



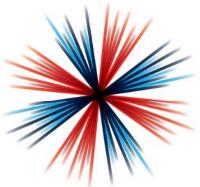
HM Government

ofgem Making a positive difference
for energy consumers

UPGRADING OUR ENERGY SYSTEM

Smart Systems and Flexibility Plan: Progress Update

October 2018



**INDUSTRIAL
STRATEGY**



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1. Summary

In July 2017, the Government and Ofgem published *Upgrading our energy system: smart systems and flexibility plan* ('the Plan').¹ This document provides an update on progress towards the actions set out in the Plan and outlines our forward priorities linked to the Plan, including some new actions.

Our electricity system is undergoing fundamental change. We are now well on the path to decarbonisation; in 2017, a record 50.1% of electricity generation came from low carbon sources.² The system is increasingly distributed, with more homes and businesses generating and storing power. Electric vehicles are becoming increasingly widespread, and electric heat may follow. New technologies, new business models and digitalisation are opening up new possibilities for how electricity can be dispatched across the system to the point and time at which it is needed.

This transformation is not confined to the UK – it is happening in countries across the world. It is estimated that global investment in renewables will make up more than 80% - or \$9.3 trillion - of total investment in new power generation between now and 2050, by which point storage and demand side response are expected to make up almost 10% of total installed capacity.³

Flexibility is increasingly central to this transforming system. Technologies and applications such as storage and demand response can help balance generation with demand and provide essential services to the grid. This can facilitate the deployment of weather-dependent renewables such as solar and wind, whilst enabling greater uptake of new types of demand such as electric transport.

These changes promise to provide significant public benefits – cleaner air, lower carbon emissions, lower energy bills, and giving consumers greater control over their energy use. A more flexible energy system could save the UK £17-40 billion across the electricity system, to 2050.⁴

The Government and Ofgem are committed to supporting this transformation. The drive towards a smart and flexible future energy system is an important part of the Government's Industrial Strategy⁵ and Clean Growth Strategy⁶, and a core component of Ofgem's work to enable the energy system transition.

The Plan set out 29 specific actions for us to deliver, alongside industry, in terms of:

- removing barriers to smart technologies, including storage;
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¹ <https://www.gov.uk/government/publications/upgrading-our-energy-system-smart-systems-and-flexibility-plan>

² Up from 45.6% in 2016, driven by an increase in renewables generation (nuclear generation decreased by 1.9%). Source: Digest Of United Kingdom Energy Statistics 2018.

³ New Energy Outlook 2018, BNEF, June 2018 <https://about.bnef.com/new-energy-outlook/>

⁴ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/568982/An_analysis_of_electricity_flexibility_for_Great_Britain.pdf

⁵ <https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future>

⁶ <https://www.gov.uk/government/publications/clean-growth-strategy>

- enabling smart homes and businesses; and
- making markets work for flexibility.

Chapter 2 of this document provides an update on progress against the actions in the Plan since its publication. To date, 15 actions have been implemented and we are committed to delivering the remaining 14 by 2022. We have also identified 9 related actions beyond those set out in the Plan that Government, Ofgem or industry have committed to since publication.

We recognise the inherent uncertainty in the changes taking place in our energy system, and that new challenges will inevitably arise. Our approach is therefore deliberately adaptive as we want to anticipate and respond to emerging trends and developments. We have set up the Smart Systems Forum to help implement the Plan and steer the Government and Ofgem's work in this area.

Chapter 3 of this document sets out the Government and Ofgem's forward priorities in this area, including implementation of the outstanding actions from the Plan and the new actions identified – including the launch of an Energy Data Taskforce run by the Energy Systems Catapult and chaired by Laura Sandys, CEO of Challenging Ideas.

If you would like to suggest other areas that we should focus on, or comment on our priorities (with respect to both policy and innovation work), then please respond to the questions at the end of Chapter 3.

2. Progress to date

Since publication of the Plan in July 2017 we have implemented 15 of the 29 actions, made significant progress against many of the others, and begun to deliver some new actions that go beyond those in the Plan.

This chapter provides a summary of that progress, with more detail on the implementation of these actions available in Annex 1.

Removing barriers to smart technologies

Our energy system was not designed with smart and flexibility technologies in mind. To move to a smarter, more flexible system, we need to ensure that our regulatory system keeps pace with technological change.

We want to create a best in class regulatory framework for smart technologies, such as storage. These smart technologies should be able to compete on a level playing field with more traditional assets to deliver improved system efficiency through integrating low carbon generation, reducing peak demand, lowering the cost of operating the system, and helping avoid or defer costly reinforcements to the network. To achieve this, we have listened to stakeholders and focused on removing the key policy and regulatory barriers. As a result, we have been examining all aspects of the policy and regulatory framework for storage including its treatment in legislation and for licensing, the planning regime, the network charging and connections regime, how policy costs are recovered, how it can co-locate with renewables, and the health and safety framework.

Since publishing the Plan in 2017, we have taken a number of steps to improve certainty over the treatment of storage, including:

- Ofgem has consulted on a modified generation licence,⁷ which clarifies storage as a subset of generation and its treatment in the applicable industry codes for storage. Holding the licence will also enable electricity storage facilities to avoid the overpayment of final consumption levies.
- Ofgem has developed new licence conditions in the Electricity Distribution Licence to clarify that Distribution Network Operators (DNOs) and Independent Distribution Network Operators cannot operate storage without Ofgem's consent.⁸ This is one of the steps being taken to ensure these licensees act impartially and do not undermine market competition by prohibiting them from operating storage assets themselves, unless for limited, specific circumstances related primarily to security of supply.

⁷ <https://www.ofgem.gov.uk/publications-and-updates/clarifying-regulatory-framework-electricity-storage-licensing>

⁸ <https://www.ofgem.gov.uk/publications-and-updates/enabling-competitive-deployment-storage-flexible-energy-system-statutory-changes-electricity-distribution-licence>

- Ofgem has published guidance for participants in the Renewables Obligation (RO) and Feed-in-Tariff (FIT) schemes who are considering co-locating electricity storage facilities with their accredited RO generating station or FIT installations without risking their existing accreditation.⁹ This builds on similar guidance relating to Contracts for Difference¹⁰ and will help enable owners to make better use of their renewables, bringing benefits to consumers and the system.
- our response to the call for evidence in 2016 stated that electricity storage is a subset of generation and that project developers and local planning authorities should bear this position in mind when considering proposed new storage facilities.¹¹ To ensure a consistent approach, the Chief Planner in England has notified Planning Authorities of the need to treat electricity storage facilities in this way.¹² The Government has also engaged widely with stakeholders on the planning process for storage in relation to the national planning threshold.
- the Government, following consultation, has introduced regulations allowing DNOs to charge assessment and design fees to recover their costs in providing connection offers irrespective of whether such offers are accepted.¹³ This will allow improvements to be made to the fairness and efficiency of the connection application process.

To provide further clarity over how to connect storage to the electricity network and, where appropriate, make this process more efficient:

- the Institution of Engineering and Technology has published a Code of Practice for Electrical Energy Storage Systems, which includes guidance on network connections.¹⁴
- the Energy Networks Association, through the Open Networks project, has established a working group to identify and make transparent best practice in flexibility queue management and identify the gaps in current connections processes. As part of this, it has consulted on whether to promote flexibility providers, including storage, within the connection queue.¹⁵ This work aims to reduce costs and the time it takes to connect.

To address disproportionate network charges faced by storage, Ofgem, in its Targeted Charging Review¹⁶, noted that changes to the residual network charges for storage could be progressed more quickly by industry to avoid the longer Significant Code Review process. Industry has raised modifications to reform transmission, distribution and balancing charges for storage, which are progressing through industry governance. The

⁹ <https://www.ofgem.gov.uk/publications-and-updates/guidance-generators-co-location-electricity-storage-facilities-renewable-generation-supported-under-renewables-obligation-or-feed-tariff-schemes-version-1>

¹⁰ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/589996/FINAL_Government_Response_to_the_CFD_Contract_Changes_Consultation.pdf

¹¹ <https://www.gov.uk/government/consultations/call-for-evidence-a-smart-flexible-energy-system> (page 17)

¹² https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/670593/Chief_Planner_Newsletter_-_December_2017.pdf

¹³ <https://www.legislation.gov.uk/ukssi/2018/254/made>

¹⁴ <https://www.theiet.org/resources/standards/eess-cop.cfm>

¹⁵ http://www.energynetworks.org/assets/files/P11.1%20Treatment%20of%20Flexibility%20-%20Consultation%20Response_vPublished.pdf

¹⁶ <https://www.ofgem.gov.uk/publications-and-updates/targeted-charging-review-consultation>

Energy Networks Association has also provided guidance on its website on the treatment of storage as non-intermittent generation in the distribution charging methodologies.

As the industry develops and storage deployment increases, it is important to ensure that an appropriate, robust and future-proofed health and safety framework is sustained. In particular, industry has highlighted the need to consolidate existing health and safety guidance, codes and working groups, and to consider the need for an umbrella standard. The Government has set up an industry-led health and safety governance group for storage which is working to achieve this.

Case Study: Liquid air energy storage

UK-based Highview Power has completed a 5MW grid-scale demonstration plant for its liquid air energy storage technology. The company uses equipment developed for the conventional power and oil and gas industries to liquefy gaseous air, store it in tanks and release it to spin turbines and produce electricity on demand.

The plant was opened in June 2018 and can now provide balancing services to the grid. At commercial scale, this technology has the potential to play an important role in providing long-duration storage to balance the UK grid.



Case Study: Co-located battery system at Blackburn Meadows

In October 2017, E.ON commissioned a 10MW lithium-ion battery at the Blackburn Meadows biomass combined heat and power (CHP) plant near Sheffield. The battery provides Enhanced Frequency Response to the Electricity System Operator, responding in less than one second by exporting or importing power to keep the frequency of electricity flows on the grid at an efficient and safe level. By carefully metering the flows of electricity on their site, E.ON has been able to co-locate the battery with the CHP plant, while keeping its accreditation for the latter under the RO scheme.



Smart homes and businesses

Demand side response (DSR) is a way in which consumers can participate in a smart energy system, shifting the time that they use energy, or turning their consumption up or down, in response to signals (usually related to price). This helps consumers manage their bills in combination with smart offers, such as smart "time-of-use" tariffs, and benefits the overall system by helping to balance supply and demand.

In the Plan, we set out a series of actions to increase participation in DSR by large users (e.g. industrial, commercial and public sector). Since publication of the Plan, we have continued to support the Electricity System Operator's Power Responsive campaign, and the development of the Association of Decentralised Energy's (ADE) code of conduct¹⁷ for aggregators in their interaction with large consumers.

In the Plan, we set out the building blocks or enablers necessary to unlock the potential for DSR from household and small business consumers. We have made the following progress:

- smart meters are a critical building block for an accessible smart energy system and there are now over 12 million smart and advanced meters operating across homes and businesses in Great Britain.¹⁸
- half-hourly settlement encourages suppliers to help consumers move their consumption away from peak times, for example through offering innovations like smart tariffs. In July 2017 Ofgem launched a Significant Code Review¹⁹ which will lead to a decision on how to proceed with market-wide settlement reform in the second half of 2019. As part of this process, in August 2018, Ofgem published an outline business case which indicates significant potential benefits from the reforms.²⁰ In light of this analysis, the emphasis has shifted from whether, to when and how, market-wide settlement reform should be introduced. Government has taken powers in the Smart Meters Act²¹ to allow Ofgem to deliver market-wide settlement reform more efficiently than under existing Significant Code Review processes.
- smart appliances are devices that are connected and able to modulate their energy consumption automatically in response to signals. They are key enablers of DSR, helping consumers to manage their bills in combination with smart offers, such as smart tariffs. Government aims to provide certainty for industry, to encourage the development of the market for smart appliances and to provide appropriate consumer protection. The Government has consulted on proposals regarding smart

¹⁷ <https://www.theade.co.uk/news/ade-news/ade-demand-side-response-code-of-conduct-consultation>

¹⁸ <https://www.gov.uk/government/statistics/statistical-release-and-data-smart-meters-great-britain-quarter-2-2018>

¹⁹ <https://www.ofgem.gov.uk/publications-and-updates/electricity-settlement-reform-significant-code-review-launch-statement-revised-timetable-and-request-applications-membership-target-operating-model-design-working-group>

²⁰ <https://www.ofgem.gov.uk/publications-and-updates/market-wide-settlement-reform-outline-business-case>

²¹ <https://services.parliament.uk/Bills/2017-19/smартmeters.html>

appliances, and published the response in October 2018.²² This explains that the Government intends to take powers to set regulatory requirements for smart appliances through primary or secondary legislation²³, when parliamentary time allows, basing any regulatory requirements on principles including interoperability, data privacy, cyber security and consumer protection.

- the Government has been working in tandem with the British Standards Institution to review the current technical standards relating to smart appliances and smart electric vehicle (EV) chargepoints. Following this, we expect industry to develop appropriate new technical standards, as necessary, and the Government will work with industry to this end.
- in addition, the Government has launched a Clean Growth Buildings Mission to at least halve the energy use of new buildings by 2030, which will involve giving consumers more control over their energy through utilising the latest smart technologies.

New sources of demand such as EVs create new opportunities for DSR and, can act as storage where they are able to export to the grid. Therefore, the Government and Ofgem are committed to ensuring that our energy system is ready for the roll-out of EVs and that they are integrated in a way which enables consumers to benefit from these opportunities. In particular, using EVs as sources of DSR and storage can reduce energy bills and help minimise the amount of new generation and network investment that will be needed. To achieve this, Government has:

- passed the Automated and Electric Vehicles Act.²⁴ This Act provides the power to require all new EV chargepoints to have smart functionality, so that consumers are able to charge their EVs when electricity prices are low, and the electricity system can benefit from the flexibility provided by millions of EV batteries.
- published the Road to Zero strategy²⁵ which sets out ambitions for EV uptake to 2030 and 2040, for EV charging infrastructure and managing the integration of EVs into the electricity system.
- launched an EV Energy Taskforce to bring together the Government and the energy and automotive industries to ensure the energy system is ready for the transition to EVs, with a strong focus on smart charging. The Taskforce has met several times, including in Birmingham at the International Zero Emissions Vehicle Summit in September 2018.
- launched a call for evidence on last mile deliveries²⁶ from which we will gather further evidence of any potential barriers preventing the electrification of fleets.

²² <https://www.gov.uk/government/consultations/proposals-regarding-setting-standards-for-smart-appliances>

²³ The UK's relationship with EU regulation, including in this area, is a matter for ongoing negotiations and these proposals are without prejudice to the UK's future relationship with the EU, after the UK has left in March 2019.

²⁴ <http://www.legislation.gov.uk/ukpga/2018/18/contents/enacted>

²⁵ <https://www.gov.uk/government/publications/reducing-emissions-from-road-transport-road-to-zero-strategy>

²⁶ <https://www.gov.uk/government/consultations/the-last-mile-a-call-for-evidence>

In addition, Ofgem has examined how electric vehicles affect different aspects of regulation. It has published a paper on the impact of electric vehicles and has consulted on reform to electricity network access to unlock capacity to accommodate electric vehicles and other demands on the system.

In addition to the many benefits of a smart energy system, there are also risks that need to be managed. Cyber security is one such risk. Therefore:

- the Government has been working to identify and address cyber security risks in the emerging smart energy system, for example through the Department for Digital, Culture, Media and Sport's (DCMS) work on Secure by Design²⁷ and via input into ADE's Code of Conduct.
- new regulations on the Security of Network and Information Systems²⁸ came into force in April 2018, creating a significant regulatory regime aimed at the security and resilience of essential services within the energy sector, within which BEIS and Ofgem jointly perform a Competent Authority role.

Case Study: Vehicle to Grid

OVO Energy is working with Nissan to deliver a domestic vehicle-to-grid demonstrator. This is supported by innovation funding from Government through Innovate UK. From April 2018, participants can register interest through their website.

The project will involve 1,000 households using OVO's grid balancing platform 'VCharge' to optimise charging/discharging according to the status of supply and demand on the electricity system. This will unlock valuable flexibility at times of peak consumption whilst delivering the vehicle charge that consumers want.



Case Study: Smart time of use tariff introduced

In June 2018, Octopus Energy launched Britain's first half-hourly time of use tariff, called Agile Octopus.

Agile uses data from smart meters to pass on the price of electricity to customers as it varies throughout the day.

This means customers can access cheap electricity by using it when demand is low or when there is plenty of generation available, which in turn enables the grid to optimise for cleaner power.



²⁷ <https://www.gov.uk/government/publications/secure-by-design>. DCMS is publishing a Code of Practice for Consumer IoT Security <https://www.gov.uk/government/publications/secure-by-design/code-of-practice-for-consumer-iot-security>, and Consumer Guidance on Smart Devices in the Home https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/747624/Consumer_Guidance_for_Smart_Devices_in_the_Home_Oct_2018.pdf. This will help UK consumers to set-up, manage and improve the cyber security of their devices.

²⁸ <https://www.gov.uk/government/collections/nis-directive-and-nis-regulations-2018>

Making markets work for flexibility

Making markets work for flexibility is key to ensuring that services, such as storage and demand side response, are fairly rewarded for the value they provide to the energy system. Flexibility providers are already competing against traditional forms of generation, particularly in balancing services and the Capacity Market.

In the Plan, we considered each of the main energy markets to ensure that flexibility providers have fair access to these markets and could stack value across them. Since publication of the Plan, the following progress has been made:

- the Electricity System Operator (ESO) has reviewed how it can improve and simplify the way it procures balancing services and has committed to receiving 30-50% of competitive tenders from demand side flexibility by 2020. For over 12 months, this ambition has been met on a monthly basis, with some months exceeding 50%.²⁹ Since its System Needs and Product Strategy³⁰ was published in June 2017, it has published roadmaps on frequency response and reserve, restoration, reactive power and wider access to the balancing mechanism.³¹ The ESO will continue to engage with stakeholders on simplifying products and creating transparency around system needs. This will ensure a level playing field for technologies and business models able to offer up services to the ESO.
- Ofgem, the ESO and industry, supported by the Government, have been working to open up access to the balancing mechanism, including through implementing the European Balancing Project TERRE (Trans European Replacement Reserves Exchange). These changes will, amongst other things, enable access for aggregators as well as flexibility providers connected to the distribution network. This will release another source of revenue for aggregators and smaller storage and demand side response (DSR) providers and has the potential to reduce costs in the balancing mechanism through increasing liquidity in the market.
- in the Capacity Market, we have simplified metering requirements, and enabled the stacking of value between the Capacity Market and balancing services. These changes enable greater access to the Capacity Market and make it easier for providers to build a business case based on multiple revenue streams. Government also introduced changes to the scheme in order that the contribution made by short duration batteries is not overvalued.

In addition to opening up existing energy markets, it is fundamental to a smart and flexible system that flexibility is fairly rewarded for the value it can provide through new markets at a distribution network level. To achieve this:

- Distribution Network Operators (DNOs) have committed to opening up network requirements to markets and competition on a business-as-usual basis³² and

²⁹ From May 2017 to July 2018.

³⁰ <https://www.nationalgrid.com/uk/documents/84261-system-needs-and-product-strategy-final>

³¹ <https://www.nationalgrid.com/uk/electricity/balancing-services/future-balancing-services>

³² <http://www.energynetworks.org/electricity/futures/open-networks-project/eoy-report-2017.html>

several DNOs have already launched tenders for flexible solutions to network issues. This will provide revenue opportunities for non-traditional network solutions such as storage, DSR and energy efficiency. This is part of DNOs becoming Distribution System Operators (DSOs) where they are more active managers of their networks, implementing innovative solutions as alternatives to network reinforcement. Ofgem's RIIO framework facilitates this.³³ DSOs have also committed to ensuring coordination with the ESO to ensure that there are no conflicting signals sent to different actors in the energy system.

- as part of the Open Networks project, the Energy Networks Association has consulted on a range of market models for the DSO transition,³⁴ to inform the debate on how flexibility services can be procured and set out the links between different actors under different models. This work will feed into Ofgem and Government's considerations about future market reforms.

Ofgem has been considering how to send price signals through network charging arrangements. Doing so should reduce the amount of procurement or buying of services by network operators. Ofgem published initial proposals for a review of access and forward-looking charges in July 2018³⁵ which seek to provide users with improved signals for the incremental costs or benefits of their network usage. This should lead to more efficient use of the network, lowering costs.

Ofgem has set out in their Framework decision for the RIIO-2 price control,³⁶ the aim to create a level playing field in price controls between demand and supply side solutions to network constraints. And that the price controls for the distribution sectors will be designed with sufficient flexibility to respond to changes in the role of networks, given work to consider the need for wider changes in the structure of the future energy market. In the meantime, as the role of the ESO evolves and DSOs emerge, it is essential that we address any conflicts of interest that may arise as a result of network operators opening up network requirements to the market. To help address this:

- Ofgem has clarified that DNOs cannot operate generation, including storage – see section on 'removing barriers to smart technologies' above.
- the Government and Ofgem have been working with National Grid to deliver legal separation of the ESO within National Grid plc group. A more independent ESO will lead to greater competition, enable markets to innovate, drive efficient outcomes and incentivise flexibility at least cost to consumers. In September 2018, Ofgem published the licence modifications necessary for National Grid ESO to take over the electricity system operators functions from National Grid Electricity Transmission from 1 April 2019, a key milestone towards achieving full separation. Also, in September, the ESO launched a separate visual identity. This allows industry to be clear when they are engaging with the ESO. Ofgem is also updating the regulatory and incentives framework for the ESO, with a new incentives

³³ <https://www.ofgem.gov.uk/network-regulation-riio-model>

³⁴ <http://www.energynetworks.org/electricity/futures/open-networks-project/future-worlds/future-worlds-consultation.html>

³⁵ <https://www.ofgem.gov.uk/publications-and-updates/getting-more-out-our-electricity-networks-through-reforming-access-and-forward-looking-charging-arrangements>

³⁶ <https://www.ofgem.gov.uk/publications-and-updates/riio-2-framework-decision>

framework put in place in April 2018 and work ongoing to develop an appropriate price control specifically for the ESO.

- the Government and Ofgem have set an expectation that network operators address the conflict of interest that arises from them being the specifier of network requirements and a potential provider in meeting those requirements. Some DNOs are already taking action to address this, for example, by ring-fencing teams within their businesses to specify network requirements and procure solutions, and by independently auditing the decisions they take in order to provide transparency to the market. The effectiveness of actions to mitigate potential and perceived conflicts of interest are one of the aspects that Ofgem and Government will take into consideration when considering if further changes are needed to the structure and roles of network companies.

Engineering standards underpin how the GB electricity network is planned and operated. Incremental updates have taken place since their creation in the mid-twentieth century, but there is a risk that out-of-date standards lead to sub-optimal build decisions by network companies, which fail to reflect changing technologies and approaches, increasing costs to consumers. 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. The DNOs have developed a revised standard (P2/7) and submitted this to Ofgem for approval. This revised standard will take account of smarter pricing signals in establishing the level of peak demand to secure, including time of use tariffs and network charges and the effect these may have in shifting demand away from the peak. P2/7 will also take account of the contribution from Distributed Energy Resources to network security. Both have the potential to help defer or avoid investment in costly network assets.

Case Study: Increasing generation access to balancing mechanism

In August 2018, Limejump launched a service that gives smaller generators access to the balancing market on a minute-by-minute basis. This is an industry first made possible through a derogation issued by Ofgem.

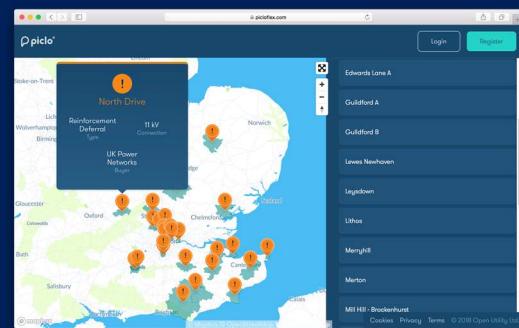
The introduction of a wider code modification through Project TERRE will open up the balancing market to a wider range of flexibility providers, which should drive down costs to the end consumer and increase system security.



Case Study: Piclo Flex

Piclo has launched an independent marketplace (Piclo Flex) which allows DSOs and flexibility providers to find and contract with each other. It enables distributed resources to identify where flexibility is needed via a dashboard, pre-qualify assets, and receive notification of relevant auctions.

Overall, the platform helps to identify DSO requirements and lowers barriers for entry for flexibility providers. Piclo is already trialling its platform with five DSOs.



Innovation

The Government, UK Research and Innovation expect to invest around £265 million between them, in smart systems research, development, and demonstrations up to 2021.³⁷ The Government expects to invest up to £70 million of this in its BEIS Smart Energy Innovation programme. Since publication of the Plan, funding has been awarded to multiple innovation projects under the following competitions:³⁸

- feasibility studies on first-of-a-kind large scale energy storage, and approaches to valuing and trading flexibility at a local level. These competitions are now complete.
- feasibility studies on domestic and commercial demand side response. Projects under these competitions are now complete and subsequent demonstration projects are underway.
- a competition focused on energy storage cost reduction. This competition is supporting seven projects, due for completion in 2021 and includes technologies such as flow batteries, power-to-gas systems and novel battery chemistries.

The Government has launched a £30 million innovation competition supporting the development and demonstration of a range of innovative vehicle-to-grid (V2G) technologies and business models, through more than 20 projects. Innovation funding such as this has led to the UK being recognised as one of the first markets to explore V2G at scale.³⁹

In addition, the UK's involvement in the international Mission Innovation programme⁴⁰ has led to joint innovation competitions with South Korea and Canada which have a focus on smart energy systems and technologies.

The Plan highlighted the announcement of the Faraday Battery Challenge, a £246 million investment to ensure the UK leads the world in the design, development and manufacture of electric vehicle batteries. To date the Faraday Battery Challenge has supported the creation of the £78 million Faraday Institution to speed up research into battery technologies, through which £42 million has already been invested in four 'fast-start' projects⁴¹ on extending battery life, battery system modelling, recycling and reuse and next generation solid state batteries. Innovate UK has invested £60 million in 39 feasibility studies and collaborative research and development projects over two rounds (to date) including improving battery lifespan and range, and how to reuse, remanufacture and recycle batteries at their end-of-life. As part of the Faraday Battery Challenge, UK Research and Innovation has invested £80 million in the UK Battery Industrialisation

³⁷ Announced in the 2017 Clean Growth Strategy: <https://www.gov.uk/government/publications/clean-growth-strategy>

³⁸<https://www.gov.uk/guidance/funding-for-innovative-smart-energy-systems>

³⁹ <http://www.cenex.co.uk/vehicle-to-grid/>

⁴⁰ <http://mission-innovation.net/>

⁴¹ <https://faraday.ac.uk/fast-start-projects/>

Centre⁴² through a consortium of Coventry and Warwickshire Local Enterprise Partnership, Warwick Manufacturing Group and Coventry City Council.

The Government has also launched the £102 million Prospering from the Energy Revolution Challenge.⁴³ This Industrial Strategy Challenge Fund programme will research, develop and demonstrate integrated smart local energy solutions across power, heat and transport to provide cleaner and cheaper energy for consumers, while building more prosperous and resilient communities. The first Energy Revolution projects have started, and UK Research and Innovation is currently evaluating bids for the Energy Revolution Research Consortium, concepts, designs, and demonstration projects.

Ofgem has incentives on innovation and runs an annual network innovation competition worth up to £600m over eight years as part of its RIIO framework for regulating the system and network companies. Ofgem is also running its Innovation Link initiative where those with new services or ideas can seek advice on how they can navigate existing market and regulatory rules.

⁴² <https://www.ukbic.co.uk/>

⁴³ <https://www.gov.uk/government/news/prospering-from-the-energy-revolution-full-programme-details>

3. Priorities for Government and Ofgem

We have now implemented over half of the 29 actions in the Plan and we will continue work to implement each of those that remain. This section outlines our forward priorities linked to the Plan, including some new actions.

Removing barriers to smart technologies

We will continue to build a best in class regulatory framework for smart technologies, such as storage, and will focus on completing the outstanding actions from the Plan. We are keen to understand any new barriers which project developers and innovators are encountering.

In the Plan, the Government committed to define electricity storage as a distinct subset of generation in the Electricity Act 1989, when Parliamentary time allows. This will clarify the treatment of storage across the energy system, strengthening the impacts of other actions. We have completed preparatory work for this measure and we are seeking an appropriate opportunity and legislative vehicle to introduce it.

Ofgem has consulted on modifying the generation licence to include storage and will finalise these changes shortly. Holding the licence will enable electricity storage facilities to avoid overpayment of final consumption levies (FCLs)⁴⁴, which should only be paid by final consumers. Electricity supplied to storage facilities licensed as generation is excluded from the supply volumes used to calculate the costs of the Renewables Obligation and Feed In Tariff schemes (which, at present, make up over two thirds of FCLs). The Government and Ofgem are working with Elexon, the Low Carbon Contracts Company and the Electricity Settlements Company to ensure that the same approach will be applied to supply volumes used to settle amounts due under the Contracts for Difference scheme and for Capacity Market auctions.

As part of the Plan, the Government committed to review the treatment of storage in the planning regime. We intend to launch a consultation on the treatment of electricity storage facilities with respect to the national planning threshold, to ensure that they are assessed fairly in the planning system without facing inappropriate barriers to deployment.

Ofgem will continue to monitor industry's development of the charging code modifications and its ongoing work to improve network connections for storage. Ofgem expects to see swift progress in these areas.

Industry will finalise the code modifications that have been raised on transmission, distribution and balancing charges for storage and submit these to Ofgem for approval. For transmission (TNUoS) and distribution (DUoS) charges, these code modifications will address the overpayment of residual charges faced by storage. As balancing (BSUoS)

⁴⁴ The Government has already clarified that the electricity received and stored by electricity storage facilities may be supplied to them free from the Climate Change Levy, where relevant conditions are met. See HMRC's Excise Notice CCL1/3 – Reliefs and special treatments for taxable commodities.

charges are not split into residual and forward-looking elements in the same way as TNUoS and DUoS, industry should consider whether certain elements of this charge can be isolated and removed to ensure that storage is charged appropriately.

There are several key actions for industry to take forward to ensure that the network connections process is appropriate and does not present any undue burdens to storage:

- Ofgem has asked all DNOs to ensure they provide clear and transparent information relating to the introduction and charging of assessment and design fees, including through consultation with their stakeholders. Ofgem has also asked the Energy Networks Association (ENA) to establish a forum for ensuring a common approach across different regions, and that where differences do occur, these are justified and appropriate.
- following the introduction of fast track approaches for connecting small scale storage by three DNOs (UKPN⁴⁵, SSE⁴⁶ and WPD⁴⁷), the ENA and other network operators should consider how a fast track approach could be implemented more widely.
- the Electricity System Operator (ESO) and ENA will conclude their reviews of the technical requirements for storage seeking to connect to the transmission and distribution networks respectively. The ESO will consult on this by the end of 2018. Any code modifications necessary to amend these requirements will be submitted to Ofgem for approval.
- the ENA will continue its work through the Open Networks Project to establish best practice in queue management for connecting storage and other flexibility providers. By the end of 2018 it will consult on specific changes to improve the queue management process, with a view to these changes being implemented by network operators promptly thereafter. The ENA will also publish guidance on connections for flexibility providers, including storage, by the end of 2018.
- DNOs will continue to outline in their Incentives on Connections Engagement reports – submitted to and discussed with Ofgem each year – the steps they intend to take to improve the connection process for flexibility sources, including storage. These reports are also available online on the DNOs' websites.

The Government will continue to support the industry-led Health and Safety governance group for storage to sustain an appropriate, robust and future-proof framework.

⁴⁵ <https://www.ukpowernetworks.co.uk/electricity/distribution-energy-resources>

⁴⁶ <https://www.ssen.co.uk/Stageoneconnections/>

⁴⁷ <https://www.westernpower.co.uk/my-connection/connecting-generation-and-energy-storage/g59q99-fast-track-applications>

Smart homes and businesses

We will continue to support work to increase the participation of large users in demand side response (DSR), including via the Electricity System Operator's ongoing Power Responsive campaign and through the launch of the Association of Decentralised Energy's (ADE) code of conduct for aggregators.

We will also continue to put in place the enablers that will unlock DSR at the smaller scale. This includes the Government's commitment to ensure that every household and small business is offered a smart meter by the end of 2020. Ofgem intends to decide on the case for market-wide settlement reform in the second half of 2019. The Government will work with Ofgem to determine the most appropriate point at which the powers under the Smart Meters Act should be drawn on to support implementation of the reforms.

Following the Government's consultation response on smart appliances, the Government intends to take powers to set regulatory requirements for smart appliances, when Parliamentary time allows, either through primary or secondary legislation.⁴⁸ Our work with industry on technical standards for smart appliances will continue in parallel.

Following the introduction of the powers in the Automated and Electric Vehicles Act, the Government will introduce secondary legislation which will prescribe requirements for smart charge points for electric vehicles (EVs). We will consult industry on these proposals by early 2019. The EV Energy Taskforce will also report on proposals for the Government and industry in 2019.

Government has now passed legislation through Parliament giving Ofgem the powers to introduce an energy price cap which will protect up to 11 million households on standard variable and default tariffs. As the rollout of smart meters progresses, and smart tariffs and other innovations become more commonplace, it will be necessary to consider if further consumer protections are needed to ensure they keep pace.

The Government has announced a review into Smart Data⁴⁹, off the back of our Consumer Green Paper⁵⁰, looking at how best to ensure that data portability is implemented in a way which supports consumers in regulated markets. This includes the retail energy market and builds upon the Midata project.⁵¹ The review will seek to identify the next steps that Government, regulators and others need to take to accelerate development of innovative intermediaries to improve the consumer experience; ensure a wide range of consumers can benefit from these services (not just the digitally confident); and establish a regulatory and policy framework which builds consumer trust in data portability, whilst addressing any market barriers.

We have been discussing with stakeholders further potential issues for consumers in a smart energy system and have begun work in some of these areas, including:

⁴⁸ The UK's relationship with EU regulation, including in this area, is a matter for ongoing negotiations and these proposals are without prejudice to the UK's future relationship with the EU, after the UK has left in March 2019.

⁴⁹ <https://www.gov.uk/government/publications/smart-data-review/smart-data-review-terms-of-reference>

⁵⁰ <https://www.gov.uk/government/consultations/consumer-green-paper-modernising-consumer-markets>

⁵¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/729908/midata-energy-sector-government-response.pdf

- setting out our intention to make consumer protection a key principle underpinning the regulation of smart appliances.
- working with industry to consider how to update the Standard Assessment Procedure to recognise smart technologies and their impacts on energy performance of homes. This could include smart technologies appearing as recommendations on Energy Performance Certificates, and could make it easier for smart technologies to be utilised under policies such as the Private Rented Sector Regulations and the Energy Company Obligation.
- in developing its proposals on access reform and its Targeted Charging Review, Ofgem will consider the implications for different types of consumer.

Ofgem is also considering the evolution of future retail markets and the development of innovative offerings like time of use tariffs.

We will continue to engage with stakeholders and evaluate the potential issues for consumers in a smart energy system to ensure protections remain appropriate and we would welcome your views on the areas we should focus on, in response to our questions at the end of this chapter.

The Government will work with stakeholders and international partners to consider the benefits of introducing a method of assessing how optimised a building is for smart technologies, for example, we will continue to engage with the EU Commission on the development of its Smart Readiness Indicator⁵².

The Government will launch a call for evidence seeking views on our proposed next steps to deliver the Clean Growth Buildings Mission, including actions to make new homes and businesses smart, early next year.

We will continue work to identify and address cyber security risks in the emerging smart energy system. This includes ongoing consideration of the impact of the Network and Information Systems Directive for the downstream smart energy system.

Making markets work for flexibility

A high priority is the creation of the missing market at a local network level. We expect network companies to open up network requirements to competition on a business-as-usual basis and to address the potential for conflicts of interest to arise from them also being a provider of network solutions. We will continue to work with industry to support this transition to ensure flexibility is valued in the distribution networks. The Government and Ofgem are prepared to take further action if the network and system operators do not take adequate measures to address conflicts of interest. The Government and Ofgem will also consider models for introducing flexibility at a local level which are not constrained by existing Distribution Network Operator (DNO) regions and geographies. For example, new

⁵² See 2018 revised Energy Performance of Buildings Directive:
<https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings>

trading platforms could enable assets to operate flexibly across different markets irrespective of historic boundaries.

Ofgem has concluded a consultation on the framework for the next set of price controls (RIOO-2) and will now focus on proposals for sector-specific methodologies, following on from their decision on the framework. The proposals will be designed so that companies develop their networks to respond to the changes happening across the energy system, simplify the way outputs and incentives are set and ensure returns that companies earn are fair for consumers and investors. Ofgem will shortly be consulting on making changes to electricity distribution licence conditions to provide clarity on what it means for DNOs to 'maintain economic, efficient and coordinated networks' and alongside will publish a guidance document setting out Ofgem's expectations.

Ofgem and the Electricity System Operator (ESO) will make changes to allow demand side response providers to reallocate their assets in the Capacity Market ahead of pre-qualification in 2019. The Government has also launched a call for evidence on the Capacity Market and Emissions Performance Standard review to seek views on how new smart technologies, including demand side response, can be facilitated fairly in the Capacity Market.

Many stakeholders have identified the visibility and use of data and the code governance system as barriers to the development of a smart, flexible energy system. As a result:

- the Government and Ofgem are launching an Energy Data Taskforce⁵³ run by the Energy Systems Catapult and chaired by Laura Sandys, CEO of Challenging Ideas. The Taskforce will look across the energy sector, identify gaps where data can be used more efficiently and make clear, actionable, recommendations for Government, Ofgem and industry. The Taskforce will consider who should access different data sets, proposals for standardisation and interoperability, the roles of different parties in governing data and how risks associated with data should be managed. Better use of data can help key players, such as network companies, operate and manage the energy system in the most effective way. Improved data flows between parties will support competitive markets, innovation and new business models, and enable technologies to know where they can deliver value on the system and provide benefits to consumers.
- Ofgem is already working to improve the current system of code governance. The Government, working together with Ofgem, will consider whether further action is needed to ensure that the code process works in the interests of consumers as part of our response to the Cost of Energy Review.

We will continue to run the Smart Systems Forum which provides input, assistance and advice to the Government and Ofgem on the implementation of the Smart Systems and Flexibility Plan and on how best to take forward the priorities set out here.

⁵³ <https://www.gov.uk/government/groups/energy-data-taskforce>

Innovation

In July 2018, Ofgem announced its decision on the framework for the second series of RIIO price controls. This included maintaining a focus on innovation but with greater focus on innovative projects which might not otherwise happen and which are aligned with energy transition challenges.

The Government will continue to monitor delivery and outcomes across each of our innovation competitions. This work will be used to inform decisions on further research and demonstration projects. We will also run a pilot to increase electrical capacity at a motorway service area. The pilot will determine what combination of increased network connection, new innovative technologies and storage could be pursued to facilitate greater numbers of chargepoints, including the higher-powered rapid chargepoints (150kW – 350kW) that will be needed to meet demand in the future.

Further innovation programmes to support smart, flexible energy systems will be developed and launched by Government by March 2019.

The Faraday Battery Challenge continues to deliver research and innovation in battery technology. The Faraday Institution will complete its engagement event programme with industry and academia and will fund its next £20 million wave of early technology readiness research projects. Alongside this a third round of collaborative research and development projects was announced by the Prime Minister at the Zero Emission Vehicle Summit in September with an indicative budget of £25 million. The UK Battery Industrialisation Centre (UKBIC) will, in 2020, open a centre that will de-risk high volume manufacturing of batteries in the UK. The Challenge will continue to support evidence gathering on the economics, infrastructure and the regulatory landscape of batteries and, via the Faraday Institution and UKBIC facility, will support the development of skills to make the UK the go-to place for battery research and development, and manufacturing.

The Government and UK Research and Innovation will drive forward the Prospering from the Energy Revolution programme and by January 2019, anticipate that the following will be underway: 10-15 concept and design studies; up to three large demonstrators; the Energy Revolution Research Consortium which will generate world-leading knowledge and insights; and, an independent impact evaluation. By summer 2019, a competition for detailed designs for smart local energy systems will be launched and an international mission to help innovative UK SMEs develop overseas markets will have taken place. The Energy Systems Catapult will support the programme by providing co-ordination, technical expertise and guidance on project integration and innovation.

The Government would also welcome stakeholder views on how future public innovation support over the next five years should be prioritised to help develop a smart and flexible energy system.

Questions for stakeholders

We recognise that as we work to implement the priorities outlined above, new issues will inevitably arise, and we may need to take further action or adapt our approach. We have worked closely with industry throughout the process of developing the Plan and since its publication. We will continue this engagement going forward and would welcome input from our wider stakeholder network at this stage.

If you would like to suggest areas that we should focus on which are not already included in our package of actions, or comment on our priorities (with respect to both policy and innovation work), then please respond to the following questions.

Question:

- | | |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Are there actions relating to a smart and flexible energy system that you think we should be prioritising, which are not discussed above (or included in Annex 1)? Please provide evidence and analysis to support your answer where appropriate. |
| 2. | Please identify and describe any key research and innovation needs which, if supported with funding in the next five years, could reduce the cost or increase the cost-effective deployment of flexibility in the system. Please provide evidence to support your answer where appropriate. |

4. General information

We are seeking the views of energy industry players, including new entrants, and consumer groups on questions around how our energy system could be smarter and more flexible. If you would like to suggest other areas that we should focus on, or comment on our priorities (with respect to both policy and innovation work), then please respond to the questions at the end of Chapter 3 by 14th January 2019.

Your response will be most useful if it is framed in direct response to the questions posed, though further comments and evidence are also welcome. Responses should be emailed to smartenergy@beis.gov.uk and flexibility@ofgem.gov.uk. Hardcopy responses sent to the BEIS or Ofgem postal address will also be accepted.

Enquiries to:

BEIS
Electricity Systems Team
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Abbey 1, L3, 1 Victoria Street, London, SW1H 0ET
Tel: 0300 068 4000
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Energy System Transition Team
Office of Gas and Electricity Markets
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Territorial extent:

Great Britain

Additional copies:

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Annex 1: Progress tracker

The tables below track progress against each of the policy areas in the Smart Systems and Flexibility Plan. The tables set out each issue that the actions in the Plan were designed to address, whether the action has been implemented, progress to date, and what work will be done next.

Where the status of an action is ‘implemented’, it means that all the necessary steps have been put in place to fulfil our commitments in the Plan. However, we also recognise that for some implemented actions the Government and/or Ofgem should continue to engage and drive progress. For example, we have fulfilled a commitment to address potential health & safety issues regarding storage by creating an industry-led group, and therefore we count the action as being implemented. However, this group will need to do the work necessary, and we will continue to participate in the group on an ongoing basis.

We have also begun to deliver in areas which were not part of the actions laid out in the Plan. Where we have identified new actions since the publication of the Plan, these are labelled as “new” in the tables below.

Removing barriers to smart technologies

Issue	Action	What we have done	What we will do next
Network charges can, in some scenarios, put storage at a relative disadvantage to other network users, preventing a level playing field.	IN PROGRESS 1.1	<p>Ofgem published its Targeted Charging Review setting out its view that, for storage, industry should bring forward modification proposals to make changes within the current charging framework.</p> <p>Industry has raised modifications for reform of transmission, distribution and balancing charges which aim to reduce disproportionate network charges for storage.</p> <p>The Energy Networks Association (ENA) published a statement that Distribution Network Operators (DNOs) consider that electricity storage falls within the definition of non-intermittent generation.</p>	Industry will finalise charging code modifications to address the storage issues identified in the Plan, and it is expected that these will be submitted promptly to Ofgem for approval.
Storage is not defined in primary legislation. Its regulatory status within the electricity system and planning regimes is unclear.	IN PROGRESS 1.2	<p>Ofgem has consulted on a modified generation licence for storage.</p> <p>The Government has completed preparatory work to define storage in primary legislation.</p> <p>The Chief Planner in England notified Planning Authorities of the need to treat electricity storage facilities in the same way as generating stations in the planning system.</p>	<p>Ofgem will implement changes to the generation licence to include storage via statutory consultation.</p> <p>The Government will define storage in primary legislation when Parliamentary time allows.</p> <p>The Government intends to consult on the treatment of electricity storage facilities with respect to the national planning threshold.</p>

Issue	Action	What we have done	What we will do next
Electricity procured by storage facilities from suppliers anomalously includes the cost of final consumption levies.	IN PROGRESS 1.3	<p>Ofgem has consulted on modifying the generation licence to include storage and will finalise these changes shortly. Holding the licence will enable electricity storage facilities to avoid overpayment of final consumption levies (FCLs). Electricity supplied to generation licence holders is excluded from the supply volumes used to calculate the costs of the Renewables Obligation (RO) and Feed in Tariff (FIT) schemes (which currently make up over two thirds of FCLs), and this will also apply to the Contracts for Difference (CFD) scheme and Capacity Market auctions.</p> <p>The Government has clarified that the electricity received and stored by electricity storage facilities may be supplied to them free from the Climate Change Levy, where relevant conditions are met.⁵⁴</p>	The Government and Ofgem are working with Elexon, the Low Carbon Contracts Company and the Electricity Settlements Company to ensure that the supply volumes used to settle amounts due under the CFD scheme and Capacity Market auctions are calculated appropriately for storage.
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 1.4	Ofgem has published guidance for participants of the RO and FIT schemes who are considering co-locating electricity storage facilities with their accredited RO generating station or FIT installation, without risking their existing accreditations. This follows guidance that had been issued previously for the CFD scheme.	

⁵⁴ As set out in HMRC's Excise Notice CCL1/3 – Reliefs and special treatments for taxable commodities.

Issue	Action	What we have done	What we will do next
Synergies between a smart energy system and future Government policy on small-scale low-carbon generation should be realised.	IN PROGRESS	1.5 The Government has published a call for evidence for the future of small-scale low-carbon generation. This includes consideration of a time of export tariff.	The Government is considering responses to its call for evidence and intends to respond in due course, including on whether there is a need for intervention on a guaranteed route to market.
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	<p>1.6 SSE and WPD have published fast-track approaches for connecting small scale storage systems to the network. This follows a similar approach published by UK Power Networks in 2017.</p> <p>The Institution of Engineering and Technology has published a code of practice which includes network connections for storage systems.</p> <p>The Government introduced regulations allowing Distribution Network Operators (DNOs) to charge assessment and design fees to recover the costs of providing connections offers, which will enable improvements to be made to the connection process.</p> <p>The Energy Networks Association (ENA), through the Open Networks Project, has established a working group to improve the connections process, and has consulted on whether to promote flexibility providers, including storage, within the connection queue.</p>	<p>Industry will conclude its review of the technical requirements for connecting storage to the network, to ensure they are appropriate for storage. It will consult on changes to the relevant transmission and distribution codes by the end of 2018.</p> <p>Ofgem has asked all DNOs to ensure they provide clear and transparent information relating to the charging of assessment and design fees, and it has asked the ENA to establish a forum for ensuring a common approach.</p> <p>The ENA, through the Open Networks Project, will consult on specific changes to the queue management process by the end of 2018, with a view to changes being implemented by network operators soon after.</p> <p>The ENA will publish a connection guide for flexibility providers, including storage, by the end of 2018.</p>

Issue	Action	What we have done	What we will do next
The health and safety framework needs to keep pace with a rapidly changing technical and commercial landscape.	IMPLEMENTED 1.7	An industry led health and safety governance group, administered by the British Standards Institution, has been set up to ensure that an appropriate, robust and future-proof health and safety framework is sustained as industry develops and storage deployment increases.	The health and safety governance group will agree priorities and report back to the Government and industry on an ongoing basis.
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 1.8	Ofgem has consulted on a new condition in the electricity distribution licence to ensure that DNOs cannot operate generation, including storage, without Ofgem's consent.	Ofgem published draft guidance alongside its statutory consultation. If after considering responses, these licence changes are implemented, Ofgem will publish the final guidance with the decision document that implements the licence changes.

Issue	Action	What we have done	What we will do next
		IMPLEMENTED	
<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 £600million is available between 2013-2021, but further trials may be needed outside the parameters of these competitions.</p>	<p>1.9</p>	<p>The Government launched a competition to reduce the cost of large scale energy storage technologies (including electricity storage, thermal storage, and power-to-gas technologies). Funding has now been committed, and projects are underway and due to complete in 2021.</p> <p>The Government launched a competition for feasibility studies for 'first of a kind' large scale storage technologies. These studies have now been concluded.</p> <p>The £102.5 million Prospering from the Energy Revolution competition has been launched which will develop and demonstrate integrated local energy solutions across power, heat and transport to provide cleaner, cheaper and more resilient energy for consumers.</p> <p>Alongside the Plan, the £246 million Faraday Battery Challenge was launched. To date it has supported the creation of the £78 million Faraday Institution to speed up research into battery technologies; the £80 million UK Battery Industrialisation Centre (UKBIC) to help upscale the supply chain; and, collaborative research and development projects, including improving battery lifespan and range, and how to reuse, remanufacture and recycle batteries at their end-of-life.</p>	<p>Projects under the competition to reduce the cost of large scale energy storage technologies will be delivered by March 2021.</p> <p>The Faraday Battery Challenge will continue to deliver research and innovation in battery technology, including the next £20 million wave of early technology readiness research projects, a £25 million third round of collaborative research and development projects, and UKBIC will open in 2020 to de-risk high volume manufacturing of batteries in the UK.</p> <p>New: The Government and UK Research and Innovation will drive forward the Prospering from Energy Revolution programme and by January 2019, anticipate that the following will have begun: the Energy Revolution Research Consortium, 10-15 concept and design studies, up to three large demonstrators, and an independent evaluation. By summer 2019, a competition for detailed designs for smart local energy systems will be launched and an international mission will have been run.</p>

Smart homes and businesses

Issue	Action	What we have done	What we will do next
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	2.1 We have supported and engaged with the Electricity System Operator's (ESO's) Power Responsive campaign which was launched to increase demand side response (DSR) participation by large industrial and commercial consumers.	We will continue to fully engage with the ongoing Power Responsive campaign, which is beginning to consider domestic DSR and electric vehicle (EV) charging.
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	2.2 Crown Commercial Service (CCS) launched a new framework to enable public sector consumers to access DSR.	The CCS will continue to assess the scope of the DSR framework, in advance of a formal review in 2019.
Smart meters are the foundation of an accessible smart energy system for consumers.	IN PROGRESS	2.3 There are now over 12 million smart and advanced meters operating across homes and businesses in Great Britain.	We will continue our programme to ensure that every household and small business is offered a smart meter by the end of 2020.

Issue	Action	What we have done	What we will do next
IN PROGRESS			
Existing price signals through the electricity settlement arrangements do not encourage suppliers to offer smart tariffs.	2.4	<p>To address this issue, work has begun to assess the case for a move to market-wide half-hourly settlement.</p> <p>In July 2017 Ofgem launched a Significant Code Review on market-wide settlement reform with a view to taking a final decision in the second half of 2019. Work has progressed in a number of areas since then including:</p> <ul style="list-style-type: none"> • publishing two iterations of the business case, setting out the strategic rationale and economic case for the reforms;⁵⁵ • consulting on whether to change existing rules regarding energy suppliers' access to consumers' energy consumption data so as to balance consumer choice over data sharing with realising the benefits of the reforms;⁵⁶ • consulting on whether to centralise the functions currently performed by supplier agents (who carry out certain roles related to the retrieval and processing of data for settlement on behalf of suppliers).⁵⁷ <p>In parallel, Elexon has been leading a Design Working Group with industry parties to consider</p>	<p>Ofgem will publish a call for evidence on consumer impacts of market-wide settlement reform by the end of 2018.</p> <p>Ofgem will publish a decision on data access for settlement purposes by the end of 2018, and a decision on whether or not to centralise agent functions by winter 2018/19.</p> <p>Elexon will deliver a final preferred Target Operating Model to Ofgem in spring 2019.</p> <p>Ofgem will publish a consultation on a draft Impact Assessment for the full business case in summer 2019.</p> <p>Ofgem will publish the full business case and a decision on market-wide settlement reform in the second half of 2019.</p>

⁵⁵ <https://www.ofgem.gov.uk/publications-and-updates/market-wide-half-hourly-settlement-hhs-strategic-outline-case>

⁵⁶ <https://www.ofgem.gov.uk/publications-and-updates/consultation-access-half-hourly-electricity-data-settlement-purposes>

⁵⁷ <https://www.ofgem.gov.uk/publications-and-updates/consultation-supplier-agent-functions-under-market-wide-settlement-reform>

Issue	Action	What we have done	What we will do next
		<p>options for the Target Operating Model, which outlines how settlement arrangements (including market participants, industry organisations and code bodies) will need to change to deliver market-wide half-hourly settlement.⁵⁸</p> <p>In addition, the Smart Meters Act provides Ofgem with new powers to directly modify industry codes for the purposes of delivering half-hourly settlement, providing a more efficient route for delivering the reforms than through the Significant Code Review process.</p>	
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 2.5	<p>We have taken a number of steps to remove barriers to suppliers offering smart tariffs, including the roll-out of smart meters and delivery of elective half-hourly settlement. We judge this is sufficient to enable suppliers to develop and offer smart tariffs – which some suppliers have already begun to offer.</p> <p>In July 2017 Ofgem published a report on the distributional impacts of time-of-use tariffs.⁵⁹</p> <p>As part of actions under 2.4 and 2.9 above, the Government and Ofgem is considering the potential social impacts of smart tariffs.</p>	<p>We will continue to monitor market developments in this area and the expected roll out of new products.</p> <p>We will continue to consider social impacts under actions 2.4 and 2.9</p>

⁵⁸ <https://www.elexon.co.uk/group/design-working-group/>

⁵⁹ <https://www.ofgem.gov.uk/publications-and-updates/distributional-impacts-time-use-tariffs>

Issue	Action	What we have done	What we will do next
IMPLEMENTED			
Limited availability of smart appliances means consumers cannot realise bill savings by providing demand response.	2.6	<p>The Government has consulted on taking powers to set regulatory requirements for smart appliances, basing any regulation on principles including interoperability, data privacy, cyber security and consumer protection.</p> <p>The Government has been working with the British Standards Institution to review the current landscape of technical standards relating to smart appliances and smart EV chargepoints in collaboration with industry.</p> <p>Since publication of the Plan, in July 2017, the Government launched a Clean Growth mission to at least halve the energy use of new buildings by 2030, whilst utilising the latest smart technologies to give consumers more control over their energy use.</p>	<p>New: The Government intends to take powers to set regulatory requirements for smart appliances, when Parliamentary time allows. This may be through primary or secondary legislation; the approach is dependent on the terms of EU exit.</p> <p>In tandem, following the review of the current technical standards relating to smart appliances, new technical standards may be developed, as necessary.</p> <p>The Government will work with stakeholders and international partners to consider the benefits of introducing a method of assessing how optimised a building is for smart technologies (for example, we will continue to engage with the EU Commission on the development of its Smart Readiness Indicator).</p> <p>New: The Government will launch a call for evidence seeking views on our proposed next steps to deliver the Clean Growth Buildings Mission, including actions to make new homes and businesses smart, early next year.</p>

Issue	Action	What we have done	What we will do next
IMPLEMENTED			
<p>The functionality of electric vehicle charge-points should be smart-enabled so that consumers are not locked out of future smart offers.</p>	<p>2.7</p>	<p>The Government has taken the Automated and Electric Vehicles Act through Parliament which provides powers to require all new EV chargepoints to have smart functionality so that consumers are able to charge their EVs when electricity prices are low, and the electricity system can benefit from the flexibility provided by millions of EV batteries.</p>	<p>The Government announced in January 2018 that from early 2019 all Government-funded domestic chargepoints would be smart enabled.</p> <p>New: The Government will consult by early 2019 on the introduction of secondary legislation to set standards for smart EV chargepoints, when Parliamentary time allows.</p>

Issue	Action	What we have done	What we will do next
IN PROGRESS			
	2.8	<p>Electric vehicle potential to provide demand-side response and storage services must be capitalised upon to ensure efficient grid integration.</p>	<p>The vehicle to grid innovation projects will be delivered. These are expected to be completed by 2021.</p>
		<p>Government and the automotive industry jointly fund the 'Go Ultra Low'⁶⁰ scheme, a communications campaign which promotes the uptake of EVs.</p>	
		<p>Ofgem has launched its consultation on access reform and forward-looking charging arrangements, and alongside this has published a future insights piece on implications of the transition to electric vehicles.⁶¹</p>	
		<p>The Government launched the EV Energy Taskforce whose scope includes smart charging and planning the energy system.</p>	
		<p>The Government launched a vehicle to grid innovation competition to research new technologies and business models that develop future vehicle to grid products, services and knowledge.</p>	
		<p>The Government published the Road to Zero Strategy in July 2018.</p>	

Issue	Action	What we have done	What we will do next
<p>Consumers should be protected from the risks of participating in a smart energy system.</p>	<p>IN PROGRESS</p> <p>2.9</p>	<p>The Government consulted on taking powers to set regulatory requirements for smart appliances (see 2.6).</p> <p>The Government and Ofgem have supported the development of the Association of Decentralised Energy (ADE) Code of Conduct for aggregators</p>	<p>We will continue to engage with stakeholders and evaluate the potential issues for consumers in a smart energy system to ensure protections remain appropriate. This includes considering the findings of the Smart Data review and Ofgem's call for evidence on the consumer impacts of market-wide settlement reform (see 2.4).</p> <p>The ADE will launch a voluntary code of conduct for aggregators.</p> <p>New: The Government will work with industry to consider how to update the Standard Assessment Procedure to recognise smart technologies and their impacts on the energy performance of homes. This could include smart technologies appearing as recommendations on Energy Performance Certificates and could make it easier for smart technologies to be utilised under policies such as the Private Rented Sector Regulations and the Energy Company Obligation.</p> <p>In developing its proposals on access reform and its Targeted Charging Review, Ofgem will consider the implications for different types of consumers.</p>

Issue	Action	What we have done	What we will do next
In the move to a smart energy system, it is essential that cyber security risks are effectively understood and acted upon.	IN PROGRESS 2.10	<p>The Government has worked to identify and address cyber security risks in a smart energy system. For example, the Department for Digital, Culture, Media and Sport's work on Secure by Design, and the ADE's code of conduct for aggregators, have taken account of such cyber security risks. Alongside this we will continue to assess the impact of the Networks and Information Systems Directive for the emerging smart energy system.</p> <p>The Government has considered cyber security in relation to smart appliances (see action 2.6), and we will also consider cyber risks in relation to standards for EV chargepoints (see action 2.7).</p>	The Government will continue to identify and evaluate cyber security risks, and continue to engage stakeholders, to ensure that risks are appropriately addressed.

Issue	Action	What we have done	What we will do next
IMPLEMENTED			
Further innovation is needed to test approaches to DSR for domestic and non-domestic consumers.	2.11	<p>The Government launched a £7.75 million competition for innovative domestic applications of demand side response technologies and business models. Feasibility studies have concluded, and projects are being selected to continue to a demonstration phase.</p> <p>The Government has launched a £7.6 million competition for innovative demonstrations of DSR technologies in the UK business or public sector to reduce peak energy usage and provide energy system flexibility. Feasibility studies have concluded, and two demonstration projects are underway.</p> <p>The Government has launched a £30 million innovation competition supporting the development and demonstration of a range of innovations relating to vehicle-to-grid (V2G).</p>	<p>Demonstration projects under the domestic DSR innovation competition will be delivered by March 2021.</p> <p>Demonstration projects under the competition focused on UK business and public sector DSR will be delivered by March 2021.</p> <p>Projects under the competition focused on V2G will be delivered by March 2021.</p>
IN PROGRESS			
Domestic and smaller non-domestic consumers must be informed and engaged to participate at scale in a smart energy system.	2.12	We have started work to consider consumer engagement, initially in the context of wider work on consumer protection, which is flagged at action 2.9.	We will continue to monitor how the market develops and we will assess the case for more proactive communications on smart energy, combined with engagement via local and community organisations.

Markets which work for flexibility

Issue	Action	What we have done	What we will do next
There is a need to ensure that storage and demand flexibility participate on a level playing field in the Capacity Market.	IN PROGRESS 3.1	<p>The Government and Ofgem have simplified metering requirements for those offering demand side response (DSR) and allowed the stacking of revenues between the Capacity Market and balancing services.⁶²</p> <p>In addition, the Government introduced changes to the Capacity Market in order that the contribution made by short duration batteries is not overvalued.</p>	<p>Ofgem and the Electricity System Operator (ESO) will make changes to allow DSR providers to reallocate their assets in the Capacity Market ahead of pre-qualification in 2019.</p> <p>New: As part of the Capacity Market review the Government launched a call for evidence on the Capacity Market and Emissions Performance Standard Review to seek views on how new smart technologies, including DSR, can be facilitated fairly in the Capacity Market.⁶³ The Government will respond to this call for evidence.</p>

⁶² <https://www.ofgem.gov.uk/publications-and-updates/publication-consolidated-capacity-market-rules>

⁶³ <https://www.gov.uk/government/consultations/capacity-market-and-emissions-performance-standard-review-call-for-evidence>

Issue	Action	What we have done	What we will do next
IMPLEMENTED			
<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>	<p>3.2</p>	<p>Ofgem issued views on the design of market arrangements for independent aggregators in energy markets.⁶⁴</p> <p>Ofgem approved modifications to the Balancing and Settlement Code (BSC) and the Grid Code which will implement the European Balancing Project TERRE (Trans European Replacement Reserves Exchange) and enable distributed generation, aggregators and consumers to register and participate directly in that market and facilitate access to the balancing mechanism.</p>	<p>Industry will implement code modifications on project TERRE by February 2019 that will improved the ESO's ability to dispatch aggregated balancing mechanism Units. This should ensure that parties can start their prequalification process in time to participate in the TERRE market and the balancing mechanism when project TERRE goes live by December 2019.</p> <p>The ESO is reviewing the rules of the balancing mechanism to allow providers to access other markets when they are not providing balancing mechanism services, making it easier to stack revenues.</p>

⁶⁴ <https://www.ofgem.gov.uk/publications-and-updates/independent-aggregators-and-access-energy-market-ofgem-s-view>

Issue	Action	What we have done	What we will do next
IMPLEMENTED			
<p>To balance the system, the Electricity System Operator (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>	<p>3.3</p>	<p>The ESO has reviewed how it can improve and simplify the way it procures balancing services and has published roadmaps on frequency response and reserve, restoration and reactive power and wider access to the balancing mechanism.</p> <p>Ofgem published a decision on the ESO's regulatory incentive framework running from April 2018 to 2021 in February 2018.⁶⁵ The new framework will take a more 'principles-based' approach to regulating the ESO. In September, Ofgem launched a call for evidence for stakeholders to provide views on the ESO's performance across all its regulatory principles, from April to September. This information will form part of the assessment under the ESO's new performance framework.</p>	<p>The ESO will deliver actions set out in its roadmaps on frequency response and reserve, restoration and reactive power and wider access to the balancing mechanism. This includes trialling innovative, closer-to-real time procurement for frequency response by spring 2019. Ofgem will be reviewing this delivery and stakeholder feedback as part of their assessment of the ESO under their incentives framework. Ofgem is appointing an independent panel of experts, who will assess the ESO's performance and stakeholder feedback and will provide recommendations to Ofgem on whether any incentive payments or penalties should be paid. This panel will be in place for the ESO's mid-year review in November.</p>

⁶⁵ <https://www.ofgem.gov.uk/publications-and-updates/policy-decision-electricity-system-operator-regulatory-and-incentives-framework-april-2018>

Issue	Action	What we have done	What we will do next
<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>	IMPLEMENTED 3.4	<p>Ofgem published its strategy for regulating the future energy system. This sets out actions Ofgem will take to ensure that regulation drives innovation, supports the transformation to a low carbon energy system and delivers sustainable, resilient, and affordable services.⁶⁶</p> <p>Ofgem has consulted on access reform and forward-looking charging arrangements. The consultation set out options to make the most of opportunities and adequately address the associated challenges in terms of the allocation and use of capacity and network usage charges.</p>	<p>New: Ofgem will publish its response to the access reform and forward-looking charging arrangements consultation and make a decision on the scope and form of the review by the end of 2018. By this time, Ofgem will also consult on its proposed decision on changes to the residual electricity network charges as part of the Targeted Charging Review.</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>	IN PROGRESS 3.5	<p>Distribution Network Operators (DNOs) can make more efficient use of new technologies, providers and solutions, as part of their evolution to Distribution System Operators (DSOs). To support this, the following progress has been made:</p> <ul style="list-style-type: none"> • the Energy Networks Association (ENA) published its 'opening markets for network flexibility report' which set out the scope of the project. DNOs have committed to opening up network requirements to the market on a business-as-usual basis, and to ensuring coordination with the ESO. • as part of the Open Networks Project, the ENA has consulted on five 'Future Worlds' 	<p>DNOs will now open up network requirements to markets and competition on a business-as-usual basis. In doing so, they should address the potential conflict of interests between them being a procurer of network services and a potential provider of network solutions. We expect DNOs to publish data, at regular intervals, on the volume of flexibility they have procured, to demonstrate progress in their transition to DSOs. The Government and Ofgem are prepared to take further action if the network and system operators DNOs do not take adequate measures to address conflicts of interest.</p> <p>To ensure the system as a whole is managed efficiently, Ofgem will shortly consult on</p>

⁶⁶ <https://www.ofgem.gov.uk/publications-and-updates/our-strategy-regulating-future-energy-system>

Issue	Action	What we have done	What we will do next
		<p>that could underpin a smart and more flexible energy system. These models explore the relationships between different parties, including between the ESO and DSOs. The ENA has commissioned independent analysis of these ‘Future Worlds’, which includes the development of an impact assessment.</p> <ul style="list-style-type: none"> • Ofgem consulted on the framework for RIIO-2. The new price control framework will create the right incentives for networks to procure flexibility solutions as business-as-usual. 	<p>amendments to the distribution licence conditions to provide further clarity on what it means to maintain economic, efficient and coordinated networks. Guidance will be published to support this change.</p> <p>The ENA has engaged a consultant to conduct an impact assessment relating to its ‘Future Worlds’ options. This will consider the costs and benefits related to how the role of DNO/DSOs and other system actors may evolve beyond opening networks requirements to market competition. This work, and stakeholder views related to it, will be provided to Ofgem and the Government, as one element of input as part of their wider considerations for the need for wider system developments.</p> <p>Ofgem will consult on the methodologies to set sector-specific price controls for the electricity transmission and electricity system operators under RIIO-2, by the end of 2020. The consultation will consider how to encourage network operators to utilise smart solutions as well as traditional network infrastructure.</p>

Issue	Action	What we have done	What we will do next
IMPLEMENTED			
	3.6	<p>There is a need to catalyse innovation by trialling ways in which energy markets may evolve.</p>	<p>The Government has launched a £600,000 competition focused on innovative approaches (technologies and business models) to value and trade flexibility in the electricity system. Projects under this competition have now concluded.</p> <p>The Government has initiated joint innovation competitions with South Korea and Canada which have a focus on smart energy systems and technologies.</p>
IN PROGRESS			
<p>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.</p>	3.7	<p>Industry has put forward proposed revisions for engineering standard P2/6. This represents an important evolution of the P2 standard, allowing DNOs to take account of behavioural changes resulting from smarter pricing signals, and the contribution of Distributed Energy Resources to network security. Both have the potential to help defer or avoid investment in costly network assets.</p>	<p>The DNOs have committed to bringing forward further changes to the P2 standard in 2019 that will better target investment in network security to the needs of customers.</p>

Issue	Action	What we have done	What we will do next
<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>	IMPLEMENTED	<p>3.8</p> <p>To help implement and steer this Plan, we have established a co-chaired stakeholder group, the Smart Systems Forum. The Smart Systems Forum has now met on three occasions and to date has discussed domestic demand-side flexibility, the Open Networks project, the transition to distribution system operators, the system impacts of electric vehicles, the Cost of Energy Review, data in the energy system and code governance.</p>	<p>The Smart Systems Forum will continue to meet and act as a forum for broader discussions to identify issues important to supporting our energy system transition.</p>
<p>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.</p> <p>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.</p>	IN PROGRESS	<p>New action</p>	<p>New: The Government and Ofgem will launch an Energy Data Taskforce that will look across the energy sector, identify gaps where data can be used more efficiently and make clear, actionable, recommendations for Government, Ofgem and industry.</p>

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