

ENA/ERA Joint Working Group – Smart Demand Response Drivers, Benefits & Requirements

11 September 2011

1. Introduction

This document has been produced to present a joint network and supplier view of the drivers and benefits of Smart Demand Response in GB and requirements that will need to be fulfilled to achieve these benefits. This work builds on and assesses previous outputs from ENA and ERA joint work and seeks to provide a foundation that can be built on to prioritise the requirements before looking at solution options to deliver them.

Such an approach is aimed to ensure that the scope of the Smart Demand Response services is fully covered while keeping options open for a variety of solutions without constraining further innovative approaches. It should be possible to place the requirements along a timeline for prioritisation and to identify those that need to be solved early or those that need a coordinated industry effort.

A broad view continues to be needed on the work to lead to successful Smart Demand Response for Great Britain and on the benefits of Smart Demand Response. There have been discussions on the use of storage and other fuels to balance the overall GB energy system, but this work will concentrate on Smart Demand Response.

1.1. Inputs

The inputs to this phase of the work include:

- Previous Demand Response work from ENA/ERA joint working and CUE reports
- ENA/ERA workshop notes

2. Smart Demand Response Definition

The definition of Demand Response can be summarised as follows:

Demand Response relates to any program which communicates with the end-customer concerning prices changes in the market and/or their own energy use and encourages them to reduce or shift their consumption (demand) of energy. The active participation of the end customers is a response to factors such as incentive pricing, new tariffs schemes, greater awareness and an increased sense of responsibility.¹

We add “Smart” to make this “Smart Demand Response” to reflect that it is the delivery of Demand Response in a smart GB energy industry, post the start of mass roll-out of smart metering and expected to include the future delivery of a GB smart grid.

3. Smart Demand Response Drivers

The key drivers of Smart Demand Response have been confirmed as already set within the key drivers of Government energy policy. In particular, one of DECC’s key priorities is to:

- Deliver secure energy on the way to a low carbon energy future
 - Reform the energy market to ensure that the UK has a diverse, safe, secure and affordable energy system and incentivise low carbon investment and deployment

¹Source, Smart Energy Alliance report: <http://www.smart-energy-alliance.com/thought-leadership/demand-response-a-decisive-breakthrough-for-europe/>

4. Smart Demand Response Benefits

Previous work on high-level benefits was further developed to provide more definition, identifying who the benefitting party is and looking into how benefit quantification could be progressed.

During workshops the benefit categories were considered and updates were agreed to produce this list. Note these are arbitrarily presented in order of “geography over which the benefit applies – from personal to national. The order is not intended to imply priority in any way:

1. **Facilitate consumer choice**
Facilitating a wide set of products and services will deliver better consumer choice and the chance to be rewarded for actively participating in the future of energy. Smart Demand Response can be a more palatable solution than service curtailment. Large energy consumers already have this choice – the proposal here is to bring this offering to a wider population and smaller consumers.
Beneficiary: Consumers and the market as a whole from increased consumer choice
2. **Manage Consumer Loading**
New load types such as Heat Pumps or Electric Vehicles can increase the total demand within a home and could be required to allow their use. However, introducing the use of this sort of load within a Demand Response package could allow the total load to remain within existing household capacity and hence could avoid or defer the need for reinforcement.
Beneficiary: Consumers may be able to adopt these devices and gain the benefits from them earlier and more affordably by avoiding or deferring the need for increased capacity. This earlier adoption also helps to realise Government policies in these areas.
3. **Avoid local network overloading and deferment of investment**
By allowing better use of existing network capacity and by facilitating Active Network Management, Smart Demand Response can decrease the need for more investment in networks and allow a more targeted and efficient investment programme, as described above. Demand Response can help defer reinforcement and thus reduce or defer costs to be passed through to the consumer.
Beneficiary: Networks, they can operate more efficient business. This is a benefit that feeds through the supply chain to consumers.
4. **Avoid regional and national network overloading and deferment of investment**
Regional and national networks can benefit from the same improved efficiency in planning. Smart Demand Response is one of a number of tools that can be used to balance networks. By facilitating Active Network Management Smart Demand Response can add to the cost effectiveness of network balancing and defer need for Distribution/Transmission investment due to the reduction of load peaks.
Beneficiary: Networks, again they can operate more efficient business. This is a benefit that feeds through the supply chain to consumers.
5. **Balance variable or inflexible generation at national level**
Smart Demand Response is one of the tools that help wind power to make a useful contribution to the generation mix. Beneficiary: The UK and the planet (and to the UK’s position by making that contribution).

6. Balance the trading position of energy suppliers
Smart Demand Response can help suppliers keep a balanced position in the market it can mitigate risk and allow better trading.
Beneficiary: Suppliers, again this is a benefit that feeds through to consumers as it makes them able to operate more efficiently and compete on customer pricing.

7. Facilitate cleaner energy / generation mix
Smart Demand Response will not reduce the need for energy generation but will help the energy demands to be met by a cleaner mix. It should be noted that this benefit is about the energy mix rather than optimising capacity.
Beneficiary: The UK and the planet (and to the UK's position by making that contribution).
It is noted that the resulting industry resilience is made worse – more efficient use of generation leads to less reserved capacity, but that the self sufficiency is improved.

8. Future flexibility
The option to use Smart Demand Response can offer a degree of flexibility to cater for unknown future generation or loads in future years. This may be difficult to quantify but the benefits shouldn't be underestimated. Although there is good appreciation of the types of challenges facing the energy industry, the precise make up of how those challenges will eventuate is very much an unknown – a level of Smart Demand Response can help cater for those unknowns.
Beneficiary: this is a benefit to all. It gives policy makers and the industry some leeway to cater for faster or slower implementation of new loads or new generation.

The proposed quantification of benefits was proposed as follows:

- Potential savings made in energy consumption against peak load
- Savings made in carbon dioxide emissions
- Customer minutes lost
- Transmission minutes lost
- Quality of supply

The results and outputs from LCNF projects are likely to help quantification of benefits.

4.1. Additional System Balancing Mechanisms

Smart Demand Response is only one of the tools that should help achieve the benefits set out in this section. There is an increasingly important role that storage is likely to play and there is also a role for other fuels, such as gas, to play in the overall balancing of GB's energy system. However this work will remain focused on Smart Demand Response and the mechanisms to deliver it effectively in GB.

5. Smart Demand Response Requirements

This section provides a list of the requirements needed to deliver the benefits highlighted above for Smart Demand Response in a smart GB market. Smart Demand Response Requirements specify the outcomes and then at a level below the requirements that need to be supported to achieve those outcomes.

5.1. Requirements

The section specifies the requirements, assuming that the pre-conditions defined below are in place:

1. Shape (decrease/increase) demand using Tariffs and other financial incentives:
 - Facilitate time of use tariffs for customers
 - Facilitate critical peak pricing tariffs for customers
 - Facilitate special rate/award (e.g. credit customer account, offering discounted rate, paying a one-off amount) for taking part in a load shedding event

These requirements will be delivered by Suppliers to consumers through their contractual relationships with customers.

2. Facilitate more cost-reflective UoS charging

This requirement will be delivered by Network Operators to Suppliers to benefit consumers.

3. Shape (decrease/increase) demand using notifications:
 - TSO, Networks, Suppliers/3rd Parties send message to consumers notifying them of a load curtailment incentive

This requirement can be potentially be delivered by Networks/Suppliers/TSO/3rd Parties to benefit consumers.

4. Shape (decrease/increase) demand via products that incentivise microgeneration:
 - Networks/Suppliers/TSO/3rd Parties manage consumer microgeneration to modify (increase or decrease) demand

This requirement can be potentially be delivered by Networks/Suppliers/TSO/3rd Parties to benefit consumers.

5. Shape (decrease/increase) demand using direct device control:
 - Create incentives to install devices to enable capability to reduce energy consumption
 - Networks/Suppliers/TSO/3rd Parties disconnect/reconnect supply
 - Networks/Suppliers/TSO/3rd Parties manage consumer appliances to modify (increase or decrease) demand
 - Networks/Suppliers/TSO/3rd Parties manage consumer devices EVs/Heat Pumps to modify (increase or decrease) demand
 - Networks/Suppliers/TSO/3rd Parties manage storage facilities to modify (increase or decrease) demand

All of these requirements can be potentially be delivered by Networks/Suppliers/TSO/3rd Parties to benefit consumers.

6. Smart Demand Response Pre-conditions

In order to carry out Smart Demand Response, we assume that there will continue to be a suitable proportion of discretionary load (and generation) and that smart metering will be in place in the expected timescales.

Using the assumptions and the requirements for the various ways of gaining the benefits of Smart Demand Response we can look at what is needed to allow Demand Response to become widely used in a smart world.

While we are not yet operating in a smart world, Demand Response already provides some of the benefits above, but is implemented quite differently across a range of different customer groups and the use is restricted by the technology in use. . This joint work is looking to open the opportunities to a much wider population – to involve more consumers and to open up more capacity to be used in this way. The challenge is getting to the point where the mechanisms above can be successfully operated in the GB market to bring the benefits identified.

To achieve any of the benefits above, a party intending to call on Smart Demand Response will generally need the following to be true:

1. The party has a population and density of response they can call on appropriate to their need and that can give a response in the timescales they need. The party has a suitable volume of points to act on in suitable density with suitable confidence of the response;
2. The party has appropriate systems and processes in place:
 - a) The party can identify conditions where a call on response is appropriate
 - b) The party knows the availability of demand
 - c) The party has the technical ability to take the action
 - d) The party has the ability to check the result of the action
3. The party have the confirmed right to take the action
4. The party have the agreement of consumers–this may mean both buy in of, and contract with, consumers in appropriate volumes.
5. The party has adequate priority, which means that there is a working market solution in place and meaning that the effect on other market parties is known / managed.

And in order for this to be achieved (for some parties at least):

6. The appropriate regulatory environment must be in place
7. And for Smart Demand Response mechanisms to be developed, all parties need to have had sufficient confidence to have made the investment in systems and processes.

6.1. Further Definition

It is worth some consideration of what these preconditions may mean – bearing in mind that different participants will have different needs – and that these needs will change over time.

1. Population and density of available response
This means that there have to be sufficient participants bought into and contracted to take part, the participants have the means to take part – sufficient discretionary load and technical solutions that allow the demand to be called.
The package has been successfully marketed to the consumers and in the locations relevant to the challenges.
2. Systems and processes
The ability to:
 - o Plan Smart Demand Response activities – at different levels this may mean at different levels of granularity:
 - Identify peak demands, winter/summer variations, location of where constraints occur, etc.;
 - Use current and estimated wholesales energy price variations e.g. during peak energy consumption times (summer/winter), to estimate the monetary benefit of reducing energy consumption during particular times;
 - Use current and estimated network charges to estimate the benefit of Smart Demand Response for suppliers; and

- Use renewable energy generation forecasts e.g. to estimate timing when excess wind generation needs to be absorbed.
 - Carry out cost and benefit analysis to ensure assurance in developing the ability for Smart Demand Response
 - Carbon Dioxide emission costs.
 - monitor for “stress” and identify needs for Smart Demand Response activities
 - estimate the response needed and expected responses
 - carry out the interaction with the market solution
 - carry out the interaction with the consumers
 - technical ability to carry out Smart Demand Response - potential solutions need to be identified e.g. for direct device control to support Smart Demand Response and make necessary arrangements to enable Smart Demand Response via direct device control
 - need for a level of device interoperability and control capabilities for futureproofing and facilitation of innovative Smart Demand Response;
 - monitor the results to feed back to the planning
3. Right to take the action, the right priority and the appropriate regulatory environment in place
An appropriate regulatory framework is in place to reflect which parties can undertake Smart Demand Response activities, at what time. (including, say, incentives to reward use of Smart Demand Response rather than reinforcement).
4. Agreement of consumers
This may mean appropriate awareness campaigning to the general population. But also successfully selling the solution to consumers by having offered packages that are sufficiently attractive for them to take part and solutions that fit with the lifestyles of the consumers. It means developing and continuing that relationship.
- contract enough Smart Demand Response participants, this may mean both contracts and the buy in of consumers in volume. Sufficient number of participants and density of response needs to be ensured to ensure benefits are brought as a result of Smart Demand Response. Participants will need to sign contracts/agreements, which detail length of contract, terms of contract – what Smart Demand Response the participants are able to participate in e.g. based on tariffs or direct device control; when participation is mandatory/voluntary; setting terms of how and when the participants will be notified of the event; identify contact persons; specify how frequently load shedding events are expected e.g. per week or per month; how the payments/discounts are applied; how the payment is determined; whether the payment is made per each event, per month, etc; whether there are any penalty fees for not shedding the load when the participation was mandatory.
 - Identify relevant participants for each Smart Demand Response;
 - Estimate how much time is needed to ensure all of the relevant parties are notified of the event in a timely fashion;
 - Provide advanced notification (via pre-agreed communication channels e.g. fax, e-mail, HAN network, call) of Smart Demand Response to the participants well in advance of the Smart Demand Response to ensure the businesses have a chance to shed load without incurring any business costs e.g. 30 min or 24 hours;
 - Send any updates on the Smart Demand Response incentives;
 - Send advice on how to improve response
5. The right priority
This suggests the need for a market solution that can assess and manage different parties calls on response. Does this solution need to know of response calls and response

available? The market solution needs to cater for actions of one party that would adversely affect other parties.

6. The appropriate regulatory environment

Policy to facilitate device interoperability and control capabilities for Smart Demand Response. Policy to ensure that networks are robust to future developments (e.g. will market driven participation be sufficient to ensure EVs charging is accommodated all all levels of network granularity LV / HV / EHV or will mandatory participation be required).

Relevant regulatory support for Smart Demand Response, for example in microgeneration and energy efficiency policies (UK Energy, Low Carbon Transition Plan, etc.). We must ensure that Smart Demand Response principles are included into new initiatives and common systems/infrastructure to provide certainty to DPCR6.

7. Confidence to invest

For the market players to have reached the point where they use demand they need to have invested in the systems and processes, they need to have had confidence that the market will deliver and allow the use of those mechanisms to realise their benefits. For example a network has to balance the return against cost of reinforcement at the relevant granularity (LV, HV or EHV). They can see policy and regulation being realised in appropriate timescales.

7. Potential Barriers – risks and issues

This section identifies potential barriers to Smart Demand Response, which will need addressing in any potential solution options:

1. Lack of incentives to facilitate Smart Demand Response – no appropriate market regulation in place, thus leading to lack of investment, lack of transparency, disorganisation amongst objectives of the stakeholders (e.g. a supplier requests an increase in demand to absorb excess wind, while a network requests a demand reduction to offset high network load), resulting industry resilience
2. Lack of technical capability – at the moment there is no industry wide solution available in place to enable successful deployment of Smart Demand Response.
3. Consumer confusion – products and tariffs created may be complex, there might be lack of information on Smart Demand Response, lack of awareness around how the energy consumption could be reduced and the arrangements in general, this could result in lack of consumer interest to participate.
4. Unpredictability – this can include load management unpredictability long term / timing constraints on network reinforcement (~10 years difficult to estimate, but in parallel with loads coming on), unpredictability of wind, solar generation, thus potential energy gap, difficulties to estimate costs and benefits of Smart Demand Response.