks would not necessarily need to bill the customer directly nor necessarily need a direct relationship with the customer for this to happen.

  Importantly however, moving towards more cost-reflection in *retail* tariffs to incentivise demand management, need not necessarily mean *extreme* cost-reflectivity (see points below on pre-condition 3 on recent trial outcomes).

  Moving towards greater cost-reflection in retail tariffs, away from today's flat tariff structures, also raises substantive issues on the topic of 'winners' and 'losers', including, in particular for vulnerable customers with high inflexible peak use – and, potentially for the general body of customers who may for a variety of reasons not opt for time-related tariffs. We explore these matters at length in our paper 8 :'**Electricity demand and household consumer issues'.**

- **Settlement** – Sustainability First Paper 7 : **'Evolution of commercial arrangements for more active customer and consumer involvement in the electricity demand-side'** started to explore how far settlement may need to be reformed with respect to non-half hourly customers - in order to facilitate certain types of DSR retail tariff. Our basic understanding is that :

  - Basic *static* ToU tariffs require a two-rate or a smart meter and supplier billing software capable of billing at up to three rates – *but* can be offered *without* full half-hourly settlement under the present Load Profile 1 arrangements. Similarly *static* load-management tariffs.

- By contrast, *dynamic* tariffs, for example **critical peak pricing** or ***dynamic* load-control** tariffs would need both smart meters *plus* half-hourly settlement to allow accurate volume allocation to the supplier and accurate customer billing.

Ofgem is presently consulting on settlement reform for its smarter markets work programme. Some early clarity on the likely timetable for any anticipated settlement reform would be helpful, but generally is assumed to be post-2020.

- **Incentives for EVs, HPs and PV** – Time-related, locational and / or capacity signals in retail prices could all be helpful in trying to encourage customers with low-carbon technologies to load-manage (be it to load-shift at peak or to charge-up in low-priced periods). However, in time, it may be that customers with EVs, HPs and PV, in return for being in receipt of a low-carbon subsidy or incentive, should be required to adopt time-related, locational or capacity related tariffs, to encourage, so far as possible, cost-efficient operation in the electricity system.

- **Automated kW / capacity management : customer consent to use of load-limiters in SMETS 2 Meters**. In December 2012, Ofgem noted that they would not expect the load-limiting functionality in SMETS 2 meters to be activated without further discussion with both suppliers and the consumer bodies.

  Sustainability First Paper 8 : '**Electricity demand and household customer issues'** stresses the need for Ofgem to clarify the use of load-limiters in SMETS 2 meters. In particular, we note two potential uses of load-limiters, and a need for clarity between the two : including the terms and arrangements for their use at scale.

  - An *overarching* need for explicit customer consent and sensitive handling by suppliers in the event of supplier use of load limiters / trickle control as a potential alternative to disconnection for non-payment for certain poor or vulnerable customer groups

    - and separately –

  - **Potential use of load-limiters for automated kW management, emergency response and capacity management** - Market actors may eventually seek to contract with customers for automated load-response via the load limiters in the SMETS 2 meters (instead of just relying on customer-initiated response to price-signals or incentives). For market actors, this could secure the required DSR response in the market when needed – and so secure the DSR value - and also avoid the financial risk of non-delivery (eg possible penalties, imbalance risk). If some household customers proved keen to enter commercial agreements regarding occasional use of the meter load-limiting capability - and also assuming that customers would explicitly *opt-in* to any such agreement - development of the potential *commercial* use of load-limiters may become of interest – for example with

respect to management of system emergencies, or, with respect to the capacity market (eg to develop *automated* critical peak pricing approaches at scale (as in the US) ; or, an *automated household TRIAD or similar response*. The recent National Grid Balancing Services DSR consultation (June 2013) cites a household customer who provides 1kW of reduction at a hypothetical VLL (Value of Loss of Load) of £10,000/MWh (£10/kWh)) as potentially being able to *receive a payment of £30 for a single interruption of three hours*. Depending on likely inconvenience, disruption, and / or the potential to over-ride, many householders may regard such a level of bill-discount of interest.

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

See earlier points on DSR and DSM price discovery, visibility and transparency.

Precondition 3. Customers need to be aware of the opportunities to provide demand-side response, able readily to access information on options and able to act.

Some basic steps likely to help in engaging customers and making them aware of the likely bill savings available to them from DSR and DSM participation, include :

- **A good grasp and insight into how different customers & consumers use their electricity. Data will be key** (see above).

- **Clear simple communication on why and how DSM may save customers money – and simple / straightforward incentive retail offers – even if there is under-lying complexity.** See our paper 7 Annex 2 on the EDF EDRP basic static ToU tariff trial, which suggested some initial customer puzzlement / scepticism as to why a retailer might wish to help customers to save money.

- **Appropriate sharing by market actors with their customers of the value of any DSM benefit which their customers provide.**

- **A good 'match' with what customers can offer to market actors -** 'Willing customers' need (1) good technical match (response-times ; endurance ; kW, kWh ; location etc) – *plus* (2) **a *sufficient* financial reward / *outcome* of a lower bill (or at least lower than otherwise).** As noted in response to question 1 above, it is presently not clear what value is available to share with customers from DSR – i.e. so what the likely price-points are for different DSR services and products which customers may be able to offer into

different parts of the value chain – and in what time-scale (2020, 2025, 2030) – especially so far as household customers are concerned[10].

In time, there will be a need for visible and transparent retail prices and DSR incentives in the market which can start to attract consumers. For most consumers (1) these are not yet available & / or (2) generally not visible and, as already noted, (3) any benefit will need to be transparent and shared appropriately with customers.

- **I&C Customers** – already participate in Balancing – and provide some DN 'fault insurance' (as yet limited). I&C customer's main business is their key interest. Sustainability First's research for paper 3 : **'What demand-side services could customers offer ? Industry Customers',** found that I&C DSR scope is fairly 'bespoke'. Access to I&C 'decision-makers' on DSR is hard. Above all, convenience and price must be right for the particular I&C customer.

- **Households – cost-reflection in retail tariffs –** It is notable that recent trials point towards at least some household customers being very open to basic static ToU tariffs today : provided these suit their way of life - and leave them with savings on their bills – not higher bills. (Examples : Ireland, EDF EDRP, CLNR).

- Also, a consistent emerging theme of those trials suggests that it seems enough for customers to be on some kind of time-varying tariff to prompt a response. Household static ToU trial participants engaged - & seemed to like their tariffs (Ireland, EDF Energy EDRP, CLNR). The differential between peak & off-peak prices - may not be the *key* determinant of customer response however. The simple fact of *being on a time-of-use tariff* – combined with other 'stimuli' (eg information, magnets, IHD) - seemed to prompt a customer response in those trials (both reduction of overall demand *and* peak). So, the reaction is not necessarily directly 'linear'.

Therefore, some customer groups will wish to engage with DSR – albeit trial customers are inevitably 'self-selecting'.

- **Understand consumer appetite for different types of price incentive.**

This is not yet at all clear – and LCNF projects will be helpful here. It will be important to use trial findings and learn the lessons to inform Ofgem and DECC views on the interest and acceptability of different tariffs to different customers. In our paper 8 : **'Electricity demand and household consumer issues' –** we have started to consider questions of how different tariff types (basic ToU, CPP, automated load control) might hold different appeal for different customer-types (clarity, simplicity, good match with routine habits, control over their usage) against the appeal of those same tariffs and incentives for market actors (certainty of delivery, obtaining value, reducing market risk).

[10] Redpoint, Baringa, Element modelling (August 2012) makes a helpful start.

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

- In our paper 8 : **'Electricity demand and household consumer issues' –** we have started to explore important questions around **consumer safeguards in a smart tariff world.**

- **Ofgem, market actors & consumer bodies will wish to address some significant consumer safeguard issues in relation to smart tariffs and smart markets which extend beyond the present Retail Market Review.** We therefore welcome the reference in the consultation to an Ofgem Consumer Empowerment and Protection project (para 3.85).

- Some key areas identified in our paper 8 are as follows :

    - **Smarter markets & tariffs** – represent a potentially a far more complex world for consumers. It will prove central to DSR and DSM success, to get consumer safeguards 'right'. **For DSR and DSM to succeed, customers need a 'good experience'.**

    - **Consumer safeguards go beyond Ofgem RMR's** 'simpler, clearer, fairer'. Ofgem, Smart Meter Central Delivery Body & others will need **to consider gaps in present safeguards – and start to address**. The RMR 2017 Review, may be rather late to ***start*** this process, given that some households will have smart meters and, very likely, some smart tariff offers before 2017.

        E.g : **price comparisons** (how to do ?) ; **pass-through of benefits to consumer** (transparency) ; **avoid 'lock-in'** (tariffs, kit); smart meter **load-limiters** ; **bundled services** (transparency) ; **distributional impacts – esp for vulnerable consumers**.

    - **Regulation : new cross-sector responsibilities** - Ofgem, Ofcom, Information Commission, & Competition & Markets Authority will each have an interest in smart retail markets. New benchmarks / metrics for judging a successful & competitive DSR market may also be needed (so, more than *just* switching levels).

    - **Pre-2020** – In terms of urgency and timing, incremental development of DSR seems likely (eg via trials ; EV / HP time-related incentives etc) – plus a focus on demand reduction. This should allow time to get smart market safeguards 'right' – ahead of universal smart meters **– provided some early thinking to identify key gaps in protections starts soon.**

- **Strawman regulatory 'principles' for customer-focused DSR**. In our Sustainability First Paper 8 (July 2013) : '**Electricity Demand and Household Consumer Issues',** we have put forward for discussion some initial strawman regulatory principles for customer-focused DSR, by which to judge both the DSR market and particular DSR offers.

  These include :

  - **Clear objectives and consumer outcomes** (eg lower prices, accuracy of billing, reduced energy consumption, protections for vulnerable customers etc).
  - **Distributional impacts** – have these been taken into account ?
  - **Clarity** – how clear / simple is the DSR proposition ?
  - **Appropriateness of the tariff** to the consumer's circumstances.
  - **Information** – adequacy, accessibility, comparability and privacy issues.
  - **Flexibility** to switch between tariffs without significant penalties.
  - **Choice** – on matters such as : automated response and controls and over-ride facilities; data-sharing.
  - **Timing** – of offers e.g. are they part of a wider energy efficiency scheme or on the back of new tighter product standards ?
  - **Intermediaries and aggregators** – can customers access these and provide data to them if they wish; regulatory and consumer protections.
  - **Dispute resolution and remediation** – clear responsibilities and processes.

Ofgem, the consumer bodies and market actors, will wish to take forward a detailed discussion of any such possible regulatory principles for smart tariffs and DSR markets for retail customers and consumers – and in particular for vulnerable customers.

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

- **Communities –** To date, there is somewhat limited experience of local or community-level involvement in DSR and DSM. Greater promotion of local approaches to DSM may be worthwhile in realising ***locational*** value of demand-side flexibility. We are beginning to see market actor partnerships with 'local champions' and local councils which should start to drive local DSM. In particular, some measures in DCPR5 and the RIIO ED1 framework may support DNOs to think and act more actively in terms of local community-level DSR and DSM. However, it is not yet altogether clear whether existing incentives are sufficient (or too piecemeal) to realise potential 'group' / community (however defined) – and / or local DSR and DSM value.

Conclusion

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

Targeting new measures for permanent electricity demand reduction at peak times also matters. Ofgem's consultation is focused on DSR and DSM. So, on temporary load-shifting and load-management measures (temporary load reduction, load-shift, or load increase in response to price).

Simply to note that there remains significant benefit in also developing incentives which can promote **permanent electricity demand reduction at peak periods** and which might therefore **target certain day-time load[11].** All things being equal, *permanent* electricity demand reductions at peak-periods ought to offer :

- The most cost-efficient demand reduction for the electricity system overall – assuming that the electricity cost-curve (both short-run and long-run) largely matches the demand curve.

- The greatest carbon reductions.

Looking beyond 2016 or so, the GB electricity-system is widely expected to face (1) greater constraints on capacity than today – and (2) higher energy / commodity costs. Within-day wholesale price differentials may therefore be expected to increase above today's levels – and

[11] See Sustainability First response to DECC consultation on Electricity Demand Reduction. February 2013.

therefore the value to the electricity system of permanent peak-period electricity demand reductions should similarly increase.

Therefore, looking ahead[12], permanent electricity demand reductions at peak-periods should help to support avoided capacity costs and peak-related network costs just as DSR and load management can do – especially if peak-load grows faster than average load. So, permanent reduction of peak-load so far as possible today, may serve to create some 'head-room' for expected future 'peak-load' growth (EVs, heat-pumps) without necessarily requiring additional peak-related investment.

The end-use modelling for Sustainability First by Brattle[13], suggests that the present loads most likely to lend themselves to load-shifting and / or permanent load reduction at evening and morning peaks are : 'on-peak' heat (commercial, household); lighting (commercial, household). Improvements in refrigeration efficiency could also make a material impact at peak-times (commercial and household refrigeration), provided old inefficient refrigeration equipment was scrapped.

DECC has now indicated its intention to take forward its Electricity Demand Reduction proposals via the capacity mechanism[14]. This could incentivise both peak and non-peak load. For the reasons outlined above, at least some focus on permanent load reduction at peak times is likely to be beneficial.

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

In general yes.

Work to identify the gaps in consumer protections in smarter DSR market and smart-tariff world should begin now. This 'gap analysis' on consumer safeguards should not await the EMR Review, expected in 2017. Rather, it should start now and feed any initial findings into the wider RMR review.

Sustainability First
July 2013

[12] Until such time as wholesale prices are predominantly wind rather than peak-driven.

[13] **See Annex 1 to this Submission** (based on : Sustainability First Paper 2. GB Electricity Demand – 2010 and 2025. Initial Brattle Electricity Demand-Side Model – Scope for Demand Reduction and Flexible Response. Serena Hesmondhalgh. The Brattle Group and Sustainability First. February 2012. ww.sustainabilityfirst.org.uk

[14] DECC. Government Response. Consultation on options to reduce electricity demand. May 2013.

Annex A – Published Papers from the GB Electricity Demand Project.

Published GB Electricity Demand Project papers – www.sustainabilityfirst.org.uk	
1	**GB Electricity Demand – context and 2010 baseline data**
2	**GB Electricity Demand 2010 and 2025 – Initial Brattle Demand-Side Model : scope for demand reduction and flexible response .**
3	**What demand-side services could customers offer ? Household customers . Industry customers.**
4	**What demand-side services can provide value to the electricity sector ?**
5	**The electricity demand-side & wider energy policy developments**
6	**What demand-side services does Distributed Generation bring to the electricity system ?**
7	**Evolution of commercial arrangements for more active customer & consumer involvement in the electricity demand-side.**
8	**Electricity demand and household consumer issues (early July 2013)**

Forthcoming GB Electricity Demand Project Papers for Smart Demand Forum		**Planned publication**
9	**GB electricity demand – 2012 & 2025. Which electricity demand-side measures might offer most 'bang for your buck'? (Extended & updated Brattle Model for the project).**	**September 2013**
10	**The electricity demand-side & local energy : bringing locational value to the electricity system**	**December 2013**
11	**How might innovation and connected customers and consumers transform the electricity demand-side in the longer term**	**March 2014**
12	**Bringing it all together : how can the electricity demand-side play in the electricity market ?**	**June 2014**

Annex B - Understanding GB Electricity End-Use

From the outset, the GB Electricity Demand project has aimed to produce a systematic overview of how different sectors in GB presently use their electricity across the day, week & seasons (Industry, Services, Households). However, electricity end-use data – including official DECC data (eg DUKEs, Energy Consumption in the UK), is somewhat limited & the modelling was somewhat historic (although welcome steps are now being taken by DECC to update and improve on some of their data sources), including appliance-level use.

We have built a 'best picture' of GB electricity demand which draws on: official UK data ; our own end-use model - developed by Brattle Group ; an Industry survey ; a review of household data and trials. Increasingly, new empirical end-use data from trials and studies will start to improve this understanding over the next few years.

Without a good grasp of when and how customers actually use their electricity, efforts (1) to engage customers in the electricity demand-side risk being poorly focused, and (2) decision-making on policy-measures, priorities & interventions risk being poorly informed.

All-Sector Electricity End-Use Model

Brattle group have developed an all-sector electricity end-use model for the Sustainability First GB Electricity Demand project[15]. This estimates likely time-of-day and time-of-year when electricity is used – and therefore adds some major insights to the analysis carried out for the DECC Electricity Demand Reduction consultation.

In particular, for both electricity demand reduction and for load-shifting the Brattle model finds that :

- At average winter weekday evening peak (January 16.00h-19.00h) : ~one-third of load (2010) may have the ***technical potential*** to permanently reduce and / or to shift (so, 18GW of 54 GW).

- Of this load, main end-uses *likely* either to reduce or to shift would seem to be - **on-peak electric heat[16] and lights[17]** (In both the Household & Commercial sectors).

[15]Presently being updated as Paper 10 : 'GB Electricity Demand 2012 and 2025. Which electricity demand-side measures offer most bang for your buck ?'. Likely publication – September 2013.

Paper 2. GB Electricity Demand – 2010 and 2025. Initial Brattle Electricity Demand-Side Model – Scope for Demand Reduction and Flexible Response. Serena Hesmondhalgh. The Brattle Group and Sustainability First. February 2012. www.sustainabilityfirst.org.uk.

[16] **Commercial 'on-peak' electric heat** – accounts for 15% of demand on a January weekday evening peak – 16.00h – 19.00h (~2% on an August weekend. 16.00h-19.00h). Possibly up to 12TWh of commercial load is used for direct-acting space heating – so perhaps could have some technical scope for flexibility / shifting / reduction / substitution. **Source :** Paper 2. Op Cit.

- Other load – motors, compressors, household wet and cold appliances. Unclear how far this other load may either reduce or shift in practice, and in what time-scales. The DECC Electricity Demand Reduction analysis offers some useful background.

- Household load – is the main contributor to evening peak – in *both* winter & summer. This load builds gradually from 16.00h towards 19.00h. Household load represents around half of daily winter evening peak load (kW), but only around one-third of average annual consumption (kWh).

- Morning peaks : there are morning peaks in both winter and summer. There may be some unexploited potential – either to reduce or to shift that load.

Household 'on-peak' electricity as main heating source – ~ 8 TWh p.a. 562,000 GB households (2.4%). 'On-peak' electric heating – our 'on peak' definition inludes all usage between 07.00h– 23.00h (so, includes 17.00 – 19.00h). Likely to be smaller homes – esp flats (older & new-build) ; private rental / owner-occupied; single households ; lower incomes (EHS 2009). **May be scope either to reduce / substitute – or to shift some electric 'on-peak' heat** – e.g. to Economy 7 (& so reduce winter evening peaks). But, would need good insulation - as well as 2-rate meters & new heating system. **'Top-up' electric 'on-peak' heat** - less likely either to reduce or shift. No knowledge of how much of the 8TWh p.a. 'on-peak' heat - is 'top-up'.
Source : Sustainability First. **Paper 3 – 'What demand side services could customers offer - Household Demand'.** April 2012.

[17] **Lighting** : accounts for around 19% of total estimated demand on a January weekday evening peak, of which around 39% is domestic lighting and 56% commercial lighting. On an August weekend, the commercial share of lighting rises to ~70%. This suggests considerable scope for more efficient lighting and / or better lighting controls (in particular in the commercial sector). Source : **Sustainability First. GB Electricity Demand Project. Paper 2. Op cit.**

This chart illustrates the high-level picture which Sustainability First has gradually built since the start of the GB Electricity Demand project in April 2011. It draws from our Brattle model and other of our project papers – and offers a very high-level summary of the potential for permanent electricity demand reduction, the daily load characteristics of each sector (industry, commercial and household) through-out the day and the year, and the likely scope for flexibility and load-shifting.

Sector	**Customer numbers / percent annual usage** (323 TWh – 2011)	**Key Characteristics of Load** (as suggested by our Brattle end-use model)
Industry **Half-Hourly settled.**	• **~117,000** • **50 %**	• **Demand reduction potential** – many cost-effective electricity efficiency measures already taken – esp for those businesses where electricity costs >10% of their operational costs. • **Fairly flat profile** - across the day, night & seasons. Chemicals, food & paper ~40% of consumption. • **DSR potential** - fairly 'bespoke' - driven by process needs.
Services / **SMEs** **Load Profiles 3-8**	• **~2 million** • **16%**	• **Demand reduction potential** - lighting (significant) ; on-peak heat. • **Morning 'rise' – but thereafter relatively flat profile through the day.** Slowly tails off through evening . • **DSR potential** – poss. scope to reduce or stagger morning 'rise'. Perhaps limited scope to load-shift at winter evening peak – but -some services load may be suited to Balancing Market.
Households **Load Profiles 1-2**	• **~27 million** • **34 %**	• **Demand reduction potential** – lighting ; 'on-peak' electric heat ; product standards. • **Greatest contribution to winter evening peak (say around half of total peak)** - Lights, cooking, electronics. Load which might **reduce** ? Lighting efficiency ; Some on-peak heat ? product standards – wet / cold appliances. • **DSR potential** : other than on-peak heat, what *other* household load in use betw 5-7 pm might shift ? (so, wet appliances? fridges? hot water ?).

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