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December 2011

Dear Lia

Smart Grid Consultation

Thanks for the opportunity to respond.

We are very supportive of the work that DECC and Ofgem are leading on Smart Grid.

We believe that it remains essential for the smart grid and smart meter activities to make mutual cross reference, and that the respective developments of smart grids and meters are vital in the low carbon transition. We believe that it is also essential to make cross reference to institutional design and arrangements (e.g. settlements), network charging (cost reflectivity and reflection of capacity costs at peak times), the regulatory model for contracting (e.g. the erosion of the supplier hub), and major developments such as Retail Market Review, Electricity Market Reform, and Green Deal / Energy Company Obligation / Feed in arrangements and wider developments such as Zero Carbon homes and Renewable Heat.

Yours sincerely

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Section 2: Smart grid evaluation framework?

Q2.1 Do you agree with our definition of smart grids?

Yes

Frontier Economics has adopted the Electricity Network Strategy Group definition, that "a smart grid is part of an electricity power system which can intelligently integrate the actions of all users connected to it – generators, consumers and those that do both – in order to efficiently deliver sustainable, economic and secure electricity supplies.'

We believe that this definition is fit for purpose in making policy decisions as it is clear from the definition that the concept of smart grid extends beyond the end of the distribution network and encompasses community concepts such as smart cities.

Q2.2 Have we captured the main complexities associated with assessing the costs and benefits of smart grids?

Yes broadly

Commercial interactions – we believe that there will be many participants in smart grids, including new kinds of market actors such as aggregators and new forms of energy service companies. The contractual models could have significant impacts on the physical models, for example potential interactions between distribution company and consumer meter, interactions between aggregators and consumer devices, and data and even instructions through the smart Data and Communications Company (with of course the proper controls such as smart energy code signatory).

Q2.3 Do you agree with our approach to dealing with these complexities, in the overall evaluation framework

Yes

in particular:

We propose to take a two-stage decision tree approach, rather than relying on a conventional cost-benefit analysis framework alone. Does this constitute an appropriate approach, given the need to measure differences in the "option value" that different smart grid investment strategies provide?

Do you agree that the year 2023 constitutes an appropriate decision point in our analysis?

Yes broadly

Decision tree – The range of uncertainty is very wide indeed and a conventional cost benefit analysis could not encompass this. By taking a decision tree approach, the key variables can be isolated and least risk strategies that deliver benefits for most outcomes can be identified.

2050 pathways - We believe that 2050 is the best year to envisage scenarios, as then the smart grid scenarios can be closely associated with the 2050 pathways. We do recognise that the national decision points correspond most closely with the distribution price controls, and that 2023 is a reasonable single date to choose as a decision point. At the same time, we believe that whole decades points (2020, 2030, 2050) are best for scenario production as this enables different analyses to converge.

Section 3: Value drivers and scenarios

Q3.1 Do the technologies set out in Table 2 constitute a sensible list of value drivers?

Mostly

Within the realm of heat and transport electrification (which we do believe is realistic), it may help to add;

i) dynamic switching of heating – these can happen at meter, circuit or device level, and can apply to space and water heating
ii) on grid technologies – to enable thermal and voltage management
iii) microgeneration – particularly in its relationship to locally stored power, and its impact on voltage

To prevent proliferation of technologies in the table, some of the categories could be grouped.

Q3.2 Do you agree with our assessment of the technical characteristics of each?

These seem reasonable. We do not have detailed comments

Q3.3 Are there any other technologies that could have a significant impact on the value of smart grids?

Some

The technologies group mainly into storage, dynamic switching, and local generation.

Further technologies could for example, improve power quality, alter voltage and phase, facilitate DC flow by conductivity and voltage change, or enable better information management through data storage, transmission, heuristics, and conflict management of commercial signals.

Q3.4 Our analysis suggests that the most important factors to vary across the scenarios will be:
the pace of electrification of heat and transport;
the increase in distributed generation; and
the increase in intermittent and inflexible generation.
Do you agree?

From a technological perspective –yes
The political, regulatory and behavioural aspects are also very important

Are there any other variables that we should look to vary across the scenarios and why?

Smart grid will be driven by consumers responding to commercial signals, and to reduce limitations on electricity use. In one scenario, “full strength” price signals are fully cost reflective at the margin, transmitted directly to consumers, and response is enabled by the smart system of metering, settlement and tariffs. In another scenario, price signals are intentionally and unintentionally suppressed/socialised, and the institutional development (settlements etc.) does not support full strength pricing. We believe that these two extremes can be characterised in terms of responsive and unresponsive demand.

Section 4: Smart grid and conventional investment strategies

Q4.1 Out of the options presented, which set of assumptions should we make on smart meter functionality?

Option 1 – smart meters allow dynamic Time of Use tariffs

The constraint is more regulatory and commercial than physical. Electricity smart meters will all be able to store consumption data at halfhourly resolution.

To deliver a smart system that is electrically intensive and infrastructure constrained, it is essential to engender dynamic demand response. To reward consumers for aspects of this requires the meter data to be used at halfhourly resolution in both billing and settlements. There are various ways to transmit tariff signals, other commercial signals, and device instruction. For the current level of detail in smart grid consideration, it is not essential to define where this functionality lies. It is our view that for best system and security management that is little as possible should bypass the smart system and the DCC.

Q4.2 Do you agree with our proposed approach of including smart appliances in the business as usual?

Yes

Smart appliances exist now, such as fridges with frequency response. It is possible to deliver value by smart appliances with neither smart meters nor smart grids, although the value is much enhanced by these.

Q4.3 Do our proposed smart grid strategies capture the main deployment options?

They seem to make sense. We do not have detailed comments

Q4.4 Have we provided an accurate overview of the main services that smart grid technologies can provide?

Yes, broadly

One thing that may be worth adding is the use of consumer meters for the purpose of virtual meters on the distribution system.

Section 5: Value chain analysis

Q5.1 Are there any other groups in society that we should consider in the value chain analysis?

Yes

Customers – we believe that this group can encompass all actors beyond the end of the distribution grid

Technologists- The smart grid solutions could provide deployment opportunity for a variety of technologies from “big infrastructure” technologies down to devices at consumer premises. This can create export potential for the Information and Communication technologies, light and heavy electrical technology and manufacturer, and consumer/appliance devices.

Q5.2 Do you agree with our conclusions regarding the distribution of costs and benefits?

Yes, broadly

From the perspective of electricity distribution, cost reduction relative to “copper in the ground” reinforcement must remain central.

Q5.3 Do you agree with our proposed approach to assessing the costs and benefits for the transmission network?

Yes

STOR is probably the best focal point for considering the benefits of smart grid for the transmission network as the dimensions of the service can be characterised in the same way as power generation, wholesale markets, and consumer demand response.

Section 6: Proposed model specification

Q6.1 How suitable is the proposed network modelling methodology which use representative networks, with headroom used to model when network investments should be made on feeders?

The approach seems reasonable

Whilst the nodal model has greater capability to extend to the specifics of individual networks, we recognise the modelling constraints and believe that the parametric approach is reasonable for the present purpose.

Q6.2 Are the voltage levels (from 132kV down to LV) being considered by the model appropriate, or should the model be limited to focus on any particular voltage levels?

I*t is appropriate – indeed essential to cover this range*

Q6.3 For each of the voltage levels we are considering, are current methods sufficient to recognise available headroom and the cost of releasing additional headroom in these networks?

If not, is the proposed approach considered to be too simple or overly complex?

The approach seems reasonable

Q6.4 Is our approach to estimating the clustering of low-carbon technologies appropriate?

Yes

Clustering is likely to cause local constraints soon and the need for solutions (reinforcement, restrictions on network access/use, technology solutions, etc) is likely to have a significant effect on driving the smart grid debate forward. Therefore the consideration of clustering is very important.

Is any other evidence available in this area?

We do not have any. Indeed it is not easy to monitor clustering since the suppliers' view of Meter Point Administration makes no reference to Service Terminations and suppliers have no sight of the other supplier MPANs anyway. In addition to this, the mapping of MPANs to electrical addresses (i.e. position in the electrical system) is far from perfect, and DNOs do not get good sight of consumption at individual MPAN level. Realistically, issues from clustering will only appear from actual loss of power, and in future, the triangulation of addresses in the smart system, and the improved mapping of electrical addresses, will significantly improve the view of clustering.

Q6.5 Are the proposed generation model assumptions (a simple stack of generator types, no technical dispatch constraints, half-hourly demand profiles for summer and winter, and representative wind profiles) suitable?

Yes broadly

Simple stack – whilst the model has limitations, these are very well known and understood

Half-hourly profiles – Given that thermal constraint commonly develops over minutes/tens of minutes, then halfhourly profiles should be adequate.

Technical constraints – The simple stacking and half-hourly profiling is already limited in its ability to model technical dispatch constraints. The constraints do not seem otherwise to affect the model adversely.

Q6.6 Should a simple representation of interconnection be included in the model?

Yes

Interconnection must be included, in order to complete the stack

A simple representation of interconnection is quite adequate for this analysis

In the future consideration of the benefits of smart grid for security of supply, a slightly more complex interconnector model would be required.

Q6.7 Does the model represent demand side response appropriately?

As noted, the complex feedbacks are necessarily excluded to make the model tractable.

We do believe that future development should include more configuration capability in the demand side model, such as local prices/incentives, and different levels of response with different levels of commercial incentive.