



Government Response to the House of Lords
Science and Technology Select Committee Inquiry:
The Resilience of the Electricity System

Presented to Parliament
by the Secretary of State for Energy and Climate Change
by Command of Her Majesty

June 2015



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Introduction

The government welcomes the House of Lords Science and Technology Committee's report on The Resilience of the Electricity System.

We have carefully considered each of the Committee's conclusions and recommendations. This document has been prepared by the Department of Energy and Climate Change (DECC) and sets out the Government's response to the Committee's recommendations.

Response to Conclusions and Recommendations

The Electricity System

Given its policy objectives, we conclude that the Government has had little choice but to play a greater role in managing the electricity system. We therefore endorse the Government's adoption of a managed market and stress that it is explicitly for the Secretary of State to provide leadership and clarity on responsibilities across the sector. Balancing security of supply, sustainability and affordability (the trilemma) is a first order issue for the Secretary of State. We recommend that the Secretary of State clearly sets out the Government's approach to balancing the trilemma and is clear with Parliament and the public about the pressures which will accrue on affordability under the current state of technology. (Paragraph 37)

The government has previously published a number of documents, such as the Annual Energy Statement, which set out the approach to balancing the trilemma.

DECC has published estimates of the impacts of energy and climate change policies on energy prices and bills, most recently in November 2014 (available here: <https://www.gov.uk/government/publications/estimated-impacts-of-energy-and-climate-change-policies-on-energy-prices-and-bills-2014>).

The report compares estimated prices and bills with policies to a world where such policies were never introduced, and estimates the net impact of policies. The report presents estimates for the average impact across households and business energy users (small, medium and energy-intensive users), and for households, and also presents distributional analysis of the impacts on different household types. The report estimated that overall, household energy bills are estimated to be lower, on average, as a result of policies – by around £90 (6%) in 2014.

Will the lights go out?

We conclude that successive governments should have anticipated the shrinking capacity margin earlier and taken steps to address it. As a result of inaction, the narrow capacity margin which emerged posed a threat to resilience. This has been mitigated using expensive measures with a heavy reliance on fossil fuel generation. This is not a good example of how the trilemma can be most effectively balanced. We recommend that the Government takes a more rigorous approach to long-term planning to avoid such situations arising in the future. Furthermore, we recommend that the Government reassesses whether it is procuring the right amount of capacity through the Capacity Market to offer an optimal cost-benefit balance to consumers. (Paragraph 98)

The Capacity Market has been put in place by government to address generation adequacy concerns from the end of this decade. It is intended to ensure sufficient investment in the overall level of reliable capacity (both supply and demand side) needed to provide secure electricity supplies at the least cost to consumers.

Prior to each capacity auction, National Grid, in its role as the Delivery Body for Electricity Market Reform, assesses how much capacity is needed to meet the Reliability Standard set by government and provides advice to the Secretary of State. Its recommendation is based on different scenarios for the level of electricity demand and the amount of capacity provided by generators who are not eligible for capacity payments. An independent panel of technical experts has been appointed to scrutinise National Grid's analysis. The government takes the final decision on how much capacity to procure in each auction based on the best available evidence.

The Capacity Market has been designed to procure the most cost-effective mix of capacity, regardless of technology, to deliver the Reliability Standard. The target amount to be procured in each auction is expressed as a sloped demand curve, derived according to an enduring methodology, which means that relatively more capacity is procured when auction clearing prices are lower and relatively less when they are higher. The bulk of capacity is procured four years ahead of the delivery

year, to ensure that new build plant is able to participate, increasing competition in the auction and exerting downward pressure on clearing prices. The balance will be procured one year ahead of the delivery year.

In order to make effective decisions on resilience, reliable information about the true costs of electricity shortfalls is needed. We are surprised to find a paucity of information in this area. We recommend that the Government funds further research into the costs of shortfalls and publishes its findings. This information should be used to determine whether the current Reliability Standard is appropriate for making decisions on the procurement of capacity. (Paragraph 99)

The GB Reliability Standard is designed to provide the optimal level of loss of load as a benchmark and involves a trade-off between the benefits of electricity supply (i.e. avoided supply shortages) and the costs of procuring additional capacity, such that marginal cost equals marginal benefit. The GB standard is a three hours of loss of load expectation on average per year and is comparable to other EU counterparts such as France (three hours) and the Netherlands (four hours). As part of the Reliability Standard calculation the cost of shortfalls in electricity is needed.

The true cost of shortfalls in electricity is difficult to assess, given the lack of observed historical data available. To address this difficult question, a comprehensive study commissioned jointly by Ofgem and DECC, conducted by London Economics in July 2013, extensively explores a number of different ways to obtain the true cost of shortfalls in electricity. The research which looks at costs to small and medium enterprises (SMEs), domestic users, industrial and commercial users during shortfalls in electricity, through very detailed customer-level survey data. As a result of this study, a Value of Loss Load (VoLL) of £17,000/MWh is used in the Reliability Standard calculation.

The Reliability Standard as set out in legislation is intended to be enduring and provide industry with confidence. We will look at this in due course with our commitment as set out in legislation to review the Reliability Standard every five years. An independent Panel of Technical Experts has been appointed by DECC to

scrutinise National Grid's analysis on how much capacity to procure through the Capacity Market. Any findings relevant to VoLL assumptions will be included in their published report at the end of June 2015.

We recommend that the Government reviews the contribution interconnection and industrial backup generation could make to capacity margins. It is not currently clear how much industrial backup generation is potentially available. We recommend that the Government identifies and publishes information on the amount of industrial backup generation which could be made available. (Paragraph 100)

The government, together with National Grid and the Panel of Technical Experts, has undertaken a significant amount of work in the last year to improve the assessment of the contribution of interconnection to generation adequacy. A review of the historical contribution to security of supply was conducted in February 2015 as part of a process to assess historical approaches to interconnector de-rating factors. A link to the Poyry report can be found here:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/404337/Final_historical_derating_of_IC_poyry_report.pdf).

Further detailed information on interconnection will be available in the 2015 *Electricity Capacity Report* prepared by National Grid and the independent report by the Panel of Technical Experts in June 2015.

Government is currently undertaking research into the existing and potential volumes of demand side response in Great Britain. Demand side response (DSR) includes a broad spectrum of technologies, one of which may be considered to be industrial backup generation, and the aim of this research is to improve our understanding of the characteristics of DSR and how the different types currently participate in the electricity market, and what the future potential of each type might be in the Capacity Market. The research is due to be published in summer 2015.

Risks to resilience

In the event of power outages, it is essential that those consumers affected can access accurate and timely information about the developing situation. We note and commend the work underway to improve communications, including the provision by April 2016 of a single national emergency number for consumers to use to contact their Distribution Network Operator in the event of a power disruption. It is important that this deadline is met and that a comprehensive plan is developed for dissemination of the national emergency number, and Parliament will wish to be kept apprised regularly of progress. (Paragraph 109)

Establishing the Single Emergency Number for electricity was a key recommendation of the last government's review of the electricity distribution industry's response to the severe storms of winter 2013/14. This programme, being delivered by the electricity industry, is progressing to plan and is on target for implementation by April 2016. DECC maintains a close view of timescales through membership of the task groups delivering the work, and the programme board that is overseeing it. Work to ensure customers are aware of this number is a core part of the project. DECC will continue to ensure that Parliament is updated on progress as required.

The risk of breaches to cyber security are real and will continue to evolve as the electricity system becomes ever more dependent on ICT. While we note that the Government is taking action in this area, we are concerned about the threat in the medium term as the electricity system becomes increasingly reliant on fast communication, on data, and dependent on automation. As new threats are identified so the Government must work ever more closely with stakeholders and provide appropriate funding for efforts to combat cyber-attack. The Government must ensure that cyber security factors are embedded at the earliest stages of electricity system design. (Paragraph 122)

The UK's National Security Strategy (published in 2010) identified cyber-attacks as one of the top four threats to UK national security alongside international terrorism. To combat this threat, an £860m National Cyber Security Programme (coordinated

by the Cabinet Office) was put in place by the last Administration aimed at increasing the UK's cyber security. A key part of this programme has been focused on our critical national infrastructure and DECC is continuing to work with government departments and agencies, as well as with industry partners, to ensure that the risks to the energy sector (including future systems) are understood and that appropriate mitigations are established. This includes ensuring cyber security factors are considered at the early design stages of future systems where possible. One example of this is smart meters, where security has been a key consideration at every stage of system development. The security architecture has been designed in close coordination with industry security experts, the Government's National Technical Authority for Information Assurance and the Centre for the Protection of National Infrastructure.

We conclude that, as far as we are in a position to judge, the Government and relevant bodies have taken—and continue to take—steps to ensure resilience to threats, and that planning and emergency response procedures seem robust. (Paragraph 129)

The government welcomes this conclusion and will continue to take steps to ensure resilience to threats and to have robust plans and emergency response procedures in place. DECC works in partnership with industry and regulators through our Energy Emergencies Executive (E3) and its committee (E3C), which are the principal fora for identifying risks and mitigating processes and actions necessary to manage emergencies affecting UK electricity supply.

We would urge the Government, however, to ensure that it:

- **engages actively with the science and engineering community in order to identify new and emerging threats to resilience; and**
- **draws on the very best available evidence to enable timely and cost effective planning. (Paragraph 130)**

The government agrees and expects to work closely with the UK as well as international science and engineering community on electricity system issues including resilience. DECC has worked with the Institution of Engineering and

Technology as observers to their investigations in to system resilience including smart meters and the advent of information and communications technology dependent usage into electricity systems. DECC also worked closely with the Royal Academy of Engineering on electricity system issues, and centres of expertise such as Imperial College and University College London.

In addition, DECC has a strong relationship, and works closely with the network operators and the system operator, which have expert knowledge bases on electricity system issues and resilience. DECC draws on best available evidence from all these sources, and other initiatives such as the Smart Grid Forum, and Energy Research Partnership, both co-chaired by DECC.

Government, working with the Government Office for Science under the direction of the Government Chief Scientific Advisor, continues to work with professional organisations and others to ensure best available evidence is used for better policies and planning and will continue to do with proactive engagement.

In emergency planning, there is no substitute for conducting periodic simulations of emergency scenarios with Ministerial involvement. We therefore recommend that periodic simulations of emergency scenarios with Ministerial involvement continue to take place and that information about such exercises, is, as appropriate, reported to Parliament. (Paragraph 131)

The government agrees with the recommendation and will continue routinely to carry out exercises to test response capabilities and ensure we are as prepared as possible for any high impact emergency situation. DECC will continue to report this information to Parliament where appropriate.

DECC maintains the National Emergency Plan: Downstream Gas & Electricity (NEP), which describes the national arrangements between government, industry, Ofgem and the European Commission, for downstream gas and electricity supply emergencies. These arrangements are tested and revised through regular reviews and emergency exercises.

In addition DECC and industry undertakes reviews of real-life events, to ensure lessons are learnt. As an example, DECC published the Severe Weather 2013 review on the performance of the network operators.

Changing demand

Smart meters, produced with appropriate functionality, will be essential in facilitating greater use of Demand Side Response in homes. We recommend that the Government ensures that no further delays occur in the roll out of smart meters and that Parliament is updated periodically about progress towards the 2020 target. Communicating the benefits of smart meters and incentivising consumers will be imperative and, to this end, we recommend that the Government, in partnership with industry, develops a comprehensive communications strategy with the aim of maximising the potential of smart meters. (Paragraph 170)

The government welcomes the Committee's recognition of the role that smart metering can play in facilitating DSR.

The government is committed to making smart meters available to everyone as soon as possible, but taking the time to build and test the solution robustly is in everyone's interest: industry and consumers alike.

The government's strategy has been to drive all parties to deliver to ambitious timescales, based on the best planning assumptions available – in order to maintain momentum and realise benefits of smart meters as soon as possible. At the same time, we have consistently said that we would review our plans to ensure systems and processes are robust, and take account of learning by all parties in the current Foundation stage of the rollout. Given that the national communications infrastructure will pave the way for demand side response and future 'smart' markets, getting it right at an early stage is important to avoid costs later.

All delivery partners are making the necessary preparations to build and test infrastructure and procure equipment to the required technical standards, so that the consumer experience of smart meters is positive. Consequently, the government has now shifted focus from design, to support effective delivery by the Programme's key

industry partners; the Data and Communications Company, energy suppliers and network operators.

In the meantime, over 1 million meters are operating under the programme and the number of smart meters installed grows each month. Consumers are already benefitting from the roll-out of smart meters - providing accurate bills and helping them understand their energy use to reduce consumption and save money.

The Department reports to Parliament, primarily through an annual progress report (the third annual progress report on the roll-out of smart meters was published on 11 December 2014¹) and via parliamentary statements.

The government considers consumer engagement to be a critical prerequisite for the success of the Programme. The Smart Metering Programme's Consumer Engagement Strategy (published in 2012) was developed in close consultation with stakeholders, informed by a range of UK and international evidence and led to an approach whereby:

- Energy suppliers will have the primary consumer engagement role as the main interface with their customers before, during and after installation;
- Supplier engagement will be supported by a programme of centralised engagement undertaken by Smart Energy Great Britain (Smart Energy GB).

The government will continue to communicate with consumers, in addition to the activity undertaken by the industry and consumer organisations, where this will provide additional benefit.

Smart Energy GB has published its Consumer Engagement Plan, which was last updated in December 2014. Its plans include: national campaigns to raise general awareness and interest in smart meters, to lay the foundation for detailed guidance during and after the installation process; a website (in English and Welsh) with detailed information for consumers on smart meters, including on the installation process and how to use a smart meter once installed; and, a series of online

¹ <https://www.gov.uk/government/publications/third-annual-progress-report-on-the-roll-out-of-smart-meters>

educational films to ensure customers get the maximum benefit from their smart meters.

Smart Energy GB is developing a partnership delivery model that will support third-party consumer engagement. The model will work from the bottom up, with frontline local community organisations who have existing relationships with consumers at its foundation, moving up through regional network organisations (such as Housing Associations), up to major national partners with significant infrastructure across GB.

Demand Side Response (DSR) offers significant potential for balancing supply and demand. We recommend that the Government ensures that DSR is not disadvantaged in the Capacity Market relative to generation. To this end, we recommend that the length of DSR contracts in the Capacity Market should be brought into line with generation. (Paragraph 181)

Government has worked with the sector to ensure that DSR is not disadvantaged in the Capacity Market. We have implemented specific features to support the participation of DSR, including a low de-minimis threshold of 2MW to encourage smaller providers, an option of three metering configuration solutions to widen participation and giving DSR resources 'price maker' status to enable providers to bid up to the overall auction price cap.

In addition, government has developed 'Transitional Arrangements' to help DSR grow before the first one-year ahead Capacity Market auction in 2017. The Transitional Arrangements auctions will offer different terms to the full Capacity Market enduring regime to limit risks, encourage enterprise and build confidence in the DSR sector.

One year capacity agreements are the default position in the Capacity Market with fifteen-year capacity agreements being available only to new build generation which requires high up-front capital investment of at least £250/kW, or three-year agreements for generation that will be carrying out refurbishment at an investment of at least £125/kW.

Analysis of currently-available evidence indicates that DSR and existing generation do not require such significant up-front capital investment, which would potentially necessitate access to long-term capacity agreements. Current evidence suggests that DSR is a relatively low-cost solution and should therefore be able to compete effectively on the basis of one-year agreements.

Experience in the United States indicates that DSR participants typically prefer the flexibility of one-year contracts and a recent Low Carbon London report on Industrial and Commercial DSR, also found that one-year contracts are optimal for attracting customer interest.

We will continue to improve our knowledge base of DSR, including their capital and operational costs through current research that is being undertaken and from learning gained from the evaluation of the Electricity Market Reform programme.

We recommend that the Government conducts and publishes detailed assessments of what Demand Side Response (DSR) could potentially achieve. In addition, we recommend that the Government develops and publishes a plan, which includes specific targets, for the public sector to implement Demand Side Response measures and so set an example. (Paragraph 182)

Government is currently undertaking research into the existing and potential volumes DSR in Great Britain. DSR includes a broad spectrum of technologies and the aim of this research is to improve our understanding of the characteristics of DSR and how the different types currently participate in the electricity market, and what the future potential of each type might be in the Capacity Market. The research is due to be published in summer 2015.

The design of the Capacity Market was developed with the sector and includes specific features to promote the participation of DSR resources. However, to encourage a mix of technologies and promote competitive auctions and therefore value for money to consumers, the Capacity Market auction is technology neutral. The auction mechanism is driven by cost-effectiveness to determine the most suitable providers and the introduction of specific targets in the Capacity Market would lead to less competitive auctions increasing costs to consumers.

Wider government is also looking to encourage public sector assets to implement demand side management. In particular, the Crown Commercial Service (CCS), which is sponsored by the Cabinet Office, runs a DSR framework contract RM964 for the UK public sector to participate in DSR. This service uses DSR aggregators to facilitate the participation of public sector assets in National Grid's Balancing Services and Triad Avoidance management.

Interconnection

There is a worrying lack of clarity about what options exist if a number of interconnected countries experience system stress simultaneously. We recommend that the Government publishes an analysis of the effects of interconnectors on UK electricity resilience under a broad range of scenarios. This analysis should include an assessment of how interconnectors might be used at times when the system is under stress. It should specifically assess the case for restrictions/agreements to be put in place with other countries at times of system stress if there is evidence that resilience could be compromised. (Paragraph 200)

DECC commissioned analysis from Baringa, published in February 2014² which suggested that an additional 5 GW of interconnection would be beneficial to GB.

However, the Committee correctly identifies the uncertainty that exists in current EU legislation about the exact procedures under market coupling when there is a stress event in two countries at the same time. The final details of these arrangements are still being negotiated and we are working closely with Ofgem, who is a lead Regulator in these Working Groups, to reach a final negotiated agreement that will benefit GB consumers by enabling better access to cheaper electricity from continental Europe without adversely affecting our security of electricity supply.

Indeed, National Grid as the System Operator has several tools that it uses to balance the system over the interconnectors close to real time. Trading is the tool that is most often used but we also regularly cooperate through System Operator to System Operator energy exchanges. If we are in an emergency situation, National

²https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/322005/new_electricity_interconnection_to_gb_operation_and_revenues_baringa.pdf

Grid has emergency services and protocols in place over each interconnector to enable them to request emergency assistance from our neighbours or bring the interconnector back to zero if necessary.

According to historical analysis of system stress events between GB and its interconnected countries conducted by Poyry for Ofgem in 2013³, the expected correlation with interconnected countries is likely to be low, despite some coincidence in times of peak demand. In terms of assessing the contribution that interconnectors can make at times of system stress, Poyry's analysis suggests the correlation of interconnection flows with low GB capacity margins was negative (i.e. that decreases in margins was associated with increases in imports to GB), but that it was low and statistically insignificant. There are good reasons for expecting the future contribution of interconnectors at times of system stress to increase relative to this analysis, for several reasons: the absence of stress periods in recent years makes any historically-based analysis less robust/representative of the future (as all markets are due to tighten following retirements of existing polluting plant); GB wholesale prices are becoming more cost-reflective in times of system stress (e.g. through cash-out reform), which should help to incentivise interconnection flows in favour of price differentials; market arrangements mean flows have not always followed prices, which should be addressed through market coupling reforms.

Electricity storage

In addition to investing in Research & Development in electricity storage, the Government and Innovate UK should ensure that high potential demonstration projects are adequately funded. In addition, the Government should take steps to improve the market framework so as to stimulate investment in electricity storage. As a step towards improving the market framework, we recommend that the Government examines whether electricity storage should be placed under the Contracts for Difference regime rather than in the Capacity Market and reports its findings. (Paragraph 213)

³ <https://www.ofgem.gov.uk/ofgem-publications/75231/poyry-analysis-correlation-tight-periods-electricity-markets-gb-and-its-interconnected-systems.pdf>

The government recognises the potential role that energy storage could play and the flexibility storage offers as a balancing solution but there are a range of possible approaches for balancing the overall energy system. We do not want to introduce targets which could lead to the deployment of one particular balancing mechanism where other solutions may offer a more cost-effective or lower-carbon solution to deal with intermittency of supply or other balancing problems.

The government is continuing to fund several demonstration projects which will be grid-connected and are testing a range of different storage technologies. DECC, BIS and Innovate UK are now considering the requirements for future research, development and demonstration support for energy storage building on the successful programmes already completed or currently underway and the ongoing innovation needs for energy storage.

We are not currently planning to introduce a framework of incentives specifically for energy storage deployment. Energy storage is one of the solutions which can be used for balancing the overall energy system and we believe that currently the commercial markets are best placed to select the most cost-effective solution for each balancing need.

We recognise that other countries are approaching energy storage in different ways. A few countries, such as Germany and Japan, which have more substantial or more urgent system balancing challenges are using operating incentives to support energy storage deployment. The UK can learn from these approaches in other countries as well as using the results from the UK's energy storage demonstrator projects to identify any key regulatory or market barriers which would prevent or deter investment in the wider deployment of energy storage systems in the future.

We will continue to keep eligibility for the Contracts for Difference (CfD), including for storage, under review.

Flexible generation

There is much debate around the costs of renewables and the costs of maintaining a resilient system that incorporates intermittent renewables. We

recommend that the Government publishes a systematic review of the evidence available on the predicted costs of integration to 2030 and beyond, taking into account a wide range of scenarios. Allied to this, the Government should also disseminate more comprehensive evidence on the potential costs of low carbon generation and improve communication with the public on the costs and benefits. This would help to bring more clarity to the current debate. (Paragraph 244)

DECC has commissioned a project on the Whole System Impacts of Electricity Generation Technologies. This project aims to systematise the government's understanding of the impacts (both costs and benefits) of electricity generation technologies, including intermittent renewables, on the electricity system (e.g. system balancing, overall capacity adequacy, networks). The first phase of the project has delivered a comprehensive framework to define whole system impacts, their components and their drivers. The second phase of the project will further develop DECC's electricity modelling capability to formally deal with the evolution of whole system impacts over time and in different technology mix scenarios.

Flexible generation will be increasingly important to balance the electricity system. The Government should ensure that incentives are in place so that all new generation is built in such a way as to maximise its flexibility, whilst ensuring that the costs to consumers are minimised. In addition, the Government should, with some urgency, clarify how Contracts for Difference will apply to Carbon Capture and Storage. (Paragraph 245)

Carbon Capture and Storage (CCS) is eligible for support through CfDs and a CCS project may currently be awarded a CfD contract bilaterally on a case-by-case basis. Such discussions are currently taking place with two project developers as part of the CCS Competition. Government is also engaging with industry and others on the design of a generic CCS CfD and the options for how these may be allocated in future. This work is progressing in parallel with the CCS Competition.

Funding for nuclear research and development is vital if the UK is to achieve the objectives set out in the Nuclear Industrial Strategy and begin to re-establish itself at the forefront of nuclear innovation. We recommend that the

next Comprehensive Spending Review makes financial provision for the nuclear R&D programme recommended by NIRAB. (Paragraph 246)

The Nuclear Innovation and Research Advisory Board (NIRAB) have recently published a ground breaking first annual report. Work is already on-going in respect to a number of the recommendations and in December last year Government announced up to £67million of capital to provide essential nuclear R&D infrastructure over the next six years.

In line with recommendations from NIRAB, the National Nuclear Laboratory and the Energy and Climate Change Committee, we are already undertaking more work to build our understanding of Small Modular Reactors and whether they can play a role in the UK's future energy mix

Other recommendations set out by the NIRAB speak to a sustained and longer-term programme of work and will therefore need to be considered as part of any future Government review of spending.

Directing the future

We recommend that the Government supports research, development, demonstration and early deployment across a diverse range of technologies. This should include electricity supply, demand side response, storage and smarter networks. Particular attention should be paid to technologies that could strengthen electricity system resilience and how these technologies fit together in systems. Given budgetary constraints, there will be a need to prioritise some technologies over others. We recommend that the rationale for these choices is clear, transparent and made publicly available. (Paragraph 268)

DECC, BIS and Innovate UK are working together with the rest of the Low Carbon Innovation Coordination Group to define the priorities and requirements for future research, development and demonstration support, building on the evidence base we have jointly gathered through the TINA (technology innovation needs assessment) process and the findings of the Innovation Strategic Framework published in March 2014, along with the learning and data from the successful

programmes already completed or currently underway. We expect to support a range of technologies and it is likely that systems issues will feature as a priority theme.

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