Department for Business, Energy & Industrial Strategy

ofgem
Making a positive difference for energy consumers

Energy Future System Operator Consultation

Closing date: 28th September 2021

July 2021

Any enquiries regarding this publication should be sent to us at:
futuresystemoperator@beis.gov.uk and SOreview@ofgem.gov.uk

Foreword

The scale of our ambition for the energy system can only be delivered through a governing architecture to match. As the energy system itself undergoes a transformation equal to any it has undergone in the past, so the rules and governing institutions of the system must adapt to support the transition away from fossil fuels to clean energy. That is why in the Energy White Paper we committed to ensure that the institutional arrangements governing the energy system are fit for purpose for the long term. The future of electricity and gas system operation is a critical part of this, and our work builds on Ofgem's review of system operation published earlier this year. We are also in parallel consulting on the future governance arrangements of the energy codes - the technical and commercial rules of the electricity and gas systems.

In this consultation, BEIS and Ofgem set out our proposal for a Future System Operator. Such a new body would take on a number of key roles in electricity and gas to facilitate net zero while maintaining a resilient and affordable system. It would need to be independent – not only of other commercial energy interests, but also from the day-to-day operational control of government. It would need to be accountable to consumers and ultimately citizens, and resilient to operational challenges over the short, medium and long-term. It would need to be excellent in terms of technical expertise and operational capability. It would need the people, assets, systems and processes to deliver on its objectives, while being supported by a sufficient and robust funding model and effective system of governance and regulation.

The proposals in this consultation would affect the current electricity and gas system operators, owned by National Grid, because a Future System Operator would be based in part on existing roles and capabilities within these organisations. Through the wide-ranging potential roles of a Future System Operator, these proposals would also affect other users of the electricity and gas systems. Consumers and citizens would also stand to benefit from a Future System Operator able to drive progress towards net zero while maintaining energy security and minimising costs.

National Grid, alongside other world-leading Great British energy companies, has played a central part in the energy system since privatisation, and the networks they own will continue to be a vital aspect of our resilience, affordability and decarbonisation goals. I welcome the engagement National Grid has shown with our work to date and look forward to continuing this important dialogue further in the coming months, including with other stakeholders responding to the questions in this consultation.

A Future System Operator, with the right roles and organisational design, has the potential to play a vital role at this critical moment for the energy system. Together with Ofgem, I am pleased to set out in this consultation our proposals for how this can be achieved.

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Ofgem Foreword

Meeting the UK's ambitious climate change goals requires a transformation across the energy system, including dramatic change to how we generate electricity, how we heat our homes and power our vehicles, and how our electricity and gas networks are built and operated. The scale and pace of change needed represents an unprecedented challenge, and an opportunity to design and deliver a much smarter, more flexible, and better integrated energy system.

We will not be able to deliver on our energy and climate change goals without the right institutional framework. Ensuring that energy system governance - including Ofgem - is fit to deliver this future is one of our five key strategic programmes.

In January, we recommended to Government that an independent system operator should be given additional responsibilities including providing independent advice, more direct planning of onshore and offshore electricity networks and the introduction of competition in network solutions; and a more active role in designing and planning the future energy system. We believe these changes can maximise value for money and ensure a level playing field between different parts of the energy network and wider energy services. In short, more effective strategic planning, management, and greater coordination across the energy system could deliver significant consumer savings.

Today, this joint consultation sets out proposals to achieve this. We propose a Future System Operator which is independent of commercial energy interests, and able to both run the day-to-day operation of the electricity system and look holistically at long term electricity and gas challenges to support the transition to net zero. This body would take a stronger role in network planning and provide expert advice across the wider energy system on how to drive forward our net zero ambitions.

This view is not driven by the experiences of the past but is grounded in the new challenges we see in the future. We see reform of the ownership and role of the system operators as a real opportunity to bring the outstanding engineering expertise within our system operators to bear on the net zero challenge. It is a chance to create an independent body that has the power and skill to deliver a pioneering approach to managing and planning the energy transition. We look forward to working with the Government, National Grid and the energy sector to develop the proposals set out in today's consultation and deliver the institutional frameworks we need.

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General information

Why we are consulting

BEIS and Ofgem are consulting on the establishment of an expert, impartial Future Systems Operator (FSO) with responsibilities across both the electricity and gas systems to drive progress towards net zero while maintaining energy security and minimising costs for consumers.

The gas and electricity system operators have a unique position at the heart of their respective systems. At their core, their responsibility is to keep each system operating in real time. This role also gives them unparalleled insight into how each system operates and relationships with other energy companies, making them well placed to fulfil wider, longer term roles on behalf of the system. The gas and electricity system operators are currently part of National Grid Plc, creating a potential conflict of interest that can already make it challenging to effectively discharge both existing roles and functions, as well as potential new roles needed to fulfil net zero. We believe that an independent FSO, with responsibilities in both the electricity and gas systems, would be able to fulfil the potential of its expertise and position in the system.

We are issuing this as joint document because both BEIS and Ofgem share a common objective - to establish an FSO able to drive progress towards net zero while maintaining energy security and minimising costs for consumers - which builds on the recommendations from the Ofgem report from January 2021. Both BEIS and Ofgem have distinct but complementary roles to play in shaping this future, and the next key decisions are ministerial decisions which will be subject to this consultation. We will continue to work closely with those organisational most directly affected by the proposals in this consultation, including National Grid plc, National Grid Electricity System Operator, National Grid Gas and Elexon.

Consultation details

Issued: 20 July 2021

Respond by: 28 September 2021

We are consulting for ten weeks as we believe that stakeholders will already be familiar with the bulk of the broad proposals. This is because this consultation builds on the recommendations from the Ofgem report from January 2021. We will also undertake stakeholder engagement during the consultation period in order to gather wide ranging views from industry and other interested parties.

Enquiries to:

Electricity Systems Team
Department for Business, Energy and Industrial Strategy
Abbey 1, 3rd Floor,
1 Victoria Street
London
SW1H 0ET

And

Future System Operation
Office of Gas and Electricity Markets
10, South Colonnade
Canary Wharf London
E14 4PU

Email: futuresystemoperator@beis.gov.uk and SOreview@ofgem.gov.uk

Consultation reference: FSO Consultation

Audiences:

Energy suppliers, generators, transmission owners, distribution networks, engineering standards bodies, energy sector research groups and any other organisations with a direct interest.

Territorial extent: Great Britain

How to respond

The consultation is available online. If possible, we would prefer to receive responses via the following link: https://beisgovuk.citizenspace.com/energy-security/future-system-operator

If you would prefer to respond via email, please ensure you respond to both email addresses below and use the response form available on the GOV.UK consultation page:

https://beisgovuk.citizenspace.com/energy-security/future-system-operator

Email to: futuresystemoperator@beis.gov.uk and SOreview@ofgem.gov.uk

If you would like to send a hard copy, please send copies to the following addresses. As this is a joint consultation, please ensure you send copies to both addresses below.

Write to:

System Governance-Electricity Systems Team
Department for Business, Energy and Industrial Strategy
Abbey 1, 3rd Floor,
1 Victoria Street
London
SW1H 0ET

AND

Future System Operation
Office of Gas and Electricity Markets
10, South Colonnade
Canary Wharf London
E14 4PU

BEIS and Ofgem will share all responses received with each other.

When responding, please state whether you are responding as an individual or representing the views of an organisation.

Your response will be most useful if you use the template provided. This is the easiest way to make sure that your response is framed in direct response to the questions posed, though the response form also allows for further comments and evidence.

Confidentiality and data protection

Information you provide in response to this consultation, including personal information, may be disclosed in accordance with UK legislation (the Freedom of Information Act 2000, the Data Protection Act 2018 and the Environmental Information Regulations 2004).

Ofgem will publish non-confidential responses (or parts of response) on its website. If you want your response in whole or in part to be considered confidential, please tell us in your response and say why. Please clearly mark the parts of your response that you consider to be confidential, and if possible, put the confidential material in separate appendices to your response.

Please be aware that we cannot guarantee confidentiality in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not be regarded by us as a confidentiality request.

We will process your personal data in accordance with all applicable data protection laws. Please see our privacy policy for further information.

All responses will be processed by both BEIS and Ofgem as this is a joint consultation.

We will summarise all responses and publish this summary on GOV.UK. The summary will include a list of names or organisations that responded, but not people's personal names, addresses or other contact details.

Quality assurance

This consultation has been carried out in accordance with the government's consultation principles.

If you have any complaints about the way this consultation has been conducted, please email: beis.bru@beis.gov.uk.

Executive Summary

BEIS and Ofgem are consulting on a proposal for an expert, impartial Future System Operator (FSO) with responsibilities across both the electricity and gas systems, to drive progress towards net zero while maintaining energy security and minimising costs for consumers.

Decarbonisation presents unprecedented challenges and opportunities for the energy system. The transition to net zero will require a much more integrated energy system and increase the complexity of operational and planning challenges across both electricity and gas. This creates the need for new and enhanced roles and functions which cut across both the electricity and gas systems and are based on deep technical understanding of system operation.

The current gas and electricity system operators have a unique position at the heart of their respective systems. At their core, their responsibility is to keep each system operating in real time. This role also gives them unparalleled insight into how each system operates and relationships with other energy companies, making them well placed to fulfil the kind of potential new roles and functions needed to drive net zero.

The gas and electricity system operators are currently part of National Grid Plc, which also has significant wider commercial interests in the energy system, creating a potential or perceived conflict of interest. There is no evidence that this potential conflict has been acted upon, but it can nevertheless make it challenging to effectively discharge existing roles and functions, as well as challenging to discharge the kind of potential new roles and functions needed to fulfil net zero. The existing gas and electricity system operators are also legally separate from one another, making coordination between gas and electricity roles and functions challenging. We believe that an independent FSO with responsibilities in both the electricity and gas systems, would be better able to fulfil the potential of its expertise and position in the system.

Proposed roles

Our proposal is for all the current National Grid ESO roles and functions to be carried out by the FSO, due to the synergies between balancing the electricity system and analysing its future needs. For gas, we consider these synergies to be weaker, while the potential cost and risk of separating real time operation from gas asset ownership is greater. We therefore propose that, of the existing roles in the gas system, the FSO should undertake strategic network planning, long-term forecasting, and market strategy functions, but not real time system operation and associated activities (these associated activities are set out in section 3.2.1). We set this against the alternative option of the FSO undertaking all gas system operation roles, including real time system operation and associated activities. Both options may require duplication of certain organisational capabilities in the FSO and National Grid Gas plc (NGG), such as those concerning gas network planning.

In addition, we consider that the FSO could support decisions by Government, Ofgem and other organisations through providing targeted advice based on its expertise on the impact of different potential decisions on the energy system. We also set out a number of areas where new or enhanced roles and functions are being developed for National Grid Electricity System Operator (NGESO) or could be developed for the FSO in future, where we believe there are potential synergies with existing system operation functions. These include roles and functions in:

- system planning and network development
- driving competition in energy networks
- energy market design
- coordination with distribution networks
- heat and transport decarbonisation
- energy data
- engineering standards and energy code development
- hydrogen
- CCUS

In undertaking all its roles, we consider that the FSO should draw on its insight and expertise across the energy system as a whole, in many cases in support of a wider Ofgem or BEIS-led process. For example, under our proposals for gas, Ofgem would remain the ultimate decision-maker on network investment plans submitted through price control processes by NGG but could do so in reference to an independent assessment of network capability produced by the FSO.

Desired characteristics and attributes of the FSO

We consider that an effective FSO able to fulfil these proposed roles will need to have the following characteristics:

- technically expert, with an in-depth understanding of the electricity and gas systems and the ability to access and use sector-wide knowledge;
- operationally excellent, with an ability to act with agility and adapt in the context of net zero;
- accountable to consumers and the public, delivering within a robust regulatory regime set by Ofgem, and within the strategic policy context set out by the Government in the Strategy and Policy Statement;
- independently minded, by acting – and being perceived to act – without undue influence from other energy interests or Government; and
- resilient, both operationally and financially.

To realise these characteristics, the FSO will need to possess certain attributes that we have categorised under people and capability; assets, systems, and processes; financial stability; and governance:

- people and capability: the ability to attract and retain employees with technical expertise.
- assets, systems, and processes: the ability to carry out the functions needed to drive net zero.

- financially stable: the ability to run and maintaining the FSO's operating systems and fund projects to ensure stability in terms of system operation as well as deliver net zero.
- governance: arrangements to ensure that the FSO acts in the interests of consumers and supports the delivery of net zero on behalf of the public.

Organisational model

Having considered the roles, characteristics, and attributes that we are proposing for the FSO, this document explores two different organisational models for the FSO:

- a standalone privately owned model, independent of energy sector interests; and
- a highly independent corporate body model classified within the public sector, but with operational independence from government.

We expect the fundamental elements of the FSO's regulatory framework to be similar for both models and to incorporate legislation, any designated Strategy and Policy Statement, licences and codes, and funding through network charges. Both models are based on the need for the FSO to be free from perceived or potential conflicts of interest within the energy sector and short-term operational influence from central government. Under both models, the FSO will need strong relationships to energy market participants, consumers, regulators and other organisations with energy interests.

However, these models also differ, in particular concerning incentives. A privately owned FSO, if it is profit-making, would be incentivised through its profit to drive performance. The non-private FSO would not be driven by shareholder or profit interest.

As we consider changes to the ownership and regulatory arrangements for NGESO, we must also consider Elexon and its subsidiaries, as a change to the ownership of NGESO could directly impact Elexon. Any proposals would need to ensure that Elexon retains its operational independence and remains accountable to the industry it serves. Further, we will consider what relationships are required between the FSO and other industry bodies (such as Xoserve) to facilitate system fund transfers.

Implementation

We propose a phased implementation of the FSO, with the FSO founded on the existing capabilities (including the people, processes, systems and assets) of NGESO, and where appropriate NGG, followed by phased introduction of any further roles to the FSO. NGESO and NGG are currently owned by National Grid plc. Therefore, any change in ownership of all or part of the capabilities of these organisations will require a sale process. These existing organisations will also need to be able to discharge all their obligations during and (where these continue) after implementation.

Effective governance of the project to establish the FSO will be vital. Much of the project governance may be internal to National Grid plc, NGESO, NGG and the FSO, but BEIS and Ofgem will also have a role to play in the overarching governance of implementation.

BEIS and Ofgem recognise the uncertainty that the review on the long-term role and organisational design of the system operator may create for NGESO employees and some employees within National Grid plc, NGG and their subsidiaries. It is vital that the implementation of the FSO should closely consider the needs of people in the transition process. We also anticipate that the FSO will be a growing organisation with greater opportunity for employees to influence the future of energy systems in Great Britain and participate in the delivery of net zero.

1. Scope, objectives and structure of consultation

1.1 Ofgem's review into system operation

In January this year, Ofgem published their 'Review of GB Energy System Operation'.[1] It considered the effectiveness of a previous reform to the arrangements for electricity system operation and whether there was need for further reform.

Ofgem's key findings were that:

- net zero requires a step-change in whole-system coordination and planning;
- the system operators are uniquely placed to play a pivotal role in the drive to net zero, and that real time system balancing experience is crucial for effective electricity system planning;
- there is a strong case for creating a system operator which is independent of the transmission asset owners and for considering combined responsibility for electricity and gas net zero system roles; and
- there are a range of practical options for creating a robust FSO, but complex trade-offs are required.

Ofgem conducted a range of detailed stakeholder interviews as part of this review and the feedback from these is reported throughout the review and informed the key findings.

Many of the proposals in this consultation adopt findings and recommendations from Ofgem's reports, and where relevant these are referenced below.

1.2 Objectives of reform

Our objective, subject to consultation and Parliamentary approval, is to establish an FSO able to drive progress towards net zero while maintaining energy security and minimising costs for consumers. An FSO able to do this will need to be given appropriate roles in the energy system and have the necessary characteristics to fulfil them effectively. These roles, functions, and characteristics that we consider would achieve this are set out in chapters 3 and 4 respectively.

[1] Ofgem *Review of GB Energy System Operation* (2021) https://www.ofgem.gov.uk/publications-and-updates/review-gb-energy-system-operation

We believe that an FSO that has such roles, functions and characteristics should help us realise:

- optimised reductions in network and balancing costs: by supporting Ofgem and industry in using investment optimally to deliver a secure electricity and gas supply with net zero emissions at least cost;
- efficient technology decisions: by providing engineering insights to government, Ofgem and industry into the fundamental system operability challenges presented by new technologies, so that government, Ofgem and industry can better identify lower cost technology mixes to reach net zero;
- co-ordinated system development: by ensuring that decision-makers (such as government and Ofgem) understand impacts across the energy system, so that we can ensure that decisions taken in one area actively support, rather than hinder decarbonisation of other sectors; and
- increased innovation: by supporting the development of rules and standards that remove barriers to new technologies and business models, so that lower cost pathways to net zero will become available to us while maintaining a resilient system.

1.3 Scope of this consultation

Within the scope of this consultation are the roles, responsibilities and organisational design of the current system operators for gas and electricity as well as any suggested transition of this activity from National Grid Plc. The aim of the consultation is to gather views on the case for change to an FSO, the proposed high-level roles that the FSO would be suitable to fulfil, and on potential organisational models for the FSO. This will inform the decisions by government and legislative proposals we intend to introduce when parliamentary time allows. Subject to these initial decisions, there will be further consultation on aspects of these reforms, including the FSO's licensing and funding arrangements, mechanisms for incentivising desired outcomes, and appropriate mechanisms for engaging sector participants in operation and oversight.

This consultation also draws on both existing and ongoing work, including on smart energy[2], energy data[3] [4], engineering standards[5], onshore network competition[6], offshore and onshore

[2] BEIS *Smart Systems and Flexibility Plan* (2021) https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021
[3] Catapult Energy Systems *Energy Digitalisation Taskforce Launches* (2021) https://es.catapult.org.uk/news/energy-digitalisation-taskforce-launches/
[4] BEIS, Ofgem and Innovate UK *Energy Digitalisation Strategy* (2021) https://www.gov.uk/government/publications/digitalising-our-energy-system-for-net-zero-strategy-and-action-plan
[5] Government and Ofgem *Electrical engineering standards: independent review* (2020) https://www.gov.uk/government/publications/electrical-engineering-standards-independent-review
[6] BEIS *Energy White Paper: Powering our net zero future* (2020) pp 76 https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future

network planning[7] and our work on hydrogen[8]. Although they are not directly in scope of the consultation there are synergies to be acknowledged which we describe further in Chapter 3.

This reform is limited to Great Britain and does not consider changes to the model of system operation or wider system governance in Northern Ireland.

1.4 Ongoing work in related policy areas

This consultation forms the core of a broader package of work to put in place the changes needed to the energy governance system to better support our net zero targets. This wider work includes:

- a review of strategic decision making and planning in the energy system more broadly, focusing on whether government has the right structures in place to perform the systems thinking and coordination required to transition effectively to the net zero energy system (our current thinking on this is set out in section 2.5 below);
- preparing to consult on a draft energy sector strategy and policy statement (SPS). The designation of a SPS (after Parliamentary approval) will support the delivery of the Government's energy policies as outlined in the Energy White Paper by providing the regulator with context and strategic guidance. The SPS would set out the strategic priorities and policy outcomes of the government's energy policy; and
- the Energy White Paper, which stated that the technical and commercial rules of the electricity and gas systems need to be overhauled if we want to transition to a clean energy system. To address this issue, our Consultation on the Design and the Delivery of Energy Code Reform ('the Energy Code Reform consultation') in parallel to this consultation proposes two institutional governance options for codes, with the preferred option being to appoint Ofgem as a 'strategic body' over the codes alongside separate code managers. The alternative option would be to appoint an Integrated Rule Making Body (IRMB), which would combine the strategic and code manager functions, with the FSO taking on this role. Both options would facilitate timely code changes in line with the government's strategic vision for the energy system, including its net zero ambitions.
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[7] Ofgem *Consultation on changes intended to bring about greater coordination in the development of offshore energy networks* (2020) https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks

[8] The UK Government will publish an overarching Hydrogen Strategy in summer 2021, which will focus on the increased production of hydrogen and use across the economy.

1.5 Structure of this consultation document

Chapter 1 (this chapter) outlines the scope, background and wider context of the proposed reform. It discusses the centrality of system operation to decarbonisation and draws links with government and industry's broader work programme.

Chapter 2 sets out the case for change in moving to an independent system operator. It argues that an independent FSO with roles in both the electricity and gas systems would be well placed to fulfil the new and emerging technical roles needed to fulfil net zero.

Chapter 3 focuses on the roles and functions of the system operators. We outline the current roles of the system operators that we consider the FSO should undertake, including how we propose gas and electricity system operation should work together in future. We propose enhancements to the system operators' current roles and functions, as well as some new ones that we consider it would be beneficial for the FSO to take on.

Chapter 4 sets out the characteristics of the FSO and the two broad models of organisational design being considered, including its incentive and regulatory framework.

Chapter 5 provides an initial high-level view of implementation of these future arrangements, subject to the outcome of this consultation.

Finally, **Chapter 6** asks questions related to our impact assessment, which is published alongside this consultation.

2 Case for change

2.1 Net zero and energy system governance

In June 2019, Parliament approved legislation requiring the UK to bring all greenhouse gas emissions to net zero by 2050[9]. In April 2021, the UK government announced a world-leading climate change target (the sixth Carbon Budget) to reduce emissions by 78% by 2035 compared to 1990 levels, on a pathway to net zero greenhouse emissions by 2050. We have made considerable progress, reducing greenhouse gas emissions by over 40% between 1990 and 2019[10] while growing the economy by almost 80%[11], the fastest rate in the G7. In 2020, around 60% of our electricity generation was from low carbon sources[12]. However, there is much more to do, and progress needs to accelerate.

Net zero is an unprecedented challenge for our economy and society – and the energy system is at the heart of this challenge. The electricity and gas systems will not only have to be decarbonised, but also enable and drive the decarbonisation of all sectors in the economy, including transport and heat. Over the last decade, once marginal technologies such as solar, wind and storage, as well as new approaches such as large-scale data use and analysis, have become increasingly widespread. This creates new opportunities to deliver a secure and decarbonised energy system at least cost.

Meeting these challenges and realising these opportunities will bring significant change to the existing electricity and gas systems as well as potentially introducing new systems such as hydrogen and carbon-capture use and storage – and indeed these changes are already happening. Realising large scale deployment of both new generation and sources of demand will require making full use of the existing capability of the transmission and distribution network. It will require significant new network build, but also significant deployment of the alternatives to new network. It will require the rules and standards of the system to adapt to maintain operability while enabling rapid decarbonisation. It will require government, Ofgem and industry to take decisions about the future development of heat, transport and energy based on high quality whole system analysis of the impacts of those decisions. It will require all these activities to be undertaken in a joined-up holistic way, that considers the impacts of individual decisions across the system rather than in isolation.

There are several areas of new and enhanced roles and functions, which we consider will be needed to drive decarbonisation at least cost while maintaining resilience, and which must be based in deep technical understanding of the energy system. These areas include network planning and development, competition to fulfil specific system needs, co-ordination (both across energy sectors and regional decarbonisation) and developing engineering and data

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[9]GOV UK *The Climate Change Act 2008 (2050 Target Amendment) Order 2019* (2019) https://www.legislation.gov.uk/ukdsi/2019/9780111187654

[10]BEIS *2019 UK Greenhouse Gas Emissions, Final Figures* (2021) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/957887/2019_Final_greenhouse_gas_emissions_statistical_release.pdf

[11]GOV UK *Build Back Better: our plan for growth* (2021) https://www.gov.uk/government/publications/build-back-better-our-plan-for-growth/build-back-better-our-plan-for-growth-html

[12] BEIS *Energy Trends table 5.1*, (2020) https://www.gov.uk/government/statistics/electricity-section-5-energy-trends

standards. The specific areas where we consider that the FSO could have a role are set out in Chapter 3. Chapter 4 then considers the kind of organisation needed to fulfil the kind of technical roles needed to drive net zero, in order to build the case for change underpinning our proposal for the FSO. We also recognise that there are potentially strategic, direction-setting roles needed to drive net zero. We set out our initial thinking in this area in section 2.5 below.

This view builds on the case for potential new and enhanced roles made previously in the Energy White Paper[13], arguing that the transforming, more complex energy system it described would require new responsibilities across different organisations. As a result, the Government committed to consult on the implications of this for energy system governance.

Our thinking also builds on work elsewhere, such as:

- the 'Cost of Energy Review' by Sir Dieter Helm commissioned by BEIS, which recommended the establishment of an independent national system operator and to open the various functions and enhancements to the networks to competitive auctions[14];
- the Energy Systems Catapult and the Institution of Engineering and Technology's, 'Future Power System Architecture' project, which identified 35 new or significantly modified functions required by 2030[15];
- Atkins in its report, 'Engineering Net Zero', identified new roles for the energy system in strategic planning, holistic thinking and managing systemic risk[16];
- the 'Electrical Engineering Standards: independent review' commissioned by BEIS and Ofgem, which concluded that a new framework with new roles was needed for engineering standards for net zero[17]; and
- the Energy Data Taskforce (EDTF), which outlined a number of functions that should be undertaken to better promote the effective use of data in the energy system. These functions include co-ordination of asset registration, improved visibility of data, infrastructure and assets[18].

Ofgem in their review of system operation reached a number of conclusions concerning the need for new technical roles in the energy system[19]. Their 'Key Finding 1' was that 'net zero requires a step-change in whole system coordination and planning'. Other conclusions included:

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[13] BEIS *Energy white paper: Powering our net zero future* (2020) https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future
[14] Dieter Helm *Cost of Energy Review* (2017) https://www.gov.uk/government/publications/cost-of-energy-independent-review
[15] Catapult Energy Systems *FPSA1 – Future Power System Architecture – Summary Report* (2017) https://es.catapult.org.uk/news/future-power-system-architecture-fpsa-summary-report/
[16]SNC Lavalin *Engineering net zero: summary report* (2019) https://www.snclavalin.com/~/media/Files/S/SNC-Lavalin/download-centre/en/report/engineering-net-zero-summary-report.pdf
[17] Government and Ofgem *Electricity Engineering Standards Review: Independent Panel Report* (2020) https://www.gov.uk/government/publications/electrical-engineering-standards-independent-review
[18] Catapult Energy Systems *Energy Data Taskforce* (2020) https://es.catapult.org.uk/case-studies/energy-data-taskforce/
[19] Ofgem *Review of GB energy system operation* (2021) https://www.ofgem.gov.uk/publications/review-gb-energy-system-operation

- current electricity and gas system functions will evolve as the energy system changes and becomes increasingly integrated. New functions will emerge and should be undertaken by those with the necessary expertise and capabilities across both electricity and gas system functions;
- greater coordination of network planning across the system (for example, across transmission and distribution, onshore and offshore and electricity and gas), and competition and market facilitation across fuels are needed to make the most effective use of available technologies and resources; and
- key strategic decisions will need to be informed by whole-system insight and impartial, technical advice.

2.2 The case for an organisation having roles in both electricity and gas

The transition to net zero will require a much more integrated energy system and will increase the complexity of operational and planning challenges across both electricity and gas. This in turn is likely to increase the synergies associated with fulfilling the kinds of technical roles needed to drive net zero in both the electricity and the gas systems, rather than there being separate organisations for these roles in each system. These synergies increase further in the case of any advisory role for such an organisation (see section 3.2 below). By being able to draw on expertise across both electricity and gas systems, such an organisation would be able to support decision makers such as government and Ofgem to think holistically and ensure that they understand the consequences and opportunities from their decisions that arise across the energy system. We therefore consider that the scope of an organisation fulfilling new net zero roles should encompass roles in both the electricity and gas systems (although not necessarily real time gas operation – see section 3.1 below).

This conclusion reflects considerations by outside experts, such as Professor Catherine Mitchell, who led Exeter University's iGov work, which among other proposals called for the creation of an 'Integrated Independent System Operator' with technical roles across gas and electricity (as well as other aspects of energy more broadly)[20]. This is also based on Ofgem's conclusions in their review of system operation[21], in particular:

- current arrangements, including discrete electricity and gas system operation frameworks, could act as barriers to the system operators taking on and performing the net zero system roles effectively;
- there is a strong case for considering combined responsibilities for electricity and gas net zero system roles; and
- based on work to date, Ofgem think there is a good case for separating key gas network planning functions from the transmission owners (TO) and combining this

[20] IGov *Getting energy governance right: Lessons from IGov* (2019) http://projects.exeter.ac.uk/igov/getting-energy-governance-right-lessons-from-igov/
[21] Ofgem *Review of GB energy system operation* (2021) https://www.ofgem.gov.uk/publications/review-gb-energy-system-operation

into a new independent system operator (ISO) to ensure this body has a substantial gas network planning team.

Consideration of specific gas roles is considered in greater depth in section 3.1 and Annex 1[22].

2.3 What kind of organisation could effectively fulfil technical net zero roles?

We consider that any organisation able to effectively fulfil the kinds of technical roles outlined in the previous section will require five high-level characteristics. It will need to be technically expert; operationally excellent; accountable to consumers and able to support the delivery of net zero on behalf of the public; independently minded; and operationally and financially resilient. These characteristics, as they relate to our proposals for the organisational design for an FSO, are set out in section 2.3. In this section, we set out why we consider that an organisation fulfilling the technical roles needed for net zero, will need to be founded on the existing capabilities and functions of NGESO, and where appropriate NGG.

These new net zero roles require a high degree of specialist expertise to fulfil them effectively. They rely on a deep understanding of current and future challenges and opportunities in operating the systems to which they relate, as well as how those systems could develop in future. They also require a sophisticated understanding of how new technologies and commercial approaches will drive change on the system.

Any organisation fulfilling these roles effectively will need to be both 'technically expert' and 'operationally excellent'. By 'technically expert', we mean qualities such as possessing an in-depth understanding of the inner workings of the energy system; and the ability to access and use sector-wide knowledge combined with advanced use of data and digital technology to provide high quality analysis. By 'operationally excellent', we mean qualities such as possessing access to market information and data flows to identify innovative solutions; the ability to exploit synergies across its different roles to drive high performance and optimise outcomes; and strong relationships with energy market participants and system users.

NGESO has a unique position at the heart of the electricity system. At its core, its responsibility is to keep the system operating in real time. It forecasts demand and the system's ability to meet demand as part of its operational planning and scheduling. It then monitors system characteristics (such as frequency, voltage and faults) and takes actions to keep these within safe and operable limits. This entails procuring increases and reductions in power and demand to keep the system stable, as well as designing the markets to enable this and forecasting what might be necessary in future.

This core role means that NGESO already possesses many of the qualities needed to be sufficiently technically expert and operationally excellent to effectively fulfil the kinds of roles needed to drive net zero within the electricity system. It possesses unparalleled insight into how the system operates, established engineering expertise, expert knowledge on existing interactions across the energy industry, an understanding of the challenges and opportunities

[22] BEIS *Future System Operator Consultation: Annex 1* (2021) https://www.gov.uk/government/consultations/proposals-for-a-future-system-operator-role

of different technologies and approaches, as well as access to industry-wide data. This skillset is reinforced by additional technical functions that NGESO is already taking on (see section 3.2 below).

This is also true of the gas system operator (GSO), which forms part of NGG. It also possesses unparalleled insight into how the system operates, established engineering expertise, existing interactions across the energy industry, an understanding of the challenges and opportunities of different technologies and approaches, and has access to industry-wide data.

In theory, a new organisation could build from nothing a workforce with an equivalent set of skills to NGESO and NGG, and attempt to recreate the information flows they have access to, to fulfil the kinds of technical roles needed to drive net zero without also operating the electricity system in real time. However, it would be very challenging to recreate the synergies that exist from combining real time electricity operation with wider roles in the technical development of the electricity system. We consider to be essential the feedback loop between electricity system balancing and understanding future operability and network need in the fulfilment of the kinds of technical roles needed to drive net zero. We have therefore not taken forward consideration of alternative options to an organisation based on operating the electricity system. This is not however, necessarily the case with real time gas system operation where the feedback loop with network planning is weaker and the challenges and costs are greater. We therefore consider different options for integrating real time gas operation in chapter 3.1. We term this proposed organisation the FSO.

The case for the electricity system operator being well placed to fulfil the kinds of roles needed to drive net zero is supported by the recent history of NGESO and its precursors within National Grid Electricity Transmission (NGET). In 2013, it was decided that the electricity system operator was the most appropriate organisation to fulfil the role of Electricity Market Reform Delivery Body. Then in 2015, Ofgem's Integrated Planning and Regulation project concluded that the electricity system operator should have a new function leading the identification of system needs and assess options to meet these needs and therefore take a greater role in planning the network[23]. Outside experts also support this position. For example, proposals by KPMG for a National Energy Agency to fulfil a wide variety of both strategic and technical net zero roles put the electricity system operator at its heart[24].

This conclusion is also based on the findings of Ofgem's review of system operation. Their 'Key Finding 2' was that 'The system operators are uniquely positioned to play a critical role in achieving net zero'. In addition, their conclusions included:

- that electricity and gas system operators have a unique and vital role to play in facilitating net zero;
- real time system balancing experience is crucial for effective energy system planning;

[23] Ofgem *Integrated Transmission Planning and Regulation (ITPR) project: final conclusions* (2015) https://www.ofgem.gov.uk/publications/integrated-transmission-planning-and-regulation-itpr-project-final-conclusions

[24] KPMG *Energy Transition: case for a national energy agency* (2021) https://home.kpmg/uk/en/blogs/home/posts/2021/02/effecting-change-the-case-for-a-national-energy-agency.html

- there is a strong case for enhancing the roles and functions of the system operators to harness their position and build upon their expertise;
- combining system operability and enhanced planning and coordination functions in a system operator would create a body best placed to:
- anticipate the operability impacts of new technologies;
- proactively consider opportunities and challenges across a range of energy markets and networks;
- provide technical advice across a wide range of decarbonisation issues.

2.4 Assessment of current arrangements

The electricity and gas systems are currently managed by the ESO and GSO respectively, the latter of which is integrated within NGG.[25] Both are ultimately owned by National Grid plc.[26] The system operators are regulated by Ofgem and incentivised through the RIIO price controls[27]. The latest instalment of the price control, RIIO-2, sets out expectations for the Electricity System Operator and for National Grid Gas Transmission (which includes gas system operation functions) between 2021 and 2026.

The integrated model of system operation, where the party responsible for the operation and technical development of the electricity and gas systems also owns all or part of the electricity and gas transmission network respectively, was largely successful in meeting the needs of Great Britain (GB) consumers following privatisation.

However, with the additional responsibilities taken on by NGESO in recent years (see 2.2 above), came concerns that it would be able to leverage its position to make decisions that would benefit National Grid plc's wider business at the expense of consumers or to the detriment of other parties in the industry. Although there was (and continues to be) no evidence of this potential conflict of interest being acted upon, the perception of such a potential conflict of interest caused BEIS, Ofgem and National Grid plc to develop a proposal to move the Electricity System Operator to a legally separated company within National Grid plc's wider group[28]. This separation, implemented in 2019, introduced four important separations from the rest of National Grid plc. These were:

- **separate licences:** Allowing the Electricity System Operator to be regulated separately from the rest of NGET;

[25] Company number - 02006000
[26] Company number - 04031152
[27] Price controls are a method of setting the amount of money (allowed revenue) that can be earned by the network companies over the length of a price control. The RIIO framework (Revenue=Incentives+ Innovation+Outputs) is a performance-based model for setting the price control.
28BEIS, Ofgem, National Grid plc *Statement on the future of Electricity System Operation* (2017) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/582899/Statement_on_the_Future_of_Electricity_System_Operation1350.pdf

- **separate governance:** A new board with at least three 'sufficiently independent'[29] non-executive directors (currently five Non-Executive Directors sit on their board);
- **separation of staff:** Staff began operating from a physically separated site, and under distinct incentive regimes; and
- **separation of information:** Information ringfences were introduced to ensure that sensitive information could not inappropriately flow from the Electricity System Operator to the TOs.

In the gas system, the GSO and the TO functions are still fully integrated under one licence and legal entity (NGG). There are no limitations in the interactions between these parts of the business.

In the context of the kinds of technical roles needed to drive net zero, and the strong case for building on the technical expertise and operational excellence of the electricity and gas system operators, these current arrangements are, however, increasingly challenging. This is partly because these separate system operators operate under distinct regimes for electricity and gas, and face information barriers between them.[30] It is challenging to drive a genuinely integrated approach within the current ownership framework due to potential or perceived conflicts of interest.

We are not making the proposals set out in this consultation because we consider that National Grid plc or the system operators have historically acted in a way that deliberately exploits any potential conflicts of interest. But crucially, the perception of conflicts of interest itself creates inefficiency, even if no actual conflicts are present. Three ways this may manifest itself are:

- the system operators may choose not to engage in a topic, because they do not consider it would be appropriate for them to opine on area where they may be conflicted;
- the government, Ofgem or industry may replicate work undertaken by the system operators to verify that the information or advice they received was correct rather than potentially based on conflicts of interest; or
- industry parties may change their behaviour towards the system operators based on a perception of conflict of interests, for example not engaging in commercial negotiations to provide an investment due to a belief that the system operators will make decisions based on their own commercial interest rather than in a free and transparent manner.

One of the organisational characteristics needed to effectively fulfil the technical net zero roles, that are listed in section 2.2 above and described in relation to our proposals for the organisational design for the FSO in section 4.1 below, is 'independent mindedness'. Among other things, that means ownership and governance that excludes other commercial interests in the energy sector which could give rise to distortive decision-making, or perceptions of it.

[29] A definition of 'sufficiently independent' directors is set out in Condition B22 of the Electricity Transmission licence, and essentially means no commercial interests.
[30] The Ofgem Review on GB Energy System Operation found information barriers included legislation prohibiting information-sharing (Section 105 of the Utilities Act 2000) and the measures taken to operationally separate the gas and electricity SOs, to restrict the influence of National Grid Plc on NGESO through NGGT.

This will ensure that market participants and government have confidence in the impartiality of the FSO's decisions and advice and in its facilitation of markets, competition, and system development.

The creation of an independent system operator is the core recommendation of Ofgem's review of system operation. The review unpacks the potential benefits of independence in more detail and suggests that significant value is at risk without it. Its 'Key Finding 3' is that 'An Independent System Operator (ISO) with enhanced functions will be required to enable and facilitate an integrated, flexible energy system' and as part of the explanatory detail, 'A crucial part of our recommendation is that the system operator for electricity is made fully independent from the transmission network owner'. Ofgem also identified further reasons for change in the inherent regulatory challenges of aligning the SOs' commercial interests with consumer interests[31].

We believe that to possess independent-mindedness, the FSO will require a new organisational model, separate from National Grid plc and the current arrangements of NGESO and NGG. This would represent the conclusion to a longer process to increase the independence of the electricity system operator. The other steps in that process were:

- information ring fences put in place as a result of the electricity system operator taking on Electricity Market Reform Delivery Body roles in 2013;
- former Secretary of State, the Rt Hon Amber Rudd, announcing in a speech in November 2015[32] that 'National Grid as system operator has played a pivotal role in keeping the energy market working. But as our system changes we need to make sure it is as productive, secure and cost-effective as possible. There is a strong case for greater independence for the system operator to allow it to make the necessary changes. So, alongside the National Infrastructure Commission, we will work with National Grid, Ofgem and others to consider how to reform the current system operator model to make it more flexible and independent.';
- in 2016, the House of Commons Energy and Climate Change Select Committee issued the report Low Carbon Network Infrastructure[33] that included among its key recommendations: 'We recommend creating an ISO. Despite strong efforts by National Grid plc itself and Ofgem to mitigate the potential for conflicts of interest, it seems intractable and growing';
- in 2017, BEIS, Ofgem and National Grid plc issued a joint 'Statement on the Future of Electricity System Operation'[34], announcing the creation of NGESO as a legally separate company that would come into force in 2019 (see above), that stated that 'a

[31] Ofgem *Review of GB energy system operation* (2021) https://www.ofgem.gov.uk/publications/review-gb-energy-system-operation
[32] BEIS *Amber Rudd's speech on a new direction for UK energy policy* (2015) https://www.gov.uk/government/speeches/amber-rudds-speech-on-a-new-direction-for-uk-energy-policy
[33] House of Commons Energy and Climate Change Committee *Low carbon network infrastructure* (2017) https://publications.parliament.uk/pa/cm201617/cmselect/cmenergy/267/267.pdf
[34] BEIS, Ofgem, National Grid plc *Statement on the future of Electricity System Operation* (2017) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/582899/Statement_on_the_Future_of_Electricity_System_Operation1350.pdf

more independent electricity system operator can realise benefits for consumers by enabling a more secure, competitive and flexible system.';

- former Secretary of State, Rt Hon Greg Clark MP, noted in a speech in November 2018[35] that Professor Sir Dieter Helm had proposed the creation of an independent system operator, and stated that Government 'will consider full separation if it should prove necessary' for the electricity system operator; and
- the Energy White Paper[36] stated that 'It is possible that there will need to be greater independence from the current ownership structure, should it be appropriate to confer additional roles on the system operator.'.

Many outside experts also believe that a system operator separate from energy asset ownership is a necessary part of energy system governance. As well as the University of Exeter (iGov), Professor Sir Dieter Helm, KPMG's UK Head of Energy and Natural Resources (whose views are all noted above), this includes the Hon Laura Sandys CBE, and Joshua Buckland[37], for example.

2.5 Improving strategic decision making and planning in the energy system

As set out above, we consider that establishment of an FSO, separate from National Grid plc and with roles in the electricity and gas systems, would be well placed to fulfil the kinds of technical roles needed to drive net zero. However, we also recognise that there are potentially new strategic, direction-setting roles emerging as well. On this matter we are aware of, and welcome, the public debate on the need for an energy system 'strategic function' and what it should look like.

It is possible that once the FSO is established it itself could fulfil some of these roles, although that is not our current proposal set out in this consultation. Ofgem also have an important role to play, and in our Energy Code Reform consultation we are proposing that they would become a new 'strategic body' overseeing the code governance landscape (and performing a vital but narrower 'strategic function' than that under discussion here). But we also recognise the role of government in strategic direction setting for the sector, and the need to ensure that we are equipped to address these issues.

We agree that delivering an increasingly complex and interconnected net zero energy system is likely to require robust systems thinking, strategic planning and coordination. The public debate on these issues has centred on whether there are improvements that could be made to existing institutional arrangements to better outcomes, both within Government and across the wider energy system. When stakeholders have provided models for a 'strategic function' to

[35] BEIS *After the trilemma – 4 principles for the power sector* (2018) https://www.gov.uk/government/speeches/after-the-trilemma-4-principles-for-the-power-sector
[36] BEIS *Energy white paper: Powering our net zero future* (2020) https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future
[37] Linkedin *Energy System Institutions Fit for the Future: Re-wiring for a net zero world* (2021) https://www.linkedin.com/pulse/energy-system-institutions-fit-future-re-wiring-net-zero-sandys-cbe/

resolve these issues, the solutions that have been proposed fall into three broad categories, which are:

- an advisory or coordinating function between various actors delivering in the net zero system;
- an active decision-making and policy-setting function, setting plans or outcomes that actors must achieve; or
- a delivery function in addition to an advisory or decision-making role (potentially including system operation).

The proposed models also differ on what the precise form of the organisation should be: from a small unit within BEIS to a large, independent agency outside of it.

We welcome this debate, and we are keen to seek views in this consultation on the issue of strategic decision making and planning, though at this point in time, we are not proposing the creation of a substantial new institution to fulfil this role. We are conscious that many of the decisions about the future energy system will require substantial trade-offs with significant impacts on consumers and the whole economy. Given that many of the choices and trade-offs involved in our journey to net zero are intrinsically political, it is likely that they will need to be made by Ministers who can be held democratically accountable. Establishing new institutions takes time, and strategic decisions regarding net zero and carbon budget six will need to be taken shortly. Therefore, while we wait for the outcome of this consultation, we shall continue to develop BEIS's capabilities to improve strategic planning and coordination of the system. Regardless of where any future strategic function may sit, we believe it should work closely with the FSO, drawing on its technical expertise to analyse and tackle systems issues.

To help us develop our view on this, we are interested in examining issues related to system-wide decision making, coordination and planning, and in seeking views on where improvements could be made to existing arrangements. Our final position will be shaped by the outcomes of this consultation and decisions around the FSO.

1. Do you agree that net zero will create the need for new technical roles in the electricity and gas systems, and require a new approach to energy system governance?

2. Do you agree that the establishment of a Future System Operator is needed to fulfil the kinds of technical roles needed to drive net zero?

3. Do you agree that a Future System Operator should have roles in both the electricity and gas systems?

4. Do you agree that a Future System Operator should be entirely separate from National Grid plc?

5. What issues are there with existing institutional arrangements in the UK energy system in relation to system-wide decision-making and planning?

6. What examples/case studies are you aware of where net zero delivery in one part of the energy system did not adequately account for cross-system impacts or costs?

7. Where should government focus in our efforts to improve systems thinking and coordination across the energy system?

3. What should a Future System Operator do?

This chapter outlines what existing, enhanced, and new roles and functions we consider a Future System Operator is well placed to take on to drive the transition to net zero.

This section outlines:

- the current roles and functions of the gas and electricity system operators, and which of these we propose are undertaken by the FSO;
- new and enhanced roles and functions required for net zero that we consider would sit well with the FSO, including those in other areas/energy vectors (hydrogen and CCUS) that the FSO could play a greater role in as the system develops (depending on decisions made about how we decarbonise).

Framing these roles is the need for the FSO to take a whole energy system approach when operating, planning and developing the network. This includes considering interactions between transmission and distribution systems, between onshore and offshore development, between gases (covering natural gas, biomethane and hydrogen), electricity and other emerging markets, such as CCUS, and between decarbonisation of energy sectors including power, heat, transport and industry. As part of all its roles, the FSO will need to identify barriers, opportunities and trade-offs across these different parts of the energy system.

The new and enhanced whole systems roles and functions we outline in section 3.2 include substantial advisory aspects, providing policy makers and wider stakeholders with technical advice, recommendations, and analysis across a range of decarbonisation issues.

3.1 Current roles

In the existing regulatory framework, the responsibilities for the gas and electricity system operators fall under three roles, made up of more specific functions (outlined in more detail in Ofgem's review[38] and in Annex 1):

- control room operations;
- market development and transactions; and
- system insight, planning and network development.

We outline below which of these existing roles and functions of the system operators we consider the FSO should undertake. How these roles would be implemented within the FSO is discussed separately in Chapter 5.

[38] Ofgem *ESO Roles Guidance* (2021) https://www.ofgem.gov.uk/sites/default/files/docs/2021/03/eso_roles_guidance_2021-23_1.pdf

3.1.1 Which current electricity system operator roles should the FSO undertake?

Our proposal is for the FSO to undertake all the existing roles and functions of NGESO. We consider that there is a strong feedback loop and synergies across these roles, as well as with the potential new and enhanced roles outlined in section 3.2.

Ofgem found strong evidence in their review that the best way to align the incentives for coordinating these two tasks for electricity is to keep responsibility for both within the same organisation. Combining system operability and enhanced planning and coordination functions in the FSO would create a body able to anticipate the operability impacts of new technologies and cross-system solutions and proactively consider opportunities and challenges across a range of energy markets and networks. This would position the FSO well to provide technical advice across a range of decarbonisation issues and take on any new and enhanced roles and functions outlined in section 3.2.

3.1.2 Which current gas system operator roles should the FSO undertake?

There are different considerations for gas. This reflects the different physical characteristics of gas and electricity, including that:

- gas is balanced over a 24-hour period rather than on a half hourly basis;
- the primary tools used by the gas control room are based on utilising equipment belonging to the gas transmission system owner, such as compressors and valves (physical network control), unlike the primacy of energy trading in electricity (electricity physical network control still sits under NGET[39]); and
- NGG operates under a safety case, regulated by the Health and Safety Executive (HSE), whereas electricity does not operate under a safety case regime[40] (more detail is provided in Annex 1).

These differences create greater challenges with moving real time system operation away from the asset owner, with the impact of doing so quantified in the Impact Assessment (IA)[41]. In particular:

- the Gas Safety Management Regulations 1996 [42] require the system operator to operate the network in accordance with its safety case. Duty holders are required to demonstrate within their safety cases that their operations are safe and that risks to the public and employees are as low as is reasonably practicable. This includes ensuring that pressures are managed in line with the design of the physical network, using both physical network assets and, less frequently, trading to minimise the risk

[39] Physical network control (the Transmission Network Control Centre, TNCC) sits under NGET still, whereas energy network control and system balancing (the Electricity Network Control Centre) sits under the ESO. These activities are more overlapping in gas and therefore harder to split, with the safety case relying on both energy balancing actions and physical network control.

[40] The electricity transmission system, whilst regulated still by HSE in respect of health and safety matters, does not operate under a safety case regime. Instead, a system of grid codes and regulations are in place - see Annex 1.

[41] BEIS *FSO Impact Assessment* (2021) https://www.gov.uk/government/consultations/proposals-for-a-future-system-operator-role

[42] HSE *Gas supply legislation, guidance and submitting gas transporter safety cases* (1996) https://www.hse.gov.uk/gas/supply/legislation.htm

of a gas supply emergency. Introducing significant changes and new interfaces between those owning the physical assets and those operating them introduces new safety risks that will need to be mitigated and will likely require a revised safety case to be approved by HSE; and

- separation of the control of physical operation of the network from network assets could result in lost synergies (as outlined in the IA, the GSO may be required to take more expensive commercial actions to manage network constraints as the Gas Transmission Operator (GTO) may no longer be incentivised to help reduce the likelihood of network constraints[43]) and possibly higher long-term maintenance costs and shorter asset lives as the system operator would no longer be incentivised to consider asset degradation.

Given these greater challenges, we outline below two options for how we could integrate gas within the FSO, with Option 1 being our preferred option (the costs and benefit estimates are outlined in the IA[44]).

Option 1: Gas strategic network planning, long-term forecasting and market strategy functions [Preferred option]

This option would involve the FSO undertaking the following current gas strategic network planning, long-term forecasting and market strategy functions (more detail is provided in Annex 1), with real time gas system operation and associated activities, outlined under Option 2 below, continuing to be performed by NGG.

- **Strategic network planning:** Undertaking long-term network capability assessments, needs case production, optioneering, economic options assessment, and publication of the Annual Network Capability Assessment Report (ANCAR), the Gas Ten Year Statement (GTYS) and Gas Future Operability Planning (GFOP).
- **Long-term forecasting**: Undertaking medium to long-term gas supply and demand forecasting, as an output of the Future Energy Scenarios (FES), which provides an input to the Gas Winter/Summer Outlook publications.
- **Market strategy functions:** Leading market participants in developing gas market strategy, publication of the Gas Market Plan (GMaP), and leading Future of Gas (FoG) forums[45].

Additionally, as part of this option, we also welcome views on whether the FSO may also be well placed to perform the independent role of the Network Emergency Coordinator (NEC)[46].

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[43] For example, by re-organising the planned maintenance of a compressor during a period of high system demand

[44] To note, the illustrative 'lower intervention' option included in the Impact Assessment (Option 1) does not carry over any gas roles to the FSO. This scenario is not a policy option in consideration, but rather included to help facilitate discussions on the value of carrying over gas roles through an additional comparator.

[45] The FoG meetings were established by NGG to coordinate stakeholders and provide a forum for discussing potential future market requirements.

[46] Further information regarding the role and responsibilities of the NEC can be found in the NEC Safety Case and T/PM/E1 – Procedure for Network Gas Supply Emergency. The role of the NEC is a requirement of the Gas Safety Management Regulations 1996.

- **NEC:** the NEC is required to establish and maintain adequate arrangements for co-ordinating the actions to be taken to prevent a supply emergency occurring or to minimise the risks and consequences associated should one develop. The NEC exercises its functions on behalf of all the gas transmission and distribution operators. The duty to appoint an NEC is currently held by NGG, but must be independent of the gas control room and transmission operations. In the event of a gas supply emergency the gas control room and transmission operations must submit to the direction of the NEC. The greater independence of the FSO could therefore suit this role provided the appointee has sufficient competence in health and safety matters and holds an NEC safety case that has been approved by HSE.

To perform these functions, in particular the strategic network planning function, the FSO will require operational and asset data regarding the gas network to be provided by NGG. Also, since the customer connections function is not included in this option, the FSO will need to be aware of planned connections/disconnections to take these into account in its network planning processes. Hence, data sharing agreements would need to be set up between the FSO and NGG, with guidance and/or methodologies underpinning these to promote efficiency and decision making. We cover legislation that may be needed to accommodate this in section 4.3.1.

Although there is no evidence of them being acted upon, there are nevertheless potential perceived conflicts of interest within current gas system arrangements concerning network investment (or decommissioning) in the gas network planning process and in the future direction of market development. We consider that the independence of the FSO would remove these and help ensure that its analysis is as robust (and perceived to be robust) as possible.

This option would also enable the FSO, alongside electricity, to consider alternative whole energy system options to satisfy customer requirements, such as distribution-level or cross-vector solutions. In the future, this may extend to considering the role that developing technologies, such as hydrogen and heat networks, can play in meeting the needs of customers. The cross-vector remit of the FSO would also enable it to lead the industry in consideration of how market frameworks can accommodate whole energy system solutions and developing technologies. Ofgem would remain the ultimate decision-maker on network investment plans submitted through price control processes by NGG but would be able to do this in reference to the independent assessment of network capability produced by the FSO in the ANCAR and GTYS, and utilising the expertise of the FSO in long-term strategic planning. We outline this rationale further in Annex 1.

Given there are some synergies and feedback loops between the real time system operation and network planning functions (for which data sharing agreements will need to be in place, as described above), separation of these roles will likely result in some inefficiencies in network planning and may require duplication of certain functions across both organisations to ensure NGG still has the ability to perform its duties.

Whilst this option may require some duplication of functions between the FSO and NGG, we consider the benefits to outweigh the costs and risks. It would also position the FSO well to provide technical whole system advice across a range of decarbonisation issues and take on any new and enhanced roles and functions outlined in section 3.2.

Option 2: All GSO roles, including real time system operation functions

This option would involve the FSO undertaking all GSO roles (as with electricity), including real time system operation and the associated functions outlined below, leaving NGG as an entity principally focused on TO activities. The FSO would take on all roles and functions outlined in Option 1, as well as:

- real time gas system operation (including the control room);
- operating and balancing the system (including short-term network capability assessment, forecasting and gas Summer/Winter outlooks);
- outage management and access planning;
- emergency response procedures;
- customer connections processes; and
- operational market functions (including gas market facilitation, gas market change, charges and revenue, capacity and contract services).

Although there is no evidence of them being acted upon, this option would fully remove any potential for perceived asset ownership conflicts of interest and thus provide the greatest degree of independence in long-term network planning. It would also maintain the existing feedback loops and information synergies between real time system operation and network planning (although we consider these could be partly mitigated through data sharing as outlined above).

However, as described at the beginning of this section, moving these additional functions away from the TO would be likely to result in loss of day-to-day operational efficiencies and could result in higher asset maintenance costs. Importantly, there would be significant safety case implications as a result of gas system operation and physical asset operation being performed by separate organisations. Overcoming safety risks would require careful interface design and likely numerous shadow functions in both organisations (such as a network operation centre within NGG controlling physical assets, closely interfaced with a gas control room in the FSO). This would create significant inefficiencies and be costly to implement and maintain (and the risk may not be mitigated entirely). More detail on the safety case is outlined in Annex 1 and cost estimates are outlined in the IA.

Our view is this option presents significant risk, complexity and potential cost, without equal benefit (cost and benefit estimates are outlined in the IA). Therefore, we do not currently think there is a case for the FSO to take on all the roles and functions of the GSO outlined in this option.

Electricity- Gas control room coordination and information sharing

Although we do not consider there is currently a case for the FSO taking on the real time system operation and associated functions outlined in option 2, there may be future hydrogen scenarios where there would be greater benefits in having a combined gas/hydrogen and electricity FSO control room operating the whole energy system on a daily basis (due to the greater interlinkages between hydrogen and electricity). The benefits from this will largely be dependent on whether any hydrogen uptake is at a national level, the prevailing type of hydrogen to be produced and who the system operator would be. Therefore, further

consideration of the costs and benefits of the FSO taking on real time system operation and any associated functions could be re-considered in light of greater clarity over this, which we expect to be in the late 2020s.

Depending on the final FSO roles and design, it is likely we will need to assess the nature of information sharing arrangements between the FSO and NGG. This would assess whether increased information sharing could improve coordination between the two bodies, whilst taking into account the broader impacts on the markets they operate.

In the meantime, Ofgem and BEIS are considering whether information sharing between the two current control rooms could be improved and assessing the potential consequences of such changes (including changes to licences and codes)[47]. This would enable the electricity and gas control rooms to coordinate actions under predefined circumstances, particularly pre-emergency or system distress scenarios, to mitigate against the risk of interoperability failures with no impact on competition. This is also being reviewed as part of the Review of the Impact of a Gas Supply Shortage on the Electricity Network (RIGSSE) project, which is a cross-industry project and being coordinated by NGG[48]. The outcomes of this work could have implications for the FSO's information sharing arrangements when it starts to operate.

8. Do you agree that the FSO should undertake all the existing roles and functions of NGESO? If not, please explain why.

9. Do you agree there is a case for the FSO to undertake the gas strategic functions outlined in Option 1? Please elaborate and provide any views on the functions we have outlined.

10. Do you agree that there is not currently a case for the FSO to undertake all GSO roles and functions, including real-time gas system operation, as outlined in Option 2? If you do not agree, please explain why.

3.2 New and enhanced FSO roles

We outline in this section a number of new and enhanced roles and functions across electricity, gas and other emerging vectors (such as hydrogen and CCUS) that we consider the FSO is well placed to take on to drive progress towards net zero. We recognise that giving the FSO new or enhanced roles and functions will affect how existing bodies such as networks and energy market participants interact with the system operator and, in some cases, the roles they themselves fulfil.

We consider that the FSO should have a clear and robust remit, but also allow provision for the detail of roles and functions (and further new roles and functions that emerge) to evolve over

[47] Any assessment will need to consider the impact on competition and market participants.
[48] RIGSSE is a cross industry project under Energy Emergency Executive Committee (E3C) comprising of stakeholders from across the gas and electricity sectors. This is looking at the current blockers to effective coordination and response options which prioritise both energy networks and is being consulted on with industry. Any recommendations are due to be finalised in spring next year.

time. We therefore propose that legislation will provide the remit for the FSO, potentially through setting out high-level roles for the FSO, such as real time operation for electricity, supporting the technical development and planning of electricity and gas networks, ensuring the future operability of the networks, and facilitating market development. Section 4.3.1 sets out potential principal objectives that could supplement this and other powers and duties for the FSO that we consider should be set out in legislation.

These roles and functions include substantial advisory aspects, providing policy makers and wider stakeholders with technical advice, recommendations, and analysis across a range of issues, including decarbonisation. If necessary, we will consider introducing primary legislation to impose a duty on the FSO to provide advice or information when requested by UK Government, devolved administrations, Ofgem, or other specified organisations with responsibilities in the energy sector, including the Committee on Climate Change (CCC), code managers and potentially local authorities. There would also need to be appropriate limits on any such duty to avoid imposing an undue burden on the FSO, including cost sharing arrangements where appropriate.

We set out this advisory role in more detail in section 3.2.1. Most of the other roles and functions draw on parallel pieces of work or are dependent on decisions made on decarbonisation pathways (such as CCUS and hydrogen) and will therefore be subject to further consultations (ongoing or planned) across the relevant policy areas in BEIS and Ofgem. We outline this at the end of each section. We also outline where the detailed provision for these functions would be set out in the FSO's licence (and other energy licences and/or codes, where necessary).

We are therefore consulting in this section on whether we have correctly identified and scoped the right areas for high-level enhanced and new roles and functions which are required to drive net zero, and which could sit well within the FSO. We will take forward any necessary legislation when parliamentary time allows.

3.2.1 Advisory role

The Government and Ofgem will have to make important policy and regulatory decisions across many areas of the energy system over the coming decades to enable progress towards net zero. Many of these decisions would benefit from drawing on specific areas of expertise of the FSO, such as the impacts of potential government or Ofgem decisions on future system operability or network investment. Being able to request and draw on specific targeted advice from the FSO will be hugely valuable to help ensure any decisions made are robust and based on full available evidence.

As an example, the FSO's advice could be particularly important in heat as there are links between electricity and gas (including hydrogen) systems, for example use of gas for power, or electrolysis, as well as hybrid heat pumps which can be operated using either gas or electricity. Other examples of where advice may be of significant benefit could include insight on the implications of different generation technology mixes, on the impact of different approaches to transport decarbonisation, and on the interactions of hydrogen and CCUS with other systems.

Other public organisations may also benefit from the expertise of the FSO. The CCC, in providing its own advice to government on our decarbonisation targets, may benefit from drawing on the insight of the FSO. As part of our proposals in our parallel consultation on Energy Code Reform, the person(s) performing the code manager function would regularly

take decisions on the future of energy codes, which may benefit from the advice of the FSO on the implications of different potential decisions on the system. Local authorities may also have key decisions to make with impacts on the energy system, for example concerning the decarbonisation of heat.

We therefore propose that the FSO would provide advice, where requested by such decision-making organisations. We will consider introducing primary legislation setting out a power to request advice or information from the FSO (and a duty for the FSO to respond) when parliamentary time allows. To ensure that this function does not put an undue burden on the FSO, we will consider whether there need to be appropriate procedural requirements or conditions that must be met for this power to be exercised. This could include satisfactory arrangements for allocating or sharing the costs to the FSO of providing this advice or information.

3.2.2 Dispute resolution

Between Ofgem and the current ESO there are a variety of functions relating to the determination of disputes. For example, they both have roles in determining disputes in relation to prequalifying industry applicants to bid in capacity auctions. Ofgem also determines disputes between industry parties and NGESO, transmission owners and distribution network operators. We are considering whether there is merit in consolidating or streamlining dispute resolution roles within the FSO, potentially including the FSO taking on a role to determine disputes between industry parties. With this in mind, we would be interested in receiving views on this proposal. Depending on the outcome of this consultation and to the extent that we are minded to modify any existing powers and functions, including through legislation, we would expect to engage further with stakeholders to allow for appropriate consultation.

3.2.3 System planning and network development

We consider the FSO should take on new and enhanced functions in system planning and network development, with a greater focus on the energy system as a whole (including both electricity and gas). In their report on system operation, Ofgem recommended that the FSO should have responsibilities in both electricity and gas network development[49]. The FSO would be well placed to take on such functions because of the synergies between electricity system development and electricity system operation, and the benefits of a whole system perspective across electricity and gas network planning. As part of this, the FSO may have a role in transferring funds between the gas and electricity sectors, if approved by Ofgem, to enable whole system projects[50]. We will consider what relationships are required between the FSO and other industry bodies (such as Xoserve) to facilitate fund transfers for this, as well as broader activities.

Examples of potential FSO functions in whole system planning and network development include:

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[49]BEIS *Review of GB energy system operation* (2021) https://www.ofgem.gov.uk/publications-and-updates/review-gb-energy-system-operation

[50] Ofgem is developing details on the operation of the Strategic Innovation Fund within its RIIO-2 network price control and will further consider how it could fund whole system projects, including potentially transferring funds between the gas and electricity sectors, in coming months.

- holistic and coordinated (onshore and offshore) network planning;
- enhanced electricity network planning and Network Options Assessment (NOA) process, such as critically evaluating and challenging the full range of possible options for addressing system needs (commercial non-network alternatives) and developing an overall electricity transmission network design;
- taking a greater role in planning and co-ordinating the gas transmission network alongside electricity, such as introducing a Gas Networks Options Assessment (this could evolve into a Whole Systems Options assessment in future);
- critically evaluating investment proposals as part of the price control process;
- providing technical advice and evidence-based recommendations to Ofgem, government and the CCC; and
- staying abreast of new technologies and identifying areas where new technology is needed (such as identifying options for hydrogen storage locations).

There are a number of reviews underway that will include further consultation, including Ofgem's strategic review of electricity transmission network planning, which will be consulted on in the autumn, and BEIS and Ofgem's Offshore Transmission Network Review (OTNR)[51] for which a consultation is currently open[52], and a further consultation will follow later this year. Ofgem will also undertake further work to consider the potential role of the FSO in gas network planning.

We expect these network planning functions to be largely advisory, providing analysis and recommendations to allow Ofgem to take decisions approving investment. However, in the future it is possible that these functions could develop to the point where the FSO could take on a stronger role in electricity network planning, potentially recommending network designs and tendering for and/or contracting with parties to build and operate network assets, particularly in areas that deliver efficient 'whole system' solutions (such as solutions that deliver efficiencies through coordination across the GB transmission network, gas[53] and electricity networks, and/or transmission and distribution networks). We will legislate if necessary to achieve this, following the outcomes of Ofgem's electricity transmission network planning review. The detailed provision for these functions would be set out in the FSO's licence (and other energy licences and/or codes, where necessary), and would be subject to future consultation by Ofgem. An early example of this could be the work on a holistic network design (combining offshore and part of the onshore transmission network planning) which is proposed in the OTNR consultation referenced above.

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[51] BEIS and Ofgem *Response to open letter on increasing the level of coordination in offshore electricity infrastructure* (2020) https://www.gov.uk/government/groups/offshore-transmission-network-review

[52] Ofgem *Consultation on changes intended to bring about greater coordination in the development of offshore energy networks* (2021) https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks

[53] The FSO would consider whole systems solutions that include considerations of the gas networks, but Ofgem would remain the decision maker in gas network investment plans proposed by NGG as part of price control processes, see Annex 1 for more details of the FSO's proposed role in gas networks.

3.2.4 Driving competition in energy networks

The FSO could take on new and enhanced functions in relation to driving competition in energy networks. BEIS has committed to introduce legislation when parliamentary time allows to enable onshore electricity network competition, by allowing parties other than the established network companies to compete for network solution build, ownership, and operation[54]. The proposed legislation would allow the Secretary of State to appoint a body or bodies to run electricity network competitions. The FSO could be a strong candidate for this role as it is closely linked to network planning and NGESO has already begun to link the NOA into early competition work[55], alongside the NOA pathfinder process[56]. This includes the delivery of its Early Competition Plan[57], as requested by Ofgem, to help Ofgem establish the next steps on early competition[58].

Examples of potential FSO functions in electricity network competition, and possibly in gas, hydrogen or CCUS in future (if a regime is developed), include:

- running tenders as part of an electricity networks competition regime (subject to consultation and Secretary of State decision) and tenders in other future regimes;
- advising government and Ofgem on tendering criteria;
- making recommendations to Ofgem on where network competition for specific projects would be in consumers' interests (building on the Early Competition Plan); and
- considering a full range of commercial non-network alternatives to traditional network solutions as part of network planning process and in any competitive tenders (building on the NOA Pathfinder processes and the Early Competition Plan).

BEIS and Ofgem will be separately consulting later this year on competition in onshore electricity networks, which will include consideration of the functions above., Any detailed provision of the FSO's role in competition would be set out in the FSO's licence (and other energy licences and/or codes, where necessary) and would be the subject of future consultation.

The above functions would involve developing expert input and providing advice into Ofgem and government decision making[59]. Although there are greater decision-making responsibilities in running tenders, Ofgem would ultimately make the final decision on whether to grant a licence to the successful bidder.

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[54] BEIS *Energy white paper: Powering our net zero future* (2020) pp 76 https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future

[55] Early competition refers to competition that occurs before the detailed design, surveying and consenting phases of solution development.

[56] National Grid ESO *NOA Pathfinders* (2021) https://www.nationalgrideso.com/future-of-energy/projects/pathfinders

[57] National Grid ESO *Early Competition Plan Project* (2021)https://www.nationalgrideso.com/future-energy/projects/early-competition-plan

[58] Ofgem *ESO Early Competition Plan* (2019) https://www.ofgem.gov.uk/publications/electricity-system-operators-early-competition-plan-letter

[59] If the FSO is not appointed as the body to running a competitive tender the FSO should be giving advice on the tender process

3.2.5 Energy market design

The FSO could play a greater role in market design and take on additional duties in relation to the electricity Capacity Market. One of the current key functions of NGESO is as the delivery body for the Capacity Market[60] and therefore would be well placed to take on any further functions that are identified. For example, the FSO could in future:

- take on responsibility for certain Capacity Market functions that currently sit with the Secretary of State for BEIS or Ofgem; and
- take a greater role in the design of energy markets more broadly, were any reforms to become necessary in future.

BEIS will shortly commence its next statutory five-year review of the Capacity Market that will review whether the Capacity Market is meeting its original objectives in light of the Government's net zero targets. This workstream will include a thorough examination of the roles and responsibilities of the organisations involved in delivering the Capacity Market, including roles for the FSO in market design and other additional duties.

The detailed provision for any functions in this area would be set out in the legislation for the Capacity Market and would be subject to further consultation.

3.2.6 Coordination with distribution networks

Distribution systems will be an important part of the transition to net zero, and we consider that the FSO should co-ordinate with the distribution networks for electricity (DNOs) and gas (GDNs). The FSO is well placed to do this given its system-wide perspective and its wider roles supporting network planning and future system operability. Whilst some work in this area is already being undertaken[61], examples of enhanced functions in coordination with distribution networks could include:

- working with DNOs and GDNs to enable whole system optimisation as part of network planning;
- engagement with GDNs to improve network processes that is beneficial to whole system efficiency and reviewing consistency across transmission and distribution gas charging methodologies (advising on whether charging principles and/or methodologies need to be reviewed); and
- the FSO taking on new DSO functions itself in the future, where appropriate and if there is a clear case for doing so (see breakout box, which includes reference to actions set out in the 2021 Smart Systems and Flexibility Plan[62]).

[60] The Delivery Body's functions are set out in the Electricity Capacity Regulations 2014 (SI 2014/2043) and the Capacity Market Rules 2014.
[61] National Grid ESO *Enabling the DSO transition* (2021) https://www.nationalgrideso.com/research-publications/whole-electricity-system.
[62] BEIS *Smart Systems and Flexibility Plan* (2021) https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021

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Breakout box: DSO transition and further actions

The 2021 Smart Systems and Flexibility Plan sets out new actions for industry to drive local markets for flexibility and ensuring coordination across all levels of the system. The plan sets out Government's and Ofgem's expectations of how DSO capabilities will need to evolve to mature local markets for flexibility and ensure network and system operators work to together to optimise decision-making across the system.

Following on from the actions set out in the Smart System and Flexibility plan in 2017, Ofgem has been updating distribution licences and the price control framework to provide updated expectations to DNOs as they develop distribution system operation (DSO) capabilities in planning, operations and market facilitation. They expect the DNOs to include aspirational plans for progressing effective and efficient outcomes from more active distribution system operation, including how they will manage any real or perceived conflicts of interest, in their business plans for RIIO2.

We also recognise how important the DSO functions are to the transition to net zero. Ofgem is undertaking a DSO Governance review and will be consulting with stakeholders in the coming year to investigate the merits of alternative models against the current model. Alternative options that Ofgem will consider include greater separation of distribution system operation functions, which could range from functional separation, to legal separation, through to full ownership separation. The functions that could be separated could be one, some, or all of their planning, operation and market facilitation functions, or elements within these. Other parties could perform some functions, including potentially the FSO.

Alongside this, we will consider how Ofgem licenses the activities. Options include maintaining the status quo, through to considering a separate licence(s), defined by either functions or voltage level applicability, or both.

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Ofgem will undertake a review of electricity distribution system operation governance over the coming year, where alternative options for DSO governance arrangements will be developed and consulted upon, with a view to making a recommendation on any changes by 2023. This could include changes to the price control, distribution licence, or institutional change, including through legislation if necessary. Following the outcome of this review, we will have clearer picture on the precise nature of distribution system operation. This will likely have significant implications for both FSO functions, and how the FSO coordinates with DSO functions. BEIS and Ofgem will work to identify whether any further changes are needed to the FSO's functions. We expect any more specific roles in relation to GDNs will be clearer in the mid-2020s when decisions are made on heat, particularly on the degree of localisation.

The detailed provision for any functions in this area would be set out in the FSO's licence[63] (and other energy licences and/or codes, where necessary) and would be the subject of future consultation.

3.2.7 Heat and transport decarbonisation

The FSO could play a greater role in providing advice and potentially coordinating elements of heat and transport decarbonisation. This would build on our proposed duty to advise key decision makers on this area, such as BEIS, Ofgem, devolved administrations[64] and potentially local authorities (see section 3.2.1 above). The FSO could be well placed to take on this role given its system-wide perspective and due to the strong links with its current and potential future responsibilities in network planning, future system operability and co-ordinating with the distribution networks.

- Examples of functions or areas that might be explored in future for the FSO to take on are:
- roles in local energy mapping and planning such as providing overarching national perspective on how plans for local energy decarbonisation area plans fit together and inform scenario development; and
- taking account of existing local plans and energy frameworks/landscapes in fulfilling its functions, particularly network planning.

We consider that the FSO could be suitable to take on further roles in this area but what precise role an FSO will need to play and the extent to which decision making will be decentralised will be determined as part of BEIS wider work on heat governance and local area energy mapping and planning. BEIS would consult before confirming any FSO role in this area.

3.2.8 Data

Providing transparent, accessible data is a key current function of NGESO and NGG. The FSO could play a greater role in data and digitalisation, which will become increasingly valuable and important to unlocking energy system, consumer, and societal benefits. The FSO may become well placed to undertake certain data functions in performing its wider roles managing complex challenges in balancing and planning a low carbon system. The Government and Ofgem have set out a vision and suite of actions for digitalising the energy system in the Energy Digitalisation Strategy[65], which builds on previous work done by the independent Energy Data Taskforce (EDTF)[66].

Examples of data responsibilities that the FSO could be suitable to take on in future, which would be the subject of future consultation, include:

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[63] Ofgem recently introduced a Whole Electricity Systems Licence condition, which sets a minimum requirement of cooperation and coordination between licensees and an obligation to consider proposals brought to them by their network users.
[64] Noting that these issues include areas of devolved authority
[65] BEIS *Digitalising our energy system for net zero strategy and action plan* (2021) https://www.gov.uk/government/publications/digitalising-our-energy-system-for-net-zero-strategy-and-action-plan
[66] Catapult Energy Systems *Energy Data Taskforce: A Strategy for a Modern Digitalised Energy System* (2019) https://es.catapult.org.uk/reports/energy-data-taskforce-report/

- undertaking horizon scanning activities, monitoring data developments, and advising the energy sector on data held by the FSO, and any future requirements that may be needed as a result;
- coordinating and maintaining data standards across the energy sector, comprising electricity and gas;
- determine current requirements needed to capture data across the system by, for example, ensuring visibility of network capacity to help increase visibility of constraints and trends; and
- delivery of coordinated data exchange, which may involve responsibilities that include having sight of the cleaning, categorising, and analysis of data from across various relevant industries.

The Energy Digitalisation Taskforce (EDiT)[67], which follows on from EDTF, will consider the market design, digital architecture, and governance of a modern digitalised energy system. BEIS will work with the EDiT process to further consider the roles that the FSO might play in data and digital governance in the energy system. A final report from EDiT is expected to be published by the end of 2021.

Once these roles and functions are further developed, the detailed provision would likely be set out in the FSO's licence (and other energy licences and/or codes, where necessary), and may also require further legislation, however this would be the subject of future consultation.

3.2.9 Future system operability, engineering standards and energy code development

In addition to our proposed duty on the FSO to provide advice to the code manager function set out in 3.2.1 above, the FSO could have enhanced functions related to future system operability, energy code development and engineering standards.[68] This would also build on NGESO's existing experience in code administration and responsibility for standards such as the SQSS[69].

As set out in section 2.1.2 of the parallel consultation on the Energy Code Reform, the FSO would be well placed to provide insight on how codes and standards could affect future system operability, and how they may need to evolve as a result.

Examples of functions set out in section 2.1.2 that the FSO could perform are:

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[67] Catapult Energy Systems *Energy Digitalisation Taskforce launches* (2021) https://es.catapult.org.uk/news/energy-digitalisation-taskforce-launches/

[68] Engineering standards are requirements specifying how the physical electricity and gas infrastructure must be built, maintained and operated. The energy codes are the detailed technical and commercial rules of the electricity and gas systems. There are 12 energy codes (including the Retail Energy Code) and many more engineering standards, some of which are embedded in the codes, but others of which sit in guidance, legislation or under the remit of non-energy specific bodies such as the British Standards Institute (BSI) or Institute for Gas Engineers and Managers (IGEM). As such, they are are governed by different rules under a number of different bodies, with varying degrees of industry and system operator influence, only some of which have oversight by Ofgem.

[69] The ESO sits on all the main grid standards panels and groupings and has considerable influence over these largely at the higher voltage levels. Changes that are put forward by various engineering standards panels would need approval from Ofgem.

- publishing an annual statement of system performance and assessment of system health for the whole electricity system;
- monitoring and proactively recommending changes to electricity and gas codes and engineering standards that it believes could affect future system operability, resilience, decarbonisation, or system cost;
- working closely with parties responsible for engineering standards that are not part of the codes' ecosystem such as BSI, and IGEM;
- acting as a code manager for one or more codes where there are benefits to do so; and
- oversight of the whole of energy code development as an Integrated Rule Making Body (IRMB) that would combine strategic and code manager functions for all codes (noting that this is not our preferred option in the Energy Code Reform consultation)[70].

The provision of advice on future system operability and for the purposes of energy code and standards development could fall under the FSO's proposed advisory function at 3.2.1 above.

If the FSO were to take on any additional functions in engineering standards, we would expect the FSO to consider our responses to the Electrical engineering standards independent review[71] published alongside this consultation[72].

Any other related potential roles and functions for the FSO will be considered by Ofgem as part of their ongoing work on energy codes reform and would be implemented through the FSO licence, whilst still being overseen by Ofgem. If the FSO was acting as a licensed code manager for in-scope engineering standards, any potential conflicts of interest would need to be carefully considered and mitigated. The proposed code manager selection process is set out in more detail in the Energy Code Reform consultation in chapter 5.2.

3.2.10 Hydrogen

In addition to its advisory role outlined in section 3.2.1, the FSO could take on additional functions to support the growth and diversification of hydrogen networks over the 2020s, to enable the UK to meet its 5GW ambition[73] and prepare for future ramp up. These functions will

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[70] BEIS and Ofgem *Consultation on the Design and Delivery of Energy Code Reform* (2021) https://www.gov.uk/government/consultations/energy-code-reform-governance-framework
The Energy Code Reform consultation published in parallel to this consultation sets out two options for future code governance. The preferred option is to designate Ofgem as a strategic body for codes with the power to license separate code managers. The alternative option presented in the Energy Code Reform consultation sees an FSO taking on the role of an Integrated Rule Making Body (IRMB) that would combine a strategic function and a code manager function. Reponses to the Energy Code Reform consultation will inform the decision as to which option would be taken forward. In addition, the code reform consultation proposes to introduce one or more code managers responsible for developing the relevant provisions in codes and in-scope engineering standards under the preferred option. Under the alternative option, this role would sit with the code manager function of the IRMB.
[71] Government and Ofgem *Electrical engineering standards: independent review* (2020) https://www.gov.uk/government/publications/electrical-engineering-standards-independent-review
[72] GOV UK *Independent Review of Electrical Engineering Standards: Government Response* (2021) https://www.gov.uk/government/publications/independent-review-of-electrical-engineering-standards-government-response
[73] HM Government *The Ten Point Plan for a Green Industrial Revolution* (2020) https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution

be dependent on greater certainty over future role of hydrogen, especially when decisions are made on hydrogen in heating (likely in the mid-2020s). As mentioned in section 3.1.2, the potential level of interaction between hydrogen and electricity networks, and decisions over any control room operations for hydrogen, could make the case to bring the gas control room into the FSO in the future. BEIS will develop thinking on this as the hydrogen market itself develops and BEIS would consult before confirming any FSO role in this area.

3.2.11 CCUS

In addition to its advisory role outlined in section 3.2.1, the FSO could have additional functions in the development of CCUS. In the early deployment phase, the development of CO2 Transport and Storage (CO2 T&S) networks is likely to be supported by government. However, over time and into the 2030s, a possible network build-out and expansion of CCUS could be overseen by the FSO (or another similar entity) alongside gas/hydrogen and electricity networks. In this circumstance, the FSO will need to consider the interdependencies of CO2 T&S networks with the wider gas and electricity networks, as part of an enhanced network planning function. It is unclear exactly what roles could emerge in relation to CCUS T&S. We will develop our thinking as the CCUS market develops over the coming decade, and would consult before deciding on any FSO role in this area.

11. Do you have views on the proposal for an advisory role? What organisations do you consider would benefit from the provision of advice by the FSO? Who should bear the costs of providing that advice?

12. Do you have any views on the other areas where we are considering new and enhanced roles and functions for the FSO (outlined in section 3.2)?

4. FSO organisational model

An effective FSO will require an organisational model that enables it to perform its functions effectively and deliver the new and enhanced roles and functions proposed in chapter 3.2 on behalf of consumers and the public. This section of the consultation outlines the high-level characteristics and detailed attributes which we consider are needed to achieve this and seeks views on two different organisational models and the extent to which they meet these characteristics and attributes.

4.1 Desired high-level characteristics of the FSO

For the FSO to fulfil the objectives for reform outlined in section 1.5, it will need to possess certain high-level characteristics that are essential to effectively deliver the roles and functions described above. The FSO needs to be technically expert; operationally excellent; accountable to consumers and able to support the delivery of net zero on behalf of the public; independently minded; and resilient, both operationally and financially.

These characteristics are developed from the Ofgem review of GB system operation[74] which set out 'accountable', 'financeable', 'operational capability', 'independently minded' and 'resilient' as key design parameters. In this consultation operational capability is considered separately under 'technically expert' and 'operationally excellent' to distinguish between expertise and process, while 'financeability' is considered under 'resilience' as a measure of financial resilience.

4.1.1 Technically expert

The FSO will be working within a complex landscape, driven by the significant technological change the sector will be experiencing, and an in-depth understanding of this by employees of the FSO is critical to its success. To possess this characteristic, the FSO will need to have:

- an in-depth understanding of the industry context, development of and operational inner workings of the energy system to enable it to deliver cost-effective network planning and - potentially - competition, and to consider and advise on the future development of that system within the Government's strategic policy framework; and
- the ability to access and use sector-wide knowledge, both internally and from a variety of different industry and independent participants and experts, to provide high quality analysis of the energy system and effectively facilitate the transition to net zero.

As set out in section 2.3, we consider an FSO that's founded on the existing capabilities and functions of NGESO, and where appropriate NGG, would provide a strong platform of technical expertise. However, organisational design choices will also have an important impact on the technical expertise of the FSO in practice.

[74] Ofgem *Review of GB energy system operation* (2021) https://www.ofgem.gov.uk/publications-and-updates/review-gb-energy-system-operation

4.1.2 Operationally excellent

The proposed roles and functions for the FSO outlined in chapter 3 require the FSO to be agile, with a clear understanding of how market participants operate and are expected to adapt in the context of net zero. But it should also offer stability and robustness in an evolving market and regulatory landscape. To possess this characteristic, the FSO will need:

- effective governance, with an impartial and experienced Board driving the FSO to deliver on its core objectives;
- strong leadership to drive organisation performance within regulatory framework;
- strong relationships with energy market participants and system users with clear routes for engagement;
- the ability to access and use funding as required;
- the ability to recruit and retain a highly skilled workforce;
- access to market information and data flows to identify where innovative solutions could be implemented to address capacity constraints. This will be particularly valuable at the interfaces between the gas and electricity system and the energy system and the wider economy; and
- the ability to exploit synergies across its different roles to drive high performance and optimise outcomes while managing risk effectively.

As set out in section 2.3, we consider that by founding the FSO on the existing capabilities and functions of NGESO, and where appropriate NGG, it would be built on a strong platform of operational excellence. However, organisational design choices will also have an important impact on the operational excellence of the FSO in practice.

4.1.3 Accountable to consumers and able to support the delivery of net zero on behalf of the public

Through the roles outlined in chapter 3, we propose that the FSO will be both the day-to-day electricity system operator and an important facilitator and coordinator in long-term change and delivery of net zero. In undertaking these roles and functions, it will need to further the interests of existing and future consumers, as well as be able to support the delivery of net zero on behalf of the public. Many of the outcomes required for an effective FSO may be challenging to measure in the short-term. To possess this characteristic, the FSO will need:

- accountability to the regulator through a robust regulatory regime to ensure transparency of decision-making, and that its roles are delivered in the interests of consumers;
- to deliver within the strategic policy context set out by the Government in any designated Strategy and Policy Statement, and within the legislative framework for the FSO set by Parliament, which is accountable in turn to the public;

- appropriate incentivisation to deliver high performance, minimise system costs, and align the operation of the FSO with the interest of consumers;
- appropriate checks and balances through oversight and monitoring of its performance, backed up with appropriate sanctions for performance failures; and
- an organisational design which minimises conflicts between consumers and FSO interests.

4.1.4 Independently minded

Independence for the FSO means acting – and being perceived to act – without undue influence from industry or short-term influence from government. It will require:

- ownership and governance that excludes other commercial interests in the energy sector which could give rise to conflicts of interest or create perceptions of it. This will ensure that market participants and government have confidence in the impartiality of the FSO's decisions and advice and in its facilitation of markets, competition, and system development; and
- government influence over the system operator to be limited to oversight that is strategic and not short-term or operational. Although the FSO will be delivering a function linked to the government's net zero targets, it is vital that short-term operational influence or operational constraints do not prevent the FSO from working efficiently.

4.1.5 Resilient

The resilience of the electricity and gas systems is vital. As a result, the FSO will need to be organisationally and operationally resilient. It will have to remain financially and operationally robust both in times of system stress and in proactively responding to new and unanticipated challenges. It will need:

- the resources to maintain appropriate people, processes and systems to fulfil its role;
- a funding framework that enables it to operate effectively and undertake capital spending as needed;
- a cyber security system and strategy that enables a 'secure by design' approach, ensuring cyber resilience to an evolving and growing cyber risk landscape;
- a robust and efficient structure to enable it to avoid, cope with, and recover from, any disruption to its overall cashflow;
- foresight and systems in place to prepare and respond to long-term challenges including climate change, energy shortages, natural disasters or pandemics; and
- an effective governance and leadership structure, allowing it to facilitate complex system changes while being held accountable for performance.

4.2 Resulting attributes

To make these characteristics a reality, the FSO will need to possess certain attributes that we have categorised under people and capability, assets, systems, and processes, financial sustainability, and governance.

4.2.1 People and capability

The FSO will need to be able to attract and retain employees with technical expertise and use their sector-wide and cross-sector industry knowledge to help achieve net zero targets according to an ambitious timeline consistent with government policy. This requires:

- the ability to function effectively within the increasingly interconnected economy, developing capability in adjacent sectors if required, and adapting to any incoming arrangements relevant to overall infrastructure policy;
- excellent leadership, establishing the FSO as a prominent and independent voice in the energy sector, capable of attracting a talented workforce and supporting its staff in delivering realistic and evidence-based targets;
- consistency and continuity in terms of personnel so that the FSO builds up institutional knowledge that can be transferred efficiently to new contexts based on what has been effective over time and gaining insights for future enhancements; and
- a motivated and knowledgeable workforce, for which the FSO must be able to compete for the best of energy market, technical and engineering expertise in the labour market. This means providing excellent career development, prospects, and training opportunities to attract, motivate and retain highly qualified staff. Relevant expertise will include data, digitalisation, technical operational, engineering, network planning and analytics, the legal regulatory framework, and cybersecurity, and may expand into potential emerging markets such as hydrogen, heat and CCUS.

4.2.2 Assets, systems, and processes

The FSO will need to be able to invest in and maintain the assets, systems and processes that enable it to carry out the proposed functions outlined in chapter 3 across both electricity and gas. The FSO will need:

- the systems and technical assets (such as the control room) to allow it to meet its obligations to operate the system in line with regulation (for example maintaining system frequency) including in stressed situations;
- appropriate rights and agreements with TOs and other energy system counterparties, or other parties over which it will need to have visibility;
- the flexibility to develop and introduce new systems and processes to ensure efficient operation and to carry out new roles, including those which could not have been anticipated at its inception;

- a high degree of operational independence without adverse commercial interests or day-to-day government or ministerial control. The FSO will have processes and arrangements in place that ensures independence from industry and government and to mitigate against any potential conflicts of interest;
- access to market information and robust flows of information with other market participants (including TOs), industry and government. This will be vital for the continuity of current activities, enabling secure data access to other industry participants and enabling future innovation; and
- the ability to invest in and maintain an appropriate level of cyber resilience to mitigate the risks that could compromise energy supply.

4.2.3 Financially sustainable

The financial position of the FSO will need to be secure to safeguard the running and maintaining of the FSO's operating systems and the funding of projects to ensure stability in terms of system operation as well as deliver net zero. The FSO will need:

- sufficient and flexible funding to support foreseeable internal costs including people, assets and wider systems, especially during the transition to the FSO;
- robust arrangements to ensure costs are efficient and represent value for consumers;
- robust arrangements for recovering costs efficiently and aligned with investment timelines and ensuring network charging systems are effectively managed;
- the ability to raise capital on reasonable terms to fund necessary business expenses and capability to deliver on current and new roles, with budgets likely to be overseen by Ofgem as part of an efficient regulatory structure;
- sufficient working capital to manage cashflow timing mismatches;
- appropriate financial resilience; and
- provisions to ensure continuity of FSO functions. This could require specific safeguards and a special administrative regime to protect the secure operation of the energy system.

4.2.4 Governance

Existing governance arrangements will need to be modified for the FSO, and additional arrangements and governance structures put in place to accommodate the desired characteristics noted above. The FSO will need:

- sufficient independence from other energy industry interests to avoid conflicts of interest, while having transparent routes for industry input (TOs, GDNs, DNOs, generators, suppliers, consumers, and wider energy bodies such as LCCC);
- incentives to act in the interest of consumers, including to deliver on net zero-related targets;

- freedom from short-term government influence, while maintaining alignment to the Government's overarching strategy. Although the FSO will need to be free from day-to-day operational influence from government, alignment with long-term policy goals will be essential to enable the net zero target to be reached. The SPS will provide a framework to enable government and the FSO to align policies for net zero.
- full accountability to the regulator through a robust and transparent regulatory regime; and
- robust controls to safeguard against national security and energy security of supply risks.

4.3 Options for organisational models

Having considered the roles, characteristics, and attributes that we propose the FSO will need, and the breadth of potential organisational structures, we are currently considering two different organisational models for the FSO:

- a standalone privately owned model, independent of energy sector interests; or
- a highly independent corporate body model, classified within the public sector, but with operational independence from government.

A privately owned model, independent of energy sector interests, would enter the market, and Ofgem's regulatory framework, on a commercial basis determined by its owners. While we are aware that there are not-for-profit organisations operating in energy and other sectors, we anticipate that to attract an owner it would likely operate on a for-profit basis. One example of this is as a shareholder owned company owned by, and accountable to, private shareholders that are not conflicted by other energy sector interests. It would be permitted to make a profit and pay a dividend resulting from its system operation activities. It would be limited, pending approval by government or Ofgem, from undertaking unregulated activities. It would use market mechanisms to fund debt. The FSO's non-executive board appointments would be controlled by its owners, with executive appointments controlled by the board, though with limitations set out in licence to prevent conflicts of interest relating to other energy industry interests.

A highly independent non-private entity would be operationally independent of government but classified as public sector. This organisation would again be independent of other energy sector interests, and distance government from day-to-day operational decisions. Board appointments would be made through a transparent process, with the executive appointed by that board. This organisation would be non-profit distributing, so its overarching objectives and obligations, as set out in articles of association, legislation and licence, would be the structural drivers of its behaviours, although financial and reputational incentives could apply to individuals in the organisation. It would have its operational independence from government enshrined in legislation and its constitutional documents and frameworks. The creation of a new body of this kind would be subject to approval by both Her Majesty's Treasury (HMT) and Cabinet Office ministers.

These models are placed in contrast to a number which are not developed further in this consultation, and which are discussed in more detail in Ofgem's review of GB system

operation.[75] The current model of private for-profit system operators owned as part of a group with energy system assets, has been discussed and rejected in the case-for change. A public sector FSO with a high level of operational control by Ministers would not meet our requirement for an independently minded body. We also do not consider there to be any significant benefits of a public-private partnership over the two models we are considering, and note that where these exist, for example NATS in the aerospace sector, the private ownership is undertaken by a group of industry participants, which would also not meet our criteria for independence.

The two models suggested here have similarities, notably in terms of long-term funding arrangements (see section 4.3.2), and the mechanism for regulation by Ofgem. They also have a number of differences in terms of ultimate accountability, influence of shareholders and incentives.

4.3.1 Regulatory framework

We expect the fundamental elements of the FSO's regulatory framework to be similar for both private, shareholder owned and non-private models and to incorporate legislation, any designated Strategy and Policy Statement, licences and codes, and funding through network charges.

Functions, powers and principal objective(s)

For both models, we propose that the high-level functions, powers and duties of the FSO would be set out in legislation when parliamentary time allows. The high-level functions of the FSO and potential duty to provide advice have been described in Chapter 3. Further proposed duties are described below in respect of any designated SPS and a duty to keep developments under review.

For a non-private FSO these could be supplemented by a duty on the FSO to have regard, in carrying out its functions, to furthering a principal objective or objectives. These objectives could cover aspects such as:

- operating the electricity system to maintain a secure reliable supply to consumers;
- taking a whole system perspective to ensure progress toward net zero;
- reducing costs for current and future consumers by encouraging the development of an efficient system; and
- protecting the interests of existing and future consumers (similar to the principal objectives of the Secretary of State and Ofgem in the Electricity Act 1989 and Gas Act 1986).

Giving the FSO these objectives would support the realisation of the benefits of reform. By taking a whole system approach the FSO can help maximise the efficiency of network expenditure through better understanding of how network investment supports different decarbonisation decisions. This in turn would help government and Ofgem to make more informed decisions about the whole system cost of different technology choices and should enable the development of a more co-ordinated energy system. We will set out strict eligibility

[75] Ofgem *Review of GB energy system operation* (2021) https://www.ofgem.gov.uk/publications-and-updates/review-gb-energy-system-operation

criteria to prevent the introduction of conflicts of interest to the ownership or governance of the FSO.

Licence(s)

The activities of the FSO to undertake its proposed functions would be licensed. Ofgem and BEIS would consider the design of one or more licences to regulate existing and additional FSO roles and functions. This would include the creation by legislation when parliamentary time allows of new licensable activities, and the creation and grant of a new, single cross energy system operator licence or multiple system operator licences (for example, one each for electricity and gas, or for operation at different levels of the network). The licence – and its accompanying industry codes[76] - would set out detailed rules and standards with which the FSO must comply. There will be further consultation on the detailed content of these licences.

Ofgem, rather than central government, would oversee the FSO's licensed activities. This model represents the smallest departure from the existing regulatory framework so would minimise disruption to the operation of NGESO and NGG during transition to the FSO and its interactions with market participants.

The non-private model considered in this consultation represents a different type of model from those that Ofgem has historically regulated. As this model will be non-profit distributing, Ofgem's traditional incentive tools will need careful consideration and may need to be modified to ensure effective regulation. Depending on the balance between public and private interests, Ofgem may require additional powers to impose penalties on a non-private entity or potentially further information gathering powers, and we will legislate, if necessary, to provide these when parliamentary time allows.

There are separate legislative and licence frameworks for electricity and gas. As system operation is intended to be a 'whole system' activity that covers both fuels, this may require amendments to provisions of the Gas Act 1986 and the Electricity Act 1989 (and potentially other energy legislation) to remove constraints on Ofgem's effective regulation of the FSO as an organisation with responsibilities in both the electricity and gas systems.

Strategy and Policy Statement

The proposed roles for the FSO will place it centrally within the Government's ambitions for the energy sector, including on net zero, security and resilience, and affordability. It is therefore important to ensure that the Government's strategic policy framework and the FSO's roles remain aligned and coherent, while respecting the FSO's operational independence.

The Energy Act 2013[77] provides a power for the Secretary of State to designate a Strategy and Policy Statement (SPS) that has been approved by Parliament[78], which would set out the strategic priorities and policy outcomes of the Government's energy policy. The Energy Act 2013 sets out that the duty to have regard to the SPS framework only applies to Ofgem and

[76] Codes will remain a part of the regulatory landscape and are undergoing changes but will not be discussed here.
[77] GOV UK *Energy Act (2013)* https://www.legislation.gov.uk/ukpga/2013/32/contents/enacted
[78] BEIS *Strategy and Policy Statement* (2015) https://www.gov.uk/government/consultations/strategy-and-policy-statement

Secretary of State in carrying out specified 'regulatory functions', although the SPS can set out roles and responsibilities of other persons. No SPS has yet been designated.

To define the FSO's operating context and strategic focus, we propose that, for the non-private ownership model, the SPS framework in the Energy Act 2013 would be amended in the following ways:

- impose legally binding duties on the FSO (as well as Ofgem and the Secretary of State as is currently the case) to have regard to the SPS strategic priorities when exercising specified functions and to carry out those functions to further the delivery of the policy outcomes; and
- impose legally binding reporting requirements on the FSO in relation to the SPS which mirror the reporting requirements on Ofgem in relation to the SPS: its forward work programme, published annually, contains its strategy for furthering the policy outcomes, and its annual report reports on how it has complied with its duties in relation to the SPS.

An SPS would provide a link between the FSO and Parliament because the SPS must be approved by Parliament before it can be designated, and Parliament will have approved the accountability of the FSO to the Secretary of State through the reporting requirements. Additionally, as happens today with NGG and NGESO, we would expect the leadership of the FSO to attend parliamentary committees to provide evidence when invited. This link between the FSO and Parliament would also help maintain the independent mindedness of the FSO in a non-private model. An SPS would also reduce frequent change to the Government's strategic priorities and desired policy outcomes as the SPS is reviewed on a five-year cycle, although there are circumstances in which an early review can be triggered.[79]

For the privately-owned model, the SPS framework would continue to impose duties only on Ofgem and the Secretary of State (to have regard to SPS strategic priorities and further SPS policy outcomes in carrying out their 'regulatory functions'). However, we propose that (subject to Parliamentary approval) any designated SPS would describe the roles and responsibilities of the FSO within the energy sector and refer to the FSO in the strategic priorities and policy outcomes. The 'regulatory functions' for Ofgem would be amended to include its licensing of the FSO, so the SPS duties would apply in the way Ofgem regulates the FSO. Government would be setting the strategic policy framework within which Ofgem regulates the FSO, and therefore indirectly setting the strategic framework for FSO performance.

Additionally, under either model, we propose that:

- future iterations of the SPS would describe the Government's strategic priorities and policy outcomes concerning the FSO, and the roles and responsibilities of the FSO; and
- if an SPS is likely to be designated by the time that primary legislation to establish the FSO is introduced, we propose to make a time-limited modification to the Energy Act 2013 to allow any designated SPS to be reviewed and amended outside of the

[79] These circumstances are set out in section 134 of the Energy Act 2013.

normal five-year cycle so the SPS can be reviewed and revised to apply to the FSO from its establishment.

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- **Ensure the FSO keeps under review relevant developments in the energy sector**
- In addition, the FSO should keep under review relevant government policy initiatives or other developments in the energy sector that are likely to impact on the FSO's work including those which occur or emerge between the (usually quinquennial) reviews of a designated SPS. The criteria for determining which government policy initiatives are relevant and are likely to impact on the FSO's work will depend on the outcome of this consultation and other context like the consultation on the Energy Code Reform. For example, we are considering how such work would operate in relation to the content of the SPS, for example in relation to the scope of what is to be kept under review. The outcome of the consultations on the SPS proposals is therefore another interdependency. If the FSO were set up as a non-private organisation this could be introduced as a statutory duty. We could also impose a statutory duty on a non-private FSO to report on what policies and developments it has considered in the preceding year and set out the initiatives it is taking forward as a result. This could be included in the requirements to publish its annual report and forward work plan.
- If the FSO were privately-owned, we could introduce the keep under review work and related reporting requirements as a licence condition.
- Irrespective of the ownership structure, the FSO would be expected to consider these developments when planning its activities.

Information sharing

The FSO might require access to relevant information held by other parties to effectively perform the proposed roles. If necessary, legislation will be introduced to provide the FSO with the necessary powers to obtain that information. Any legislative provisions will include appropriate protections for parties disclosing information, such as specifying the purpose(s) for which the information can be obtained and used. It might also require amendments to the exemptions to the general restrictions on the disclosure of information in section 105 of the Utilities Act 2000 to ensure that information could be disclosed by Ofgem to the FSO and vice-versa.

4.3.2 Funding

The FSO will take on roles relating to electricity and gas system operation and will need to cover the costs associated with these functions with adequate revenue streams. Some of these roles already exist within the current system, some are new roles relating specifically to electricity or gas, and some will be new and cross-cutting. In total, however, the FSO's enduring costs are likely to be roughly comparable to those related activities undertaken by the current system operators. A fuller analysis of this is presented in the impact assessment that accompanies this consultation.

System operators in Great Britain, like many other system operators internationally, are funded via industry, and ultimately consumers, through network charges at a level determined through a price control mechanism, and we intend for this model to continue in essentially the same form as today.

With either a public or private model, Ofgem would set the cost recovery framework and regulate costs to drive efficient expenditure. This framework will be set out in the licence and codes as part of implementation and may include cost-efficiency incentives. In a privately owned model, a price control will remain very significant in ensuring value for money and a reasonable rate of return while avoiding excessive profit and is likely to build on the current price control approach. In a non-private model, value for money considerations continue but, concerns around excessive profits will not be relevant.

The FSO, in either model, will continue to need appropriate financial standing and risk rating to manage its cashflow and borrow when necessary. It will continue to operate the large number of contracts and agreements required to ensure ongoing system performance in an economic and efficient manner.

4.3.3 Independence

As set out in 4.2.4, to ensure that market participants and government have confidence in the FSO's advice and in its facilitation of markets, competition, and system development, the FSO will need to be unconflicted by energy sector interests. To ensure ongoing market confidence in the FSO's operation will also require that it be free from short-term operational influence from central government.

In both organisation models, ownership, or board membership by those conflicted by energy sector interests would not be compatible with this required level of independence. There is a difference between, at the one end of a spectrum, sole ownership by an energy company and at the other end of the spectrum a small shareholding by a large investment group with a highly diverse portfolio. We will continue to develop our thinking on this and would welcome views on the level of shareholding, control or other 'energy interest' at which a conflict of interest would become a concern.

Political influence would already be limited in a privately owned FSO. In the non-private FSO any levers of control from government would be highly limited and structured to ensure political influence operated only at a strategic level. For example, while a private owner would have the power to appoint both executive and non-executive directors, in the non-private model considered here, government's control over the board would be limited to managing a transparent appointment of the non-executive, while the Board appointed the executive.

4.3.4 Incentives

The incentives driving FSO behaviour would differ depending on the organisation design model chosen. Both models would make the FSO accountable to Ofgem through the licence, but the models differ depending on to whom else the FSO's leadership is accountable and how extensively financial incentives can apply.

A privately owned FSO would have a fundamental drive to deliver value for its owners which may not be aligned with consumer interest, and a board accountable to those owners. This profit motive would, as with the current system operators, be used by Ofgem to incentivise

performance within the regulatory framework, through the application of organisation-wide financial incentives that put profit at risk.

The non-private FSO would not be driven by shareholder or profit interest. The benefit of organisation-wide financial incentives (profit-based incentives) is less clear in this model, and they would likely not be used to drive organisational performance although financial incentives, such as bonuses, could still be used for individual performance.

4.3.5 Engagement with other parties

While the independence of the FSO from sectoral interests will be highly important its effectiveness will also be contingent upon good relationships with market participants, other organisations with roles in and connecting with the energy sector, and consumers.

We will carefully consider the FSO's relationships with:

- **Market participants**: Operating transparently and without actual or apparent bias will be crucial to maintain the reputation of the FSO and ensure conflicts of interests are avoided. The regulatory approach will set out strict eligibility criteria for the FSO in relation to its ownership and governance. The FSO will be expected to create robust routes for engagement and information exchange with the energy industry. This engagement could include appropriate forms of industry advisory group, expert panels or challenge groups with varying levels of responsibility. We will provide further detail on the overall approach to regulation through a programme of stakeholder engagement on implementation;
- **Other organisations:** The new roles of the FSO will operate in the context of an evolving energy landscape in which organisations such as the CCC, local authorities, LCCC, standard-setting bodies such as the HSE and the proposed code manager function (depending on the outcome of parallel consultation on Codes) all have vital roles to play. The FSO will need to work closely with such organisations to fulfil its roles effectively and support them in doing the same;
- **Consumers**: Ofgem's primary role is to protect the end consumer, which will manifest in ensuring the system operators deliver efficiently for the long-term. As consumers become more active users of the system it will be important to ensure there is effective communication between the FSO and its end customers and that due consideration is given to any impacts on vulnerable consumers. This may be through organisations such as Citizens Advice, or another form of representation such as a citizen panel; and
- **Regulators**: Ofgem will be the FSO's primary regulator. However, the FSO will need to engage with other regulators with interactions with the energy system. These include the environmental regulators (in particular concerning air quality), Competition and Markets Authority, Oil and Gas Authority, Ofwat, and the Financial Conduct Authority, among others.

4.4 Elexon and Xoserve

Elexon

Elexon Limited[80] (referred to as Elexon in this document) was established on 1 August 1999 to administer the Balancing and Settlement Code (BSC) and procure the systems needed to implement it ahead of the New Electricity Trading Arrangements that went live on 27 March 2001. In addition, it performs some wider settlement services for other energy policy schemes, such as for the Low Carbon Contracts Company (LCCC) in respect of the Contracts for Difference scheme and the Electricity Settlements Company in respect of the Capacity Market. Elexon will also have a central role in the implementation of Market Wide Half Hourly Settlement (MHHS)[81]. Elexon is wholly owned by NGESO, although it is operationally and financially independent of it. It is fully funded by and accountable to its customers – almost 500 signatories of the BSC – making it a not-for-profit service provider to industry. Although NGESO is Elexon's only shareholder, its powers to appoint or remove directors are completely constrained under the BSC, it has no influence on Elexon's strategy or budget and Elexon's financial results are not consolidated with those of NGESO.

As we consider changes to the ownership and regulatory arrangements for NGESO, we must also consider Elexon and its subsidiaries, as a change to the ownership of NGESO could directly impact Elexon. The future role of code administrators, including Elexon, are the subject of proposals in our consultation on the Energy Code Reform[82] and any implications will be considered holistically.

Any proposals would also need to ensure Elexon retains its operational independence and remains appropriately accountable to the industry it serves. If needed, we will legislate to achieve these aims when parliamentary time allows. Should a new arm's length body be necessary that would also be subject to approval by both HM Treasury and Cabinet Office ministers. We are engaging with Elexon and will engage with other relevant stakeholders who may be impacted.

Xoserve

Xoserve Ltd[83] acts as the Central Data Services Provider (CDSP) for the gas industry and produces invoices on behalf of NGG, the GDNs and the Independent Gas Transporters (IGTs). It also delivers the Gemini trading platform for users of the National Transmission System (NTS) to buy and sell capacity products. It is owned jointly by National Grid gas transmission business and Britain's four major gas distribution network companies. We are not currently proposing any changes to this industry ownership arrangement. We will consider the impact of our decision on the appropriate roles of the FSO concerning gas on Xoserve.

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[80] ELEXON LIMITED - Company number 03782949
[81] Ofgem *Electricity Retail Market-wide Half-hourly Settlement: Decision Document* (2021) https://www.ofgem.gov.uk/publications/electricity-retail-market-wide-half-hourly-settlement-decision-and-full-business-case
[82] BEIS and Ofgem *Consultation on the Design and Delivery of the Energy Code Reform* (2021) https://www.gov.uk/government/consultations/energy-code-reform-governance-framework
[83] XOSERVE LIMITED - Company number 05046877

What are your views on our proposed characteristics and attributes of a future system operator and how the models presented would deliver against them? Are there other characteristics or attributes that we have not yet considered?

Are we considering the right organisation models for the FSO? And why?

Are we considering the right elements for the FSO's regulatory and accountability frameworks? And why?

Do you have views on the level of shareholding or control involving other 'energy interests' and the FSO at which a conflict of interest would become a concern?

Are we considering the right implications of our proposals for Elexon and Xoserve?

5 Future System Operator Implementation

In this section we set out a preferred high-level approach for implementation of the FSO with the aim of seeking views on how the FSO can best implemented in practice.

The approach to implementation presented here is at a sufficiently high level that it can accommodate all options currently under consideration for the roles and organisational design of the FSO. More detailed plans for implementation of the FSO will be dependent on the roles and organisational design that are ultimately selected. To support development of more detailed plans for implementation of the FSO, BEIS and Ofgem will continue to engage stakeholders on implementation as the proposals are further developed.

5.1 Implementation Approach

5.1.1 Preferred approach

As set out in section 2.2, BEIS and Ofgem consider that the FSO would be well placed to take on the future technical functions we have identified for net zero because of the unique skills and capabilities that come with operating the electricity system in real time, and the synergies that come from possessing functions in both the electricity and gas systems. Many of the capabilities (including the people, processes, systems and assets) needed to perform the proposed functions of the FSO are already present within NGESO and NGG.

As a result, our preferred approach is that these existing capabilities would, where appropriate, be the foundation of the FSO, with additional capabilities added as required to deliver the full range of functions of the FSO. This approach to implementation ensures the preservation and use of these highly specialised industry capabilities. The preferred approach provides better value for money for consumers by using these capabilities rather than recreating them. It also reduces additional risk of disruption to the operation of the energy system as a result of the transition to the FSO, by minimising changes to arrangements as far as possible. Implementation options where an entirely new organisation is created to perform the proposed functions of the FSO, without using the capabilities of NGESO and NGG, have been discounted.

NGESO and NGG are currently owned by National Grid Plc. Therefore, any change in ownership of all or part of the capabilities of these organisations will require a sale process. These existing organisations will also need to be able to discharge all their obligations during and (where these continue) after implementation. Hence, in some specific instances, there may need to be duplication of certain organisational capabilities to enable this (such as duplication of capabilities in gas network planning between the FSO and NGG, as described in Annex 1).

Our preferred approach is also that there would be a phased implementation of the FSO, with the FSO taking on all the existing capabilities and functions of NGESO as a first step, followed by phased introduction of any further functions of the FSO (as described in chapter 3). This aims to minimise the risk of disruption to the operation of energy networks during the transition, by enabling control of the amount of simultaneous change to system operation arrangements.

Sequencing of the introduction of additional functions of the FSO should aim to prioritise functions that release the highest benefit to consumers and to net zero. However, the timing of implementation of each additional role will also depend on the complexity of the systems and assets involved, as well as the extent of changes to legislation, licences and codes required.

In practice, under a phased implementation approach, the functions of NGESO could continue to evolve to include some of the proposed functions of the FSO, in the period after the Government's response to this consultation. BEIS and Ofgem will consider how existing licencing, codes and price control arrangements could accommodate early implementation of certain functions, as well as value for money and alignment with policy objectives, before introducing any enhanced functions to NGESO.

We are considering how to implement the proposals. Primary legislation will be needed to implement some aspects, followed by any necessary secondary legislation, changes to the licensing framework and code changes. We will legislate when parliamentary time allows.

An indicative, high-level plan based on the preferred implementation approach is shown below:

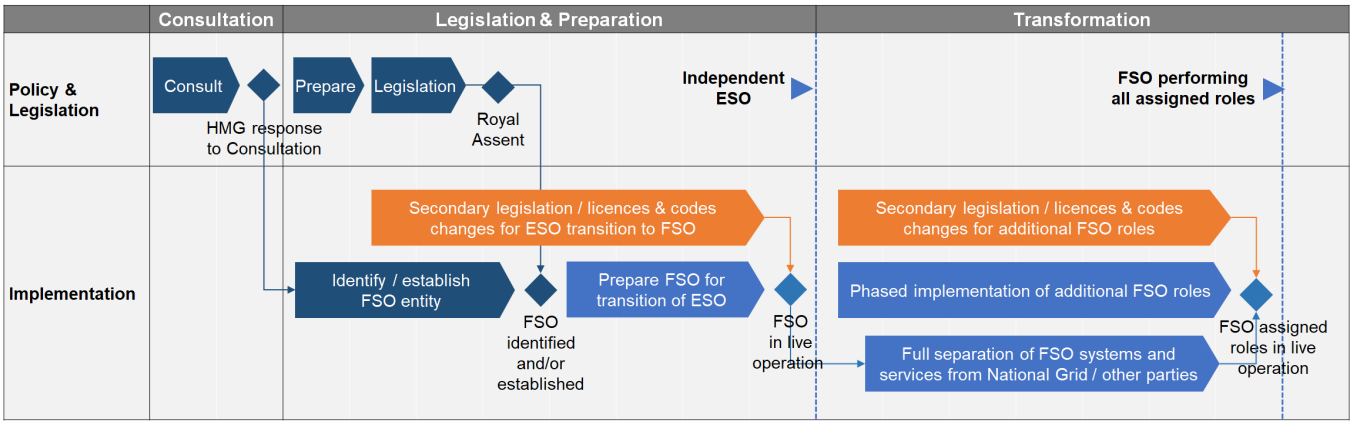

Figure 1: Indicative high-level implementation plan

The time taken for the FSO to be performing all its assigned roles and functions will be highly dependent on the roles selected for the FSO. Selecting fewer roles and functions could bring timelines forward, but some options (such as the FSO performing short-term operation of the gas transmission system, which is not our preferred option) would take longer to implement. Delivery timelines will also depend on the organisational design and the process followed to enable the FSO to take on the capabilities and roles of NGESO and any required capabilities that currently sit within NGG.

5.1.2 Governance of the implementation process

Effective governance of the project to establish the FSO will be vital to ensuring that the reform meets the objectives of this work. Much of the project governance may be internal to National Grid plc, NGESO, NGG and the FSO. However, BEIS and Ofgem will have a role to play in the overarching governance of the implementation project; in particular, to seek assurance of successful delivery and the mitigation of risk to existing operations from the transition to the FSO. This role would also be to support National Grid plc, NGESO, NGG and the FSO, as well as the wider British energy industry, in their readiness for the changes that creation of the FSO will entail. We will discuss project governance arrangements as part of the stakeholder engagement on implementation.

5.2 People

BEIS and Ofgem recognise the uncertainty that the review on the long-term role and organisational design of the system operator may create for NGESO employees and some employees within National Grid plc, NGG and their subsidiaries.

We value the expertise and experience held within these organisations and recognise that this is critical to the ongoing safe and effective operation of the energy networks and will be essential to supporting the transition to net zero. This is why it is vital that the implementation of the FSO should closely consider the needs of people in the transition process. In addition, with the proposed new roles and responsibilities outlined in this consultation, the capabilities of the system operator will need to be expanded within the FSO. Hence, we anticipate that the FSO will be a growing organisation with greater opportunity for employees to influence the future of energy systems in Great Britain and participate in the delivery of net zero.

- **What is your view on the preferred implementation approach? Please explain why.**
- **Based on the areas where we are considering new and enhanced roles and functions for the FSO, which of these should be prioritised for development? Please explain why.**
- **What do you believe are the risks to implementation? How can these be mitigated?**
- **Do you have any comments on potential implications of implementation for you, your organisation, or other stakeholders?**

6. FSO Impact Assessment

An impact assessment (IA) is presented alongside this consultation to assess the likely costs, benefits and distributional impacts of the policy options considered. We are seeking consultation responses to further test the assumptions used throughout the impact assessment and to ensure due consideration has been given to all impacted groups. These responses will help to inform any final stage impact assessment that may follow from this consultation.

What is your view on the position there are likely to be cost savings across the energy system from an increased "whole system" view, as described in paragraphs 47-52 of the IA? If so, is the potential magnitude of savings illustrated fairly in the IA? If not, why not?

What is your view on the conclusion that policy intervention is likely to increase the benefits of onshore electricity network competition, as described in paragraphs 53-59 of the IA? If you agree, is the potential magnitude of savings illustrated fairly in the IA? If not, why not?

Do you think that the impact assessment has identified and considered the key costs and benefits of policy intervention? If not, can you provide details on other impacts that have not been considered?

Do you think that the distribution of impacts is fairly represented, with impacted groups correctly identified? Outlined in table 5 of the IA.

We invite respondents' views on whether the proposals for energy system governance reform may have a different impact on people who have a protected characteristic (age, disability, gender re-assignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex or sexual orientation), in different ways from people who don't have that characteristic. Please provide any evidence that may be useful to assist with our analysis of policy impacts.

Consultation questions

1. **Do you agree that net zero will create the need for new technical roles in the electricity and gas systems, and require a new approach to energy system governance?**

2. **Do you agree that the establishment of a Future System Operator is needed to fulfil the kinds of technical roles needed to drive net zero?**

3. **Do you agree that a Future System Operator should have roles in both the electricity and gas systems?**

4. **Do you agree that a Future System Operator should be entirely separate from National Grid plc?**

5. **What issues are there with existing institutional arrangements in the UK energy system in relation to system-wide decision-making and planning?**

6. **What examples/case studies are you aware of where net zero delivery in one part of the energy system did not adequately account for cross-system impacts or costs?**

7. **Where should government focus in our efforts to improve systems thinking and coordination across the energy system?**

8. **Do you agree that the FSO should undertake all the existing roles and functions of NGESO? If not, please explain why.**

9. **Do you agree there is a case for the FSO to undertake the long-term strategic functions outlined in Option 1? Please elaborate and provide any views on the functions we have outlined in Option 1.**

10. **Do you agree that there is not currently a case for the FSO to undertake all GSO roles and functions, including real-time gas system operation, as outlined in Option 2? If you do not agree, please explain why.**

11. **Do you have views on the proposal for an advisory role? What organisations do you consider would benefit from the provision of advice by the FSO? Who should bear the costs of providing that advice?**

12. **Do you have any views on the other areas where we are considering new and enhanced roles and functions for the FSO (outlined in section 3.2)?**

13. **What are your views on our proposed characteristics and attributes of a future system operator and how the models presented would deliver against them? Are there other characteristics or attributes that we have not yet considered?**

14. **Are we considering the right organisation models for the FSO? And why?**

15. **Are we considering the right elements for the FSO's regulatory and accountability frameworks? And why?**

16. **Do you have views on the level of shareholding or control involving other 'energy interests' and the FSO at which a conflict of interest would become a concern?**

17. **Are we considering the right implications of our proposals for Elexon and Xoserve?**

18. **What is your view on the preferred implementation approach? Please explain why.**

19. **Based on the areas where we are considering new and enhanced roles and functions for the FSO, which of these should be prioritised for development? Please explain why.**

20. **What do you believe are the risks to implementation? How can these be mitigated?**

21. **Do you have any comments on potential implications of implementation for you, your organisation, or other stakeholders?**

22. **What is your view on the position there are likely to be cost savings across the energy system from an increased "whole system" view, as described in paragraphs 47-52 of the IA? If so, is the potential magnitude of savings illustrated fairly in the IA? If not, why not?**

23. **What is your view on the conclusion that policy intervention is likely to increase the benefits of onshore electricity network competition, as described in paragraphs 53-59 of the IA? If you agree, is the potential magnitude of savings illustrated fairly in the IA? If not, why not?**

24. **Do you think that the impact assessment has identified and considered the key costs and benefits of policy intervention? If not, can you provide details on other impacts that have not been considered?**

25. **Do you think that the distribution of impacts is fairly represented, with impacted groups correctly identified? Outlined in table 5 of the IA.**

26. **We invite respondents' views on whether the proposals for energy system governance reform may have a different impact on people who have a protected characteristic (age, disability, gender re-assignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex or sexual orientation), in different ways from people who don't have that characteristic.**

Please provide any evidence that may be useful to assist with our analysis of policy impacts.

Next steps

We are seeking comments by 28 September 2021.

BEIS and Ofgem will be hosting a webinar during the consultation where we will provide an overview of the content of this consultation and provide an opportunity for clarificatory questions. Details of this will be provided in the coming weeks.

We will review the responses to this consultation to inform our continued policy development and will publish a government response in due course. This will include our proposed organisational model of the two set out in chapter 4 and set out the necessary legislation to achieve this. This could include legislation on:

- creating or amending licensable activities
- licence transfers
- information sharing
- dispute resolution
- funding mechanisms
- special administrative regimes
- implementation expenditure
- establishing a new body (if necessary)
- extending the Strategy and Policy Statement framework; and
- to ensure our objectives for the future of Elexon are met.

In other areas, there will be further consultation by Ofgem or BEIS on aspects of these reforms, including the FSO's licencing and funding arrangements, mechanisms for incentivising desired outcomes, and appropriate mechanisms for engaging sector participants in operation and oversight.

Legislative proposals outlined in this document which are confirmed in the government response would be taken forward when parliamentary time allows.

To support development of more detailed plans for implementation of the FSO, BEIS and Ofgem will continue to engage stakeholders on implementation as the proposals are further developed.

Glossary

ANCAR	Annual Network Capability Analysis Report
BEIS	Department for Business, Energy and Industrial Strategy
Decarbonisation	The process of reducing the greenhouse gas emissions associated with an activity
BSC	Balancing and Settlement Code
BSI	British Standards Institution
BSUoS	Balancing System Use of Services
CAIR	BEIS Corporate Finance Advisory and Investor Relations Team
CBA	Cost Benefit Analysis
CCC	Committee on Climate Change
CCUS	Carbon, capture, usage and storage
CION	Connection and Infrastructure Options Note
CNI	Critical National Infrastructure
CO2 T&S	CO2 Transport and Storage
DER	Distributed Energy Resource
Distribution system	The distribution system connects a transmission system (for example gas transmission or electricity transmission) to individual consumers
DNO	Distribution Network Operator
DSO	Distribution System Operation
DSR	Demand-side response
EDiT	Energy Digitalisation Taskforce
EDTF	Energy Data Taskforce
EJP	Engineering Justification Paper
Electricity distribution	Electricity distribution networks carry electricity from the high voltage transmission grid to industrial, commercial and residential buildings
ESA	Energy Smart Appliance
ESO	Electricity System Operator
ESQCR	Electricity Safety, Quality and Continuity Regulations 2002
FES	Future Energy Scenarios
FIOC	Funded Incremental Obligated Capacity
FoG	Future of Gas

FSO	Future System Operator
GDN	Gas Distribution Network
GFOP	Gas Future Operability Planning
GMaP	Gas Market Plan
GSMR	Gas Safety Management Regulations
GSO	Gas System Operator
GTO	Gas Transmission Operator
GTYS	Gas Ten Year Statement
HMT	Her Majesty's Treasury
HSE	Health and Safety Executive
IGEM	Institute for Gas Engineers and Managers
IA	Impact Assessment
IGT	Independent Gas Transporter
ISO	Independent System Operator
LCCC	Low Carbon Contracts Company
MEDA	Modernising Energy Data Access
MHHS	Market Wide Half Hourly Settlements
Net zero	Refers to the balance between the amount of greenhouse gas produced and the amount removed from the atmosphere. The UK is required by law to reach net zero carbon emissions by 2050
NGET	National Grid Electricity Transmission
NGG	National Grid Gas
NOA	Network Options Assessment
NTS	(Gas) National Transmission System
OTNR	Offshore Transmission Network Review
RIGSSE	Review of the Impact of Gas Supply Shortage on the Electricity Network
RIIO	Revenue = Incentives + Innovation + Outputs
SEM	Specific Engineering Matters
SICE	Services & Infrastructure Core Enterprise
SOF	System Operability Framework
SPS	Strategy and Policy Statement

TNCC	(Electricity) Transmission Network Control Centre
TO	Transmission Owner
VoLL	Value of Lost Load