Kickstarting the negawatts market

How to make sure the electricity demand reduction pilot succeeds

green alliance...

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How to make sure the electricity demand reduction pilot succeeds

By Katherine Watts and Friederike Metternich

Green Alliance
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Green Alliance
36 Buckingham Palace Road, London, SW1W 0RE
020 7233 7433

ga@green-alliance.org.uk
www.green-alliance.org.uk
blog: greenallianceblog.org.uk
twitter: @GreenAllianceUK

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Summary

The UK's electricity system is undergoing radical change in response to the challenges of decarbonising the electricity system, keeping bills affordable and ensuring that the lights stay on. The government has created a 'capacity market' to ensure there will be sufficient future capacity to meet electricity demand at peak times.

Additionally, the government is establishing a two year pilot to see whether and how energy demand reduction (EDR) measures, resulting in what we call negawatts, could be part of the capacity market, or whether another mechanism, such as an electricity efficiency feed-in tariff (FiT), might be more suitable.

The UK has great electricity saving potential which current policies are not exploiting sufficiently. By 2030, if that potential is realised, government figures estimate conservatively, that almost 39TWh, around ten per cent of the country's total electricity demand, could have been reduced.

Our analysis shows that 'generating' negawatts could result in a peak load reduction of 6.4GW, equivalent to the capacity of eight 800MW combined cycle gas turbine (CCGT) power stations. This means that £3.9 billion capital costs could be avoided on those plants alone, with additional savings from avoided operation costs and deferred investment in transmission and distribution infrastructure.

The UK is not the first country to consider using demand reduction in a capacity market. The US has two capacity markets in operation. Their requirement for good measurement and verification has led to an understanding about how negawatts can be realised in power markets; and the data has helped grid operators to balance localised transmission and distribution systems better. Data showing the reliability of negawatts gave New England's system operator sufficient confidence to avoid investing in transmission upgrades, saving $260 million (£156 million). One reason for the rapid growth in negawatts in US capacity markets has been their interaction with other policies and incentivising measures.

With the final rules for the pilot being decided, this report aims to demonstrate the value of negawatts, how the capacity market could work to promote them and how the pilot scheme needs to be improved, drawing on the experience of the US markets.

Our five recommendations are:

1 Remove additionality requirements for the EDR pilot

Capacity payments are for services rendered, by supply or demand reduction, to ensure adequate capacity is available to meet peak electricity demand. Creating additionality requirements for services delivering negawatts, such as limitations on projects with short payback periods, but not for electricity generators, would be a market distortion and limits the range of measures the pilot can trial.

2 Multiple measures should reward negawatts benefits

Electricity demand reductions have numerous benefits, and the capacity market rewards just one of these. To maximise the benefits of negawatts, including reducing emissions and energy costs, EDR projects should be able to access funding from any policies and measures that support their services. Projects supported by other schemes, which also reduce peak demand, would be denied payment if additionality requirements were in place.

3 Guarantee an ongoing support mechanism

The pilot will only run for two years. Clear signals guaranteeing ongoing support for negawatts beyond the pilot are needed. It should be made clear that projects qualifying for the pilot will also be eligible to participate in the next stage, whether through the capacity market or another instrument, giving investors the confidence of long term support.

4 Ensure a diversity of projects

The aim of the pilot is to gain a better understanding of the potential for negawatts in the capacity market. The government should ensure a good mix of project types and actors represented in the prequalification process, and that auction criteria are not solely based on least cost, but also consider project diversity.

5 Collect good quality data

The pilot can gain value and set a precedent for high quality information gathering about negawatts. This will help to build evidence so that, when negawatt schemes are mainstreamed into the electricity market at scale, the UK can make informed decisions about grid operation and infrastructure.

The UK capacity market: new support for negawatts?

The UK's electricity system is undergoing significant changes in response to three fundamental energy policy challenges:

- ensuring enough electricity generation capacity for future demand, especially during peak times;
- decarbonising the electricity system;
- ensuring energy bills stay affordable.

The government's Electricity Market Reform (EMR) has been formulated in response to these challenges. In particular, the new capacity market aims to ensure there is sufficient generation capacity available at peak demand periods.

The UK is facing a tightening of its capacity margin, particularly in the years 2015-16, owing to the closure of some existing power plants. The capacity market will help to ensure that there is capacity to meet peak demand, by providing predictable payments to capacity providers. This market will be implemented later in 2014 and generators, demand side response (DSR)[1] and energy storage will all be eligible to participate. (See page four for more details about how the capacity market will work.)

To explore whether and how energy demand reduction (EDR) can be incorporated into the capacity market, the government has put forward £20 million to establish a two year pilot. The pilot is an opportunity to road test design elements but also to gain high quality data through measurement and verification of energy savings. And, in the event that a support mechanism other than the capacity market is set up, it will still provide relevant information.[2] Many of the rules for the EDR pilot have already been defined, but our analysis is relevant not only to the pilot itself, but to whatever mechanism might follow it. In any case, the existence of the pilot demonstrates that the government now has the appetite to create a new mechanism to promote permanent electricity efficiency savings.

The capacity market in a nutshell

Currently, a generator is paid for each unit of electricity it produces. The new capacity market will also pay generators for simply being there, ready to meet future demand, especially at peak times. This is because traditional generators, such as gas plants, will go from running almost constantly at base load to a role that will serve just to back up renewables. To make them economic to operate, they will need some form of payment to exist, rather than only being paid when they run. This is the capacity market.

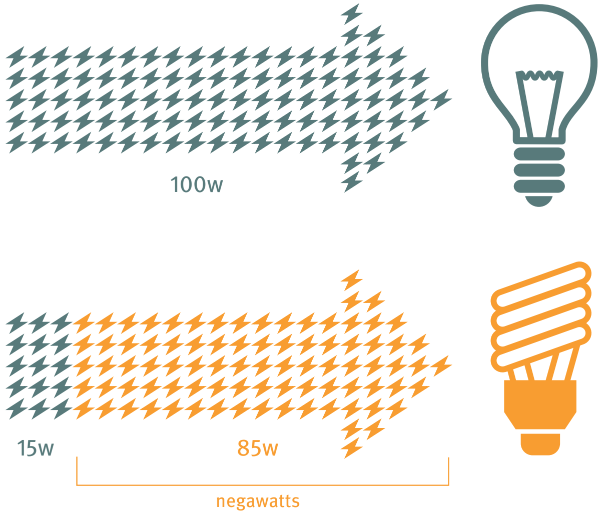
Set amount to auction	Reliability standard established by government System operator develops scenarios of peak demand, and advises on the amount of capacity needed to meet the reliability standard
Eligibility and pre-qualification	Demand side response, storage and generation are eligible All bidders have to go through a pre-qualification process
Auction	A central auction is held to set a price for capacity and to determine which providers are issued with capacity agreements
Trading	Capacity providers may adjust their position in private markets
Delivery	Providers of capacity commit to be available when needed or face penalties in the delivery year
Payment	The costs of capacity are shared between suppliers, in proportion to their share of peak demand

A central auction is held to set the price for capacity. Providers that clear this auction are issued with capacity agreements. The amount of capacity needed will be announced and applicants will submit bids. All participants will be paid the same price per unit of capacity – the clearing price – and the price is set by the most expensive bidder needed to achieve the desired amount of capacity. However, capacity providers that clear the auction will get contracts for different durations. If generators fail on their capacity commitments, they will face penalties. Currently, electricity generation, demand side response and storage will be allowed to bid into the capacity market.

What are negawatts?

Instead of building new low carbon power stations to ensure sufficient capacity and then attempting to cut emissions in the future, negawatts, or power saved through electricity efficiency, could be generated instead.

Imagine a 15 watt lightbulb replacing a 100 watt bulb. The 85 watts saved can be used elsewhere, or not used at all. These are negawatts.



How this saving could be rewarded in a capacity market

The 85 negawatts saved might not be able to participate in a capacity market, as it depends on whether a lightbulb is on at peak time. If, for example, a more efficient lightbulb would be running ten per cent of the time at peak, 8.5 negawatts could bid into the market.

Negawatts: the UK's untapped potential

The UK has vast potential to reduce its electricity demand. Across the UK, conservatively, 39 TWh could be saved through energy efficiency measures in 2030,[3] equivalent to almost ten per cent of the country's total electricity demand.[4]

Realising this potential would help the UK to meet the three energy policy challenges of ensuring sufficient energy supply at affordable cost, while making the transition to a low carbon energy supply.

Negawatts reduce peak demand

In recent decades, the UK's capacity margin has been relatively large. This is the amount of total reliable generation capacity available above peak demand. Usually, demand is significantly below the peak which, for the UK, occurs on very cold weekday evenings in winter. However, this margin is expected to become somewhat tighter in the future, mainly as a result of old coal and oil plants closing down.[5] While National Grid already uses demand side response to shift electricity demand away from peak times, electricity demand reduction measures would also reduce peak demand significantly. Realising the UK's untapped negawatts potential in 2030, could result in a 6.4GW peak load reduction.[6] This is equivalent to the capacity of eight medium combined cycle gas turbine stations (CCGTs).[7]

Negawatts reduce bills

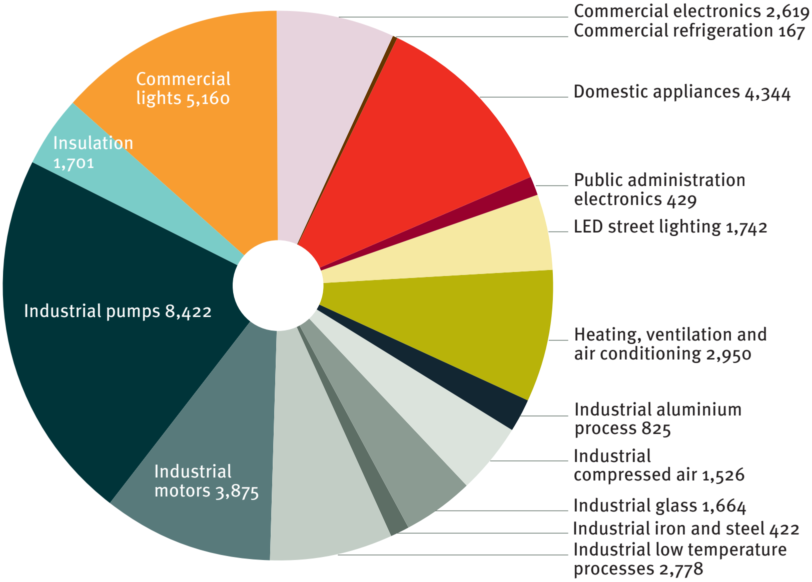
Energy bills have been increasing in recent years: the average annual domestic electricity bill has gone up from £366 in 2007 to £510 in 2013. Energy intensive industries warn about the impact of increasing energy costs on their competitiveness. Reducing electricity demand protects domestic and corporate users from volatile and rising energy costs. It also reduces the need to build costly generation capacity and associated infrastructure, removing capital costs from energy bills. It is estimated that £3.9 billion in avoided capital costs could be saved in 2030 with even more savings from avoided investment in additional transmission and distribution infrastructure.[9] If the avoided new capacity avoided the need for new renewables to be built, savings would be even higher, as renewables have higher capital costs for equivalent capacity.

Negawatts reduce emissions

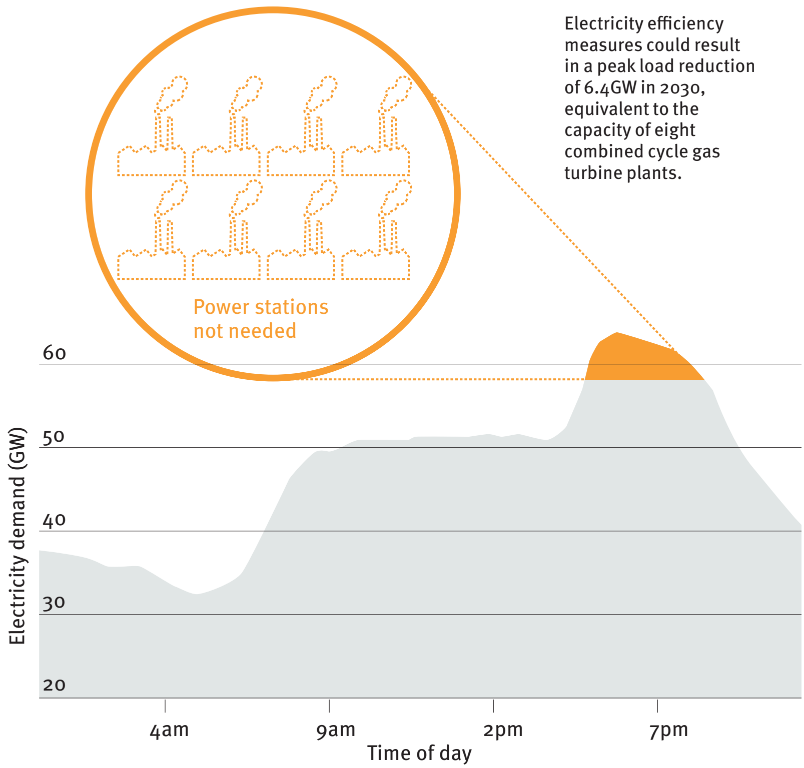
To achieve the 2050 80 per cent greenhouse gas emissions reduction target set by the Climate Change Act, the Committee on Climate Change has advised that the UK should decarbonise its power sector. Reducing electricity demand is a cost effective way to cut the use of fossil fuels, and could thereby reduce emissions significantly.

"The global market for negawatts is gaining momentum. In 2011 it attracted $300 billion (£180 billion) in investment worldwide and there is still much untapped potential."[10]

Different sectors' electricity saving potential in 2030 (in GWh)[11]



Electricity saving = gas power stations not needed in 2030



Negawatts in the US capacity markets

The UK is not the first country to be interested in incorporating negawatts into a capacity market. The US has two existing markets, one managed by the Independent System Operator for New England (ISO-NE) and another managed by PJM.[12,13] Both markets allow efficiency resource providers, as well as providers of other demand resources, to participate in the capacity markets and compete with electricity generators. The US markets show that negawatts can successfully and cost effectively participate in capacity markets. Lessons from the different designs of the two markets can inform the design and development of the UK pilot and the subsequent negawatts support mechanism.

The rules of the US capacity markets

Rule	ISO-NE and PJM markets
Minimum project size	The minimum size of eligible projects is 100kW.[14]
How many years negawatts can bid into the market	The two capacity markets differ: ISO-NE allows efficiency resource providers to bid into the capacity market and receive payments for cleared efficiency projects for the full expected life of the efficiency savings; eg if a lightbulb is expected to provide savings for five years, the resource can receive capacity payments for all five years. In contrast, PJM only allows efficiency measures to be treated as a capacity resource for a maximum of four years.
Measurement and verification (M&V) requirements	In both markets extensive M&V manuals state what efficiency resource providers must do to demonstrate that their resources are real and will reliably deliver savings at the time of system peak. These manuals summarise the methods that can be used to document savings, including baseline definition.
Additionality	There is no additionality requirement. Bidders do not have to demonstrate that the efficiency upgrades would not have been installed without the capacity market or other incentives from efficiency programmes. All energy saving projects that generate savings at peak time can participate, regardless of payback time or other economic factors.[15] There is no restriction on projects also being additionally supported by other mechanisms participating.

“Arguably, EDR has been the most reliable of all of the energy resources that have cleared the market.”

Negawatts are reliable

The US experience shows that negawatts can be relied upon to deliver significant demand reduction at peak consistently.

The success of the participation of efficiency resources is demonstrated by the rapid growth in negawatts resources within the two existing schemes. Negawatts in ISO-NE's forward capacity market have more than doubled over the past seven years, from clearing 655MW in the capacity market to 1,538MW, representing 4.25 per cent of the total capacity cleared. Similarly, efficiency participation in PJM's capacity market has nearly doubled over the past five years, from 569MW to 1,117MW, approximately 0.64 per cent of the total capacity cleared. These examples show the extent to which energy efficiency can make a significant contribution to meeting system peak demand.

In addition, since system operators are highly conservative professionals with a reliability mandate, the measurement and verification (M&V) costs are very high in the US. Suppliers have said that that they are bidding in less than the amount of electricity efficiency actually being installed just to have a margin and avoid penalties. So negawatts may actually be delivering more reliability than conventional supply.

In the PJM market in 2013, more negawatts were delivered than originally cleared the market; ie more than were initially successful in the auction. If a capacity provider is unable to deliver capacity when needed, it can fill its missing capacity by acquiring another resource on a secondary market. This is called the net replacement rate. Net replacements for energy efficiency were relatively small in 2012 (-5.2 per cent) and similar to generators as a whole (-5.4 per cent), so both demand and supply side participants used resources from the secondary market to ensure that they met their capacity commitments. In 2013, their net replacement rate was substantially positive (+13.3 per cent compared to generators -6.1 per cent), meaning that negawatts were called upon to plug the capacity gap by other bidders. Arguably, EDR has been the most reliable of all of the energy resources that have cleared the market.[16]

If the UK decided to include negawatts in its capacity market, there is clear evidence that they are a reliable resource for reducing peak demand.

Reducing the cost of capacity

Negawatts reduce capacity costs in two ways: directly, by reducing the clearing prices set by the auctions for capacity payments; and, indirectly, by avoiding investment in generation and other more expensive infrastructure. The US experience demonstrates that negawatts in the capacity market could help the UK to address the challenge of keeping energy bills affordable.

Broadening the scope of capacity markets to include negawatts should lead to reductions in the clearing prices, with attendant benefits to consumers. The first auction in the ISO-NE market was cleared at a lower price due to negawatts' participation, and between $72 million and $108 million (£43

“The participation of negawatts in the US capacity markets has reduced the amount of new infrastructure needed.”

and £65 million) were made in savings to consumers in just one year. Similarly, the auction for capacity to be delivered from the beginning of summer 2015 cleared at a lower price, resulting in between $69 million and $138 million (£41 and £83 million) in consumer savings due to EDR participation.

The participation of negawatts in the US capacity markets has reduced the amount of new infrastructure needed. Formerly sceptical supply planners now have the confidence of knowing that efficiency resources are real and can be relied upon to meet system needs. ISO-NE is making great efforts to improve forecast trends in EDR to adjust its own estimates of system needs, not only for capacity, but also for transmission infrastructure. After completing a recent comprehensive forecast of energy efficiency impacts, it concluded that it could defer ten upgrades of transmission lines previously planned for the states of Vermont and New Hampshire. These states have a shared population of just 1.9 million people, and the cost savings of $260 million (£156 million) meant savings of $136 (£82) per person.

Future price reductions, both direct and indirect, resulting from negawatts in the capacity markets are expected to be even more pronounced, as the ISO-NE and PJM markets have both experienced rapid growth in the amount of energy efficiency resources bidding in.

Measurement and verification gives economically valuable system data

Strict measurement and verification protocols in the ISO-NE and PJM markets have caused efficiency resource providers to invest in a number of sophisticated and detailed studies of many different efficiency measures targeting a variety of different residential and business electricity end uses. The studies have enriched the understanding of the magnitude of annual energy savings. This has not only given accurate data on how much different measures save at system peak (the key consideration for participation in capacity markets), but also the role they could play in addressing more localised transmission and distribution system peaks. These often peak at different times than the system as whole and will become an increasingly important issue for grid operators to manage as renewables increase their share of generation capacity. Quality data can also inform investment decisions on whether capacity upgrades are needed.

Negawatts only have to prove they reduce peak demand

Neither of the US markets has a requirement that negawatt projects are additional, ie that an efficiency upgrade would have not been installed without the capacity payment. They only need to show that real negawatts are created as a result of the upgrades, as measured against the defined baseline. There are no restrictions on which measures can participate in the capacity market, as long as the negawatts delivered contribute towards achieving the capacity market’s aim of ensuring adequate supply at peak demand times. Not putting additionality restrictions on negawatts projects helps to ensure that their potential to reduce peak demand is not unnecessarily limited.

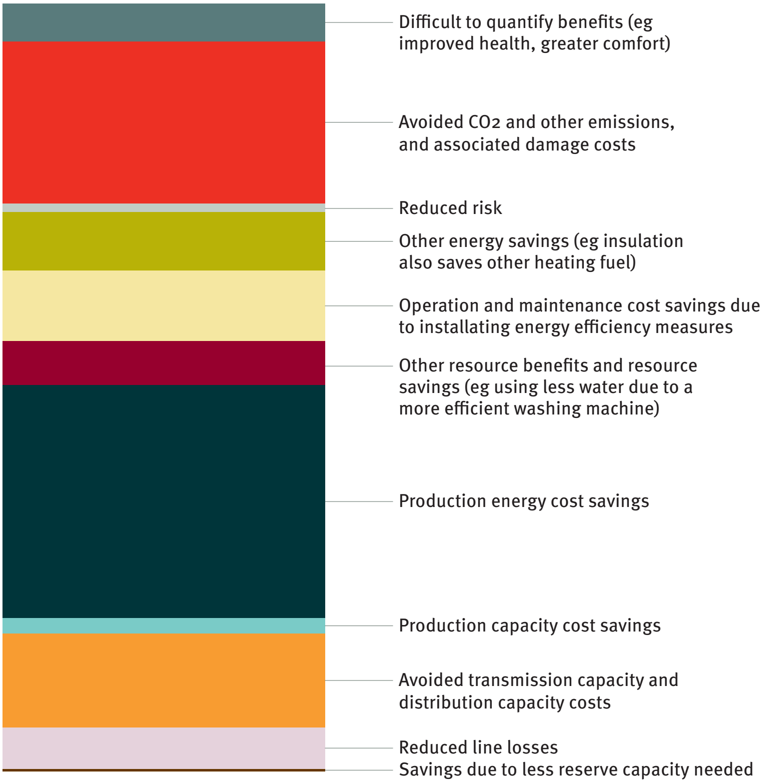
“To capture the multiple benefits of electricity efficiency, complementary policies and measures are needed.”

Complementary policies and measures value other benefits of negawatts

Negawatts provide many different benefits to the electricity system. In addition to reducing peak demand, they reduce investment in transmission and distribution infrastructure, line losses, fuel and other generation expenses and emissions. However, the US experience shows that capacity markets only compensate negawatt investors for a small portion of the value of their investments.

It can be difficult to quantify all the benefits of electricity efficiency, such as health improvements or the avoided effects of CO_2 emissions. But it has been attempted in the US, where benefits were translated into a cents per kWh value. The total value of the benefits was calculated as nearly 19 cents per kWh.

The different benefits from electricity efficiency, totalling 19 cents per kWh in Vermont, USA[17]



Only paying for the peak time capacity that negawatts provide undervalues them. To capture the multiple benefits of electricity efficiency, complementary policies and measures are needed. The small amount provided by the capacity payment means it is unlikely to be a game changer in stimulating investment in reducing electricity demand.

“In the US markets, negawatts are free to bid into the market even if they receive support payments from other sources.”

In the US markets, other policies and revenue streams are designed to complement the capacity market and support the deployment of energy demand reduction measures into it. The penetration of negawatts into the ISO-NE market is driven far more by energy saving obligations set by each of the six states covered by the market than by the capacity payments themselves, which account for only about ten per cent of the cost of acquiring the capacity resources bidding into the market. The New England states each have their own obligation level but the average of the regional targets is around two per cent per year, making it the most ambitious region in the US. States participating in the PJM market have lower energy saving obligations, mostly around one per cent per year, and so it has a lower participation of negawatts. Efficiency measures that bid into the ISO-NE market are supported by other revenue streams, including efficiency programme charges collected on utility bills and carbon revenues from the region’s cap and trade program (the Regional Greenhouse Gas Initiative, or RGGI). PJM is not covered by a regional carbon trading scheme and so lacks access to such a revenue stream.

While the New England market can boast that 4.25 per cent of its capacity comes from negawatts, the PJM market has only 0.64 per cent of its capacity needs met in this way. This is, in part, because the ISO-NE market has been around longer, allowing more efficiency to accumulate, and because it allows efficiency to be bid over the entire life of the savings, rather than the PJM’s cap of four years. However, the larger share of negawatts in the ISO-NE capacity market is also due to New England’s stronger efficiency obligations.

Rules are symmetrical for electricity supply and negawatts

In the US markets, negawatts are free to bid into the market even if they receive support payments from other sources. This maintains symmetry between negawatts and energy generators. Generators do not have to prove that they provide capacity only because of the capacity payment, indeed, they receive payments in both the electricity and capacity markets, and may also receive support from other policies. The capacity market should pay for the service rendered in reducing peak demand levels, just as it pays for supply capacity being available, and should not restrict other benefits of negawatts being rewarded.

Getting the UK's EDR pilot right

The UK government is preparing to launch its EDR pilot to see if negawatts should eventually participate in the main capacity market.[18] There will be a minimum bid size of 100kW in the auction within the pilot scheme. Only efficiency projects not already supported by other government schemes are eligible to participate. The government is exploring additionality requirements to ensure that the pilot does not support EDR savings that would have happened anyway. In a pre-selection process, projects have to set out the measurement and verification process. If successful, applicants can bid into an auction where funding will be allocated until available financing has been fully deployed.

Set against the experience of the US markets, we have considered a number of questions in relation to improving the design of the pilot.

Are capacity payments enough to incentivise efficiency investments?

We undertook case studies (see page 18) to gain an understanding of what it would mean for different organisations to participate in the EDR pilot, as well as in a long term capacity market, and how much each could reduce peak demand. The figures from our case studies indicate that capacity payments are likely to make a useful, but incomplete, contribution to the feasibility of many negawatts projects, especially to those with long payback periods. While they may tip the balance for some activities, not allowing other revenue streams and incentives to work in parallel may effectively disincentivise deep efficiency retrofits.

The table below shows the payback time of UK-wide efficiency measures in 2030. It clearly illustrates that capacity payments bring down the payback period and incentivise projects to go ahead that might not otherwise, but that the effect is still relatively marginal. This underlines the need for other mechanisms to realise the full potential of negawatts across the UK.

Payback time in years for UK-wide electricity efficiency measures in 2030

Energy demand reduction categories	Payback before capacity market payment	Payback with the max capacity market payment of £75/kW
Insulation	4.3	4.0
Lights	1.9	1.7
Commercial refrigeration	1.0	0.9
Commercial – electronics	0.2	0.2
Domestic appliances – best available technology	7.9	6.0
Public administration – electronics	0.2	0.2
Street lighting	2.2	2.0
Heating, ventilation and air conditioning	0.4	0.4
Industrial processes	3.6	3.4

> **“If short payback activities are excluded from the EDR pilot, it may fail to incentivise other energy demand reduction activities.”**

While capacity payments provide a revenue stream to support electricity demand reductions, they should not be seen as the only way to achieve the full potential of negawatts.

Does the pilot set unnecessary barriers to participation?

One of the stated aims for the EDR pilot is to build an understanding of additionality. A project is defined as being additional if it is not already in operation and does not receive any additional economic support from the government, even though such restrictions are not placed on electricity supply in the capacity market. Furthermore, the pilot may exclude measures with less than a two year payback period.

The government’s EDR pilot foresees excluding projects that receive support from other schemes. In contrast, both capacity markets in the US allow for energy efficiency projects involved in other schemes to participate. It is clear from the comparison of these two markets that the one with the stronger policy drivers and other revenue streams operating alongside the capacity market has been better able to maximise the penetration of negawatts into the market.

Strong additionality requirements for negawatts, especially if carried into the capacity market, could end up over estimating the actual level of peak demand, as more electricity savings would be in the system than are being recognised by the capacity market. This could mean that they remain inadequately accounted for in the management of the grid, and lead to the building of more generation capacity than is actually needed.

There is no additionality requirement for generation in the UK’s capacity market. Electricity suppliers will receive payment simply for the service of providing capacity. Suppliers do not need to prove that they would close without the capacity payment. High additionality requirements can create a significant and potentially off-putting administrative burden. This asymmetry effectively discriminates against negawatts. As long as verified negawatts contribute to reducing peak demand, they should be eligible to participate in the markets.

If the EDR pilot limits measures with short payback periods, it may also make bundled activities unviable. Energy demand companies often make more expensive measures, with longer payback periods, financially viable by bundling them with measures that have short paybacks. This reduces the payback time of the measures overall and so can encourage deeper retrofitting. The government has suggested that it might restrict activities with payback times of less than two years in the EDR pilot. If this applies to bundling, it could lead to deeper retrofits becoming financially unviable and, therefore, being untested in the pilot. If taken forward into the capacity market such a limit could lead to an over estimation of peak demand. If short payback activities are excluded from the EDR pilot, it may fail to incentivise other energy demand reduction activities.

Both of the US markets outlined previously have rapidly growing EDR sectors, which helps to give confidence that, if the UK replicated key elements, especially putting in place complementary policies and measures to support EDR, the savings potential by 2030 of 6.4GW could be realised.

“Projects in the EDR pilot will have only one year’s guaranteed support and no certainty about the future policy framework.”

Will the pilot attract and involve a wide range of actors?

The EDR pilot is an opportunity to understand the actors that can create portfolios of negawatts activities and fulfil the measurement and verification requirements. However, there are potential barriers that may prevent it from involving a beneficially diverse set of participants.

At the moment it is not clear whether EDR will be able to participate in the long term capacity market. Some of the bidders may be large companies already investing in energy demand reduction, as in the case studies. Some demand side response companies interviewed for this report indicated that they are reserving judgment on the EDR pilot until there is greater clarity on the rules and long term policy structures. Projects in the EDR pilot, even if successful in their bids, will have only one year’s guaranteed support and no certainty about the future policy framework.

As the EDR pilot is operating on a short timeline, it is likely that the bidders into the pilot will come mainly through existing energy demand management companies or other existing players with ‘shovel ready’ projects. This has the advantage that implementation structures will already be in place but means it is unlikely that EDR projects which were not already well advanced will participate.

Even if the pilot attracts a range of participants, if it is run on a ‘best value basis’, it could miss out on gaining experience of a variety of actors and projects participating in the market.[19] Valuing the breadth of information that the pilot would deliver could give the government greater understanding of how different project types and actors will interact in reducing peak demand and in EDR.

The importance of measurement and verification

The EDR pilot is an excellent opportunity to gather data and experience, and to create interest in new support mechanisms across a variety of EDR actors.

A sufficiently rigorous measurement and verification (M&V) system can provide information not just on theoretical levels of savings, but on real time energy use, including how people interact with efficiency technologies, which can have a profound effect on the actual energy savings achieved. The US experience demonstrates the value of real time information, which has led to a greater understanding of energy savings throughout the year, not just at system peaks. This information is valuable for grid operators’ understanding of localised transmission and distribution peaks, which can help better management of the system, particularly as generation capacity becomes increasingly decentralised.

Data from rigorous M&V is also needed as a basis on which investment decisions can be made on the supply side. However, the right balance needs to be found between the benefits of good data and the costs of gathering it, which may make participation uneconomic.

The pilot gives an opportunity to explore how negawatts could participate in the UK’s capacity market, but more importantly it is a chance to establish good M&V rules that will be relevant to any negawatt support mechanism developed after the pilot.

Recommendations

Remove additionality requirements for the EDR pilot

Capacity payments are a payment for a service rendered, by supply or demand reduction, to ensure adequate capacity is available to meet peak electricity demand. Putting additionality requirements on negawatt projects but not on generators is a market distortion. Electricity suppliers do not have to demonstrate that their electricity supply is new to be able to bid into the capacity market, yet some potentially significant negawatts capacity could be excluded from the pilot if the government excludes projects that could have happened without the additional revenue stream of the capacity payment. It also limits the range of measures the pilot can trial, which is one of the pilot's main aims.

The suggestion that measures with payback times of less than two years should be ineligible for the EDR pilot fails to recognise the role that such measures play in making bundles of measures economically viable. It would unfairly introduce a requirement for negawatts that electricity generators do not have to meet and also, potentially, exclude the low hanging fruit.

Multiple measures should reward negawatts benefits

Energy demand reductions have numerous benefits, and the capacity market rewards just one. To maximise the benefits of negawatts, including their role in reducing emissions and energy costs, EDR projects should be able to access support from any appropriate policies and measures that provide payment for the range of services negawatts can provide.

Excluding EDR projects that receive support from existing measures would greatly limit the range of projects eligible to participate in the pilot and reduce the information gained about how different types of EDR project could function in a capacity market. It would also unfairly deny activities that are providing the service of reducing demand at peak periods from receiving payment for that service. The requirement that participating negawatts can't receive other revenue streams, apart from the EDR pilot revenue stream, should be dropped. This rule should especially apply if negawatts are incorporated into the capacity market.

Guarantee an ongoing support mechanism

Giving confidence for the medium term should be a priority for the government, both to help create interest for the EDR pilot, but also to give a clear signal of political intent beyond the pilot that investors need to pursue projects. While a pilot is important, without any long term guarantee that some form of EDR mechanism will continue beyond the pilot phase it is unlikely this will lead to any investment in this model over the next two years. Once the pilot is over and a new set of rules is developed, it will take even longer to build up the market unless there is a clearer trajectory from the outset.

“To create greater investor confidence, the government should guarantee ongoing EDR support after the pilot.”

Ensure a diversity of projects

The pilot is fundamentally different to the capacity market, as it seeks to understand different types of project and participants. Since information gathering is such a fundamental part of the EDR pilot, the ‘best value’ basis on which the government plans to run its auction needs to ensure that a variety of project types and actors are included by valuing diversity, as well as the lowest cost. The pilot should not aim solely to maximise the negawatts achieved out of the £20 million, but use the opportunity to learn important lessons which can lead to greater efficiencies in the future. The pilot should be seen as an opportunity to ensure there is a good mix of project types and actors represented, both in the prequalification process and the auction. The auction criteria should allow diversity to be considered, as part of defining the portfolio of projects that will take part in the pilot.

Collect good quality data

The US experience demonstrates the value of information gathering about energy demand reduction. Good data helps the grid operator to manage the system better and can inform investment decisions. The pilot is an opportunity to set a precedent for good quality information gathering about negawatts. This will help to build datasets that, when negawatts are mainstreamed into the electricity market at scale, would allow the UK to make decisions on infrastructure needs, based on clear evidence.

Case studies

The private and public sectors in the UK are already generating negawatts. Below are three case studies which illustrate how much energy efficiency can help at peak times and how much these projects could receive if they were to participate in the capacity market. Together, the electricity savings from just these three case studies achieve a peak load reduction of over 1,800kW, equal to the peak power demand of around 2,900 UK households.[20]

BASF

As a heavy energy user, BASF is always keen to invest in electricity efficiency projects. Electricity efficiency measures vary from upgrading cooling towers and converting to LED, to upgrades in air filtration systems. Completed and planned electricity saving measures result in a peak load reduction of 884kW. These electricity load reductions are equal to the typical power required by 1,427 homes in the UK.

Past efficiency projects have resulted in annual electricity bill reductions of £98,523 and planned projects will save another £425,000, which adds up to £523,523 of annual electricity savings. If these and other projects were to participate in the capacity market, they would receive between £38,929 and £66,357 per year in capacity payments,[21] or up to 13 per cent of its electricity bill savings.[22]

Guy’s and St. Thomas’ NHS Foundation Trust

The Guy’s and St Thomas’ NHS Foundation Trust is widely known as a leader in the field of environmental sustainability. The Trust has undertaken electricity saving projects that include switching to LED lighting, putting frequency inverters on fixed speed motors and installing a high specification chiller.

These measures result in a peak load reduction of 674kW and are equal to the typical power required by 1,086 households in the UK at peak. The Trust is already saving £500,000 per year and will be investing in further measures. If the Trust received a capacity payment on projects like these, it could receive between £29,635 and £50,514 a year, up to ten per cent of its electricity bill savings.[23]

Oxford Brookes University

Oxford Brookes University has implemented numerous electricity saving measurements over the past few years. Due to the higher unit cost of electricity compared to gas and higher associated carbon emissions, the university focuses its available funding predominantly on saving electricity. Computer and IT optimisation projects, such as cold aisle containment in the data centre and PC power management software, accounted for 36 per cent of the power saving. A further 16 per cent of the power saved is due to new building management controls and 23 per cent of the power saved comes from introducing light sensors, while another 20 per cent comes from switching to LED lighting.

Electricity saving projects since November 2010, together with planned projects, will reduce loads at peak time by a total of 273kW. These electricity load reductions are equal to the typical peak power required by 440 homes. Total financial savings from the electricity saving projects (completed and planned) stand at £259,703 per year. If these electricity saving projects were included in the capacity market, the university could receive between £12,030 and £20,506 a year, or up to eight per cent of its electricity bill savings.[24]

Endnotes

[1] Demand side response (DSR) describes the process whereby electricity demand is shifted from peak times to less intense periods of demand. In this way, energy demand is temporarily reduced. It includes measure such as turning off or lowering power supply to retail refrigeration, air conditioning and lighting. By contrast, Energy demand reduction (EDR) leads to permanent reductions in demand at all hours of the year, including during peak demand. It includes measures such as more efficient lighting.

[2] There are other options for incentive schemes to deliver demand reduction. As well as exploring the advantages and disadvantages of a capacity market approach, in *Creating a market for electricity savings* (Green Alliance, 2012) we evaluated supplier obligations and the option of electricity efficiency feed-in tariffs, favoured by many.

[3] Received DECC data, 2014, estimates an untapped energy saving potential in 2030 of 38.6TWh

[4] Assumes an electricity demand of 400TWh in 2030. Source: Committee on Climate Change, 2013, www.theccc.org.uk/wp-content/uploads/2013/12/1785a-CCC_AdviceRep_Chap3.pdf

[5] See Ofgem, 2013, *Electricity capacity assessment report 2013*, www.ofgem.gov.uk/ofgem-publications/75232/electricity-capacity-assessment-report-2013.pdf. Ofgem's 2013 reference scenario foresees de-rated capacity margins decreasing to four per cent in 2015-16 before recovering. It should be noted that this is within the risk accepted by other countries, including France, Ireland and Belgium. It is the sensitivities applied that would bring the capacity down to a critical stage. However, there are many uncertainties about whether this will actually occur.

[6] Based on DECC's estimated 38.6TWh energy saving potential in 2030. 6.4GW peak load reduction is the result of Green Alliance analysis. We applied annual running times to energy saving measures to calculate the reduction in connected load (GW saved in 2030), which was then multiplied by a peak coincidence factor, resulting in the 6.4GW peak load reduction.

[7] Assumes a medium sized combined cycle gas turbine (CCGT) with a 800MW capacity

[8] Source: DECC, 2013, *Average annual domestic standard electricity bills by home and non-home supplier,* www.gov.uk/government/statistical-data-sets/annual-domestic-energy-price-statistics

[9] Based on pre-development and construction costs of CCGT of £610 per kW. Source: DECC, 2013, www.gov.uk/government/uploads/system/uploads/attachment_data/file/223940/DECC_Electricity_Generation_Costs_for_publication_-_24_07_13.pdf

[10] IEA, 2013, www.iea.org/Textbase/npsum/EEMR2013SUM.pdf

[11] Figures based on received DECC data, 2014

[12] Data on the ISO-NE and PJM markets is taken from an unpublished 2014 study for Green Alliance by Chris Neme of the Energy Futures Group and Richard Cowart of the Regulatory Assistance Project.

[13] ISO-NE is the Independent System Operator for New England which manages the capacity market. PJM is a regional transmission organisation which co-ordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia.

[14] This is equivalent to peak saving of approximately 20,000 compact fluorescent lightbulbs. With that cut off point, less than 70 different efficiency resource projects (from approximately 25 different companies) cleared the market in its first year.

[15] Unlike the UK, where peak demand is defined by DECC from 3pm to 7pm on winter weekdays for the pilot, peak demand occurs during summer weekdays in the US because of air conditioning demands.

[16] This reflects only two years of any real participation by efficiency in the PJM market, and the magnitude of participation has been relatively small in comparison to generators and demand response providers. See 'ISO on background: energy efficiency forecast', presentation, 12 December, 2012, by Anne George, vice president, external affairs and corporate communications, and Stephen J Rourke, vice president, system planning, www.iso-ne.com/nwsiss/pr/2012/ee_forecast_slides_final_12122012.pdf

[17] RAP 2013, *Recognizing the full value of energy efficiency*

[18] DECC, 2013, *EMR: Consultation on proposals for implementation*, Chapter 4: 'EMR: Capacity market, detailed design proposals'

[19] DECC, 7 April 2014, *Electricity demand reduction pilot information update*

[20] All numbers based on an assumed typical UK domestic peak load of 620W. See: www.gov.uk/government/uploads/system/uploads/attachment_data/file/208097/10043_R66141HouseholdElectricitySurveyFinalReportissue4.pdf

[21] According to the government, the capacity auction will be capped at £75 per kW. See: www.gov.uk/government/news/electricity-market-reform-capacity-market-design

[22] Based on BASF paying 5p per kWh

[23] Based on Guy's and St. Thomas Hospital paying 10p per kWh

[24] Based on Oxford Brookes University paying 13p per kWh

Green Alliance
36 Buckingham Palace Road
London SW1W 0RE
T 020 7233 7433
ga@green-alliance.org.uk
www.green-alliance.org.uk

blog: greenallianceblog.org.uk
twitter: @GreenAllianceUK

The Green Alliance Trust
Registered charity no. 1045395
Company limited by guarantee
(England and Wales) no. 3037633
Registered at the above address