Title: Future of the System Operator **IA No:** BEIS050(F)-21-ICE **RPC Reference No:** RPC-BEIS-5076(2) **Lead department or agency:** BEIS **Other departments or agencies:** Ofgem	**Impact Assessment (IA)** **Date:** 22nd December 2021 **Stage:** Final **Source of intervention:** Domestic**Domestic** **Type of measure:** Primary Legislation **Primary legislation** **Contact for enquiries:** Ben Eyre-White benedict.eyre-white@beis.gov.uk

Summary: Intervention and Options

RPC Opinion: Fit for Purpose

Cost of Preferred (or more likely) Option (in 2020 prices)			
Total Net Present Social Value	**Business Net Present Value**	**Net cost to business per year**	**Business Impact Target Status** Non qualifying provision
NA	NA	NA	

What is the problem under consideration? Why is government action or intervention necessary?

Achieving net zero will require a transformation of both the energy system and its governance structure. The unique position of the System Operator (SO) at the heart of the energy system makes it well placed to take on enhanced roles and responsibilities for achieving net zero at least cost whilst ensuring a secure and stable energy system. However, the current ownership of the SO by National Grid Plc, as asset owner, creates a potential or perceived conflict of interest. While there is no evidence that this has been acted upon, it nevertheless inhibits the SO from taking on the enhanced roles desirable to reach net zero. To overcome this potential conflict of interest, the 2021 Ofgem Review of GB Energy System Operation concluded the need for government to create a new independent future system operator (FSO).

What are the policy objectives of the action or intervention and the intended effects?

This intervention intends to remove the current potential conflict of interest by creating an independent FSO able to drive progress towards net zero while maintaining energy security and minimising costs for consumers. To do this, the FSO will need new roles and responsibilities in the electricity and gas systems and will need to have the following characteristics outlined in the Ofgem report and further developed by BEIS: (i) Technically expert, (ii) Operationally excellent, (iii) Accountable, (iv) independently minded and (v) resilient. This intends to enable FSO to provide improved advice to government and Ofgem and to take a "whole system" view in areas such as network planning. As a result, intervention intends to reduce the overall system cost required to meet net zero while maintaining energy security and minimising costs for consumers.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

Options presented in this Impact Assessment are stylised and used to illustrate the magnitude of impact this policy may have based on the scale of intervention. Final options are subject to a sale process with National Grid Plc and the views collected at consultation. Illustrative options presented in this impact assessment are: (1) **Do nothing:** National Grid Plc continues to operate the electricity system operator. National Grid Plc continues to undertake the gas system balancing and operating role, with a new private investor after the sale of the majority stake of NGG is completed. Expected higher energy system costs of reaching net zero against policy options. (2) **Option 1:** The FSO undertakes day-to-day operation of the electricity system operator and takes an increased role in planning the electricity system and facilitating competition. No formal gas roles performed by FSO. (3) **Option 2: (Preferred):** In addition to roles included in option 1, the FSO also undertakes increased coordination and advice on rulemaking responsibilities. The FSO is responsible for long-term planning and forecasting for the gas National Transmission System (NTS). (4) **Option 3:** The FSO is responsible for the day-to-day operation of the gas NTS in addition to all functions listed in option 2. Under Options 1-3, the FSO is a public corporation, with operational independence from government. The preferred option was broadly supported at consultation and found to have the strongest economic case

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** to be confirmed

Is this measure likely to impact on international trade and investment?		No		
Are any of these organisations in scope?	**Micro** Yes	**Small** Yes	**Medium** Yes	**Large** Yes
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)		**Traded:** NA	**Non-traded:** NA	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible SELECT SIGNATORY: ..... Date: .....

Summary: Analysis & Evidence

Policy Option 1

FULL ECONOMIC ASSESSMENT

Price Base Year 2019	PV Base Year 2020	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate:**

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				

Description and scale of key monetised costs by 'main affected groups'

Across all options there are no material costs of primary legislation which are deemed enabling only. All costs of secondary are given as a range due to the uncertainty of estimates. The costs to implementing the FSO under this option are estimated as between £50m-£140m. This includes one-off separation costs incurred by the current and new owner of FSO functions, on-going costs due to the duplication of corporate services, legal, financial and consultancy costs. Any capital costs associated with FSO implementation are commercially sensitive and therefore removed. These costs may be recouped against the future guaranteed revenue streams available to the FSO.

Other key non-monetised costs by 'main affected groups'

There may be significant learning and familiarisation costs to all stakeholders. These costs are likely to be largest for the FSO, since internal learning costs will also be incurred as the newly created body adjusts to its organisational design and internal processes.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				

Description and scale of key monetised benefits by 'main affected groups'

There are no material benefits of primary legislation across any option considered. For secondary impacts, the improved "whole system" view of the FSO is illustrated as reducing the future costs of the electricity system by between £210m-£2,500m across generation, network development and system balancing, though this is highly uncertain. This is in part, due to the reduced potential and perceived of conflicts of interest in network development as well as increased co-ordination of investment decisions across the sector and across energy vectors. An independent FSO is also expected to better facilitate competitions for third parties to provide assets for pre-identified system needs, this is estimated to save between £80m-£300m compared to if the current SO facilitated competition.

Other key non-monetised benefits by 'main affected groups'

The removal of potential conflicts of interest in the FSO is likely to reduce the perception of conflicts of interest in their expert advice provided to government, Ofgem and energy participants, improving technology decisions. For government and Ofgem, this is also expected to reduce the level of internal scrutiny required allowing for more timely decisions. Improved co-ordination across the energy system may lower the risk of unplanned outages and system failures, particularly during periods of system stress.

Key assumptions/sensitivities/risks	**Discount rate (%)**	3.5

Quantified results are sensitive to two key assumptions. Firstly, is assumed that the reduced costs as a result of the FSO's "whole system" view can be fairly illustrated by a range of between 1% to 5%. Secondly, it is assumed that the FSO will improve facilitation of network competition by an illustrative range of 25%-50%. These illustrative ranges are not distinguished across policy options due to the uncertainty in assessing the magnitude of benefits. Several key risks exist including reduced efficiency under the FSO, increased uncertainty to energy system participants and the creation of a "single view" of the energy system which could worsen decisions made.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs:	**Benefits:**	**Net:**	

Summary: Analysis & Evidence

Policy Option 2

FULL ECONOMIC ASSESSMENT

Price Base Year 2019	PV Base Year 2020	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate:**

COSTS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				

Description and scale of key monetised costs by 'main affected groups'

The cost of implementation is higher compared to Option 1, amounting to an expected £90m-£270m due to the additional gas and electricity roles and responsibilities taken on by the FSO. Primarily, this rise in implementation costs is a result of higher expected separation and/or duplication costs of gas functions due to their current integration with the gas transmission operator. As above, any capital costs associated with FSO implementation are excluded due to their commercial sensitivity.

Other key non-monetised costs by 'main affected groups'

Non-monetised costs are the same as those listed in Option 1. The magnitude of these costs is expected to be larger under this option due to the increased number of roles and responsibilities for gas and electricity taken on by the FSO.

BENEFITS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				

Description and scale of key monetised benefits by 'main affected groups'

In addition to Option 1, the increased gas forecasting and planning functions are expected to enable further cost reductions across the energy system of between £80m-£600m, due to improved "whole system" decision making now also applying to natural gas and hydrogen, reducing future network development, balancing and potential decommissioning costs.

Other key non-monetised benefits by 'main affected groups'

The key non-monetised benefits are expected to be the same as those in Option 1. It is expected that the greater number of gas roles and responsibilities taken on by the FSO will increase the magnitude of benefits accruing from improved trusted advice and system co-ordination.

Key assumptions/sensitivities/risks	Discount rate (%)	3.5

Quantified results are sensitive to two key assumptions. Firstly, is assumed that the reduced costs as a result of the FSO's "whole system" view can be fairly illustrated by a range of between 1% to 5%. Secondly, it is assumed that the FSO will improve facilitation of network competition by an illustrative range of 25%-50%. These illustrative ranges are not distinguished across policy options due to the uncertainty in assessing the magnitude of benefits. Several key risks exist including reduced efficiency under the FSO, increased uncertainty to energy system participants and the creation of a "single view" of the energy system which could lead to poorer decisions being made by the FSO than currently.

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs:	**Benefits:**	**Net:**	

Summary: Analysis & Evidence

Policy Option 3

FULL ECONOMIC ASSESSMENT

Price Base Year 2019	PV Base Year 2020	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate:**

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				

Description and scale of key monetised costs by 'main affected groups'

The costs of implementation are estimated at between £260m-£790m, substantially higher than Option 2 due to the high separation and on-going costs incurred by carrying over the day-to-day operations of the gas system operator. Separating day-to-day gas operations from the transmission owner is also expected to introduce a loss of operational synergies, increasing the costs of balancing the gas system. This loss of synergies exposes the FSO to cost uncertainty, with estimates ranging between a net-cost of between £410m and £70m.

Other key non-monetised costs by 'main affected groups'

Non-monetised costs are the same as those listed in Option 1 and Option 2. The magnitude of these costs is expected to be larger than both options due to this option carrying over day-to-day gas functions into the new FSO.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				

Description and scale of key monetised benefits by 'main affected groups'

It is expected that carrying over day-to-day gas operations will not improve "whole system" decision making compared to Option 2, resulting in no further cost reductions expected.

Other key non-monetised benefits by 'main affected groups'

The key non-monetised benefits are the same as those under Option 1 and Option 2.

Key assumptions/sensitivities/risks	Discount rate (%)	3.5

Quantified results are sensitive to two key assumptions. Firstly, is assumed that the reduced costs as a result of the FSO's "whole system" view can be fairly illustrated by a range of between 1% to 5%. Secondly, it is assumed that the FSO will improve facilitation of network competition by an illustrative range of 25%-50%. These illustrative ranges are not distinguished across policy options due to the uncertainty in assessing the magnitude of benefits. Several key risks exist including reduced efficiency under the FSO, increased uncertainty to energy system participants and the creation of a "single view" of the energy system which could lead to poorer decisions being made by the FSO than currently.

BUSINESS ASSESSMENT (Option 3)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs: NA	**Benefits:** NA	**Net:** NA	**NA**

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Evidence Base

Background

1. Delivering net zero will bring significant challenges for the electricity and gas systems. Not only does it require the decarbonisation of the electricity system, but also greater integration with, and electrification of, the transport and heat sectors. This change is in turn making operating the energy system more challenging and brings potential new roles and responsibilities to the system, all of which will need to be delivered in a coordinated and efficient way. To perform these roles effectively, the system operators (SO) will require both high levels of engineering capability, and the organisational design, incentives and accountability to act in the best interests of consumers free of commercial or other interests.

2. 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 gives them unparalleled insight into how each system operates, which makes them very 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, which also owns and maintains gas and electricity transmission assets. This creates the potential for conflict of interest between National Grid Plc's role as the SO in recommending changes to the system to support system operability, and National Grid Plc's role as a transmission company whose remuneration comes from building additional network to support these needs. While there is no evidence of this conflict being acted upon, the perception and potential for conflicts can nevertheless make it challenging for the system operators to fulfil their existing roles, and it would be even more challenging to give them some of the potential new roles needed to fulfil net zero. Following an assessment of the system operator, Ofgem published a report[1] ("the Ofgem report") recommending the creation of a fully independent system operator, separate from National Grid Plc. The 2020 Energy White Paper stated that 'we will ensure that the institutional arrangements governing the energy system are fit for purpose for the long term, consulting in 2021 over organisational functions, including system operation and energy code governance.'[2]

3. In Great Britain, National Grid Electricity System Operator (NGESO) is responsible for ensuring the stable and secure operation of the national electricity transmission system (NETS). NGESO is legally separated from the electricity transmission owner (TO), National Grid Electricity Transmission (NGET). Gas System Operator (GSO) functions, including operation of the National Transmission System (NTS), are performed by National Grid Gas Transmission (NGG). NGG is also the transmission operator (TO) and owner across GB. The electricity and gas systems are governed by separate legislative and regulatory arrangements meaning NGESO and NGG only have roles and functions in their respective sectors. Both NGESO and NGG are part of National Grid Plc, one of the world's largest investor-owned energy companies that operates in the UK and US. National Grid Plc also has a range of other subsidiary companies. Throughout this document, SO is used to refer to both the GB gas and electricity system operator. When referring to the future state of the electricity system operator we use the term "Future System Operator" (FSO) which includes for some GSO functions.

4. Northern Ireland is excluded from this analysis as the scope of this policy is GB, and system operator functions for both gas and electricity in NI are carried out by separate system operators which are not considered in scope.

Rationale for Intervention

[1] https://www.ofgem.gov.uk/publications-and-updates/review-gb-energy-system-operation

[2] https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future

5. The challenge of governing the energy system is an example of a 'principal-agent problem'. The system operator (the agent) makes decisions on behalf of energy consumers (the principal via Ofgem), but the system operators can be motivated to act in their own best interests which is contrary to the best interest of energy consumers. In the absence of full information, the principal can often only partly mitigate the agent's incentive to act in their own best interests.

6. For the energy system, both conditions are present for the principal-agent problem to occur. There is:
    i. **A Misalignment of incentives**: The commercial interests of the SOs (as part of National Grid Plc) may not be fully aligned with the interests of energy consumers. National Grid Plc's other business interests include the ownership of the electricity and gas transmission networks[3]. The SOs could be incentivised to make decisions that increase the revenue of National Grid Plc's profit-making assets (e.g., transmission network assets) and avoid outcomes that negatively affect their commercial interests, even if these outcomes would be in the best interests of consumers. The SOs may also lack the incentive to ensure sufficient scrutiny of their own processes[4] or data and advice provided by the TO. Further, annual corporate reporting and shareholder reporting cycles can drive a short-term focus on within-year performance.

        i. In gas, the SO and TO functions are carried out by an integrated company, NGG. There are no limitations in the interactions between these parts of the business in order to mitigate potentially misaligned incentives.
        ii. In electricity, NGESO has been legally separated into a separate company from National Grid Plc and there are licence conditions to support this separation. However, the Ofgem report concluded that despite legal separation, a perceived conflict of interest within NGESO remains, due to for example, senior governance interactions within National Grid Plc.

    ii. **Asymmetric Information**: The SOs hold significantly more information than Ofgem and could leverage this information to their advantage. The SOs' unique position in the energy system requires considerable technical expertise and gives them access to substantial data and information. It is unlikely to be possible for Ofgem to fully mitigate these information asymmetries. For example, the SOs have no competitors, therefore it is difficult to create a counterfactual against which performance can be benchmarked. This makes it challenging to set quality of service or consumer benefit performance targets to correct the misalignment of incentives.

7. Together this creates a **potential or perceived conflict of interest** that cannot be fully mitigated through the current regulatory framework. While there is no evidence of National Grid Plc acting in a way that deliberately exploits any potential conflicts of interest, this nevertheless results in a '**market failure'**, since Ofgem are unable to fully mitigate against the risk of sub-optimal outcomes, such as:
    i. **Potential conflict of interest in transmission network development:** The SO's decisions could lead to an inefficient (increased) level of transmission network investment. The SO could inflate long-term forecasts of the need for network assets[5] or fail to appropriately challenge the TO's investment proposals. The SO could also

[3] Note in March 2021, National Grid announced its intention to sell National Grid Gas Transmission in the second half of 2021 with a view to complete the transaction within 2022: https://www.itv.com/news/2021-03-18/national-grid-agrees-78bn-electricity-deal-and-set-to-offload-gas-business

[4] For example, Ofgem recently fined NGESO £1.5m for failure to provide accurate and unbiased seven day ahead electricity demand forecasts over periods of 2017. This failure was found to have financially benefited NGESO by around £130,000. Whilst Ofgem concluded that NGESO did not deliberately set out to breach the conditions of Standard Condition C16 of its electricity transmission licence, inadequate oversight and compliance controls were in place to mitigate the behaviour.

[5] For example, by understating the existing network capabilities.

fail to take on the views of other energy system stakeholders, likely resulting in an informational bias towards SO network solutions.

ii. **Potential conflict of interest in facilitating network competition:** The SOs may limit the role of competitive pressures to reduce system costs where this would reduce the return of National Grid Plc's profitable assets. For example, NGESO could be potentially conflicted in establishing the rules for competitive tenders for network build in order to limit the role for third parties to provide network or non-network solutions.

iii. **Potential conflict of interest in advice:** A perceived lack of independence may limit the extent to which stakeholders (including government and Ofgem) trust the SOs' advice. At an industry level, commercial stakeholders may be unwilling to fully collaborate with NGESO, leading to less competitive and less efficient outcomes. Government may delay or be unable to take important policy decisions due to concerns with the SO recommendations. This prevents the SO's considerable technical and operational expertise being fully utilised. In the context of climate change, this could affect the UK's ability to meet its net zero target on time[6].

8. In addition to these existing potential consequences, the potential conflicts of interest are likely to be barriers to the SOs taking on the enhanced roles needed for the transition to net zero. The enhanced roles include greater coordination, network planning and strategic and advisory roles. Enhanced co-ordination and network planning roles are likely to increase the existing information asymmetry exacerbating the perceived or actual conflict of interest faced by the SO.

9. The FSO will need to be deemed impartial to carry out these enhanced roles and responsibilities, and will also need to have the following characteristics outlined in the Ofgem report and further developed by BEIS:
   i. **Technically Expert**: able to attract and retain world class technical capability and utilise sector-wide knowledge to provide definitive analysis of the energy system;

   ii. **Operationally excellent**: Able to operate at the pace necessary to deliver change, with a clear understanding of the way in which industry operates;

   iii. **Accountable**: to citizens/consumers today, and to those of tomorrow;

   iv. **Independently minded**: Not conflicted or occupied by other commercial interests and government influence over the system operator is strategic and not short-term; and

   v. **Resilient**: Both in times of system stress and in proactively responding to new challenges.

10. Overall, by addressing the perceived or potential conflicts of interest faced by the SO this intervention looks to increase the trust that the SO acts impartially in its decision making and advice. In turn, this increased trust in the impartiality of the SO looks to overcome existing market failures and enable enhanced roles to be assigned to the SO. Together, and alongside equipping the FSO with the characteristics listed in paragraph 9, these intend to maximise the value of the SO's unique position in the energy system in order to help realise government's strategic aim of delivering net zero at least cost through reduced energy system costs[7] whilst maintaining security of supply and improved advice to government.

[6] To note that even if the SO never behaves as though there were a conflict as set out in 7.i and 7.ii, the perceived risk of one is likely to be sufficient to cause problem 7.iii.

[7] It is expected that these reduced costs could extend across the whole system from generation, transmission, distribution and system balancing.

Updates since consultation IA:

11. Consultation responses and further policy development have resulted in a number of changes to the options considered and supporting analysis included at consultation IA stage[8].

12. Those impacting the stylised options analysed here are summarised as:
    - **A privately operated and shareholder owned FSO was found to be less effective at achieving our objectives:** A private sector FSO would be challenged by an inability to completely remove or mitigate conflicts of interest arising from ownership, the inability to completely align shareholder and consumer interests, particularly around many of the new and enhanced roles, and the potential risk of reclassification to the public sector. It was also very unclear whether there would be any meaningful appetite for ownership of a private sector FSO.

    - **Consultation and policy development indicate greater FSO electricity system roles and responsibilities may be required to achieve objectives:** This reduces the likelihood of stylised Option 1, detailed below.

    - **Consultation and policy development indicate carrying over day-to-day gas functions of the GSO is unlikely at this time:** This reduces the likelihood of stylised Option 3, detailed below.

13. Whilst Option 1 and Option 3 no longer appear viable options, in light of policy development and consultation feedback, they are included to illustrate the magnitude of impact policy intervention may have and help to illustrate the economic case for why Option 2 performs comparatively well against them.

14. Key changes to the analysis are:
    - **Increased range of sensitivity scenarios tested:** A greater number of uncertainties in the implementation and performance of the FSO are now included in sensitivity analysis, including learning and familiarisation costs and potential benefits the FSO may have across the entire energy system. These were chosen to reflect consultation responses and points highlighted during the internal governance process.

    - **Inclusion of 'onshore transmission network competitions' benefits into the 'improved whole system view' benefit:** Analysis at consultation stage monetised the potential benefits the FSO may have via an improved facilitation of onshore network competition. Consultation responses highlighted the uncertainties in the analytical approach taken, and as such, this IA chooses to no longer explicitly quantify these benefits and instead, to group these under the 'improved whole system view' benefit.

    - **Greater appreciation of wider costs, benefits, and risks:** Consultation responses and subsequent policy and analytical work have enabled a more detailed assessment of the potential wider impacts and risks of this intervention.

    - **Additional detail on our Monitoring and Evaluation plan is now included**

Policy Objectives

[8] A link to the consultation and attached consultation IA can be found here: https://www.gov.uk/government/consultations/proposals-for-a-future-system-operator-role

15. Our objective is to establish an independent 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 are summarised in brief in paragraphs 8 and 9 above and are described more fully in the consultation response.

    We believe that an independent FSO that has such roles, functions and characteristics should help us realise the four key intended outcomes:

    i. **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;

    ii. **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;

    iii. **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

    iv. **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.

Options under consideration

16. As set out above, there is no evidence of National Grid Plc acting in a way that deliberately exploits any potential conflicts of interest. Nevertheless, the perception of and potential for conflicts nevertheless creates barriers to fulfilling our policy objectives. All options considered therefore look to reduce the perceived or potential conflict of interest faced by the SO. Ofgem has already implemented initial efforts to help achieve this, primarily through requiring National Grid Plc to legally separate NGESO from National Grid Electricity Transmission, which came into effect on April 1st 2019. However, the Ofgem report found that some features of the current energy systems governance arrangements, such as potential asset ownership conflicts of interest, were expected to limit the SOs' ability to perform new and enhanced roles required (e.g. network planning and competition) to achieve net zero effectively at least cost. Furthermore, the report also outlines the case for addressing the potential conflicts of interest in the GSO, whilst appreciating the additional complexities in separating the current fully integrated SO-TO model NGG operates under due to the physical characteristics of the gas system. To overcome the perceived conflicts of interest that exist under the current ownership structures of both NGESO and GSO, the report recommended a new independent system operator with enhanced electricity and gas functions.

17. Government agrees with Ofgem's findings and therefore this Impact Assessment only considers options for the roles and responsibilities that could be carried out by a new independent FSO. Alternative options to overcome the perceived or potential conflict of interest faced by the SO such as the creation of a new 'Energy Agency' responsible for the

new and enhanced functions proposed were considered and deemed less desirable in the Ofgem report[9].

18. Additional to this policy intervention, reform is also being considered to other aspects of energy system governance, as outlined in Section 2.5 of our 2021 consultation document[10]. This is to help ensure that the institutional framework of the energy system remains fit for purpose as we transition to net zero.

19. There are five broad categories of choice in designing and delivering the FSO, these are:
    a. **electricity system operator roles and responsibilities:** this considers the range of roles an electricity Future System Operator (FSO) would be responsible for;
    b. **gas functions:** this considers the functions of the existing Gas System Operator (GSO) that the FSO would be responsible for;
    c. **organisational design:** this considers what type of organisation would be best placed to deliver the FSO's roles and responsibilities;
    d. **implementation:** this considers how the proposal will be delivered in terms of the transition from existing SOs to a new FSO; and
    e. **funding:** this considers how the on-going expenditure of the FSO will be funded.

20. Longlisted options under each category of choice were assessed against the overarching spending objective to achieve net zero at least cost whilst maintaining security of supply alongside the relevant critical success factors listed in the Green Book[11]. Following this internal assessment, the suitable options identified were carried forward into the short list for further appraisal.

21. There are a large number of possible combinations of short-listed options across each category of choice outlined in paragraph 19. Therefore, options considered in this Impact Assessment present 'stylised combinations' of the short-listed options across each category in order to assess their impacts. As noted in paragraph 12, all options have been revised since Consultation IA stage to reflect our refined understanding of what options are both feasible and desirable.

22. Note that all options are subject to a sale process with National Grid Plc and therefore those included here are illustrative. It is also noted that National Grid have not had any input on the assessment of any costs included in this IA.

These options are as follows:

'Do minimum' Counterfactual – Status Quo (including RIIO-2 changes)

The short-listed options are compared to a 'do minimum' baseline option. This option reflects the existing structure of the SOs but includes the changes Ofgem are planning to make to NGESO in the RIIO-2 period (2021-2026), These changes[12] aim to further mitigate any conflicts of interest, however there is limited further separation of functions in NGESO and limited changes to the GSO.

Option 1: 'Lower Intervention'

[9] The Ofgem report writes "We consider that the SOs would be better positioned than an Energy Agency to take on new and enhanced functions beyond real-time system operation given the importance of real-time system balancing experience for effective system planning."

[10] https://www.gov.uk/government/consultations/proposals-for-a-future-system-operator-role

[11] The 2020 Green Book, page 32, Box 9 - https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent. Critical success factors considered relevant are (i) strategic fit, (ii) value for money, (iii) organisational capability, (iv) Resilience and (v) achievability.

[12] This includes stronger restrictions on ESO's use of shared services provided through National Grid Plc; stronger restrictions on day-to-day governance interactions with National Grid Plc and its affiliated companies; changes to NGESO board's role and structure to increase the role of the independent directors' and removal of any scope for 'dual fuel' employees to exist.

a. Electricity Roles: Day-to-day operation + advising + planning and competition
b. Gas functions: No roles transferred
c. Organisation Design: Public corporation, with operational independence from government
d. Funding: Consumer funding (i.e. BSuoS[13])
e. Implementation: Existing organisation, phased transition

Option 2: 'Preferred Way Forward'

a. Electricity Roles: Day-to-day operation + advising + planning and competition + co-ordination + data and standards
b. Gas functions: Long-term forecasting & network planning + strategic market functions
c. Organisation Design: Public corporation, with operational independence from government
d. Funding: Consumer funding (i.e. BSuoS)
e. Implementation: Existing organisation, phased transition

Option 3 'Greater Intervention':

a. Electricity Roles: Day-to-day operation + advising + planning and competition + co-ordination + data and standards
b. Gas functions: Long-term forecasting & network planning + strategic market functions + day to day operation
c. Organisation Design: Public corporation, with operational independence from government
d. Funding: Consumer funding (i.e., BSuoS)
e. Implementation: Existing organisation, phased transition

23. For electricity roles (a):

- in option 1, the FSO is responsible for the real time system balancing of the electricity system and also undertakes advisory, enhanced planning and competition roles. This could include holistic and coordinated onshore and offshore network planning, enhanced NOA process, and running tenders for electricity network competition. All of these roles would be subject to further consultation; and
- in option 2 and 3, in addition to the functions taken on in option 1, the FSO would also be responsible for co-ordination, engineering standards and data. For co-ordination, the FSO could be responsible for taking greater roles in coordinating elements of heat and transport decarbonisation, for example in local energy mapping and planning. It could also have responsibility for co-ordinating across organisations (e.g. DNOs, TOs, gas networks and government departments) to ensure that there is a consistent strategic direction. This option could also include functions in energy code governance, engineering standards and data. All of these roles would be likely to be subject to further consultation.

24. For gas roles (b):

- in option 1, the FSO would not undertake any formal role in gas, however capability would be built up within the FSO to contribute to long-term forecasting and some strategic gas functions. This builds on the limited gas strategic thinking and work that NGESO already does through the future energy scenarios (FES), including input into FES, Gas 10-year statements and Gas Markets Actions Plan[14];

[13] https://www.nationalgrideso.com/industry-information/charging/balancing-services-use-system-bsuos-charges

[14] To note, the option to carry over no gas roles is not included as a policy option in the consultation document. The primary purpose of including no gas roles in Option 1 is to illustrate the impact of a wider range of example interventions, helping facilitate discussions on the value of carrying over gas roles.

- in option 2, the FSO would undertake long-term strategic planning, markets and forecasting functions. This would include network capability planning (which could be formalised into a Gas Network Options Assessment process analogous to that already performed by NGESO for electricity networks) and strategic capability assessment for new connections, asset replacement and decommissions, and medium to long-term forecasting; and
- in option 3, the FSO would undertake the roles outlined in option 2 but additionally take on control room functions, including day-to-day network balancing, operational planning (2 weeks ahead) and both emergency response and outage co-ordination.

25. Note that in March 2021, National Grid Plc announced its intention to sell National Grid Gas Transmission in the second half of 2021 with a view to completing the transaction within 2022[15]. We do not consider that the intention of this sale impacts the feasibility of the options considered.

26. For organisational design (c), funding (d) and implementation (e), all three options present the same choices which are assessed qualitatively and do not feature as part of the quantified analysis.

27. Under organisational design (c), only one viable option is considered, that is deemed both achievable and able to meet the required characteristics described above in section 2. This is a public sector entity; a corporate body model classified within the public sector, but with operational independence from government. Unbound by day-to-day government operational control but operating within the strategic framework set out by Parliament.

28. Under funding (d), it is assumed that the FSO will be paid for through charges on users of the system that will eventually be passed on to consumers[16], similar to current ESO and GSO arrangements. Options for central funding by government are unlikely due to both the political challenge and risk that central government involvement with budget setting could compromise the independence of the FSO.

29. Under implementation (e), the FSO will be founded on the existing capabilities (including people, processes, systems and assets) of NGESO, and where appropriate NGG, followed by phased introduction of any further roles to the FSO. (The functions of NGESO may also continue to evolve to include some of the proposed functions of the FSO, in the period after the Government's response to this consultation and prior to transition to an FSO, where appropriate and subject to feasibility under existing licencing, codes and price control arrangements).

30. All options considered would require primary legislation taking place as part of the 2022 Energy Bill.

Rationale and evidence to justify the level of analysis used in the Impact Assessment (IA)

31. The approach used in this Impact Assessment is deemed to be proportionate and intends to convey the uncertainty that is inherent to the policy at this stage. Detailed consideration has been given to the rationale for intervention and how the options considered meet the policy objectives and key impacts have been identified with their distributional effect considered.

[15] https://www.nationalgrid.com/proposed-acquisition-western-power-distribution-and-strategic-portfolio-repositioning

[16] This is likely to exclude the cost of purchase of SO assets from National Grid Plc, which are discussed separately under costs beginning paragraph 34.

32. This analysis builds on the 2021 Consultation Stage IA and has incorporated responses from both internal governance stakeholders and consultation respondents. Where impacts have remained unquantifiable, we have drawn from wider evidence sources such as the academic literature.

33. We have also provided an initial assessment of risks and uncertainties and the key distributional impacts that are likely to occur. This policy is dependent on subsequent secondary legislation or other provisions, such as changes to license conditions.

Description of Costs and Benefits

Costs and Benefits of Primary Legislation

34. Primary Powers are not expected to have any substantial impacts given these are enabling powers. Whilst primary powers also include the ability for government to mandate the purchase of SO assets, this would not take place until secondary legislation was implemented, nor would the creation of the FSO envisaged be possible without subsequent secondary legislation.

Illustrative Monetised Costs and Benefits of Secondary Legislation

35. The timeframe for analysis is 2022-2050, representing the earliest stage at which the costs of options may begin to incur[17], until the 2050 legislated target of reaching net zero emissions. Several key benefits of intervention are deemed unquantifiable such as the value of impartial advice to government. Therefore, the quantified net present value (NPV) should be viewed as a partial NPV and considered in tandem with the non-monetised costs and benefits to fully assess the impact of proposed options. It is also noted that the quantified impacts are illustrative with the views of stakeholders on how analysis can be improved sought as part of consultation.

Costs

Capital cost of implementation: (*Numbers redacted for commercial reasons*)

36. A significant cost in the establishment of a new FSO will be the capital cost to Government associated with implementation. The nature of the outlay required will depend heavily on the outcomes of negotiations with National Grid plc.

37. Any estimate of capital costs associated with the FSO implementation are commercially sensitive and therefore removed. The initial capital cost might be repaid through the guaranteed revenue stream taken on by the government. The underlying assets of the ESO are also likely to be transferred to HMG. It is expected that these two factors result in the exclusion of these costs having minimal impacts on the conclusions of this IA.

Cost of implementing the FSO:

38. Implementation costs included in our estimate are:
    - **legal, financial and consultancy costs:** the FSO will be founded on the capabilities and functions of NGESO and (where appropriate) NGG. The process of achieving this will involve costs, including legal, financial and consultancy costs;

    - **separation costs:** These are one-off project costs incurred by National Grid Plc (and any future owner of NGG) and the FSO (or government) in separating the roles and capabilities of NGESO and relevant functions of NGG from their current situation, such as recruitment, property and IT systems separation costs incurred in separation; and

[17] Some administrative costs have already been incurred such as internal government resource, however since these are sunk costs under all scenarios they are excluded from analysis. This is a modelling assumption and not a policy decision.

- **on-going costs:** These are ongoing costs incurred by National Grid Plc (and any future owner of NGG) and the FSO (or government) as a result of separation the roles and capabilities of NGESO and relevant functions of NGG from their current situation (i.e., the duplication of corporate services). These may include the costs of additional personnel for roles that are currently shared, duplicate licences for IT and technology, and duplicate services.

39. For all three options, legal, financial and consultancy costs are assumed to be incurred between 2020-2025 whilst the separation costs take place between 2024-2026 with the costs of separation assumed to be spread evenly over the three years. On-going costs are also assumed to begin in 2024 and continue at a constant annual cost over the timeline of analysis. Administrative costs occurred before 2022 are deemed to be sunk costs and therefore removed from analysis[18]. To note, these dates included are modelling assumptions and not policy positions.

40. Legal, financial and consultancy costs incurred from 2022 onwards are estimated using internal estimates of BEIS and Ofgem project budgets. Separation and on-going cost estimates are produced by FTI Consulting[19]. In all options, the full costs of separating NGESO are assumed to apply, which we have estimated as a one-off cost of separation of £22m (2020 prices) based on FTI's analysis, however these are expected to be substantially lower than the cost of fully separating the GSO. This is because much of the costs of separating NGESO occurred during the 2019 legal separation of NGESO from NGET[20]. For the GSO, we estimate the implementation cost of full separation as a one-off cost of £100m[21]. In option 1, no formal gas roles are carried over to the FSO, instead, capability is expected to be built up within the FSO to assess and forecast strategic gas capabilities and requirements. It is assumed that this would cost an illustrative 1% of the total cost of full separation. For option 2, modelling assumes transition of network planning roles to the FSO increase these costs to 20% of the £100m. Option 3 assumes 100% of the costs apply since day-to-day operation and all supporting functions transition to the FSO.

41. Estimates for each option are described in table 1. To emphasise the uncertainty in these figures high and low estimates are also presented in the table by increasing and decreasing the central estimate by 50%. This is purely to provide an illustrative range. Actual costs could fall significantly outside of the numbers presented as highlighted in consultation responses from National Grid plc and National Grid ESO. As a result, these figures are further tested through sensitivities.

Table 1: Costs of implementation for options (rounded to nearest £10m)

£ (Present Value, 2020£), 2022-2050	Low	Central	High
Option 1 - 'Low Intervention'	50	100	140
Option 2 - 'Preferred Intervention'	90	180	270
Option 3 - 'Greater Intervention'	260	520	790

[18] These costs range from around £1m (2020 prices) in Options 1 and 2 to around £1.5m (2020 prices) in Option 3 and therefore make no substantial difference to the benefit to cost ratio of any option considered. The figure of £100m is arrived at by using FTI's estimate of £89m and adjusting upwards to remain conservative. (i.e., accounting for any potential optimism bias).

[19] Taken from Annex 1 of Ofgem's Review of the GB energy system operation. https://www.ofgem.gov.uk/system/files/docs/2021/01/final_-_fti_consulting_-_ofgem_gb_so_review_2021-01-22_0.pdf

[20] For outstanding costs of ESO separation, such as the costs of IT separation, these are assumed to take place in the 'do nothing' counterfactual and are therefore deemed appropriate to exclude from analysis. The rationale for this assumption is based on the RIIO-2 Final Determinations – Electricity System Operator report, page 89, section 8.6 and 8.7. This outlines Ofgem's view that full IT separation is desirable and key to delivering net zero.

[21] This is assumed to be lower at £50m in FTI's high case outlined in table 4.4 of their report, however the low estimate was chosen to remain conservative.

Loss of operational synergies (*gas only*)

42. Unlike in electricity where NGESO is a legally separate entity, the GSO and GTO functions are currently integrated within the same company (National Grid Gas Plc) due to the different physical characteristics of the gas system. Under the integrated SO-TO structure of NGG, the GSO control room uses transmission network assets (network control) to operate and control the network, manage constraints and ensure system safety. For example, the GTO may delay the planned maintenance of a compressor to reduce the likelihood of a network constraint. The alternative to using network assets, is to balance the system by taking commercial actions to adjust the flows of gas across the network, however these actions are often more expensive and have an indirect effect on consumers through changing the price of gas.

43. Under the current regulatory arrangement, the GSO and GTO have the incentive to minimise the combined cost of operational and commercial actions (the Constraint Cost Management (CCM) Scheme[22]), therefore the GTO may be willing to incur the additional cost of an operational action if the cost was less than the potential reward to the GSO. While the GTO is willing to take these short-term operational actions, the GSO is required to take fewer, more costly, commercial actions to balance the network. This reflects the operational synergies of the two bodies while they are integrated within NGG.

44. We assume that if the GSO control room were separated from the GTO, the GTO would be less willing to take operational actions for balancing[23] and therefore the GSO would have to take more commercial actions. Following the approach set out in FTI analysis[24] we assume the GSO would take around 3 actions per year, compared to an historical average of 0.4.

45. This would increase the cost of balancing actions, it is difficult to forecast the cost of commercial actions but based on FTI analysis of an oversupply event in 2016, we assume the cost of location trades to be around £80k, and commercial buybacks to between £3.5 and £11.6m. However, we assume that the current CCM incentive that costs around £5.2m[25] per year would be removed as NGG would no longer have an active role in balancing. This could partly offset the expected increase in costs of balancing the gas system.

46. Based on the assumptions outlined above, the loss of operations synergies could range from a cost of around £410m[26] if the cost of commercial actions are high, to a cost of around £70m[27] if the cost of commercial actions is lower than the cost of the CCM incentive (present value). The additional exposure to cost uncertainty for the GSO may present an additional cost.

[22] To encourage NGGT to resolve this congestion efficiently, Ofgem developed the Constraint Cost Management ("CCM") incentive scheme (or "CCM incentive") as part of the RIIO-T1 price control. This is assumed to cost £12m per year.

[23] The cost of capacity buybacks is higher as such operations can have an indirect impact on consumers as the restriction in the volume of gas on the network can translate into an increase in the wholesale price (or National Balancing Point) of gas as a result. The Ofgem paper notes that there are a few reasons to believe this assumption may be conservative.

[24] See Section 4 and annex beginning paragraph A1.22. https://www.ofgem.gov.uk/system/files/docs/2021/01/final_-_fti_consulting_-_ofgem_gb_so_review_2021-01-22_0.pdf

[25] £5.2m reflects the recently announced cap on the CCM of £5.2m per year under RIIO-2. Conversations with Ofgem reveal that we expect the actual annualised cost of the CCM to be lower than the cap. This is significantly below FTI's annual cost saving estimate of the CCM at £12m per yar.

[26] Cost is calculated as increased cost = ('estimated increased in number of locational actions'*'cost of locational trade') + ('estimated increase in capacity buy backs'*'cost of capacity buy backs')-('estimated reduction in short-term asset optimisation'*'cost of short-term asset optimisation)-'annual cost of CCM incentive'

[27] These figures also differ to FTI's analysis due to the higher discount rate used (i.e., FTI used a discount rate of 2.88% compared to the Green Book aligned 3.5% used in this appraisal).

47. For NGESO, we assume loss in operational synergies has already occurred due to the 2019 legal separation of NGESO from NGET. No further losses in operational synergies are considered in modelling however this remains an uncertainty.

Benefits

Reduced potential conflicts of interest in transmission network development

48. Under existing arrangements, while there is no evidence of such a conflict being acted upon, there is nevertheless the potential for the SO to overestimate network transmission needs in long term forecasts or fail to properly scrutinise the TO assessment of network needs.

49. There are several mechanisms by which this could occur, each of which may not be unique to the current energy system governance structure. Those considered here are:

i. interruptions and outages on the energy system may result in reputational and financial damage to the SO[28]. Given the SO is risk-averse, the SO may be incentivised to overstate the future needs for network assets, "overengineering" the system beyond what is required to lower their exposure to risk below what is the social optimum. (Applicable to all SO governance models)

ii. the common ownership of the SO and TO may result in overstating[29] the need for network assets due to an informational or financial potential conflicts of interest towards transmission network asset solutions to energy system problems[30]. (National Grid Plc specific)

iii. the RIIO-1 framework rewarded National Grid Plc for meeting energy system needs at a lower cost than forecast, by allowing National Grid Plc to retain a proportion of the 'cost-saving' as additional profits via the Totex Incentive Mechanism (TIM). This was likely to incentivise National Grid Plc to 'overstate' their future expenditure[31] on network assets in forecasts. Retaining underspend as profits via TIM has now been removed under RIIO-2[32] reducing the potential for conflicts of interest in forecasts. (National Grid Plc specific, no longer applicable)

50. Of the two mechanisms considered, only mechanism ii. is specific to the current SO-TO ownership structure operated by National Grid Plc, however this more closely aligns with the benefit of "improved whole systems thinking", which is considered below. For mechanism i., it is not clear that any option considered would resolve the mechanisms by which the SO has the potential to overestimate network asset requirements and mechanism iii. is no longer applicable. Furthermore, the costs of underestimating future network needs are likely to be asymmetrically greater to the consumer than overestimating future network needs. Given the significant uncertainty that exists in all long-term forecasts and in light of these asymmetric costs, it is assumed that the FSO would also be incentivised to "overengineer" the system.

[28] As illustrated by the financial and reputational damage taken on by the companies found responsible for 9th August 2019 Power Outage. Detailed here https://www.ofgem.gov.uk/publications-and-updates/investigation-9-august-2019-power-outage.

[29] This is only a direct cost to the system if National Grid choose to act upon this conflict of interest, of which there is no evidence.

[30] For example, all of the Future Energy Scenarios (FES) developed by NGESO see a prominent role for hydrogen in achieving net zero. Whilst hydrogen is an important technological solution to decarbonisation, it also creates the need for retrofitting gas networks and reinforcing gas transmission network infrastructure. This perception that NGESO could be subject to potential conflicts of interest towards hydrogen solutions may reduce trust in the FES scenarios and the credibility of NGESO advice, or offer as an example of potential conflicts of interest towards transmission network solutions, since no solution is offered without a prominent role for hydrogen.

[31] To note, the informational asymmetry between National Grid and Ofgem may have limited mechanisms included in TIM designed to limit the 'overstating' of future costs.

[32] 7.38 in RIIO-2 final determinations: https://www.ofgem.gov.uk/system/files/docs/2020/12/final_determinations_-_core_document.pdf

51. For these reasons, the reduction in transmission network development costs from mechanism i. are assumed to be zero[33]. There may however be savings due to mechanism ii., which is considered as part of the potential for improved "whole systems" decision making.

Improved 'whole systems' decision making

52. A significant benefit that a new FSO could deliver is an improved "whole systems" approach to network development and assessing energy system needs. These benefits are directly related to the reduction in the perceived or actual conflicts of interest faced by the SO under current arrangements. While there is no evidence of such a conflict being acted upon under the current arrangements, removing this potential conflict of interest nevertheless enables the FSO to take on enhanced roles and responsibilities which will help to ensure that decisions made across the system work together to meet decarbonisation and security of supply goals at least cost.

53. Dependent on the option taken[34], the improved whole systems insight under an FSO would be expected to:

- improve network planning through removal of the current informational and financial potential conflicts of interest the SO has towards transmission network solutions as outlined in Paragraph 49. (ii)[35]. For example, free of potential asset ownership conflicts of interest, the FSO could better identify efficient investments in assets located in National Grid Plc asset locations that might alleviate the need for reinforcements;
- better identify and promote cost-effective and innovative solutions. These solutions may be found across areas such as technology, logistics as well as market design and business models;
- better identify challenges to system operability and take the steps to address them;
- better co-ordination of investment decisions to ensure alignment with whole system needs and policy goals. For example, an integrated FSO with responsibility for both GSO and ESO functions may have increased flexibility to meet network development and system balancing needs across fuels, minimising costs across infrastructure projects across energy, heat and transport networks that would otherwise be siloed; and
- better co-ordination and promotion of innovation projects involving actors from across the energy system. The improved perception of impartiality of the FSO is expected to increase energy actors' willingness to participate in joint-innovation projects.
- Improved facilitation of competition: As noted in our consultation IA, the FSO may be well placed to identify, develop and facilitate competitive tenders across the energy system. For example, competition in onshore electricity networks[36].

54. These benefits are likely to result in reduced costs across the entire energy system including generation, system-balancing and policy costs passed through to consumers via

[33] A significantly different assessment of potential cost savings from reduced asset ownership conflicts of interest is offered by FTI in their analysis for Ofgem's review of the GB energy system operator. Here they estimated savings to be between 1%-10% of total network costs. These differ with analysis included in this assessment because potential cost savings included in FTI analysis are considered as part of cost savings due to "whole systems" decision making.

[34] All benefits are expected to accrue under options 2 and options 3 given the greater number of roles and responsibilities within gas and hydrogen. Option 1 is modelled as only allowing benefits to accrue from the electricity. It is likely that the extent to which the FSO could be expected to achieve these benefits would be larger under option 2 and option 3 given the greater oversight of the energy system.

[35] As stated above, this is only a direct cost to the system if National Grid choose to act upon this conflict of interest, of which there is no evidence.

[36] This potential benefit was included separately at consultation stage. Consultation respondents broadly agreed that this the FSO may better facilitate network competition however disagreed with analysis' approach to quantification. These benefits are therefore removed at final IA stage.

energy bills[37]. Given the variety of sources cost savings could come from, this analysis chooses to quantify savings that occur due to transmission network cost savings only. This analysis only considers the potential cost savings in future transmission network development. The reasons for doing this are two-fold. Firstly, these costs are more easily quantifiable than the costs of other aspects, such as future policy costs. Secondly, these costs also help to illustrate the potential benefits a reduced information or financial potential conflicts of interest to transmission asset-oriented solutions may have.

55. Estimating the magnitude of the quantified benefits relies on forecast total expenditure (totex) on the transmission network to 2050 across a range of net zero and Carbon Budget compatible scenarios. This total expenditure estimate is based on the existing TO costs in the RIIO-2 business plan. For years beyond RIIO-2 the expenditure estimates are then scaled based on the possible development of the transmission network. For electricity, we scale total expenditure based on the Allowed Revenues forecast using the Dynamic Dispatch Model (DDM) under the 2019 high and low reference case scenarios, which was used to inform the Carbon Budget 6 Impact Assessment and are described at a high level in Annex 2 of the report. For natural gas, we scale total expenditure based on consumption estimates in UK Times Carbon Budget 6 (CB6) scenarios. For hydrogen there is no existing transmission network costs to base the estimate from, instead we use an estimated network cost of £2.2m/TWh and apply this to the UK Times final energy consumption estimates for hydrogen under different CB6 scenarios.

56. We then assess the potential savings in network costs by assuming a proportion of this total expenditure could be saved as a result of improved whole systems decision making. It is difficult to determine the proportion of transmission network costs that could be saved. As an illustrative assumption we consider a proportion between 1-5%.

57. This calculation gives an estimate of the potential savings in transmission network development as follows: Electricity: £210m to £2500m, Natural Gas: £50m to £300m, Hydrogen £30m to £300m (present value, 2020 prices). The potential cost saving in the electricity transmission network is higher than natural gas and hydrogen. This is due to i) the existing network being more expensive (electricity Totex in the RIIO-2 is around £1.3bn per annum, compared to around £550m in natural gas) and ii) that we forecast the electricity network to increase in size out to 2050, while the natural gas network is expected to decline across all scenarios considered.

Summary of monetised costs and benefits

58. The results of quantified analysis are presented in table 2, illustrating a less favourable “low” and more favourable “high” scenario to create a central range.

59. In option 1, implementation costs are assumed to be lowest due to NGESO already having incurred many of the costs of separation during legal separation in 2019. Under this scenario quantified benefits are assumed to accrue from electricity only. Whilst the full range of benefits has been appreciated below, it is likely that option 1 will be less likely in achieving the ‘high’ outcomes than options 2 and 3, where the enhanced roles and responsibilities are assigned to the FSO enabling greater “whole system” decision making.

60. In option 2, the greater number of GSO functions and enhanced roles of the FSO raise implementation costs compared to option 1; however, since day-to-day operations are retained within NGG, it is assumed that there is no loss of operational synergies in balancing the gas system. The greater gas roles taken on by the FSO enable the realisation of improved “whole system” decision making across both gas and hydrogen.

[37] This could occur for several reasons, for example, improved advice to government enabling better decision making or the identification and promotion of more cost-effective solutions reducing policy costs.

61. In option 3, these benefits are assumed to be the same despite day-to-day operation of the gas system being transferred over to the new FSO. This is based on the assumption that system balancing requirements are simpler on gas when compared to electricity, therefore the feedback loop between efficient network planning and experience of balancing the system is less of a concern for gas than electricity and benefits can be achieved without taking charge of day-to-day system balancing. Instead, carrying over the day-to-day system balancing costs is likely to pose significantly higher costs for both implementation and system balancing, due to the loss of operational synergies[38].

Table 2: Summary of high-level quantified analysis (£m, present value, 2020£)

	Option 1		Option 2		Option 3	
Scenario	**Low**	**High**	**Low**	**High**	**Low**	**High**
Costs						
Cost of asset purchase	(t)	(t)	(t)	(t)	(t)	(t)
Implementation Costs	-140	-50	-270	-90	-790	-260
Loss of operational synergies (*gas only*)	0	0	0	0	-410	-70
Benefits						
Reduced potential conflicts of interest in transmission network development	0	0	0	0	0	0
Improved "whole system" decision making (*electricity*)	210	2,500	210	2,500	210	2,500
Improved "whole system" decision making (*natural gas*)	0	0	50	300	50	300
Improved "whole system" decision making (*hydrogen*)	0	0	30	300	30	300
Net Present Value (£m)	**60**	**2,400**	**10**	**2,900**	**-900**	**2,800**

Note: (1) For transmission costs: Low scenario represents the lowest available demand projection and 1% reduced costs due to the improved "whole system" decision making. High scenario represents the highest available demand projection and a 5% reduced costs assumption. (2) Results presented are rounded to the nearest 10 for costs below 1bn and 100 for those above.

Sensitivities

Uncertainty over benefits

Improved 'Whole System' decision making

62. Sensitivity analysis focuses on testing the quantified benefits from improved "whole system" decision making and facilitation of electricity network competition. This is because these benefits represent the greatest overall impact on quantified analysis however rely on illustrative scenarios to assess the magnitude of impact. There are also reasonable chains of reasoning to suggest that quantified benefits may be lower or higher than the scenarios currently included in core analysis. For example:

- the role proposed to be given to the FSO may reduce the role for TOs and DNOs in assessing future investment needs resulting in a "single worldview" of energy system needs. If contracts between the FSO and network operators are difficult to define, this may result in energy system needs being determined by an FSO that has less information available than TOs and DNOs. Under this scenario there may be **fewer benefits from the improved "whole system" decision making**. Conversely, however,

[38] Under scenarios with high hydrogen uptake and electricity/hydrogen linkages, there may be a case to take over day-to-day gas functions in the future. This is not modelled in options for this IA and future analysis (once there is greater certainty in the role for hydrogen) may find it valuable to carry over day-to-day gas functions to the FSO.

the positive benefits from improved whole system decision making may be even greater than expected; and

- efficient network competitions may be achievable under the status quo through adequate design of competitive processes. For example, National Grid Plc and now NGESO has successfully run the Contracts for Difference allocation process since 2014. In this time there has been no clear evidence of conflicts of interest or insufficient competitive pressure due to NGESO's ownership structure. Conversely, greater co-ordination across the system and the enhanced responsibilities of the FSO may enable new opportunities for competition that would not otherwise be identified.

63. In central analysis, we assumed the improved "whole system" decision making would result in savings of between 1% to 5%. To test the chains of reasoning included above, an illustrative "worst-case" scenario is presented where: there are no benefits from whole system decision making; and demand for network development is low, decreasing the scope for potential benefits. An illustrative "best case" scenario is also presented where there is a 10% reduction in transmission network costs due to improved whole system decision making, moreover, demand for network development is high. These are illustrated below in table 3.

Table 3: Summary of sensitivity analysis (£m, NPV, 2020£)

Scenario	**Worst Case** (Low demand, 0% whole system saving)	**Central: Low** (Low demand, 1% whole system saving)	**Central: High** (High demand, 5% whole system saving)	**Best Case** (High demand, 10% whole system saving)
Option 1	-140	65	2,400	5,400
Option 2	-270	15	2,900	6,400
Option 3	-1,200	-900	2,700	6,200

Results rounded to nearest 10 below 1bn and 100 above.

64. In the 'worst case' scenario, the net-present value is negative across all three options considered. Implementation costs (and loss of operational synergies in option 3) are incurred with no quantified benefits. In the 'best case' scenario, the quantified net-present value almost doubles compared to the central high scenario, increasing from between £2,400-2,900m to £5,400-6,400m. This reflects the sensitivity of quantified results to assumptions made about the magnitude of potential benefits, particularly, the assumed benefit that improved "whole system" decisions will bring.

65. Given the significant uncertainty and impact of this assumption we tested the 'breakeven' point to assess how large the benefits from an improved "whole systems" view would need to be for the project to have an NPV of zero. In both the high and low scenario included in table 4.

Table 4: Summary of breakeven analysis (Savings as a % of total expenditure required)

Scenario	***Low*** (Low demand, High implementation costs)	***High*** (High demand, Low implementation costs)
Option 1	0.4%	0.1%
Option 2	0.8%	0.1%
Option 3	3.6%	0.5%

66. Assessing the results presented in table 4, the improved "whole system" view taken by an FSO would need to result in reduced costs of transmission network developments between 0.1 – 3.6% to break even. Under the preferred option, this benefit would need to be greater than 0.1-0.8% in order for benefits to exceed the costs of creating an independent FSO.

Furthermore, these "whole system" savings are only quantified from one aspect of the energy system (i.e., transmission networks).

Inclusion of wider energy system benefits

67. When considering the potential for cost savings that could occur elsewhere in the energy system due to a "whole system" view, the breakeven point at which a positive NPV occurs is likely to be even lower. This highlights that whilst there is significant uncertainty in estimating the magnitude of potential benefits, the range of uncertainty over which benefits could occur is asymmetrically skewed towards outcomes resulting in a positive NPV given only a relatively small benefit is required to materialise to overcome the quantified costs of intervention.

68. As highlighted throughout consultation response, there is likely to be additional benefit from the "Whole Systems" view taken by the FSO beyond the transmission network, including for generation, distribution and system balancing and stability services, each of which are excluded from core economic analysis.

69. Governments recently published Net Zero Strategy[39] estimates that achieving Net Zero and our Carbon Budgets could require between £280-£400bn in generation capacity alone. Assuming the same 1% to 5% range of potential cost reductions enabled by the "whole system" view taken by the FSO, it is estimated that the FSO could generate additional benefits of between £3bn (1% saving, low) to £20bn (5% saving, high) in generation costs, (undiscounted, 2020£). We anticipate that the future total expenditure requirements on the distribution network out until 2050 may be broadly similar to that of the transmission network and therefore assume a similar scale of potential of cost savings, resulting in a further range of additional FSO 'whole system' net benefits from between around £200m to £2,500m. Together with quantified transmission savings, this could take the benefit of the FSO providing a whole system view to a lower estimate of around £3-4bn to an upper estimate of around £25bn. Though these figures are illustrative, we have more confidence around the order of magnitude of the costs than the benefits. There is the potential that the benefits could be an order of magnitude larger than the costs and so it highlights the potential 'size of the prize'.

70. We also do not appreciate balancing and system stability services in these costs, these represent a further additive saving which the creation of an FSO may unlock.

Uncertainty over costs

Greater costs of implementation

71. As noted in consultation responses and in paragraph 41, the costs of implementation may be greater than our upper estimates included in core analysis. To reflect this, we include an additional sensitivity in table 5 below, in which all implementation cost estimates are doubled. This highlights that whilst there is cost uncertainty around the cost of implementation, when balancing the potentially large benefits described in the paragraph above, the creation of an FSO is still likely to have an overall positive NPV. Please note that the cost envelope for implementation is not being set with reference to the analysis in this impact assessment, but will require further work between BEIS, Ofgem, National Grid (including the ESO) and others.

Familiarisation and learning costs

72. The creation of any new entity is likely to pose significant learning and familiarisation costs. In the case of the FSO:
    - learning costs to the FSO are likely to be both internal and external. Internally, the FSO's organisational design and processes may require several adjustments before working as

[39] Page 99, paragraph 18, https://www.gov.uk/government/publications/net-zero-strategy

intended. Also, time may be required until the FSO is able to maximise the enhanced roles and responsibilities assigned to them, particularly in cases where the reassignment of roles to the SO and away from others in the energy system results in a loss of corporate memory. Externally, the FSO will require time to establish the correct lines of communication;[40]

- familiarisation costs are posed to Ofgem, HMG and National Grid Plc (discussed above) and all other energy industry participants. For Ofgem and HMG, given the system operator sits at the heart of the energy system, the creation of a new FSO is likely to impact almost all policy areas related to energy. This may create significant adjustment costs. For all other energy system participants, the significant change to the system may require firms to understand the new market structure. The increased co-ordination function of the FSO may require firms to hire new employees to engage with the FSO. In options where the FSO takes an increased role in network planning across the whole system, firms may have to adjust their own planning functions to co-ordinate effectively with the FSO; and

- the impact of these costs is intended to be minimised through the approach to implementation of an FSO as well as its organisational design, however some costs are unavoidable. Whilst it is not possible to quantify the multitude of learning and familiarisation costs it is likely that these costs will be substantially higher in GSO functions compared to ESO functions. This is because NGESO is currently a legally separate entity whilst the GSO is currently integrated within NGG.

73. These costs are illustrated in sensitivity analysis by delaying benefits from the creation of the FSO by a 5-year period. This is considered to capture the core risk associated with learning and familiarisation costs however, there may be additional costs incurred by industry in understanding how to interact with the newly created FSO. Table 5 below illustrates these costs. These highlight a high potential downside risk under Option 3, whilst only a small downside risk exists under Option 1.

Table 5: Options under higher costs (NPV, 2020£m, 2021 discounting perspective).

	Option 1		Option 2		Option 3	
Scenario	**Low**	**High**	**Low**	**High**	**Low**	**High**
Higher implementation costs	**-70**	**2,400**	**-300**	**2900**	**-1300**	**2600**
High learning and familiarisation costs	**10**	**2,100**	**-70**	**2,500**	**-1100**	**1,800**

74. However, a substantial amount of costs and benefits remain unquantified. Therefore, the quantified NPV is only one aspect of this Impact Assessment and must be considered in tandem with the unmonetized costs and benefits considered below.

Illustrative unmonetised Costs and Benefits of secondary legislation

Costs

75. Note, given the remaining uncertainties in the implementation of options and performance of policy design, several costs are considered under “risks and uncertainties” since effective policy design intends to mitigate them. Those costs included here are assumed to apply in all scenarios. However effective policy development can limit the magnitude of impact.

[40] The Transfer of Undertakings (Protection of Employment) Regulations 2006 (TUPE) are designed to minimise the impact of these learning costs, helping enable a smooth transition and the retainment of corporate memory.

Increase SO to TO transaction costs

76. The separation of ownership of the SO and TO functions in gas is likely to result in a loss of operational synergies not captured in quantified analysis. These costs may include:
    - replication of roles across FSO and TO to ensure effective communication and collaboration; and

    - contractual agreements allowing the FSO to operate TO assets may be difficult to establish. A 2013 report to Ofgem[41] notes that these difficulties currently exist between NGESO and both the Scottish TOs and OFTOs and may be significant. However, the report also notes that some of these costs may also occur under the counterfactual in electricity where TOs outside of England and Wales are beginning to play a larger role in the electricity system.

77. These costs are expected to be increasing in the number of roles and responsibilities carried over to the FSO and therefore highest in Option 3 and lowest in Option 1.

Learning and familiarisation costs

78. Whilst above sensitivity analysis captures the core of the uncertainty created by learning and familiarisation costs, additional costs remain unmonetized. Principally, the costs to business of becoming familiar with the new roles, responsibilities and opportunities to engage with the FSO. These costs are likely to be in part proportional to the size of the energy market participant and the extent to which their business chooses to engage. Therefore, these costs are deemed inappropriate to cost.

79. However, to provide an indicative sense of the minimum cost these unmonetized learning and familiarisation costs may pose, analysis assumes a 'cost per day of an energy sector representative' to be within £600-£1200. This is based upon data provided by code administrators as part of our 2021 Energy Industry Code Reform IA[42]. At a minimum, we assumed that all energy industry participants will need to spend 1 working day per year during the transitionary period as the FSO is implemented and begins to perform new roles and responsibilities. Whilst we assume this captures an effective minimum cost, some firms with more engagement with the SO function, such as DSOs may have substantially higher familiarisation costs including potential costs such as upskilling.

Benefits

Improved advice to government

80. Benefits from this improved advice may come from two key sources.

81. Firstly, the greater trust in the impartiality of the FSO will enable government and Ofgem to act more quickly upon advice provided by the FSO, requiring less internal scrutiny before making decisions. A small benefit may come from the reduced resource requirements on Ofgem and HMG however the largest benefit is expected to come from a greater ability to make timely and robust policy decisions in the energy system.

82. Secondly, the enhanced roles and responsibilities of the FSO enable an improved whole system oversight, which in turn, is likely to increase the value of advice provided by the FSO. For example, this improved whole system oversight may enable the FSO to advise on developments in different areas of the energy system that misalign with policy objectives or

[41] Page 35; Strbac, G., Konstantinidis, C.V., Konstantelos, I., Moreno, R., Newbery, D., Green, R. and Pollitt, M. (2013), Integrated Transmission Planning and Regulation Project: Review of System Planning and Delivery, Final Report to Ofgem, May.

[42] https://www.gov.uk/government/consultations/energy-code-reform-governance-framework

each other. This may enable better government decision making and in turn reduce the costs of government interventions.

83. The magnitude of these benefits would be likely to increase in relation to the size and scope of the FSO. Therefore, the greatest benefits are expected in Option 3. Benefits are likely to be further increased if GSO and ESO functions were integrated within the same entity. This would enable advice to be made across energy vectors.

Improved “whole system” decision-making

84. Improved decision making across the “whole system” is the largest quantified benefit and is also pivotal in the FSO being able to provide improved advice to government, however there are several aspects of this benefit that are not mentioned elsewhere.

85. Firstly, monetised values only considered reduced costs in transmission network development. These reductions in costs may also occur elsewhere in the energy system due to a “whole systems” view. For example, system balancing, and network costs (including the distribution network) may be reduced under an integrated FSO able to co-optimise across both gas and electricity requirements. This benefit is likely to be substantially larger under future scenarios with a greater role for hydrogen. This is partly appreciated in sensitivity analysis above.

86. Secondly, a greater harmonisation of operational and investment decisions across the entire energy system may lower the risk of unplanned outages and system failures through greater co-ordination of energy system participants. The added gas roles and responsibilities taken on by the FSO under Option 2 are likely to increase the size of this benefit under Option 1. Benefits under Option 3 are expected to be comparable to Option 2 since it is unlikely that day-to-day gas functions will be required to enable a “whole system” view to be taken for gas.

Increased adaptability

87. The increased roles and responsibilities of the FSO could enable the FSO to both better predict and better respond to changing energy system needs. For example, an increased role in co-ordination could allow greater responsiveness of the energy sector during periods of extreme weather, such as the 2018 ‘Beast from the East’. Option 2 and Option 3 are likely to better adapt to challenges requiring cross-vector adaptability.

Increased innovation

88. The FSO will have a clear focus on innovation and could help to remove barriers to new technologies and business models, meaning that lower cost pathways to net zero may become available to us that would be otherwise shut down by prescriptive system rules that do not leave room to try new things.

89. This remit would be supported by the potential benefits to innovation brought about by improved “whole system” decision making enabling new opportunities for innovation and improved co-ordination facilitating its delivery. These supporting roles are present or likely to be larger under Option 2 and Option 3, compared to Option 1.

Introduction of competition on gas/hydrogen network assets

90. There may also be future benefit in introducing competition for large and separable gas or hydrogen projects in the future, and if so, whether the FSO is appropriately placed to identify, facilitate, and advise on these projects. Given natural gas networks are expected to

decline across most net zero pathways[43], it is expected that the potential cost reductions as a result of input competition would be largest under pathways with significant scale up in the use of hydrogen. It is likely Option 2 and Option 3 will better deliver this benefit compared to Option 1 due to their great roles and responsibilities in the gas system.

Risks, Uncertainties and Assumptions

Risk and Uncertainties

Increased inefficiency of the SO under the FSO

91. There is a risk that the FSO could be less efficient than the status quo resulting in higher internal costs and more importantly higher costs required to balance system balancing costs. This is likely to occur if the organisational design and resulting incentive structure applied to the FSO cannot create the same pressure to minimise costs.

92. A 2019 paper by NERA[44] compared the performance of network operators based on their organisational design (i.e., public vs private) and found evidence that private firms have historically been more efficient in meeting energy needs with fewer unplanned outages and lower costs. However, there is less evidence that examines the SO function specifically, which may be effectively incentivised under a range of organisational design structures. The development of a strong organisational design model for the FSO is necessary to mitigate this risk. Moreover, there is a risk of inefficiency created by decision making and delivery being linked within a single organisation. Some consultation respondents highlighted that this could potentially leading to operational delivery being prioritised ahead of strategic decisions.

93. However, the removal of a profit incentive may also benefit non-profit or public organisational models by allowing greater focus to be given to softer, less profit-making areas important to overall system performance. This is likely to exist across all options, however, the magnitude of any potential inefficiencies is increasing in the size of the FSO, and therefore largest in Option 3.

Increased uncertainty in governance structure

94. The transition to an FSO creates uncertainty to the energy industry which may inhibit or delay investments. For example, distribution network operators (DNOs) may be uncertain what their future role in energy system planning and delay investments into new modelling capabilities as a result. Delaying planned investments to the electrification network may pose risk to the electrification pathway required under future scenarios. This is likely to be largest in Option 3 given the larger impact on the gas system, and in turn those operating in the gas sector. Conversely, this is likely to be smallest in Option 1 due to the FSO taking no formal roles and responsibilities for gas.

Cost overrun and delays

95. There is a risk the cost of implementation and delivery timelines may over run. Work on the development of a clear and robust implementation delivery plan is intended to mitigate this. This is likely to exist across all options with increasing costs under options in which more roles and responsibilities are carried over, and therefore largest in Option 3.

Reduced accountability

[43] For example, the use of natural gas declines across all scenarios considered in the Carbon Budget 6 Impact Assessment: https://www.legislation.gov.uk/ukia/2021/18/pdfs/ukia_20210018_en.pdf

[44] https://www.nera.com/content/dam/nera/publications/2019/NERA%20Economic%20Consulting%20Public%20Private%20Energy%20Networks%20UK%20July%202019.pdf

96. The increased number of responsibilities attached to the FSO for the delivery of outcomes in the energy system may reduce the accountability for the delivery of these outcomes to any one body. This risks creating a "*blame game*" across HMG, Ofgem and the FSO. Developing clear roles and responsibilities and a transparent decision-making process is intended to mitigate this risk.

Increased risk of health and safety issues under the FSO transition

97. Gas transmission in the UK is currently subject to a "Safety Case" owned by the Health and Safety Executive (HSE). The increased loss of operational synergies in gas between SO and TO functions may increase the risks to the system and require a review of the Safety Case. This risk principally applies to Option 3.

Creation of a "single view" of the energy system

98. Whilst it is expected that an increased "whole system" view will result in improved decision making across the energy system there is also a risk of creating a single view of the energy system and limiting diffuse decision making based on those with the best information. This could create inefficiencies in the delivery of policy objectives and raise costs to consumers.

99. In the context of net zero, the increasing complexity of the energy system is likely to limit the effectiveness of any single entity from having the necessary information to make informed decisions across the whole system. The design of roles and responsibilities taken on by the FSO look to limit this and ensure the active participation of stakeholders in the design of future system needs. This risk exists most strongly under Option 3 where the GSO as a separate entity is entirely removed.

Optimism bias

100. The cost of implementing the FSO is likely to be subject to optimism bias, with costs larger than expected and benefits smaller than expected. This applies to both monetised and non-monetised costs and benefits. This risk exists under all options.

Unknown uncertainties

101. The energy system is undergoing a period of rapid transformation and as such, there are likely to be risks that are unknown currently. To mitigate this uncertainty, careful consideration will be given as to how the FSO can be equipped and incentivised to new challenges.

Assumptions

102. There are several assumptions made throughout quantified analysis.

103. When calculating the benefit that improved "whole systems" decision making could have on reducing transmission network costs:

- **Assumption 1:** For electricity, it is assumed that future total expenditure on electricity transmission can be calculated by scaling current costs by the growth rate in allowed revenues used in BEIS' Dynamic Dispatch Model reference cases.

- **Assumption 2:** For natural gas, it is assumed that future total expenditure on gas transmission can be calculated by scaling current costs by the growth rate of natural gas and hydrogen production in BEIS' UK Times internal Carbon Budget 6 runs. i.e., assumes that network costs scale linearly with demand.

- **Assumption 3:** For hydrogen, it is assumed that the cost of the hydrogen network is £2m/TWh, this is based on a previous Baringa model[45].

- **Assumption 4:** For all three fuels, it is assumed that the reduced costs as a result of the FSO's "whole system" view can be fairly illustrated by a range of between 1% to 5%. Given there is little evidence for this range, this assumption is the key focus of sensitivity testing.

104. When considering the loss of operational synergies that would occur in gas between the GSO and GTO under option 3:
    - **Assumption 5:** This analysis directly replicates FTI analysis produced for Ofgem and therefore inherits their assumptions, listed in their report[46]. Broadly this assumes that the existing operational synergies allow the TO to use network assets to manage constraints and balance the system. If these options were lost, the GSO would need to take more commercial actions which would increase the cost.

105. Across all options:
    - **Assumption 6:** It is assumed that all costs and benefits (excluding implementation costs) start in 2026 and continue out until the end of the timeline for analysis, in 2050.

106. There is also an assumption across all benefits listed this:
    - **Assumption 7:** The FSO's risk appetite for trying new things is at least as great as under the status quo. This assumption is important to realising the benefits of a more innovative and flexible system.

Wider Impacts and Distributional Effects

Wider impacts

107. Beyond the quantified and unquantified costs considered so far, the creation of a new FSO may have several environmental, social and reputational impacts.

108. The creation of a new FSO represents a significant action to facilitate the enabling environment required to meet both domestic (UK Carbon Budgets, net zero) and international climate (UK Nationally Determined Contribution (NDC), net zero) commitments. This may increase the UK's credibility and provide lessons learning opportunities when influencing other countries to raise ambition on climate. This may contribute to ensuring the success of COP26, when countries NDCs will come into effect under the Paris Agreement.

109. The FSO is also likely to contribute to enabling the uptake of a Smart Grid and low carbon flexible assets. This supports the vision set out in the recently published 2021 Smart Systems and Flexibility Plan[47]. Similarly, the FSO may also be well positioned to support the decarbonisation of inter-related sectors such as heat and transport. For example, for advising on the optimal integration of electric vehicle charge points and ensuring the grid remains stable whilst doing so.

110. This policy intervention is also likely to contribute towards achieving governments objectives in sectors dependent on the electricity sector, such as the UK's target to rollout 600,000 heat pumps per year by 2028. Similarly, the creation of the FSO may help to enable governments Data and Digitalisation Strategy[48]. Therefore, the creation of an FSO may

[45] Not publicly available

[46] https://www.ofgem.gov.uk/system/files/docs/2021/01/final_-_fti_consulting_-_ofgem_gb_so_review_2021-01-22_0.pdf

[47] https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021

[48] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1004011/energy-digitalisation-strategy.pdf

reduce the delivery risk associated with achieving Net Zero and our Carbon Budget pathway.

Equalities Assessment

111. The transition to a FSO may have differing impacts on current employee's dependent on their protected characteristics. Ensuring full compliance with both the Transfer of Undertakings (Protection of Employment) Regulations 2006 (TUPE) and Public Sector Equality Duty set out in the Equality Act 2010 are critical to mitigate this. There are also potential opportunities in the creation of new roles and capabilities within the System Operator for wider social impacts through high-quality job creation. Preventing any adverse impacts and amplifying the potential opportunities outlined above will be kept under review as the implementation proposals are developed. We are also considering the wider societal impact that the FSO will have through its future roles and the extent of its advisory and decision-making responsibilities and have developed proposals to place a statutory duty on the FSO to consider the impact on consumers.

Justice Impact Test

112. This intervention does not expect to impact on the justice system. An internal assessment of the measures taken found it was unlikely that the creation of an FSO would result in any implication on the justice system.

Human Rights

113. The power to force the sale of National Grid assets to government may impact on property rights. We intend to mitigate this by ensuring that the parties are appropriately compensated for the elements of their businesses that are transferred into the FSO.

Price and Bill Impacts

114. The creation of an FSO is likely to have upfront and ongoing costs of implementation which are likely to be passed onto end consumers of electricity, and under option 3, there is also additional costs via the potential loss of operational synergies. Whilst it is expected that benefits of intervention will also be passed onto consumers in the form of lower prices, the temporal effect of more near term costs before benefits are incurred could risk higher bills for end users of energy.

115. Internal analysis concluded that the size of costs incurred across all options would not result in any substantial increase in end user bills. However, over the longer term, the potential for more substantial cost reductions could have scope to reduce the bills of end users. This is not modelled given the illustrative nature of quantified benefits.

Distribution of Impact

116. A high-level assessment of the distributional impacts across groups and time is detailed in table 6 for our preferred option. Impacts on business are then considered in more detail in the following sections, splitting out the overall impact to business and the impact on small and micro businesses. Whilst no assessment of distributional impacts is exhaustive, consultation responses broadly agreed that the distribution of costs illustrated below was correct.

Table 6: *Distribution of impacts over groups and time – option 2*

Group	**Costs**	**Benefits**	**Time-horizon for costs and benefits**

National Grid Plc	Internal resource costs (i.e., costs of sale process), separation. Loss of revenue streams. (i.e., BSUoS) Loss of incentive scheme revenues (i.e., Information Quality Incentive) Loss of corporate memory and employee talent. Loss of SO-TO operational synergies. Loss of future RAV growth. Reduced decision making in network planning. Familiarisation and learning costs.	Capital cost associated with sale of SO assets.	For the purposes of our assessment, we assume that National Grid Plc faces internal resource costs to enable the establishment of a new FSO from 2022-2026. For the purposes of our assessment, we assume that in 2026, National Grid Plc will receive the capital cost associated with implementation, however we also assume that it incurs all remaining costs at this time. [49]
FSO	On-going costs Familiarisation and learning costs Potential capital cost of implementation (if the FSO is to be privately owned)	Revenue streams (i.e., BSUoS) Incentive scheme revenues (i.e., Information Quality Incentive) Future RAV growth. Enhanced roles and responsibilities	For the purposes of our assessment, benefits are assumed to begin in 2026.
HMG	Legal, financial and consultancy costs Capital cost of implementation (if the FSO is to be non-private) Familiarisation and learning costs	Improved impartial advice provided by the FSO to government enabling better decisions and reduced policy costs. Greater ability to meet policy goals (i.e., net zero, reduced fuel poverty) and ensure strategic alignment with them in the energy system. Greater transparency in decision making.	Costs of implementation and capital cost of implementation are assumed to take place 2021-2026. Benefits expected to accrue over longer timeframe, post 2026.

[49] These assumptions are for the purpose of the IA and producing quantified results only and do not constitute policy decisions.

Ofgem	Internal resource costs to make appropriate adjustments in regulation for new FSO. Familiarisation and learning costs	Improved trust in SO decisions. Improved trust in SO advice.	Costs assumed to take place pre-2026. Benefits expected to accrue over longer timeframe, post 2026.
Energy firms (*Generation, transmission, distribution, supply***)**	Loss of some decision-making abilities due to increased role for FSO. Increased uncertainty in system governance structure. Internal resource to participate in government policy consultation process. Familiarisation and learning costs.	Improved trust in SO decisions. Increased opportunities to participate in competitions. More belief in fair consideration of their network solution proposals. Increased opportunities for innovation. More responsive energy system to changing needs.	Costs illustrated as accruing from 2026, during transition to new FSO. Increased uncertainty in system governance structure may be incurred from present until 2026. Benefits accrue over longer timeframe, post 2026.
SME energy firms	Increased uncertainty in system governance structure. Internal resource to participate in government policy consultation process. Familiarisation and learning costs	Improved trust in SO decisions. Reduced barriers to participation More belief in fair consideration of their network solution proposals. Increased opportunities for innovation. More responsive energy system to changing needs.	Familiarisation and learning costs illustrated as occurring from 2026[50], during transition to new FSO. Increased uncertainty in system governance structure may be incurred from present until 2026. Benefits accrue over longer timeframe, post 2026.
Energy end users (*Industrial and household consumers***)**	New FSO roles and responsibilities passed through to consumers' energy bills (expected to be negligible) Risk of outage during SO ownership transition (particularly gas) No substantial bill impact from capital and implementation costs identified	Reduced energy bills Potential for increased future system reliability Increased number of innovative opportunities for participation (i.e., Demand Side Management, Prosumers)	Risks associated with transition to new FSO expected in 2026[51] with on-going costs of new FSO roles and responsibilities passed through to consumers thereafter. Benefits expected to accrue over longer term, beginning 2026 but predominantly 2030 onwards.

[50] Given these costs are not monetised, no assumptions are made over how long these learning and familiarisation costs will last.

[51] Given these costs are not monetised, no assumptions are made over how long these learning and familiarisation costs will last.

Additional detail on distribution of costs and benefits

Direct Business Impact

117. As noted in table 6, in the energy sector, direct costs to business are likely to be limited to learning and familiarisation costs alongside the internal resource costs required to participate in subsequent government consultations. However, BEIS considers these impacts to be pro-competition and therefore to fall out of scope of a more detailed assessment of business impacts. According to the Better Regulation manual[52], a regulatory measure needs to satisfy all of four conditions to be considered to promote competition. In the following section we list the four conditions and provide a comment for each of them to explain how the proposed measures meet them:

    a. *The measure is expected to increase, either directly or indirectly, the number or range of sustainable suppliers; to strengthen the ability of suppliers to compete; or to increase suppliers' incentives to compete vigorously.*

Comment: This intervention looks to remove the perceived or potential conflict of interest in SO decision making. This intends to enable greater competition through two means. Firstly, the enhanced roles and responsibilities of the FSO will enable a “whole system” view which may result in realising new opportunities to create competition. Secondly, the current perception of conflicts of interest in SO decision making may act as a barrier to entry for firms looking to enter competitions. By creating an impartial FSO, this barrier of entry is reduced since firms are likely to have greater trust that they will be treated fairly throughout the competitive process. These two policy aims intend to meet all four criteria, listed under paragraph 114.

    b. *The net impact of the measure is expected to be an increase in [effective] competition (i.e., if a policy fulfils one of the criteria at (a) but results in a weakened position against another) and the overall result is to improve competition.*

Comment: At its core, this intervention intends to remove the perceived or actual conflict of interest that exists under the current ownership arrangements, under National Grid. This is because National Grid are a profit-making company with business interests in other areas of the energy system such as interconnectors[53]. As noted throughout supporting literature[54], this has the potential to limit effective competition by favouring system solutions supporting their business interests or disfavouring (via delays, higher connection charges, etc.) competitive rivals.

It is also expected that the FSO will identify new opportunities for competition across the energy system and act as an impartial facilitator of these competitions. These may also extend to gas and hydrogen networks in the future. Respondents at consultation stage broadly agreed the creation of the FSO would result in improved facilitation of network competition however disagreed with our approach to quantifying impacts, therefore no quantified impacts are explicitly included. These benefits do contribute towards our ‘whole system’ view benefit quantified above.

    c. *Promoting competition is a core purpose of the measure.*

Comment: Yes. The overarching strategic aim of this intervention is to contribute to delivering net zero at least cost to consumers. A core part of the intervention achieving this will be through the FSO increasing the frequency and intensity of competition across the energy system. This is informed by the conclusions of the 2021 Ofgem Review of the GB Energy System Operator,

[52] https://www.gov.uk/government/publications/better-regulation-framework

[53] As noted here, National Grid owns several of the current interconnectors. https://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/interconnectors

[54] An early example of this is supporting analysis undertaken by Imperial College and Cambridge University as part of Ofgem’s 2013 Intergated Review of Planning and Regulation (page 16, https://www.ofgem.gov.uk/sites/default/files/docs/2013/06/imperial_cambridge_itpr_report_0.pdf)

who found that stakeholders viewed current arrangements as inhibitive of fair competition, acting as a barrier to entry.

d. It is reasonable to expect a net social benefit from the measure (i.e., benefits to outweigh costs), even where all the impacts may not be monetised.

Comment: Yes. Central estimates included under monetised impacts find that the three options assessed result in net present values of between a net cost of £900m to a net benefit of £2,900m. However, the preferred option is expected to result in a net benefit of between £10m to £2,900m. When also considering non-monetisable impacts, the learning and familiarisation costs are only expected to be transitionary whilst benefits such as the improved value of advice to government is expected to be on-going. Overall, it is reasonable that intervention will present a net social benefit.

Small and Micro Business Assessment (SaMBA)

118. BEIS's Business Population Estimates[55] listed in tables 7 and 8 provide the combined number of employers in the 'Electric power generation, transmission and distribution' and the 'Manufacture of gas; distribution of gaseous fuels through mains' sectors. In 2020 there were 2,060 micro businesses in the electricity sector and 55 in the gas sector. There were 415 small businesses in the electricity sector and 15 in the gas sector. There has been a particularly large increase in the number of micro and small businesses in the electricity sector since 2013, the earliest year for which data is available, there has been around a 300% increase in the number of SME firms, compared to rises of around 175% and 65% for medium and large businesses respectively. These figures show that micro and small businesses already play an important and significant role in the electricity sector, which will be expected to increase further in the future, as more decentralised systems allow for a greater degree of small-scale generation.

119. For gas, the role of SME firms appears more stable with no rise in the number of small firms and about a 50% increase in the number of micro firms, roughly comparable to the 100% increase in the number of large firms.

Table 7 - Number of employers in the private sector, Electric power generation, transmission and distribution industry group, UK, start 2020

	Firms (*number*)	Employment ('*000s*)	Turnover (*£m*)	Firms (%)	Employment (%)	Growth in firms since 2013
All employers	2,555	101	101,065	*100.0*	*100.0*	296%
Micro (1 - 9 employees)	2,060	8	6,898	*80.6*	*7.9*	308%
Small (10 - 49 employees)	415	6	*	*16.2*	*5.9*	295%
Medium (50 - 249 employees)	55	6	*	*2.2*	*5.9*	175%
Large (250+ employees)	25	82	85,319	*1.0*	*81.2*	67%

*Key: * refers to missing data*

Table 8 - Number of employers in the private sector, Manufacture of gas; distribution of gaseous fuels through mains, UK, start 2020

	Firms (*number*)	Employment ('*000s*)	Turnover (*£m*)	Firms (%)	Employment (%)	Growth in firms

[55] https://www.gov.uk/government/statistics/business-population-estimates-2020

						since 2013
All employers	85	44	40,845	*100.0*	*100.0*	42%
Micro (1 - 9 employees)	55	*	*	*64.7*	*	57%
Small (10 - 49 employees)	15	0	*	*17.6*	*0.0*	0%
Medium (50 - 249 employees)	5	*	1,229	*5.9*	*	0%
Large (250+ employees)	10	*	*	*11.8*	*	100%

120. The main cost borne by SME firms in the energy sector is likely to be learning and familiarisation costs, such as administrative costs of understanding the new roles taken on by the FSO. Whilst these costs will be felt across all stakeholders it is likely that the fixed costs of this administrative burden are likely to have a larger impact on SME firms, who are likely to have both a smaller revenue base to absorb these costs and fewer internal resources to fully adjust to operation under the FSO.

121. There may also be secondary impacts to SME firms that are subject to further consultation. SME firms may also feel the impact of new roles and responsibilities assigned to the FSO if they are license holders or signatories of energy codes. This is because their obligations under these licenses or codes may change. Given these are subject to consultation, SME firms will also have the opportunity to make representation on any specific elements of new FSO roles that have an effect on them, prior to those roles coming into effect. As stated in the 2021 consultation, we intend to make sure that SME industry participants are appropriately represented in any forums that contribute to that overarching governance helping to ensure impacts to SME firms can be mitigated.

122. A core purpose of intervention is to enable an improved facilitation of competition and reduced potential for conflicts of interest towards transmission network solutions. Currently, the fixed costs of participating in competitions is likely to represent a greater burden on SME firms than larger firms, for example the cost of developing formal bids. The perception of conflicts of interest in competition is therefore more likely to deter SME firms from participating since the cost of participating is relatively higher. By ensuring SME firms feel competitions are facilitated fairly, the barriers to participation are then lowered. Similarly, given its economies of scale, the transmission network in operated by large firms only. Therefore, the perception of conflicts of interest towards transmission network solutions is likely to act as a barrier to entry for SME firms since these solutions exclude SME solutions. Removing the perceived or potential conflicts of interest towards them is likely to increase the willingness of SME firms to enter the energy market by increasing the perceived or actual benefit of doing so.

123. For SME firms outside of energy, any additional costs passed through to energy bills are likely to be small and have no significant impact on firm productivity, as confirmed by our price and bills assessment above. The long run impact of intervention is intended to facilitate net zero at least cost meaning a lower bill impact to all end users.

Monitoring and Evaluation

124. Monitoring and Evaluation (M&E) in this impact assessment outlines the objectives of M&E for this policy intervention and outline the likely data requirements and approach that may be taken. Additional detail will be required to refine the plan and ensure proportionality to be developed alongside implementation.

Policy Objectives

125. Policy intervention intends to achieve the objectives established through consultation and as set out above, in paragraph 15. Ensuring that these objectives can be interpreted in a

SMART[56] manner is important for enabling effective M&E. However, the Future System Operator is a market-enabling policy which intends to help the energy system achieve net zero out to 2050 at least cost. As such, there is no clear 'completion date' by which we expect objectives to have been fully realised. This makes it difficult to reflect the objectives of policy intervention in a time-bound and measurable manner.

Theory of Change

126. The theory of change for how policy intervention intends to achieve objectives is set out in annex 1, figure 1. This process chart outlines how we expect intervention to achieve our intended outcomes and contribute towards our overarching policy objective of helping to achieve Net Zero at least cost whilst ensuring security of supply.

127. The achievement of this theory of change is dependent on a number of assumptions linking actions, outputs and outcomes in the figure above. These assumptions relate to external factors, outside the control of policy intervention and reflected in the risks section above.

128. It is also assumed that policy intervention will work as intended and the new arrangements will result in the achievement of objectives whilst not also producing any unintended consequences. The impact of wider contextual arrangements such as the rate of power sector decarbonisation, the emergence of new technologies or the existence of new bodies such as a Strategic Body overseeing Energy Codes is important to consider alongside this policy intervention.

Objectives of Monitoring and Evaluation

129. Ensuring that the governance of the energy system is fit for purpose is crucial to the achievement of Net Zero, whilst ensuring security of supply and universal access to affordable energy.

130. **Aim 1: To provide clear, impartial and robust evidence to demonstrate the intervention's impact or wider outcomes:** it is important that robust M&E is available in a timely manner in order to help ensure that governance arrangements are fit for purpose and highlight where additional action may be required. This need for M&E is heightened by the uncertainties and assumptions illustrated of the future state of the world and energy system needs, illustrated in the narrative supporting our theory of change in paragraph 123.

131. **Aim 2: To provide useful and timely learning about the roll and performance of the FSO:** This policy intends to leverage M&E to highlight early signs of both good and poor performance in both the process of delivering the FSO and subsequent performance of governance arrangements in achieving policy objectives.

132. In the event that M&E highlights shortcomings in the delivery or performance of the FSO, evidence may then inform decisions on how these shortcomings may be appropriately addressed. In all eventualities, evidence provides learning useful for other wide scale governance reform projects and helps ensure BEIS is accountable to policy customers and tax-payers.

Monitoring and data requirements

133. Monitoring requirements are under development. An update will be provided in subsequent IAs produced at secondary legislation stage.

[56] Specific, Measurable, Achievable, Realistic and Timebound

134. Stakeholder feedback on the performance of the existing ESO has been collected through consultation and through stakeholder engagement. There is also an existing annual ESO performance panel[57] which challenges the ESO's plans before the start of the year, evaluates the ESO's performance after six months (mid-year review) and performs an end of year assessment, as part of Ofgem's RIIO framework.

135. It is expected that monitoring the performance of the FSO will look to utilise these existing performance panels, with additional indicators requested in order to ensure as many relevant indicators are captured as possible. This work is ongoing and will continue to be developed ahead of the implementation of the FSO and before outcomes of the policy intervention are observable.

Evaluating performance

136. To provide a full understanding of policy intervention, and, given the difficulties in effectively monitoring the performance of intervention on an ongoing basis, at this stage, it is deemed likely to be proportionate to carry out two evaluations; a lighter-touch process evaluation at the time of implementation followed by a value-for-money performance evaluation 5 years following implementation, when it is expected there will be sufficient experience of the new governance arrangements to assess their performance and desirability.

Process evaluation (within 1 year of implementation):

137. To complement the monitoring approach, we might expect to carry out a light-touch process evaluation to explore the implementation of the proposed changes. Given the robust nature of the monitoring process, the process evaluation will be relatively light-touch and explore the following thematic questions:

a) Was the intervention to establish a Future System Operator delivered as intended? What lessons can be learned from the implementation of the FSO? (Process evaluation)
    - Were there any unexpected or unintended issues in the delivery of the intervention?
    - Was security and stability maintained during the transition?
    - Did the change create regulatory uncertainty for investors?
    - Were timelines realistic?

b) Is the theory of change still reflective of our policy intervention? How have wider contextual factors or unforeseen dependencies influenced our understanding of the intervention?
    - Is the governance structure still equipped with the right skills, roles and resources to meet our objectives in light of this new information?
    - Has the development of wider factors influenced the requirements of this policy intervention to meet its objectives?

Impact and value-for-money evaluation (5-years post implementation):

138. We may also expect to carry out a robust evaluation of the impact and value for money of establishing the FSO five years post implementation. This evaluation would make use of the monitoring data collected over time and supplement this with new data and analysis.

Thematic questions this evaluation will look to address are:

a) Did delivering an FSO achieve the expected outcomes and objectives of intervention? To what extent are these attributable to this policy intervention?

[57] https://www.ofgem.gov.uk/publications/eso-performance-panel-end-year-review-2020-21

b) How cost-effective was the intervention to FSO? Have different groups been affected in different ways, how, why, and in what circumstances?

c) Are governance arrangements and the FSO' role within it fit for purpose into the future? Does the emergence of unintended consequences, new energy system challenges or wider contextual factors require reform to current arrangements?
    i. For example, Does the FSO hold the correct roles and responsibilities?

Approach to evaluation and additional data requirements

139. We anticipate that any evaluations would be largely survey and interview based, using a range of expert interviews alongside surveys to capture the views of relevant parties across the energy system, ensuring a sufficient range of relevant parties are reflected. This approach is preferred due to both the highly bespoke nature and universal application of the Future System Operator and the pace of whole system change in the energy sector making it difficult to establish a counterfactual by which quantitative or experimental approaches to evaluation could be compared. Similarly, the multitude of interdependencies and supporting policy interventions in the energy sector makes it difficult for quantitative analysis to identify the causal impacts of this intervention.

140. Data collected by the FSO performance panel could also be used to evaluate the intervention. This data will be collected on an annual basis. We will review the evidence that is collated through the existing process and identify any gaps in the monitoring which could be filled with existing administrative data or, if needed, primary research (e.g., surveys). Data will also be collected from individuals involved in the intervention to answer the process evaluation questions. Data on the cost of the intervention will also be collected.

Justification of preferred Option

141. **The preferred option in this IA is Option 2, which designs the FSO as a public corporation[58], sitting within the public sector, but with operational independence from government, to carry out all electricity roles and all gas roles excluding day-to-day operations**. This preferred option has been informed and chosen based on the analysis presented in the economic case, alongside detailed policy analysis and overarching strategic considerations which are not able to be fully reflected in the economic case.

142. The analysis in this impact assessment concludes support for the preferred option via:

- **Quantified analysis concluding that Option 2 presented the highest net-present value:** Whilst there is significant uncertainty about both the potential costs and benefits of an FSO, quantified analysis concludes that Option 2 is the preferred option, since Option 2 is able to achieve the same benefits as Option 3 whilst not incurring the additional costs. Compared to Options 2 and 3, Option 1 achieves significantly fewer benefits whilst only incurring small cost savings relative to Option 2.

- **Sensitivity analysis highlighting that benefits would only need to be small in order for intervention to 'break even':** There is significant uncertainty in the effectiveness of the FSO in reducing costs across the energy sector. Sensitivity analysis highlights that under Option 2, the FSO would be required to reduce the costs of delivering a Net Zero energy sector by a fractional amount compared to Options 3. Looking at the future transmission costs alone, the FSO under Option 2 would only need to reduce transmission network costs by 2%, compared to over 5% under Option 3.

[58] Subject to an ultimate decision on classification by the Office of National Statistics

- **The non-monetised risks associated with Option 3 are significantly higher than other options:** Carrying over day-to-day functions of the GSO to the FSO creates greater safety risks. Given the probability of a safety event occurring is unknown, costs are not monetized, however, these could be significant. It is also reasonable to expect higher learning and familiarisations costs alongside greater risk of delay to implementation timelines, eroding benefits.

143. In addition to the analysis included in this impact assessment, there are also strategic policy considerations in support of the preferred option are:

- **Implementation timeline risks:** The greater risk of delay to implementation timelines under Option 3 may inhibit the FSO from supporting key decarbonisation decision points, such as CB6. This may occur directly via delayed FSO advice or decision making, but also indirectly, via increased investment uncertainty for industry. This preferences Option 2, which is found to have similar implementation risks as Option 1 however a greater achievement of this business cases policy objectives.

- **Safety risks**: Option 3 raises concerns over the HSE Safety Case for gas which would need to be revisited.

144. On balance, these considerations indicate that roles prescribed to the FSO under Option 1 would not fully capitalise on the potential strategic and economic benefit of the FSO. Roles prescribed under Option 3 would allow for these benefits to be realised however present significantly higher costs associated with implementation, alongside new costs and risks due to the loss of operational synergies expected to occur in gas. To cover these increased costs, sensitivity analysis highlights those benefits would have to be substantially higher under Option 3 compared to Options 1 or 2, which policy development and consultation did not indicate would be the case.

145. As a result, Option 2 is the preferred option, since it is expected to maximise the economic and strategic benefit an FSO can have whilst minimising the downside risks highlighted. These conclusions and the underpinning economic analysis were broadly supported via consultation feedback, providing a further form of evidence for the above conclusions.

146. Across all options, a publicly listed company, with operational independence from government, was found to be most viable. If any option is implemented, Monitoring and Evaluation will play an important role to ensure that the process of implementing the FSO and it's performance are in line with expectations. Similarly, Monitoring and Evaluation may also assess whether the roles and responsibilities carried out by the FSO are sufficient, or whether further roles, such as planning responsibilities for CCUS networks, are required. Further details of this are presented in the Monitoring and Evaluation section.

Annex 1:
Figure 1: Future System Operator theory of change