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The demand side of the electricity market

Why we're (still) failing and how to succeed

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Summary[1]

Despite general acceptance that a failure to fully exploit demand side measures will undermine the ability to deliver energy policy objectives, they remain an afterthought in the policy process. This is due to ingrained institutional bias against demand side resources that is based on the perception that supply side solutions are known and certain whilst those on the demand side are unknown and uncertain.

This situation will not change without significant action. It is essential to force those in Government and key delivery institutions to improve action to address the demand side of the market through imposing ambitious targets for the deployment of demand side resources. The current focus on introducing a flawed capacity mechanism is unhelpful and is distracting attention away from developing the demand side potential.

In the short term, it is not too late for Parliament to force a reassessment of the capacity market design as relevant secondary legislation is considered over the coming weeks. There are many alternative targeted approaches that can be used to manage system security in a more cost-effective manner than a market-wide capacity mechanism and these should be deployed whilst longer term solutions are re-evaluated.

In the longer term, major institutional reform is required and the creation of an Independent System Operator to deliver Government policy objectives should be considered. The current system for controlling energy costs (the Levy Control Framework) is also not fit for purpose and policy in this area needs to be re-considered.

Finally, and possibly most importantly, demand side resources are always likely to remain under-developed whilst those in and around the energy industry persist with talking about 'the lights going out'. There is no excuse for not providing all consumers with the services

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[1] A modified version of this briefing was first submitted to the House of Commons Energy and Climate Change Committee inquiry into 'Electricity demand-side measures' in July 2014

they require at a price they are prepared to pay and the focus should be on developing this new conversation.

Context

Electricity demand side measures include permanent reduction in demand (often considered as synonymous with energy efficiency), temporary reductions in demand usually in response to periods of high price (demand response) and the deployment of small scale generation in homes and businesses (distributed generation). There is now a broad acceptance that these measures present a valuable and under-utilised system resource and that existing policies have failed to realise their full potential.

Demand reduction

The White Paper on electricity market reform published in 2011[2] recognised that electricity demand reduction has a key role to play in reducing the costs of decarbonising the power system through avoiding significant investment and operational system costs. A project was initiated by the Government to explore the potential for electricity demand reduction and how this might be most effectively delivered.

Various analytical studies have been undertaken that all clearly demonstrate there is significant potential for using electricity more efficiently in the UK and that, even after taking account of existing and planned policy, it is unlikely that this potential will be realised without new policy initiatives. The most recent analysis[3] suggests that this potential is around 36TWh per year. In light of these conclusions, the UK Government has decided to include electricity demand reduction within the proposed capacity mechanism as a new policy initiative, initially through a pilot auction that is due to be undertaken in 2015.

There is considerable evidence from international power markets that appropriately designed mechanisms, such as capacity markets, can deliver a surprisingly large and valuable system resource through reductions in demand. Indeed, there is strong evidence from many examples that electricity demand can be reduced by an incremental 2% per year over the course of many years (see, for example, recent reports by the Lawrence Berkley National Laboratory and the American Council for an Energy Efficient Economy reviewing the current situation in the USA[4]).

Therefore, both analysis relating the UK and practical international experience with electrical efficiency programmes suggest that there is the potential to avoid significant volumes of electricity demand in the future.

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[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48129/2176-emr-white-paper.pdf

[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/245121/Review_of_EDR_technical_potential_by_Nick_Eyre.pdf

[4] http://emp.lbl.gov/sites/all/files/lbnl-5803e.pdf , http://aceee.org/files/pdf/policy-brief/eers-07-2014.pdf

Demand response

The UK Government has also recognised the significant potential of temporary demand response to improve system security. Traditionally, demand response services have been restricted to large energy intensive consumers. However, the deployment of smart meters now opens up the prospect of demand response services being provided by all categories of consumers, including domestic (see report commissioned by the UK Government from Frontier Economics and Sustainability First in 2012[5]). In light of this potential, the UK Government has decided to include demand response in the capacity mechanism that is currently being introduced and has also encouraged National Grid to introduce new demand response system services specifically designed to address near term security of supply concerns.

There is now increasing evidence, particularly from the USA, that a well-designed capacity mechanism can reduce system peak demand by as much as 10-12%[6] through demand response measures. Moreover, this has been delivered more reliably and at much lower costs than the alternative of additional generation resources[7].

It is, therefore, reasonable to expect that in the UK there is the potential for several GWs of demand response in the near term and significantly more than this as smart infrastructure is rolled out to domestic and commercial premises.

Distributed generation

There is an increasing trend for end consumers to invest in their own locally based generation resources, often acting together in community based projects. Although this change has hitherto been less marked in the UK than in some other EU member states such as Germany, the introduction of feed-in-tariff support for small scale renewables projects in 2010 has led to a significant growth in deployment of locally based generation. By the end of the third year of the scheme in March 2013, 1.8GW of small scale renewable generation had been installed with an annual electricity production of 1.7TWh[8].

The UK Government has stated that it is committed to continue to promote the development of small scale generation and has agreed a strategy to drive forward

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[5] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48552/5756-demand-side-response-in-the-domestic-sector-a-lit.pdf

[6] See, for example, 'Demand Response as a Power System Resource, Program Designs, Performance, and Lessons Learned in the United States, Synapse Energy Economics Inc., May 2013

[7] On 7th January 2014 the North Eastern States of the USA were in the grip of the Polar Vortex and the generation outage rate was 22% which is 3 times the normal winter outage rate. The PJM Independent System Operator (ISO) reported that: "The responding, voluntary demand response resources…performed very well…The load management deployment in particular attracted imports because it set high prices ($1,800/MWh)…This helped PJM successfully meet an all-time record winter peak of 141,846 MW at 7:00 p.m. January 7 with no reliability issues."

[8] https://www.ofgem.gov.uk/ofgem-publications/85271/fityear3annualreport-finaledition.pdf

deployment[9]. If the current level of deployment is maintained over the next ten years, the amount of small scale generation will have increased significantly to around 6TWh. Deployment rates could increase significantly beyond this level with improvements in technology.

Challenges facing deployment of demand side measures

Despite the overwhelming evidence that demand side resources represent the premier system resource, there remains an ingrained institutional bias in favour of supply side measures within Government and traditional power industry organisations.

Despite all the initiatives outlined above, the UK Government continues to discount the future potential of demand side resources. This is illustrated in the letter[10] sent to the UK Government from DG Competition in reference to state aid case SA34947 'Electricity Market Reform - Investment Contract (early Contract for Difference) for the Hinkley Point C New Nuclear Power Station' reflecting the comments provided by the UK in support of the investment contract for Hinkley Point. Paragraph number 254 lists the series of measures that the UK government has implemented to improve energy efficiency and concludes:

"…the UK considers that gains from demand-side response which go beyond those achieved through existing policies cannot be considered certain, in particular since the demand-side response market might take time before becoming effective."

It is extraordinary that concerns about delivery certainty and timescales for demand side response can be made in comparison with the risks associated with the construction of a new nuclear power plant.

This inherent bias against demand side measures can also be seen within the Electricity Capacity Report recently produced by National Grid in its role as electricity market reform delivery body[11]. This report illustrates the comparative lack of focus placed on the future potential of demand side response and states that:

"Currently, there is around 500 – 1,800MW of triad avoidance, i.e. Demand-Side Response (DSR) at times of system peak……[although]…….very little of this is officially notified to National Grid as per the Grid Code. National Grid has reasonably accurate data around the peak demand periods but limited data for other demand periods."

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[9] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48114/2015-microgeneration-strategy.pdf

[10] ref. C(2013) 9073 final

[11] http://www2.nationalgrid.com/UK/Our%20company/Electricity/Market%20Reform/Announcements/June%202014%20Auction%20Guidelines%20publication/

Indeed, the Panel of Technical Experts appointed by DECC to provide independent advice on the quality of National Grid's analysis reported[12] that:

"The Panel raised concerns regarding the lack of information and understanding regarding Demand Side Reduction (DSR). The Panel prefers the term Distributed Energy Resources (DER) which imports the full range of contribution that could come from sources other than conventional generation whereas the term DSR appears to constrain demand-side awareness to mere reductions in demand and embedded generation. Noting the importance of building a strong institutional knowledge of DER amongst DECC and NG, the Panel recommended a programme to investigate this area further so that opportunities are captured in the future."

In short, supply side resources are perceived to be known and certain whilst demand side resources are seen as unknown and uncertain. This would matter little in a market that was simple, accessible and devoid of centralised interventions since demand side resources would be able to compete on a level playing field with supply side resources. However, this is far from the case with the electricity market. Participation requires compliance with a complex set of centrally administered rules and the majority of major investment decisions are the subject of centralised planning decisions.

Strategic planning of the power system has evolved in a piecemeal and *ad hoc* fashion – largely because the Government is still reluctant to acknowledge that such planning exists. Low carbon generation investments are now determined by DECC through an iterative process with National Grid whilst the network is planned independently by National Grid and distribution network operators under the oversight of Ofgem. The capacity market has also been designed, consciously or unconsciously, to bring forward new CCGTs and promote life-extension of existing coal-fired plant.

Demand side resources, however, have not benefited from strategic support – presumably as a result of the perception of uncertainty that surrounds their potential. This has led to an approach that is sometimes characterised as 'price and pray' whereby demand side measures are expected to comply with the market rules and come forward in response to market price signals alone. This is in stark contrast to the supply side which benefits from specific volume targets and dedicated revenue support mechanisms.

Market mechanisms, such as the capacity market, have been designed to reflect the operating and construction characteristics of power plant. For example, the 4 year-ahead auction timescales and the investment threshold to qualify for 15 year contracts are designed to suit new build CCGTs. Similarly, the investment threshold for 3 year contracts is based on the expected retrofit costs for existing coal-fired plant wishing to comply with the Industrial Emissions Directive. No specific design features have been included to support demand side resources and the more obvious approach of holding annual year-ahead

[12] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/324976/EMR_Panel_s_Final_Report_on_National_Grid_s_ECR.pdf

capacity auctions has been rejected despite the fact that this is likely to be more in keeping with investment timescales for demand side resources.

Similarly, the System Operator retains the view that resources can only deliver system security services if they are 'dispatchable' – in other words, if they behave like a large power plant. This leads to a set of rules that includes minimum size thresholds, instruction timescales and, most importantly, penalties that present difficulties for demand side resources. Put another way, System Operator procedures are based around resources that are 100% available for 80% of the time (i.e. power stations) rather than 80% available 100% of the time (i.e. demand resources)[13].

Finally, demand side resources have suffered from having low priority in the allocation of public funds. There is a wealth of experience with design and implementation of energy-saving programmes that show these programmes almost never work without having a sufficient and stable source of funding (along with an enforceable savings target and an effective delivery system)[14]. Where efficiency investments are increased, analysis shows that the full value of avoided energy use is substantially greater than the direct value of the energy savings (by a factor of three to five)[15], thereby representing excellent value for consumers.

However, the constraints on funding introduced through the Levy Control Framework coupled with the prioritisation of supply side measures in accessing these funds have severely constrained the opportunities to reliably fund efficiency programmes. In particular, electricity demand reduction has been incorporated into the capacity mechanism even though its value goes far beyond supporting resource adequacy at time of system peak demand. A more appropriate 'demand side feed-in-tariff' was rejected on the basis that it would compete for funds with feed-in-tariffs for low carbon generators. This has left investors in electricity demand reduction schemes having to comply with a series of inappropriate procedures designed to incentivise the dispatch of peaking generation plant.

Short term solutions

There is an urgent need to build the familiarity and knowledge regarding the potential of demand side resources within Government and delivery institutions. This should not be restricted to 'desk-based' learning along the lines of the various reviews conducted by DECC over recent years. Instead, it is necessary to present National Grid in the role of EMR delivery body with concrete targets for the procurement of demand side resources. These

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[13] Actually, data from the US ISOs suggests that the net availability of demand response is actually in the high 90%s which represents far superior performance than that provided by generation.

[14] See IEA Report, "Best Practices in Designing and Implementing Energy Efficiency Obligation Schemes" (RAP: Crossley et al, 2012).

[15] See: Presentation by Richard Cowart and Chris Neme, January 2012, Brussels: "Energy Efficiency: Power Markets, System Benefits and Key Design Issues" http://www.raponline.org/EVent/rap-presents-at-energy-efficiency-workshop-in-brussels-power-markets-system-benefits-design; and RAP paper "Recognizing the full value of energy efficiency, September 2013, http://www.raponline.org/document/download/id/6739

targets should be sufficiently ambitious to push National Grid to innovate in the way it approaches the identification and procurement of such resources as well as revising traditional system operations procedures to accommodate resources with new characteristics.

The capacity market design does take some steps in this direction by holding back some volume of capacity to auction at the year-ahead stage. However, whilst the basic focus of the capacity mechanism remains on supply side resources, it is likely that this volume will simply be allocated to smaller generation plant, possibly using environmentally unfriendly fuels such as diesel.

The capacity market represents a critical measure in the context of stimulating demand side resources. It is possible for such markets to be designed in a way that is positive in bringing forward low cost resources for the benefit of consumers as a whole. However, the design proposed by the Government appears wholly negative in this regard and risks locking consumers into paying considerable sums for resources that are neither required nor cost-effective.

It is not too late for Parliament to force a reassessment of the capacity market design as relevant secondary legislation is considered over the coming weeks. There are many alternative targeted approaches that can be used to manage system security in a more cost-effective manner than a market-wide capacity mechanism and these should be deployed whilst longer term solutions are re-evaluated. It is far from clear that there is a resource adequacy issue and a proper assessment would need to include a realistic assessment of the potential contribution of resources from the demand side and interconnection.

Moreover, it is likely that the reforms to the balancing market recently introduced by Ofgem will lead to higher availability from generation plant at time of system need. If it is still considered that additional supply side resources are required following a proper assessment of resource adequacy then it is appropriate to introduce a targeted procurement exercise that values the broader contribution to system security of new generation plant including the ability to dynamically respond to the output of intermittent renewable generation.

Long term solutions

Although it is important to move forward quickly to develop an improved understanding of the potential of demand side resources within Government and delivery institutions, it will be difficult to completely remove the ingrained biases without fundamental institutional reform.

It is necessary to clarify the role of Government in setting the strategic priorities for the electricity industry and create a suitably resourced and independent institution to ensure that these priorities are delivered robustly in an uncertain future. Good energy policy manages the risk of future policy failure by harnessing a diversity of resources, reducing delivery risks and creating options. Demand side measures provide a critical set of tools

required to meet these objectives and it is vital that the delivery institution is devoid of the biases that discriminate against these resources.

The Labour Party has proposed an 'Energy Security Board' to co-ordinate the long term strategic planning of the industry. However, the scope of such a body might be too narrow to fill the need for an independent delivery body. Elsewhere in the world, the Independent System Operator model has become widely accepted as a core element of a well-functioning liberalised power market[16]. Such an institution has the potential to co-ordinate the long term planning with the short term operation of the market to ensure coherent delivery of policy objectives.

In particular, it is evident that extensive progress has been made by many of the US ISOs in developing demand side measures. It is interesting to note that this progress has not been accompanied by any of the adverse press comment (e.g. references to three day weeks, de-industrialisation and general failure in Government energy policy) that is often seen in the UK when demand response initiatives are mooted.

This highlights the need to move away from the all-pervading and pernicious 'the lights will go out if….' narrative. The energy industry has all the tools available to deliver consumers the energy services they require at prices they can afford – always. However, this requires that the processes and technologies are introduced that will harness the fact the different consumers place different value on energy at different times. The idea that consumers operate in a binary world of 'light and darkness' over which they have no control is entirely unhelpful and should be eliminated as part of the industry discourse.

Role of the Levy Control Framework

One key element of the suite of energy policy objectives relates to affordability and the need to manage future energy prices. The Government has adopted the Levy Control Framework (LCF) as the key vehicle to achieve this objective.

However, the structure of the LCF is flawed, creating a series of perverse incentives which have particularly affected the development of demand side resources:

- The LCF does not relate to consumer costs and is actually likely to prevent expenditure when consumer costs are lowest.
- Key elements of 'unavoidable consumer expenditure' are excluded from the LCF including all those costs associated with system operation, network investment and the new capacity mechanism

[16] See US Federal Energy Regulatory Commission Order 888, 24 April 1996, Pgs. 279-286 setting out the key principles underpinning an ISO.

- The LCF is silent about the medium to longer term future and the Government can commit to significant costs affective expenditure over these timescales (e.g. nuclear CfDs).
- There is no process to ensure that LCF spend leads to a best overall value outcome for consumers. If this were the case, expenditure on demand side resources would be prioritised.

It is, therefore, extremely important that policy objectives relating to affordability are re-thought to avoid the perverse outcomes that arise with the LCF.