



• **Delivering on the**
• **Potential of Flexibility**
• A smart flexible energy
• system in the transition
• to a net-zero economy

A joint report from:



With thanks for support and input from:



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Opening Comments

Audrey Gallacher, Energy UK



When the UK Parliament legislated for the UK to be net zero by 2050 they made a bold statement, one which the UK energy industry was well behind. But we now have only 120 quarters before the UK needs to achieve its net-zero target and we need to go further and faster in our efforts to meet that target.

A lot of the discussion across Government and the country so far has been about how we will decarbonise transport, defining the major consumer behavioural changes that will need to be made, and the role that increased tree planting will have. Discussion in the energy industry has focused largely on how we build on world leading efforts to decarbonise our generation mix further, alongside reducing the use of energy in our homes and businesses.

But if we're to meet net zero as an energy sector there is far more that we should be doing, and will be doing. Going further and faster will require efforts that complement and enhance the increased low-carbon generation mix as increased demand requires investment in a wide range of resources of varying sizes and technologies. This report aims to highlight one important aspect of comprehensive energy industry efforts to meet net zero: the potential benefits of flexibility.

Our members are already delivering vital aspects of the industry transition like building of large infrastructure projects and delivery of innovation, but also increasing the flexibility of our energy system is essential if we're to get anywhere near net zero. However, flexibility has the dual benefits of helping enhance the security of our energy system while keeping bills down for customers.

Releasing the potential of flexibility at this time is an opportunity to further engage customers in the future of their energy usage in their homes and businesses. Whether that sees more and more customers using their electric vehicle to power their home or simply taking active decisions to use energy when it is cheapest. In some circumstances, increasing the opportunity for flexibility will also mean customers will be paid to use low-carbon electricity – something unthinkable 10 years ago.

Realising the potential for a more flexible energy system may not make headlines, but it is the enabler by which the energy industry can take another great stride to delivering a fully decarbonised system. We must work collaboratively, as we have with this paper, to draw out the benefits, address the challenges, and enable the market to develop solutions that target the ultimate goal of delivering a net-zero economy at the lowest cost to customers.

Audrey Gallacher
CEO, Energy UK



Energy UK is the trade association for the GB energy industry, with a membership of over 100 suppliers, generators and stakeholders with a business interest in the production and supply of electricity and gas for domestic and business consumers. Our membership covers over 90% of both UK power generation and the energy supply market for UK homes. We represent the diverse nature of the UK's energy industry – from established FTSE 100 companies right through to new, growing suppliers and generators, which now make up over half of our membership.

Opening Comments

Dr Joanne Wade, ADE

The imperative to transition to a net zero carbon energy system is stronger than ever and the challenges inherent in responding to this imperative are well understood. Key to meeting these challenges is the development of policy and regulation that is designed with the energy user's perspective at its heart: only then will the transition deliver net-zero cost effectively and also create a system that offers improved energy services to all end users.

Flexibility is vital to the transformation from a centralised, 'one-way' system providing energy to passive consumers to a dynamic system, balancing demand and supply to deliver high quality energy services. The need for instantaneous demand response to manage frequencies will continue to be critical, whilst the benefits of longer term demand shifting to smooth peaks and troughs in both demand and supply will only increase as we electrify a significant proportion of our heating demand and increase our electric vehicle fleet. The desirability of flexible heating and vehicle charging demand illustrates well the need for consumers to play their part in the system of the future and for them to be rewarded appropriately for doing so.

The companies supplying this flexibility stand ready to deliver: aggregators and energy suppliers are developing new consumer offerings; the energy efficiency supply chain can provide the thermal inertia needed for heat flexibility; the finance sector is looking for low carbon investments to support. These elements of the jigsaw are in place, but there are still missing pieces. The familiar narrative of a smart flexible energy system of the future does not tally with the current reality for businesses in these sectors, who find it difficult at times to make the business case for flexibility stack up. Policy needs to step up and fill in the gaps.

The Smart Systems and Flexibility Plan was rightly acknowledged as a significant step forward when it was published. But progress since then has been too slow and too patchy. We now need to go further: we must start asking the questions that net zero poses for flexibility and for the energy system more general, and we must urgently set out a policy programme of reforms that answer these questions. Industry is ready to continue working with government on this and, given the right policy framework, to invest in the development and delivery of the solutions consumers want.

Dr Joanne Wade

Deputy Director, ADE



The Association for Decentralised Energy is setting the vision of a local, efficient, low carbon energy system which enables energy users to make the choices which work for them.

We are the leading trade association for decentralised energy, representing more than 140 interested parties from across the industrial, commercial and public sectors.

Opening Comments

Dr Howard Porter, BEAMA

BEAMA endorses this report and the call to action it presents. BEAMA's recently published report Net-Zero by Design outlines how to ensure the net-zero target remains commercially viable for businesses and consumers. The UK is currently on track to miss its carbon abatement targets. There are a number of reasons for this, but among them is the immaturity of the market for energy flexibility. Current policies are not sufficient to deliver the smart, flexible energy system critical for a Net-Zero Britain. BEAMA represents key supply chains for the energy sector and we recognize a struggling investment landscape for our members, driven by the pressures of Brexit as well as by the lack of unified, strong Government action to bring about the changes necessary to support a smart, flexible and low carbon energy system.

We fear that the confidence the Smart Systems and Flexibility Plan created is being lost. BEAMA members need clear, decisive action to justify investment into a UK supply chain for the low carbon energy sector. 'Minded to' decisions on the targeted charging review and a lack of ambition and clear timelines for market reform are leaving the market in a state of flux.

Setting the net-zero target in legislation alone is not enough; clear regulatory action needs to be taken. Meeting the target will require bold action from Government, including more ambitious reform of the retail market and a rebalancing of subsidies and tax to incentivize low carbon fuels. Fundamentally, what is missing is clear revenue streams for all participants in a flexibility market, most importantly for the domestic customer who needs to be adequately incentivized to adopt new low carbon solutions.

Brexit has had a significant impact on UK manufacturing and therefore on the ability of the UK supply chain to deliver Net-Zero. We are pleased to be part of a united effort to elevate this issue and provide solutions that will support the growth of UK manufacturing for our low carbon economy.

Dr Howard Porter

BEAMA CEO



BEAMA is the UK trade association for manufacturers and providers of energy infrastructure technologies and systems. We represent more than 200 companies, from start-ups and SMEs to large multinationals. Our members provide generation, transmission and distribution equipment, heating and ventilation products, EV infrastructure, electrical systems, and flexibility assets in networks and the built environment. We promote regulation, markets and products that support a safe, smart and secure low-carbon energy system.

Executive Summary

Introduction

Flexibility has been recognised by the Government, regulator and industry alike as a vital element of delivering a secure net zero energy system at lowest cost to consumers. In practical terms, this means using a wide range of controllable resources, from large-scale generation to domestic demand side response, to maintain not only secure but optimal operational conditions across energy networks.

Flexibility on the GB energy system is vital to two core elements of decarbonisation:

- System Decarbonisation: Enabling energy sector decarbonisation to continue being delivered at pace and at lowest cost to consumers to meet the UK's legal obligations and a net zero ambition.
- Customer-led Decarbonisation: Supporting the uptake of low carbon generation, transport and heat assets at the demand side of the network at lowest cost to consumers.

Both elements are necessary to meet a 2050 net zero ambition, just as both are rapidly changing the nature of the energy system. Intermittency on the system will continue to increase as typically less controllable low carbon generation replaces typically controllable capacity from higher carbon sources.

At the other end of the system, a gradual increase in uptake of low carbon technologies like electric vehicles and heat pumps will significantly increase users' potential to provide flexibility to the system as well as profoundly impacting demand profiles and capacity requirements. Ensuring appropriate price signals are in place will enable the energy sector to continue to innovate in delivering business models that utilise automation to integrate flexibility into assets while reducing the required direct engagement from consumers.

The UK made a bold statement in committing to a net zero ambition for 2050, supported by the energy industry. With this target looming, it is vital that we maintain our role as a world leader in decarbonisation. We must continue to develop technologies and expertise to realise the potential benefits of a smart flexible energy system and the export opportunities for technologies, skills, and services.

The Smart Systems and Flexibility Plan

Research performed by Carbon Connect and Imperial College London in 2016 informed the development of a joint Government and Ofgem plan for delivery of a smart flexible energy system in GB. This research set out the potential reductions in cost that could be delivered by effective competitive markets for flexibility, estimating this at between £17-40 billion by 2050 and around £8 billion per year up to 2030ⁱ.

The Smart Systems and Flexibility Plan (SSFP) that followed that research was welcomed by industry, and lent a level of confidence to the market at that time, initiating investment in a range of technologies and emerging markets. The activity initiated by the plan is beneficial, as is the work progressed by Ofgem and BEIS since the plan's publication.

BEIS and Ofgem published an SSFP update report in October 2018, setting out where the actions have been implemented. Overall, many tangible but more specific activities within actions have seen progress. However, BEIS and Ofgem themselves note that implementation of actions does not mean delivery of outputs: access to market mechanisms remains patchy and revenue streams remain uncertain in many areas.

The initial confidence sparked by the plan has faltered, leaving the UK at considerable risk of realising a pathway aligned with a ‘slow start’ scenario and the accompanying £9bn cost to consumersⁱⁱ. The table of actions attached to this paper sets out views on what actions have been implemented, rating progress made in delivering those actions and their intended outcomes on a red-amber-green scale.

It should also be noted that we find that the use of the term implemented in the SSFP update report to be problematic. While the report itself clarifies the intended definition of the term and is clear in its intent, the use of the term without caveat or explanation in wider engagement has portrayed a more positive picture than the plan itself, given the number of incomplete actions given this status. The term should be replaced in future to ensure progress updates and wider engagement reflects the true state of each action.

A notable gap is apparent in progress made to date in terms of the lack of a single holistic vision driven forward by Ofgem and BEIS. The SSFP has the potential to promote and deliver a comprehensive market framework that incentivises investment in flexibility and effectively realises faster and further decarbonisation, but this has not been seen to date.

Our Recommendations

Recommendations:

- To avoid the cost to consumers of a ‘slow start scenario’ and to develop markets in the early 2020s, appropriate, clear, and stable market mechanisms need to be established now to enable the investment case to develop.
- To restore market confidence, regulated monopolies, such as distribution network operators, should be barred from participating in ancillary service markets, as they are from energy markets.
- To coordinate delivery of a successful market framework for flexibility, the Government should publish a second iteration of the SSFP. This plan should include:
 - Existing actions, as well as any necessary additions given changes in the years since the original plan.
 - Clear indication of the steps required to achieve each action, intended prioritisation, the desired timeframes intended for full implementation, and the metrics for measuring success.
 - Replaced terminology of ‘implemented’ actions, to present a more reflective assessment of progress made across the actions.
 - Increased collaboration with industry, including formation of an industry-led advisory group to contribute towards delivery of the actions of the SSFP.

The industry asks that the SSFP be reviewed and renewed by summer 2020. This review should aim to develop a more substantive strategy for flexibility in the GB energy system.

Whilst we recognise this is a complex exercise, without at least some assessment of this, it is impossible for Government, the regulator or industry to know if the narrative on achieving a smart system is backed up by robust and sufficient policy. This makes it difficult for industry to give specific and constructive feedback on the plan.

To date, individual policies identified in the SSFP have assessed their impact on the market but the SSFP itself has not. As a result, the SSFP is mostly qualitative and does not present a view of how far the policies identified will indeed create the system reform and investment frameworks to deliver the necessary amount of flexibility to meet consumers’ needs by 2050 and whether there remains a gap.

We ask that, as part of this review, all actions be given clear timelines, monitoring, and measurements of success reflective of the urgency of each output. Beyond this we ask for a stronger level of leadership and clear vision from the Government and Ofgem for the near to medium term to ensure strong investment signals are in place. Further detail on how this could be achieved is set out in this paper and its supporting annexes.

A Commitment from Industry

The energy industry remains committed to decarbonisation and the delivery of a system that meets changing system needs at lowest cost to consumers. The UK has already invested both private and public funding into energy system decarbonisation. This has been seen in consumer funding for technologies like enhanced network monitoring, the ongoing rollout of smart meters, and the over £200bn invested by industry since privatisationⁱⁱⁱ.

Energy UK estimates, in its Future of Energy publication, that a similar amount of investment will be necessary between 2019 and 2030 to deliver decarbonisation^{iv}. This is further supported by the CCC's estimate, in its net zero technical report, of £20bn per year investment required in the power sector through to 2050, up from £10bn per year currently^v.

Investment decisions made to date have been based upon the direction set out in the SSFP, incremental changes to regulation and legislation, and a wider rhetoric used across messaging. The adoption of a net-zero 2050 target will accelerate uptake of low carbon technologies and the shift to increasing amounts of decentralised and typically less controllable low carbon generation.

We will continue to coordinate our engagement where possible moving forwards in order to support BEIS and Ofgem in delivery of the actions set out in the plan in a timely manner. In order to deliver this collaboratively, we propose a series of workshops and a direct forum for input into the progression of the plan.

As such, we offer to host, coordinate, and support further work led by industry to increase coordinated input from those bodies involved in developing this paper. This includes leading roundtables on specific issues, developing modification proposals and wider coordination of industry-led activity under a single vision set by the government. This proposal is set out in an attached annex.

Chapter One: The state of the market

Key points:

- Some existing energy markets remain difficult for various types of flexibility providers to access, and work is needed to identify and remove specific barriers.
- There remains a lack of long-term, strategic focus across a number of markets, resulting in uncertainty over current and future revenue streams.
- Network operators should be barred from participating in ancillary service markets as they are from energy markets to avoid jeopardising market confidence.

The UK is a global leader in the transition to low carbon, thanks to the rate of decarbonisation delivered in the GB power supply sector. The UK should continue to hold this position as increasing amounts of low carbon generation capacity comes online and decarbonisation efforts expand across heat, transport, and industry. This will require greater utilisation of flexibility across the GB energy system, where we seem to be falling behind^{vi}.

This progress will not continue if the focus and ambition of the UK falters, and we are already at risk of missing the 4th and 5th carbon budgets intended to enable achieving the previously targeted 80% carbon reduction^{vii}. Flexibility must be unlocked to act as an enabler to that continued progress for GB decarbonisation, realising benefits for all consumers in carbon reductions and lower energy bills, and enabling the nascent markets related to flexibility to continue to be areas in which the UK is a global leader.

The positions set out in this chapter were complimented by industry engagement regarding the current state of market access across a range of revenue streams for those providing flexibility in its many forms. Based on those initial discussions, we will progress specific workshops and discussions to identify actions that should be taken to remove barriers and enable market growth.

Wholesale Market

The wholesale market is the main mechanism by which energy is bought and sold in GB. It is where suppliers purchase the energy needed to provide for the needs of their customers. Although the EU requires aggregators be given fair and equal access to all markets, it continues to be difficult for those active in the GB market to participate in this market with non-traditional assets.

It should be noted that, while TERRE is referenced in the SSFP, the integration of more flexibility providers into the wholesale mechanism for balancing supply and demand is not a direct focus of the plan, but has been progressed alongside the SSFP actions. This is an area in which little activity has been progressed, although a number of changes have been set out for introduction to the wider Balancing Mechanism, including Project TERRE and the creation of 'Virtual BMUs'.

We are considering the way in which addressing barriers to access to the wholesale market could be approached, with an initial workshop session leading to a number of views, and will look to propose options for review. These options must be based on ensuring a level playing field across technology types to enable robust competitive markets to drive down cost for consumers.

The Capacity Market

The GB Capacity Market (CM) has undergone a series of changes to encourage and enable the participation of Distributed Energy Resources (DER), including demand side response

(DSR) and energy storage. These assets make up a sizeable amount of this market, which was relatively unforeseen in 2014. This is an area of relative success for the GB market.

We support the continuation of the Capacity Market as the most appropriate mechanism to ensure security of supply at least cost to customers within the current system arrangements. With the reinstatement of the CM's State aid approval, there is scope for further changes to the Capacity Market to support greater access for flexible assets. For the short- to medium-term, these could be explored through the 5-year energy market review.

In future, many of those offering flexibility are expected to compete using a wider range of components that are individually smaller than now. We support the ESO ambition to reduce the minimum threshold for the CM to 1MW, and the intention to make fundamental changes to the Portal to allow much greater automation and simplify the process of qualification.

Balancing Mechanism and GB Balancing Services

Forming a significant part of GB markets for flexibility, **ancillary services** provide flexibility to the Electricity System Operator (ESO) in a range of ways. There are a number of issues with the existing ancillary service markets, and industry welcomes the efforts of National Grid ESO to reform and modernise these products.

Industry strongly welcomes progress being made to integrate Wider Access to the Balancing Mechanism (BM), the mechanism that enables GB balancing activity to take place. This could be a step-change in unlocking flexibility. This said, crucial associated changes to the BM and its surrounding systems have progressed slowly in recent years.

This seems to be a result of the number of modifications becoming more than National Grid is equipped to progress at speed, as well as wider delays to dependencies, particularly in developing new IT solutions within National Grid ESO. National Grid ESO engagement and activity in this area has improved in recent years, and we will continue to fully engage through the range of feedback routes available.

Modifications slowed by this slipping of timelines include the web-based alternative to Electronic Dispatch & Logging (EDL) and Electronic Data Transfer system which would reduce a significant barrier of entry to the BM for new participants, the modernisation of the Energy Balancing System (EBS) and implementation of the Platform for Ancillary Services project with an effective Distributed Desk to enable dispatch of a large number of small assets. These modifications showed promise when introduced a number of years ago and still hold the backing of industry.

Overall, communication at such a time of reform must continue to be improved. Where changes are made to timelines or parameters, industry is not being given time to prepare and alter its own implementation plans. In the case of, for example, DSR aggregators, a change in implementation timelines of a new National Grid market will change business planning and resource not only for the aggregator centrally but also by each one of their customer sites.

One significant and urgent issue to address in SSFP activity is ensuring that competition does not continue to be impeded by the participation of a DNO, a regulated monopoly, in the ancillary services market. This has the potential to, in the opinion of much of industry, render untenable the developing business models of many of those participating in the balancing services markets.

Beyond the removal of existing conflicts impacting market confidence there is an additional need to ensure the implementation of a regulatory framework clarifying the role of network

flexibility. European legislation and common regulatory approaches are set out below, and are in clear contradiction to the current approach of Ofgem.

Industry welcomes Ofgem's commitment to make a decision on how network assets can contribute to system security, but the initial decision^{viii} should have been consulted upon for implementation before allowing the participation of any DNO in competitive markets. Further detail on this issue is set out in Chapter 2.

New Services and DSO Involvement: A CEER Conclusions Paper - Council of European Energy Regulators, 2019

Where a DSO is participating in a competitive market, there is the risk that it may refer to its knowledge of operational parameters of the network to gain an advantage – this would be a market distortion which would be further amplified by DSOs' access to capital at lower cost (supported by their regulated asset base) to fund any investments for undertaking service activities. Such conflicts of interest must be avoided wherever possible. Where this is not possible, they must be managed appropriately to reduce the risk of distorting markets.

European "Clean Energy Package" (DIRECTIVE (EU) 2019/944 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU)

"62. System operators should not own, develop, manage or operate energy storage facilities."

...

"Article 33.2: Distribution system operators shall not own, develop, manage or operate recharging points for electric vehicles, except where distribution system operators own private recharging points solely for their own use."

https://eurlex.europa.eu/legalcontent/EN/TXT/?uri=uriserv:OJ.L_.2019.158.01.0125.01.ENG&toc=OJ:L:2019:158:TOC

Distribution-level Markets for Flexibility

Local markets for constraint management services at lower network voltages are being trialled across the UK and show some promise as a market mechanism for flexibility providers. We welcome the progress being made in the Open Networks project, and the recent publication by the ENA of a Flexibility commitment^{ix} supported by all DNO companies.

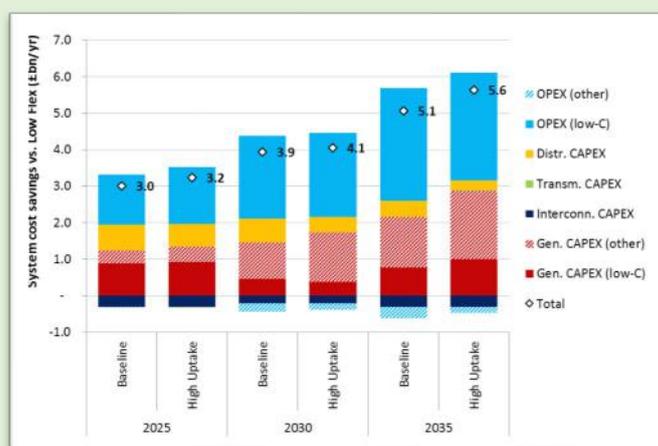
The balance between contracted markets for flexibility and the use of network charging signals (including the use of non-firm connections and Time of Use network charges) needs to be developed further as RIIO-2 frameworks and the Access and Forward-looking Charges Review progress. Market prices used in current DNO flexibility tenders is, on average, relatively limited and seems significantly less than the modelled network savings for avoided network reinforcement and replacement.

CASE STUDY

The MADE Project: Whole-System Network benefits with Integrated smart low carbon technologies (LCTs)

The Multi Asset Demand Execution (MADE) project has studied the implications of utilising multiple energy assets with integrated smart control within a home, and to better understand the feasibility of managing and aggregating these energy assets affordably to reduce network demand, and minimise the requirement for network reinforcement

Imperial College modelled multiple LCTs within the home that are integrated with smart control at GB Whole-System Network level. The benefits are significant and can exceed £5.6bn per year in the 2035 horizon. The analysis assumes that fully flexible EV charging including V2G would be a component. In addition to this, Imperial College have also estimated the benefits if V2G services were not enabled as part of coordinated portfolio of smart EVs and HHPs. The results are shown in the below table:



The main categories of cost savings through integrated LCTs with smart control include:

- Reduced investment cost of low-carbon generation.
- Reduced investment cost of conventional generation.
- Reduced investment cost of distribution networks.
- Reduced operating cost of low-carbon generation.

The ENA's commitment to publish transparent methodologies and decision-making regarding investment decisions in flexibility or network infrastructure is welcome, but this must be accompanied with a clear set of criteria from Ofgem concerning what constitutes the most cost-efficient investment and a standardised approach to valuing flexibility across different time periods.

There remains a risk that a lack of coordination or frameworks for Distribution System Operation functions is resulting in Distribution-level markets for flexibility being divergent, and this complexity has begun to cause market uncertainty, requiring greater homogenisation across the range of developing markets and services. We welcome Ofgem's focus on convergence to 2021, but remain wary of the existing potential for divergence.

We would welcome Ofgem showing the same historic leadership in this area as has been seen in other areas, delivering a single vision that industry can get behind to ensure a coordinated whole system outcomes from these activities.

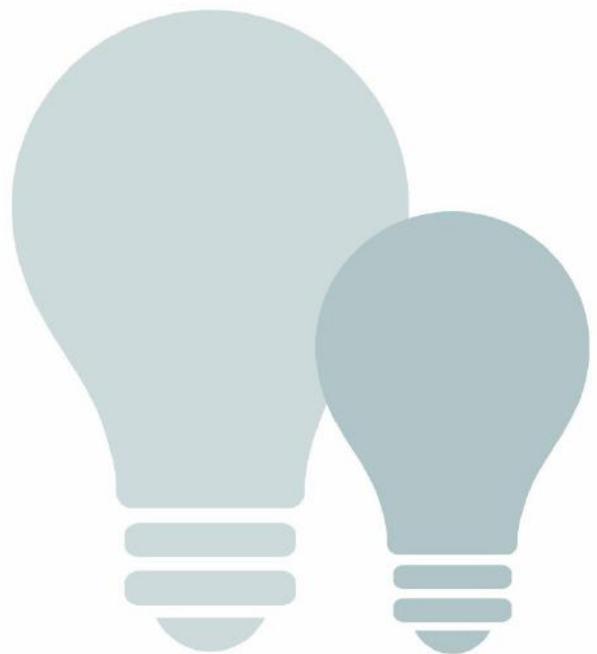
Vivid Economics and Imperial College Evidence for the CCC, Pg. 5

Large-scale policy reform and market design are needed to deliver a flexible electricity system.

Current market arrangements are not adequate to deliver large-scale battery storage and demand response. Ofgem, BEIS and National Grid are working to ensure storage and demand response providers can be rewarded for the value they deliver, and to remove barriers to their participation in the electricity system.

These objectives will need to be achieved by the early 2020s to support the necessary investment.

In parallel, a shift in consumer attitudes will be needed to support demand response. Consumers will need to accept to move from fixed to time of use electricity pricing, and to engage with new technologies and business models to vary their electricity demand in line with the value they place on it.



Report – Energy UK: The Future of Energy

The Future of Energy

"A low carbon energy system that customers see as fair and which delivers excellent service, choice and value for money to all homes and businesses"

[Read the Summary Report](#)



The Energy Sector is Not Only Embracing Change, but Leading it.

Every one of us depends on energy, and each day we rightly expect it to be there to bring warmth, light and help us in myriad ways to live and work. Yet behind the switches we flick every day, a quiet revolution is happening. **The energy sector is transforming to a future system that will be unrecognisable from what we know today.**

From decarbonising our electricity supply to embracing new data technologies, and from enhancing customer relationships to offering a wider range of heat and transport solutions, we see exciting ways to deliver our services at the lowest cost while enhancing the customer experience. This report explores five areas of the energy transition in detail, each with a report section that can be read as a standalone document.

Report section

[The future retail market and customers' relationship with it](#)

A small version of the sustainable city illustration, showing wind turbines, modern buildings, a tram, a cyclist, and a bus.

Report section

[Funding future electricity generation and system services](#)

A small version of the sustainable city illustration, showing wind turbines, modern buildings, a tram, a cyclist, and a bus.

Report section

[Reducing emissions from buildings](#)

A small version of the sustainable city illustration, showing wind turbines, modern buildings, a tram, a cyclist, and a bus.

Report section

[The sustainable transition to a low carbon road transport system](#)

A small version of the sustainable city illustration, showing wind turbines, modern buildings, a tram, a cyclist, and a bus.

Report section

[Transporting energy to and from customers through transmission and distribution networks](#)

A small version of the sustainable city illustration, showing wind turbines, modern buildings, a tram, a cyclist, and a bus.

Chapter Two: The value of flexibility in the 2020s

Key points

- For markets to develop in the early 2020s to avoid a 'slow start', appropriate market mechanisms need to be established now to enable the investment case to develop.
- Robust competitive markets for flexibility will deliver value to consumers whilst ensuring the continued security of the GB energy system.
- Network access remains a barrier to investment, and a coordinated approach to reform will be vital to delivering certainty.

Avoiding a Slow Start Scenario

Alongside the potential benefits of flexibility set out by Imperial and Carbon Connect in 2016, the potential risks of a 'slow start' scenario were explored in that initial research. In this scenario, the anticipated cumulative cost to consumers of constrained deployment of flexibility in 2020-2025 was estimated at around £9bn by 2050.

More recently, the Committee on Climate Change (CCC) reported to the Government on feasibility of a net zero 2050 target for the UK, where it also noted the potential value of system flexibility in achieving net zero at lowest cost to consumers:

“Improvements in system flexibility have the potential to bring electricity system costs down by £3-8 billion/year by 2030 ... and £16 billion/year by 2050 ... by making better use of low-carbon generation.”

The National Infrastructure Commission has also noted the need for regulatory systems and frameworks to be updated in order to effectively face the challenges of reaching net zero in its paper appropriately titled Strategic Investment and Public Confidence. The paper notes that “*public confidence in the system must be improved to enable long-term certainty for investors and promote investment*”, and makes a number of recommendations for how to approach this^x.

National Infrastructure Commission Annual Monitoring Report 2019, Pg 28:

While progress is being made across the actions set out in government and Ofgem's Smart Systems and Flexibility Plan, the Commission thinks that the next priority for government should be to set out criteria and a process for evaluating their combined impact and what potential savings consumers are on track to realise.

Vivid Economics & Imperial College evidence regarding net zero was developed for the CCC and suggests that the required acceleration of electrification of certain sectors could involve up to 9 million electric and plug-in hybrid vehicles and up to 2 million heat pumps by 2025. Looking further ahead, certainty is lower, but National Grid's Future Energy Scenarios (FES) report outlines a net zero scenario where, while overall electricity demand reduces, peak electricity demand has nearly doubled from 60 GW today to 115 GW in 2050.

This requires continued investment in generation capacity to ensure we can meet the needs of consumers, but also emphasises the role of smart technologies and demand-side assets' capabilities to manage faster electrification. For example, the FES estimates that industrial and commercial DSR could provide 13 GW of flexibility in 2050, compared to around 1 GW today.

Flexibility will continue to be provided by a range of technologies which vary based on size, location and attributes, including generation assets, interconnectors, energy storage and demand side response (DSR). Each of these face similar requirements in terms of feasibility, as schemes must be practical, controllable, quantifiable, commercial, reliable, timely and material. These requirements require a level of certainty to be delivered.

Although there is high interest in flexibility in the GB market, market drivers are weak at this time as electricity demand has fallen with greater energy efficiency. This provides an opportunity to roll out services as the need for flexibility grows. This will also allow the technology to be fitted to the new markets and delivered to customers. There will be a need for government to support the new services as they are trialled, for instance, the use of the Regulatory Sandbox for services that don't fit with existing market rules^{xi}.

CCC Net Zero Technical Annex – Integrating variable renewables into the UK electricity system, Pg. 4:

Meeting peak demand. In particular there may be periods where demand is high, but intermittent renewables make a limited contribution to meeting it. To ensure the system is secure and reliable there needs to be enough firm capacity to meet peak demand with low contribution from intermittent sources.

Using available generation. With high penetrations of intermittent renewables there are likely to be periods where output is in excess of demand. This output would effectively be wasted and have no value.

Balancing requirements (e.g. reserve and response). There would also be challenges to balance the system and maintain grid frequency. That could require additional system flexibility, such as battery storage, or 'part-loading' of decarbonised gas plant, to be able to respond to rapid changes on the system.

Networks. Renewables - such as wind in Scotland, or in the North Sea - may be located far from where electricity is needed. Additional investments in electricity networks could be required to transport this electricity.

Improving system flexibility can help to meet these challenges. Even with high flexibility, challenges and costs will remain - our net-zero scenarios include all relevant costs to meet the four challenges above and ensure security of supply is maintained.

Maintaining a Positive Customer Experience

The GB energy system already requires a degree of flexibility in order to meet peak demand at the lowest possible cost to consumers. As intermittency increases and the amount of flexible capacity on the network continues to fall in order to maximise the utilisation of existing assets, alternatives need to be developed to continue to address that requirement and meet the expected quality of service expected by GB consumers.

We cannot raise the impact of potential disruptions to supply without noting the recent August 2019 disruption that affected nearly one million customers. This event was caused by a wide range of factors, but highlighted the potential impacts of power disruptions to consumers. Based on a range of existing research identified by the CCC^{xii}, it is possible that without a greater focus on developing market mechanisms for flexibility in the early 2020s to support the Government's intended ambition of deploying 40GW of offshore wind^{xiii}, the risk of significant national events and localised power disruptions will increase.

The need for action to deliver robust competitive markets for flexibility is particularly time-sensitive as the UK implements a net-zero target that will accelerate decarbonisation with much faster adoption of low carbon technologies. Estimates from Poyry^{xiv} and Aurora Energy Research^{xv} respectively set out between 15GW and 25GW of existing capacity will be retired by 2025, with over 10GW of that flexible CCGT generation.

At the same time, consumption is expected to rise by around 5% following increased uptake of low carbon technologies at the demand side. It is important that appropriate revenue streams are accessible to encourage the investment in a range of sizes and types of flexible technologies reflective of the changing needs of the system.

As we transition to a net zero economy by 2050, the range of market mechanisms discussed in chapter one and wider regulatory frameworks will require comprehensive coordination in order to ensure consistent price signals. A wide array of existing flexible generation assets retire over coming years, so this activity cannot wait until 2023, when many change processes regarding charging and network price controls will be implemented.

It is vital that charging arrangements and wider price signals are set out to encourage customers to voluntarily change their behaviours by choosing from the increasing range of energy service models and time of use tariffs. These arrangements will further enable the energy sector to offer innovative business models and energy tariffs that deliver flexibility to the system and reduce the cost of operating low carbon technologies.

These energy service models will increasingly use automation, utilising data and technology like machine learning to ensure that consumers are not expected to consistently engage with their energy use to reap the benefits of their EV, heat technology, or smart appliances. This will aid in maintaining a positive customer experience while meeting consumer demands at lower cost.

CASE STUDY: GRIDBEYOND AND EURAC

Eurac is the leading specialist manufacturer in the casting and machining of brake discs. In 2018, they started working with GridBeyond and their Hybrid Battery & Demand Network.



The Hybrid Battery & Demand Network is a portfolio of commercial batteries and demand assets, connected over multiple sites and organisations, working in harmony to provide flexibility to the grid. This solution benefits sites with little energy flexibility to access the fastest responding balancing services, they would otherwise not be able to achieve on their own.

The technology enabled Eurac's less flexible assets, for example older equipment, which previously could not respond for fast acting frequency response and other flexibility programmes, to participate in the most dynamic services. With GridBeyond, Eurac decided to further improve its energy strategy and resilience with the installation of a no-capex 1.6MW battery at its site in Poole.

Overall, Eurac and GridBeyond have achieved around £192k in demand-side response revenues and around £50k in savings from dynamic price optimisation.



INDUSTRY VIEWPOINT - RENEWABLEUK

Flexible technologies will play an ever more important role in the distributed, low carbon electricity system we need to meet the 2050 net zero target. Flexibility services, such as storage, demand-side response and interconnection are estimated to reduce total energy costs up to £7bn per year on average between 2030 – 2050.

We have already seen an 80% fall in the cost of battery storage and by 2050 there are expected to be over 35 million EVs on the road in the UK. Greater flexibility, through smart charging and vehicle-to-grid technology will, therefore, be vital in order to accommodate the active decarbonisation of transport.

The SSFP has been a welcome joint initiative by the Government and Ofgem driving the agenda for the challenges which need to be overcome to enable the transition. We now need to build on its success, working to set the trajectory and actions needed in the next 10 to 30 years.

We are hopeful that a reformed SSFP will be able to drive this agenda forward and continue the development of a robust policy framework that encourages flexibility in the transition to net zero.



Hugh McNeal
Chief Executive, RenewableUK



Network Access and Flexibility

To enable a wide range of flexible assets, in terms of scale and technology types, to access the range of markets that enable recovery of investment, those assets need to be able to connect to the network. The Open Networks project has held a significant amount of focus on the future arrangements for a DSO, but arguably the most valuable contributions to date have been in simplifying and standardising existing connections processes.

The wider review of access and forward looking charging arrangements is also expected to deliver improvements to the process of connecting to the network. Again, we would note that in the timeframe for implementation of these changes and the timeframe of implementation of the next network price control framework may come too late to ensure robust competitive markets are in place by 2025. This is contributing to wider uncertainty about network flexibility.

Against consensus reached across Europe's combined national regulated authorities, the GB regulator has allowed network assets utilising voltage reductions to be used in balancing markets in direct competition with other providers. These network assets immediately

undercut the market for flexibility, with initial DNO bids in the Firm Frequency Response market succeeding in achieving the highest approval rate of any actor type, taking 44% of accepted bids from April 2018 – September 2018, and yet this trend has been allowed to continue to develop^{xvi}.

Development of these assets to provide the service was through publicly-funded research and development, and much of the investment risk for the assets is now being taken on by the consumer.

Network flexibility has an increasingly important role to play as an emergency resource. Voltage reduction is already used as an emergency action, taken in urgent situations to reduce the likelihood of interrupting customers' supply of electricity. As the amount of voltage reduction available in an emergency is reduced, resorting to full interruption would, theoretically, become more likely.

Beyond the immediate concern of decreased emergency control to rely upon, the use of network assets in markets will reduce the overall amount of flexible capacity available to the ESO. Reductions in flexible capacity will be based on two factors:

1. Barriers to entry, both real and perceived, in existing GB markets and the lack of development of additional market mechanisms leading existing and potential providers to invest elsewhere.
2. Voltage reductions and other network manipulation technologies reducing the ability of customers to adjust energy usage or generation to participate in flexibility markets.

This is resulting in an unnecessary increase in risk, exacerbated by the type of markets flexible network asset technologies will curtail. Impacting the market by continuing to hold a dominant position, as seen in existing bids, will reduce the amount of flexibility available to the system.



INDUSTRY VIEWPOINT – REA

Flexibility is key to integrating more renewables onto the system and delivering the smarter, cheaper energy system we need. Government and Ofgem have made progress in the past few years but the perception is that this has started to slow and renewed impetus, especially on the development of effective markets, is necessary.

The events of 9th August in the UK brought the changing energy system into sharp focus but the fact that energy storage responded so quickly to events helped manage the impact on the system and indicates the possibilities such services provide.

We are confident that with appropriate actions and renewed vigour, the SSFP can be delivered and the system transition to be smarter, more decentralised and ultimately more secure and of course decarbonised.



Dr Nina Skorupska CBE FEI
Chief Executive, REA



Improvements to data access

Industry fully supports the recommendations of the Energy Data Taskforce, particularly on the need for the immediate focus to be in opening up network and system data to the market. This is a vital enabler for the market for flexibility and would equalise the current advantage held by networks in terms of an unequal access to information gathered using public funding.

The digitalisation strategies and developing Long-Term Development Statement frameworks must incorporate the publication of granular information on the state of the network, wherever this aligns with the triage process put forward by the Energy Data Taskforce. This will enable actors to plan investment based on accurate information, whether in justifying new sites or in the optimisation of existing sites from generation assets to households.

The importance of market participant access to accurate granular data cannot be understated in terms of the impact it may hold on developing flexible capacity and supporting the UK transition to net zero.

Developing Market Mechanisms

Coordinating effective market mechanisms and giving providers the ability to compete for a range of revenue streams will enable continued growth in the amount of flexibility available throughout the 2020s. Delivery of this will greatly increase the potential for UK consumers to avoid the cost of a 'slow start' scenario and reap the long-term benefits of a smart flexible energy system.

Nascent markets depend upon policy clarity and clear market mechanisms, particularly in a marketplace as complex as the GB energy industry. Developing an effective commercial market infrastructure in 2020, setting out clear contractual terms and mechanisms that define routes to revenue and potential returns on investment, is crucial to delivery of the amount of flexibility required by 2025.

The ambition set out in the ESO's RIIO-2 Business Plan indicated that the ESO is listening to industry and committing to deliver tangible improvements to balancing. It is, however, important that the ESO recognise the importance of significant IT upgrades to enable these projects to be delivered, and that appropriate resource be dedicated to modernisation of these systems in a timely manner.

Until such a time as the market has delivered investment in adequate research and development to enable reductions in cost and other efficiencies enabled by effective competition and economies of scale, the cost of investment will be difficult to recover. In order for investment in flexibility in GB to continue to be attractive, providers will need the ability to participate in the full range of GB energy markets.

Reaching net zero will need the Government to use all the appropriate policy levers at its disposal. Thus far we have seen some reluctance on the part of Government to coordinate market reform, innovation support and regulation with other measures such as subsidies and tax reform. As a first step, the Government should review the tax landscape and act to remove market distortions and barriers to the take-up of low-carbon technologies.

There is scope for better targeted incentives for technologies, devices and services that improve energy efficiency and reduce carbon emissions. An expansion of the list of products that attract a reduced rate of VAT to include more technologies that improve energy efficiency, generate renewable power or provide system flexibility would be a positive start.

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CASE STUDY: FLEXITRICITY AND GLEN AVON GROWERS

Glen Avon Growers, a third-generation family run business, was established in 1936 in Cottingham England, by the family's grandfather.

From providing fresh produce for the local market in Hull, the business now has glasshouses spreading over 16 acres, producing tomatoes and cucumbers for major retailers such as ASDA.

With demand-side response provider, Flexitricity, the commercial horticulturist has created new revenue streams by optimising the flexibility it has with its combined heat and power (CHP) plant, generating over £300,000 during the past decade.

This has been achieved through participation in Short Term Operating Reserve (STOR) and most recently the Balancing Mechanism with Flexitricity's new service Flexitricity+, managing its electricity consumption and generation in real-time.

In doing so, Glen Avon Growers has improved its bottom line whilst helping National Grid meet the energy demands of the UK as we move to a low carbon economy.



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Report – BEAMA: Net-Zero by Design



BEAMA members have signed a commitment to the net-zero target. This not only sets out their own commitment to reduce their company footprints, but the commitment to make changes to the supply chains necessary to deliver on net zero. However, this can only be delivered with clear and decisive action from Government.

Electricity networks play a key role in facilitating strong growth in electric vehicles and heat

The UK energy system is at a high transition period and there is a need for enhanced supply chain engagement and planning to ensure a buoyant market in the UK and to help channel investment effectively. For some time, manufacturers have witnessed reductions in investment in traditional network products in line with typical asset replacement rates in addition to an absence of new reinforcement which would create additional capacity. In many cases new technologies trialled through NIC, NIA and LCNF projects which will be key in enabling advances in flexibility across the system, are yet to be deployed at scale. There are a number of reasons causing these trends, and it is key to address them and create a clearer market for the reinforcement and advancement in flexibility across the system so the supply chain can be prepared.

Recognising projections from The CCC and Imperial College in their net-zero review a potential spend of £2billion a year on network investment by 2050 to deliver the target is required. This level of renewed investment requires significant planning and is also dependant on a viable flexibility market in the UK. Without flexibility the known cost of this will be far higher.

RIIO2 is expected to increase financial pressures on network operators, regulating them to earn and spend less, whilst the expectation of network transformation and preparedness for low carbon technologies and new energy demand continues to ramp up. The question is; does this strike the right balance and enable the appropriate investment signals at such a critical time? Utilities are typically assumed to be a low risk investment, but we are now entering a high-risk period and opportunities should be provided for network operators to outperform targets, where they take on greater risk. Squeezing the network operators will result in a reluctance to invest and in cost pressures being passed on to those less able to bear them

Net zero must be customer led - low carbon heat and hot water

We know net zero can only be met with a radical transformation in the efficiency of existing UK homes and the fuels they use to heat them. Retail and market reform must be delivered to ensure it is economically viable for UK consumers to transition to low carbon technologies and retrofit their homes. This requires new market services and new ideas in how consumers engage with their energy use e.g. Energy as a Service models, and a viable flexibility market is absolutely essential in achieving this transition. Major barriers today include the cost of electricity and the upfront cost of retrofitting existing housing.

BEAMA's net zero by design work goes some way to approach how these barriers can be overcome and how in turn this will provide certainty for the UK supply chain to deliver the technologies required.



Chapter Three: Conclusion and Recommendations

Key Points:

- The SSFP lacks a single comprehensive vision and incremental measurable targets, and requires greater transparency in this area through Government and Ofgem action.
- Industry is eager to contribute in a more meaningful and productive manner to the delivery of the actions of the SSFP, and offers resource to support swift and effective delivery.

A Single Vision

The SSFP update report setting out progress made in delivery was a publication with high potential. That potential was not realised, and industry would like to see the next update hold more tangible and specific examples of how far the plan has gone in realising a single holistic vision. A new update report could be incredibly powerful if it was also linked into the UK's net-zero target and wider changes in the nature of the market.

The energy industry would ask that the Government and the regulator treat the development of market mechanisms with a level of urgency and deliver clarity over roles and responsibilities in the provision of flexibility. We wish to be clear that we are not asking for BEIS and Ofgem to 'reinvent the wheel', but rather that the welcome and important work they are already progressing sees more active progress and a greater level of coordination and transparency.

While the market will define the technologies and business models best able to deliver for customers, there must be a clear set of timelines for development and opening up of market mechanisms for flexibility to enable the market to mature. It is vital that ministers and industry are able to hold to account the bodies responsible for meeting those timelines for implementation, and that clear priorities are set to ensure that the most critical issues are resolved ahead of those that can wait.

In order to ensure this, we ask that the SSFP be retargeted, reassessed, and driven forwards with a renewed vigour alongside increased and coordinated industry engagement.

Renewing the SSFP

Firstly, this can be achieved by prioritising actions already in the SSFP to focus on meeting the needs of the system by 2025 and enabling continued decarbonisation at pace. Industry will contribute to the process of prioritisation as set out below in order to ensure Ofgem and BEIS feel confident in holding the support of industry in finding and implementing the most efficient path forwards.

Secondly, the SSFP should put forward more ambitious policy for the 2020s and towards achieving net zero in 2050. This should set out what the Government and the regulator expect must be achieved under different scenarios by 2050 to reach net zero and then work backwards to set out what will be needed by 2040 and 2030 for this to be realistic. As far as possible, such latter, medium-term outcomes should be well-defined and specific so that industry can clearly understand and assess who is responsible for their delivery and ultimately whether they have been met.

It will be important for this latter change to be coordinated with the wide range of relevant bodies in climate change discussions to ensure a coordinated approach to the cross sector decarbonisation that the SSFP could enable. These bodies include the Committee on Climate Change and the newly-formed Cabinet Committee on Climate Change.

To date, individual policies identified in the SSFP have assessed their impact on the market but the SSFP itself has not. As a result, the SSFP is mostly qualitative and does not present a view of how far the policies identified will indeed create the demand for flexibility needed by 2050 and whether there remains a gap. Whilst we recognise this is a complex exercise, without some assessment of this it is impossible for Government, the regulator or industry to know if the narrative on achieving a smart system is backed up by robust and sufficient policy.

Thirdly, the SSFP should ask the bolder, more strategic questions of GB energy policy that individual policies taking a more incremental approach cannot. These could include:

- How should the wholesale and retail market policy and regulation respond to a smart system increasingly comprised of flexible demand, generation and storage and with potentially many more participants who are not licensed generators or suppliers? What is the long-term policy framework and ambition for small-scale renewable generation, storage and flexibility?
- While the Capacity Market 5-year review will set out incremental changes for the short- to medium-term, are there more substantial, long-term changes required to accommodate future evolutions in flexibility?
- What is the Government and the regulator's own view of the ESO's role to 2030 and beyond? Will the existing market and IT frameworks support an increase in volumes of flexibility procured as renewable penetration continues to increase? Beyond RIIO-2, is further policy and regulation needed to realise what is required of the ESO?
- How developed should markets and network signals for flexibility at distribution be by the start of RIIO-2 in 2023 and by its end? Should, for example, distribution network operators still constrain off distributed energy generators as standard to ensure stability or should they be required to find alternative forms of flexibility? How should flexibility be valued across different time periods? What levels of automation should industry expect from Distribution System Operations?

In order to ensure the maturity of competitive markets for flexibility, this renewal of the SSFP should be delivered by the summer of 2020. If this is not delivered, the industry expects that GB investment will falter as other nations overtake GB efforts in this sector.

Coordinated Industry Engagement

While the scale of change across industry is causing some constraint on resource, we offer as a collective energy sector to support in the efficient and timely delivery of the plan wherever possible. To aid in this, we will initially develop a framework for coordination of our respective inputs, and further coordination as a single industry delivery body to progress changes at a faster rate to deliver against a single shared direction of travel.

This will require resource from each of the associations involved in delivery of this report as well as input from a wider range of stakeholders through a series of initial workshops and discussions to be held throughout the six months following this report. Our intentions in leading such a group are set out in an Annex below, based on initial industry engagement.

No single actor can solve the challenge of delivering a smart flexible energy system. As such, we come to you as a single industry to request greater clarity and offer our support in delivery through an industry-led Smart Systems Advisory Group. Such a forum alongside specific priorities and monitoring for the SSFP would enable the development of a single unifying vision of the future energy system, under which investment and market confidence would flourish.

We hope that this report and the associated list of recommendations aid in delivering faster implementation of the actions of the SSFP. We stand ready as a united energy industry to effectively support in the delivery of a net-zero economy at lowest cost to consumers.



Appendix 1: Smart Systems and Flexibility Plan Actions

This annex sets out the actions listed in the original Smart Systems and Flexibility; noting that further actions have since been added. Against each action, it sets out Ofgem and BEIS' assessment of progress against that action as stated in the Progress Update and the industry's high-level view of how well each of these areas are being progressed.

It is important to note that BEIS and Ofgem's assessment only considers whether or not the specific action has been progressed or not. This report's Red-Amber-Green scale considers this as well as the process that was followed and the outcome for industry. Further comments are provided where needed to clarify the rationale behind each RAG rating. Exact details of those concerns differ from organisation to organisation and require more detailed discussion.

The Government's use of the term 'implemented' in the SSFP update report and wider communications is not sufficiently clear. In future iterations, it would be more helpful if the Government set out the overall outcome, the actions required to reach that outcome (which may not wholly be in the gift of Government and Ofgem) and then assessed progress on the basis of how many actions have been completed as well as whether the outcome has been, or is nearer to being, achieved.

Overall, we find that only five of the actions set out in the SSFP have been implemented, used to mean completed, and finds that five actions fall into the 'Red' category due to a high level of concern over progress made to date.

Removing barriers to smart technologies

| Action No | Workstreams and issue definition in SSFP | Ofgem & BEIS progress Classification | Industry Progress Classification | Perceived risk for timely delivery: [Red; Amber; Green] |
|-----------|--|---|--|---|
| 1.1 a | Targeted Charging Review Modifications to network charges for storage. Network charges can, in some scenarios, put storage at a relative disadvantage to other network users, preventing a level playing field. | Ensure that storage is not disadvantaged in the form of being overcharged for use of distribution, transmission and balancing system. In Progress | In Progress. Overall development of charging reform will take time to develop and refine. | Amber |
| 1.1 b | | DNO definition of storage as non-intermittent generation: Implemented | Implemented | Green |
| 1.2 a (1) | Storage is not defined in primary legislation and its | Modification of the Generation | Delayed. Changes to the | Red |

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| | regulatory status within the electricity system and planning regimes is unclear. | Licence: In Progress | Generation licence are yet to be implemented. Current drafting includes overly burdensome reporting requirements for those operating storage. | |
| 1.2 a (2) | | Modifications to the Distribution Licence: In Progress | Delayed. DNOs are still not disallowed from owning energy storage assets, although this is an existing Ofgem position. | |
| 1.2 b | | Storage defined in primary legislation: In Progress | Delayed by the parliamentary timetable. | |
| 1.2 c | | Planning framework for storage reviewed: In Progress | In Progress | |
| 1.3 | Electricity procured by storage facilities from suppliers anomalously includes the cost of final consumption levies. | In Progress | Delayed. Changes to the generation licence are progressing, but these have been slow to progress and currently include overly burdensome requirements in an attempt to mitigate this issue. Any assets below 50MW (not covered by the Generation Licence) still have no clarity, with a range of workstreams being progressed and little central coordination. However, storage operators are successfully | |

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| | | | applying for generation licences which, whilst not ideal, has limited the impact of this delay for some participants. | |
| 1.4 | Some renewable generators receiving support under the RO, CFD, or FITs schemes are concerned they may put their accreditation at risk if they apply to install storage assets on the same site. | Implemented | In Progress. Some industry stakeholders continue to hold concerns. | |
| 1.5 | Synergies between a smart energy system and future Government policy on small-scale low-carbon generation should be realised. | In Progress | In Progress. Concerns remain from distribution connected parties following the removal of embedded benefits and slow progress to implement any alternative price signals for small scale low carbon generators. | |
| 1.6 | Network connection rules were not designed with storage in mind, which can lead to a number of issues including a lack of understanding of how storage connections should be treated (by both network operators and connecting customers) and the cost and time of connecting. | In Progress | In Progress. The development of a single process for flexible assets connecting to networks continues to be developed by the ENA. | |

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| 1.7 | The health and safety framework needs to keep pace with a rapidly changing technical and commercial landscape | Implemented | <p>In Progress. A BSI group has been established which is welcome.</p> <p>However, on an outcomes-basis, health and safety changes are not keeping pace with the changing nature of the energy system, for example in installation of EV charge points.</p> | |
| 1.8 | Where flexibility assets are owned and/or operated by network operators there is potential to distort competition in markets for flexibility services or deter new entrants. More clarity on the application of existing unbundling rules to storage is required and further consideration is needed on the necessity to strengthen those rules. | Implemented | <p>In progress. Under the SSFP actions, this action was interpreted narrowly to consider only storage assets. The energy industry agrees that stronger guidance has been published clarifying that network operators cannot operate storage without Ofgem consent. However, DNOs have not been disallowed from ownership of energy storage assets.</p> <p>Another element causing industry concerns is SECMP0046, which continues to progress, and may allow direct DNO operation of EV chargepoints via smart meters.</p> <p>However, the action refers to flexibility assets in general; of which storage is only one strand. In this regard,</p> | |

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| | | | <p>progress has not been made and has in fact reversed.</p> <p>Electricity North West Ltd. continues to participate in ancillary service markets using flexible network assets.</p> | |
| 1.9 a | <p>There is a wide range of storage technologies at an early stage of development. Further innovation is needed to reduce technology costs, especially those with potential to be more cost-effective than lithium-ion batteries, and/or to operate on a large scale. Storage has been trialled through Ofgem's electricity Network Innovation Competition, through which £600m is available between 2013 and 2021, but further trials may be needed outside the parameters of these competitions.</p> | <p>Cost reductions in energy storage: Implemented</p> | <p>In Progress.</p> <p>The industry agrees that several innovation competitions have been launched and supports this. They continue and are expected to deliver benefits to consumers and industry.</p> <p>However, when considering outcomes alongside the action itself, cost reductions will be best achieved using economies of scale, which will not emerge unless market mechanisms develop.</p> | |
| 1.9 b | | <p>Feasibility of new large-scale storage technologies: Implemented</p> | <p>In Progress. As above.</p> | |

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| 1.11 | Data is intrinsic to the transition to a smart system, including the efficient operation of electricity networks. It reveals opportunities for optimisation and allows innovators to realise where they can add value to the system. However, there is currently a lack of transparency of, and access to, certain data sets, which can limit competition for energy services, and can present a barrier for innovators entering the market | In Progress | In Progress. Ofgem is implementing changes to reflect the recommendations of the Energy Data Taskforce, but coordination is still needed for a range of workstreams related to increased visibility of the network. | |
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Smart homes and businesses

| Action No | Workstreams and issue definition in SSFP | Ofgem & BEIS progress Classification | Industry Progress Classification | Perceived risk for timely delivery: [Red; Amber; Green] |
|------------------|---|---|---|--|
| <u>2.1</u> | The participation of large non-domestic consumers in demand-side response (DSR) should be encouraged. A number of barriers have been identified, including knowledge, complexity and access to markets to increase commercial incentives. | Implemented | In Progress. Engagement with Power Responsive is welcome. However, when considering outcomes, it is not effectively delivering an increase in the understanding of all UK businesses regarding how to participate in DSR. In particular, there remain gaps in market information for flexibility providers at both system and distribution level. | |

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| <u>2.2</u> | The participation of public sector consumers in DSR should be supported to demonstrate the benefits of DSR alongside more established technologies, enabling it to compete in the wider market. | Implemented | In progress. There remains further work to be done to encourage uptake by public sector consumers and the issues highlighted for non-domestic DSR above pertain. However, the framework itself is adequate. | |
| <u>2.3</u> | Smart meters are the foundation of an accessible smart energy system for consumers. | In Progress | Delayed. Smart meter delivery continues to be impeded by delays. | |
| <u>2.4</u> | Existing price signals through electricity settlement arrangements do not encourage suppliers to offer smart tariffs | In Progress | In Progress. Whilst half-hourly settlement is now moving forward, wide reform of charging must be implemented for price signals to encourage uptake of smart tariffs. | |
| <u>2.5</u> | The limited availability of smart tariffs means consumers cannot realise bill savings by providing demand-side response, and the system and consumers as a whole cannot benefit from this | Implemented | In Progress. as Per 2.4 | |
| <u>2.6</u> | Limited availability of smart appliances means consumers cannot realise bill savings by providing demand response. | Implemented | In Progress. The original actions in the SSFP have now been completed. BEIS / Ofgem have now expanded upon this action with new areas for implementation that have not been completed. | |

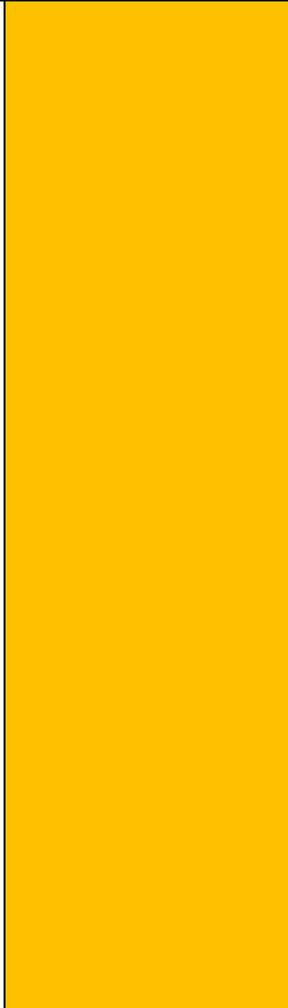
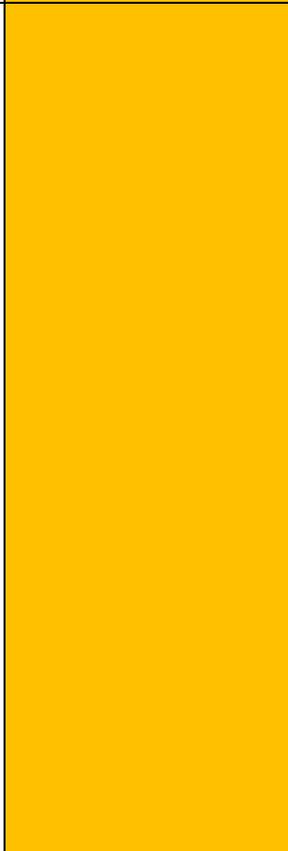
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| <u>2.7</u> | The functionality of electric vehicle charge-points should be smart-enabled so that consumers are not locked out of future smart offers. | Implemented | In Progress. This cannot be counted as implemented until BSI PAS standards and OLEV development of regulations for mandatory standards are complete. Existing progress has focused on a smart integrated solution that would effectively mandate the use of smart meters. This level of prescription, rather than taking an outcomes-based approach (prioritising, for example, interoperability) could lock consumers out of other smart offers and curtail innovation. | |
| <u>2.8 a</u> | Electric vehicle potential to provide demand-side response and storage services must be capitalised upon to ensure efficient grid integration. | Innovation projects: Implemented | Implemented | |
| <u>2.8 b</u> | | Regulatory, Network, and Tariff implications: In Progress | In Progress. There remains a need for network charging reform to be implemented. There is a risk to these services from SECMP0046. | |
| <u>2.9</u> | Consumers should be protected from the risks of participating in a smart energy system | In Progress | In Progress. BSI smart standards will deliver some protections. Work being progressed by Energy UK, ADE, and Citizens Advice will explore potential areas in need of further protections. | |

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|----------------------|--|----------------------------------|--|--|
| <u>2.10</u> | In the move to a smart energy system, it is essential that cyber security risks are effectively understood and acted upon. | In Progress | In Progress. Work is needed to develop an evidence base for any further activity in this area and coordinate any activity accordingly. | |
| <u>2.11 a</u> | Further innovation is needed to test approaches to DSR for domestic and non-domestic consumers | Non-Domestic: Implemented | In Progress. Whilst the innovation competition has been launched, the demonstration projects will be delivered by March 2021. | |
| <u>2.11 b</u> | | Domestic: Implemented | In Progress. As with 2.11 a. | |
| <u>2.12</u> | Domestic and smaller non-domestic consumers must be informed and engaged to participate at scale in a smart energy system. | In Progress | In Progress. Work to date has been delivered by industry in terms of marketing and the development of new business models. | |

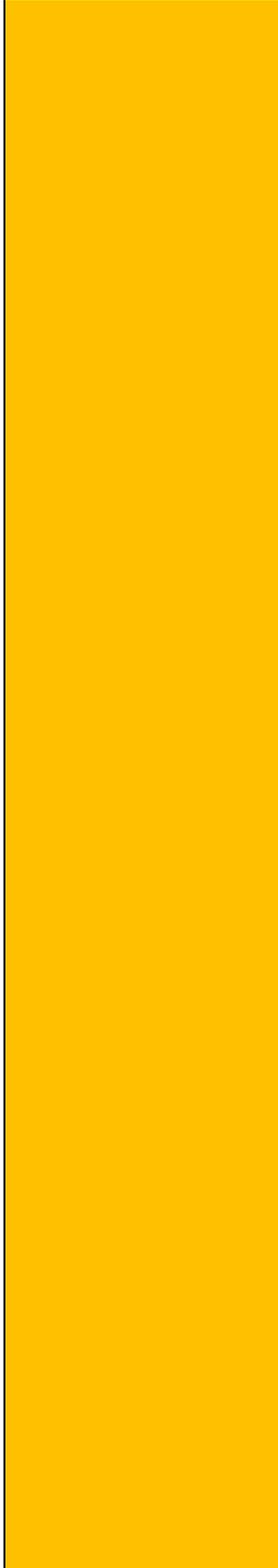
Markets that work for flexibility

| Action No | Workstreams and issue definition in SSFP | Ofgem & BEIS progress Classification | Industry Progress Classification | Perceived risk for timely delivery: |
|-------------------|--|---|---|--|
| <u>3.1</u> | There is a need to ensure that storage and demand flexibility participate on a level playing field in the Capacity Market. | In Progress | In Progress. The specific SSFP actions remain in progress. Regarding outcomes for the market, concerns remain from some regarding derating factors of storage and DSR assets. | |

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| 3.2 | <p>Independent energy aggregators are currently unable to access the Balancing Mechanism (BM) directly. Aggregators could facilitate more demand-side response and increase competition in the BM.</p> | Implemented | <p>In progress.</p> <p>Although TERRE is delayed, Ofgem has approved the changes required to implement wider access to the BM and aggregators are becoming Virtual Lead Parties. Further modifications remain ongoing.</p> <p>On an outcomes-basis, there remain concerns that distributed flexibility still faces soft barriers to full BM access.</p> | |
| 3.3 a | <p>To balance the system, the ESO contracts for balancing services from providers, including frequency response and reserve. Balancing services can suffer from complexity, overlap and lack of transparency. They may also reflect a historical focus on generation rather than demand-side balancing solutions.</p> | Reforms to Balancing Services: In Progress | <p>In progress.</p> <p>The week-ahead trial has now been implemented and the ESO has published further progress in the design of new products.</p> <p>However, the ESO is yet to deliver upon intended reforms and delays continue across the board, with very little notice of changed deadlines given to industry.</p> | |
| 3.3 b | | A new regulatory framework for the ESO: Implemented | Implemented. The ESO performance review panel is in place. | |

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| <p>3.4</p> | <p>There are concerns that the existing network charging and wider market arrangements do not create the right incentives for those connecting to the network, including that they do not reflect the costs and benefits they can create for the network and system as a whole.</p> | <p>Implemented</p> | <p>In progress. In the SSFP, this action considered both the Targeted Charging Review on residual charges and the Access and Forward-looking Charges review on cost-reflective charges. The former is now being implemented through modification groups. However, the latter remains ongoing.</p> <p>On a process basis, the failure to coordinate the implementation of these reforms, despite widespread support across industry, consumer groups and the ESO, is of concern.</p> |  |
| <p>3.5 a</p> | <p>As the system changes, network and system operation need to evolve to ensure that the system as whole is managed efficiently. There are a range of areas where opportunities for efficiency savings are expected, including through active use of new technologies, providers and solutions and through greater coordination across the transmission and distribution boundary.</p> | <p>ENA Open Networks to open up DNO network requirements as business as usual and define areas for better coordination: In Progress</p> | <p>In Progress. The work recently to outline more clearly enablers for DSO is positive and constitutes stronger leadership on the DSO transition from Ofgem than previously.</p> <p>While the Open Networks project continues to develop, Ofgem and BEIS recently wrote to the ENA to request more tangible outputs be progressed in line with this and other actions.</p> <p>DNOs are yet to address areas of potential conflict</p> |  |

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| | | | of interest across their businesses in delivery of this action. | |
| 3.5 b | | Regulatory clarifications for network companies in the near term: In Progress | <p>Delayed. Ofgem's recent publication of a position paper on DSO functions and the consultation on network enablers is positive.</p> <p>However, it has not resolved concerns over role creep from DNOs. Continued lack of clarity in this area has undermined investment in distribution level flexibility. DNO ownership and operation of flexible assets including network assets capable of offering flexibility continues to undermine the market.</p> | |
| 3.6 | There is a need to catalyse innovation by trialling ways in which energy markets may evolve. | Implemented | Implemented | |
| 3.7 | Engineering recommendation P2/6 (originally conceived in the 1950s) dictates the minimum level of security of supply DNOs must provide for demand on their networks. To reflect system and technology changes and greater flexibility, changes could potentially be made to the standard that could improve its efficiency. | In Progress | In Progress. Changes are being developed to reduce the P2 requirement and allow a lower level of security of supply in order to enable connection of more assets. There is a concern that this will enable sweating of network assets to justify increased reinforcement spending. | |

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| <p>3.8</p> | <p>There is a need to maximise our stakeholder engagement on smart energy systems, building on the strong engagement we have had so far.</p> | <p>Implemented</p> | <p>In Progress.</p> <p>The Smart Systems Forum brings together senior members of industry and has been a welcome initiative. But the focus of the Forum should now turn to specific medium-term strategic policy questions rather than general discussion of the policy and market landscapes.</p> <p>Outside of the Forum, the BEIS Smart Systems team have made considerable and welcome efforts to engage with industry at company and trade association levels.</p> <p>We urge the Government and Ofgem to engage with stakeholders with even greater urgency and transparency in the coming year to address and remove the barriers to an efficient and transparent market in which providers of flexibility are rewarded and innovation is supported.</p> |  |
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Appendix 2: Proposal for an Industry-led SSFP Advisory Group

Context

The existing Smart Systems Forum has delivered information provision and high level discussion of specific areas of delivery for the SSFP. The group lacks tangible outputs and has not enabled direct scrutiny of delivery of the actions of the plan. The group also lacks a focus on the state of the market and the investment case for flexibility, which must be considered to deliver the required flexibility over the coming decades.

The attendants of the forum are senior representatives well placed to input into the overarching questions and concerns surrounding and driving the SSFP. More specific discussions of individual actions or workstreams may not be the most effective use of those representatives' time, and would be better set for an industry-led group. Those not involved in the forum further find the group's discussions, purpose, and outputs to be lacking in transparency, with only one publicly accessible meeting note available at the time of writing^{xvii}. For the whole market to be confident enough to invest and innovate as necessary, this issue must be resolved.

Proposed Solution

Those parties included in this report would ask for support from BEIS and Ofgem for the establishment of a Smart Systems Advisory Group to more directly engage and make recommendations regarding:

- prioritisation of actions;
- intended rate of delivery;
- accountability of delivery bodies including Ofgem, BEIS, National Grid, DNOs, and industry actors, and;
- proposals of and integration of additional actions for industry actor progression.

The group must be connected to the existing senior representation seen at the Smart Systems Forum, but will increase the rate and quality of the feedback loop between delivery bodies and industry. Industry is committed to delivering this in a coordinated manner, just as has been seen in the development of this paper.

To be successful, the group will need frequent direct engagement from BEIS and Ofgem, as well as the other parties responsible for delivery of actions within the SSFP, but must be able to set out industry views in both formal and informal ways with an understanding that these will gain responses from the parties responsible for delivery.

Energy UK offers to act as secretariat for the group, convening the group in much the same way as the ENA has convened the groups delivering the Open Networks project. The group would meet once a quarter, and would deliver recommendations and support to BEIS and Ofgem in delivery of the SSFP.

The group would further deliver workshops and discussion sessions at appropriate times in order to define market participant views on the barriers and opportunities within the range of markets for flexibility. This will include, wherever relevant, indications of where barriers exist for the entire market and where they are specific to one section of industry.

Membership of the group and participation in workshops could be extended beyond the organisations behind this document. This would be based on the inclusion of investment organisations, consumer representative organisations, and representatives from other sectors expected to take on significant cost during decarbonisation efforts.

Appendix 3: Literature

BEIS research

- *An Analysis of Electricity System Flexibility for Great Britain* – Carbon Trust and Imperial College London on behalf of UK Government - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/568982/An_analysis_of_electricity_flexibility_for_Great_Britain.pdf
- BEIS, 2018, Updated Energy and Emissions Predictions for 2017: <https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2017>

Regulatory reports

- New Services and DSO Involvement: A CEER Conclusions Paper - Council of European Energy Regulators, 2019 <https://www.ceer.eu/documents/104400/-/-ef4d6e46-e0a5-f4a4-7b74-a6d43e74dde8>

Committee on Climate Change

- Roadmap for flexibility services to 2030 (Poyry & Imperial College) – <https://www.theccc.org.uk/publication/roadmap-for-flexibility-services-to-2030-poyry-and-imperial-college-london/>
- Net Zero –Technical Report, 2019- <https://www.theccc.org.uk/publication/net-zero-technical-report/>
- Accelerated Electrification and the GB Electricity System (Vivid & Imperial College) – <https://www.theccc.org.uk/publication/accelerated-electrification-and-the-gb-electricity-system/>
- Analysis of alternative heat decarbonisation pathways Imperial College (2018): <https://www.theccc.org.uk/publication/analysis-of-alternative-uk-heat-decarbonisation-pathways/>

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- Strategic investment and public confidence, National Infrastructure Commission, 2019: <https://www.nic.org.uk/publications/strategic-investment-and-public-confidence/>
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- Fast frequency response for effective frequency control in power systems with low inertia Hong et al., 2019: <https://pureportal.strath.ac.uk/en/publications/fast-frequency-response-for-effective-frequency-control-in-power->
- Electricity System Change: Flexibility and Costs, Strathclyde flexibility event 2018 - <http://www.ukerc.ac.uk/network/network-news/electricity-system-change-flexibility-and-costs.html>
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- Energy Watch Group (Ram et al.), 2017: <http://energywatchgroup.org/wp-content/uploads/2017/11/Full-Study-100-Renewable-Energy-Worldwide-Power-Sector.pdf>
- Schulz et al., 2017: <https://www.sciencedirect.com/science/article/pii/S0140988316301682>
- Jacobson et al., 2015: [https://web.stanford.edu/group/efmh/jacobson/Articles//CombiningRenewWorldGridIntegration.p](https://web.stanford.edu/group/efmh/jacobson/Articles//CombiningRenewWorldGridIntegration.pdf)
[df; http://web.stanford.edu/group/efmh/jacobson/Articles//AllCountries.xlsx](http://web.stanford.edu/group/efmh/jacobson/Articles//AllCountries.xlsx)

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- FUSION project due diligence documents [to be released].
- Imperial College London - Collated estimated flexibility requirements -<https://www.storage-lab.com/system-value>
- LCP research – to be added
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i

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/568982/An_analysis_of_electricity_flexibility_for_Great_Britain.pdf

ii

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/568982/An_analysis_of_electricity_flexibility_for_Great_Britain.pdf

iii Energy UK analysis of ONS' data, adjusted for inflation

iv <https://www.energy-uk.org.uk/our-work/future-of-energy.html>

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- xiii https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/853886/Queen_s_Speech_December_2019_-_background_briefing_notes.pdf
- xiv Analysis by Poyry for Energy UK
- xv <https://www.nic.org.uk/wp-content/uploads/Power-sector-modelling-final-report-1-Aurora-Energy-Research.pdf>
- xvi Research regarding the impact of DNO participation on the market delivered in 2019 by Cranfield University on behalf of Energy UK. Acceptance rates for tender data from April 2018 - September 2018 [excepting bids rejected due to mutual exclusivity] were identified as: DNOs - 44%; Generators - 31%; Aggregators - 18%; Suppliers – 7%.
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