Title: Future of the System Operator **IA No:** BEIS021(C)-21-ICE **RPC Reference No:** RPC-BEIS-5076(1) **Lead department or agency:** BEIS **Other departments or agencies:** Ofgem	Impact Assessment (IA) **Date:** 20/07/2021

Summary: Intervention and Options

RPC Opinion: Not Applicable

Cost of Preferred (or more likely) Option (in 2019 prices)			
Total Net Present Social Value	**Business Net Present Value**	**Net cost to business per year**	**Business Impact Target Status** Non qualifying provision
£m	£m	£m	

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, 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. ***(Note** – option 1 is not an option considered in consultation, but rather, an option included here to help illustrate varying impacts.)* (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.

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:**	**Non-traded:**	

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'

All costs are given as a range due to the uncertainty of estimates. The costs to implementing the FSO under this option are estimated as between £50 million -£140 million. 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'

The improved "whole system" view of the FSO is illustrated as reducing the future costs of the electricity system by between £210 million - £2,500 million 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 £80 million -£300 million 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 £90 million -£270 million 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 £80 million -£600 million, 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 £260 million -£790 million, 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 £410 million and £70 million.

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 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 have recently 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 these system operators we use the term "Future System Operator" (FSO).

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 to 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 (such as the 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

[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.

system costs[7] whilst maintaining security of supply and improved advice to government.

Policy Objectives

11. Our objective, subject to consultation and ministerial decision, is to establish an FSO able to drive progress towards net zero while maintaining energy security and minimising costs for consumers. An FSO able to do this will need to be given appropriate roles in the energy system and have the necessary characteristics to fulfil them effectively. These roles, functions and characteristics are summated in brief in paragraphs 8 and 9 above, however described in full detail in chapters 3 and 4 of the consultation document.

    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

12. As set out above, while there is no evidence of National Grid Plc acting in a way that deliberately exploits any potential conflicts of interest, 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 (such as 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

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

report recommended a new independent system operator with enhanced electricity and gas functions.

13. 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[8].

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

15. 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.

16. 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[9]. Following this internal assessment, the suitable options identified were carried forward into the short list for further appraisal.

17. There is a large number of possible combinations of short-listed options across each category of choice outlined in paragraph 18. Therefore, options considered in this Impact Assessment present 'stylised combinations' of the short-listed options across each category in order to assess the magnitude of impact options may have based on the scale of intervention that they require. 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[10] aim to further mitigate any conflicts of interest, however there is limited further separation of functions in NGESO and limited changes to the GSO.

[8] 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."

[9] 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.

[10] 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.

Option 1: 'Lower Intervention'

a. Electricity Roles: Day-to-day operation + advising + planning and competition
b. Gas functions: No roles transferred
c. Organisation Design: (i) Highly independent public sector entity, (ii) Private, for profit
d. Funding: Consumer funding (such as BSuoS[11])
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: (i) Highly independent public sector entity, (ii) Private, for profit
d. Funding: Consumer funding (such as 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: (i) Highly independent public sector entity, (ii) Private, for profit
d. Funding: Consumer funding (such as., BSuoS)
e. Implementation: Existing organisation, phased transition

18. 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 (such as 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 subject to further consultation.

19. 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[12];
- in option 2, the FSO would undertake long-term strategic planning, markets and forecasting functions. This would include network capability planning (which could be

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

[12] 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.

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.

20. Note 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 complete the transaction within 2022[13]. We do not consider that the intention of this sale impacts the feasibility of the options considered.

21. 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.

22. Under organisational design (c), two models are considered to best reflect the required characteristics listed in paragraph 9:

    i. highly independent public sector entity: a corporate body model classified within the public sector, but with statutorily assured operational independence. Unbound by day-to-day government operational control but operating within the strategic framework set out by Parliament; and

    ii. private, for profit: a private, shareholder owned model similar to the status quo, however delivered by a private company fully independent of the TO.

23. As noted in the consultation document, further work is required to understand the implications and feasibility of these models more fully. Therefore, this Impact Assessment does not attempt to quantify the implications that models of organisational design may have on quantified results, but instead discusses them at a high-level in terms of non-monetised benefits. Whilst this Impact Assessment assumes all three policy options are deliverable under both models of organisational design, further work is needed on the feasibility of all roles to each organisational model.

24. 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[14], 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.

25. 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).

26. All options considered would require primary legislation to be implemented.

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

[14] 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.

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

27. As highlighted above, several options are still being considered across each category of policy design.

28. Given these uncertainties, it is deemed proportional to focus the IA on ensuring a robust rationale for intervention is established before then assessing the magnitude and distribution of impact that the establishment of an FSO may have at varying scales of intervention. This high-level analysis quantifies impacts where possible using assumptions that have been tested through sensitivity analysis. A large proportion of impacts are deemed unquantifiable and are therefore explained qualitatively. Where possible, these qualitative explanations have drawn from wider evidence sources such as the academic literature.

29. Since this is a consultation IA, key assumptions included in the IA (of which, National Grid has not contributed to) are expected to be tested against stakeholders' views and outcomes from the consultation, which will help inform future analysis. As policy develops, future analysis will look to assess refined options at a more granular level.

Description of Costs and Benefits

Monetised Costs and Benefits

30. The timeframe for analysis is 2022-2050, representing the earliest stage at which costs of options may begin to incur[15], 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*)

31. A significant cost in the establishment of a new FSO will be the capital cost associated with implementation. The nature of the outlay required will depend heavily on the organisational design that is settled on.

32. Any 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 owner.

Cost of implementing the FSO:

33. 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

    - **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

[15] 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.

capabilities of NGESO and relevant functions of NGG from their current situation (such as 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.

34. 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[16]. To note, these dates included are modelling assumptions and not policy positions.

35. 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[17]. 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 £22 million 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[18]. For the GSO, we estimate the implementation cost of full separation as a one-off cost of £100 million[19]. 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 £100 million. Option 3 assumes 100% of the costs apply since day-to-day operation and all supporting functions transition to the FSO.

36. 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.

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

<u>Loss of operational synergies (*gas only*)</u>

[16] 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).

[17] 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

[18] 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.

[19] 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.

37. 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.

38. 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[20]), 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.

39. 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[21] and therefore the GSO would have to take more commercial actions. Following the approach set out in FTI analysis[22] we assume the GSO would take around 3 actions per year, compared to an historical average of 0.4.

40. 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 £80,000, and commercial buybacks to between £3.5 million and £11.6 million. However, we assume that the current CCM incentive that costs around £5.2 million[23] 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.

41. Based on the assumptions outlined above, the loss of operations synergies could range from a cost of around £410 million if the cost of commercial actions are high, to a cost of around £70 million [24] 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.

42. 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

[20] 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.

[21] 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.

[22] 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

[23] £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.

[24] 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).

43. 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.

44. 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[25]. 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[26] the need for network assets due to an informational or financial potential conflicts of interest towards transmission network asset solutions to energy system problems[27]. (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[28] on network assets in forecasts. Retaining underspend as profits via TIM has now been removed under RIIO-2[29] reducing the potential for conflicts of interest in forecasts. (National Grid Plc specific, no longer applicable)

45. 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.

46. For these reasons, the reduction in transmission network development costs from mechanism i. are assumed to be zero[30]. There may however be savings due to mechanism ii., which is considered as part of the potential for improved "whole systems" decision making.

<u>Improved 'whole systems' decision making</u>

[25] 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.

[26] 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.

[27] 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.

[28] 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.

[29] 7.38 in RIIO-2 final determinations: https://www.ofgem.gov.uk/system/files/docs/2020/12/final_determinations_-_core_document.pdf

[30] 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.

47. 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.

48. Dependent on the option taken, 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 44. (ii)[31]. 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.

49. 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 energy bills[32]. 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.

50. 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)[33] under the 2019 high and low reference case scenarios, these are not currently public. For natural gas, we scale total expenditure based on consumption

[31] 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.

[32] 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.

[33] The DDM is an energy model owned by BEIS, described here: https://www.gov.uk/government/statistics/the-dynamic-dispatch-model-a-fully-integrated-power-market-model

estimates in UK Times[34] Carbon Budget 6 (CB6) scenarios. Whilst the underlying data is not for these scenarios is not currently public, they inform the CB6 Impact Assessment[35] and are described at a high level in Annex 2 of the report. 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[36] and apply this to the UK Times final energy consumption estimates for hydrogen under different CB6 scenarios[37].

51. 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%.

52. This calculation gives an estimate of the potential savings in transmission network development as follows: Electricity: £210 million to £2500 million, Natural Gas: £50 million to £300 million, Hydrogen £30 million to £300 million (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 £1.3 billion per annum, compared to around £550 million 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.

Improved facilitation of network competition (electricity only)

53. The GB electricity market is expected to move to the competitive appointment of onshore transmission owners[38]. This would involve running competitions to provide assets to satisfy pre-identified system needs. In a counterfactual scenario, this tendering function is likely to be delivered alongside Ofgem, who may take on the official remit of tendering for onshore transmission owners. However, it is likely Ofgem will still look to an SO responsible for advising on network planning to help identify system needs that are suitable for competition, administer some components of the competitions and advise on the preferred solution to meet any given system need.

54. While there is no evidence of equivalent conflicts being acted upon under the current arrangements, the current ownership of NGESO may nevertheless limit the benefits to competition that can be realised. This could result from NGESO favouring NGET solutions, identifying areas for competition where NGET has a comparative advantage, or favouring competitions in Scotland where NGET does not own the transmission assets. The perception of conflicts of interest may also act as a barrier to entry for firms who may be concerned that their bids may not be assessed fairly or informational advantages will be offered to NGET. This is likely to result in lost efficiencies due to lower competitive pressure.

55. An independent FSO may result in improved facilitation of network competition. This is because:

- the increased perception that the FSO is impartial may increase participation in competitions resulting in greater competitive pressure and likely reducing costs[39];
- the enhanced powers taken on by the FSO may enable more opportunities for competition to be identified and realised; and

[34] UK Times is an energy systems model developed jointly by BEIS and UCL, described here: https://www.ucl.ac.uk/energy-models/models/uk-times#:~:text=UK%20TIMES%20is%20an%20energy,Clean%20Growth%20Strategy%20in%202017.

[35] https://www.legislation.gov.uk/ukia/2021/18/pdfs/ukia_20210018_en.pdf

[36] Figure is based on 2017 modelling by Baringa exploring potential hydrogen supply chains for BEIS.

[37] To note, this estimate for hydrogen networks is highly uncertain, however, due to the restricted role that hydrogen plays across all UK Times final energy consumption pathways, the impact of the uncertainty in hydrogen network costs is deemed small.

[38] https://www.ofgem.gov.uk/electricity/transmission-networks/competition-onshore-transmission

[39] Currently, this perception of conflicts of interest may deter firms from entering competitions, acting as a barrier to entry.

- better decisions may be made on the location, timing and design of competitions by removing the potential conflicts of interest that currently exist.

56. To estimate the magnitude of savings, analysis first assesses the total cost savings in transmission network development that are expected to occur due to competition before then assuming that a proportion of these benefits from competition is lost due to the perceived or actual conflict of interest under the current SO.

57. Taking figures from the 2016 Impact Assessment[40] on the potential for onshore[41] electricity network competition, expected net benefits from competition are estimated at between £300 million to £600 million[42] (cumulative savings over 30 years, present value, 2020£). We do not assume any competitive procurement in the gas transmission network as any proposals to introduce this are speculative.

58. It is not possible to accurately estimate the proportion of cost saving that would not be realised under the counterfactual option. However, in line with FTI analysis, we consider an illustrative proportion as between 25% and 50%.

59. This calculation gives an estimate of between £75 million and £300 million (rounded to nearest 5) for the cost of perceived or potential conflicts of interest in competitive procurement, which could be saved from removing the conflict of interest in NGESO (discounted figures).

Summary of monetised costs and benefits

60. 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.

61. 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.

62. 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.

63. 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[43].

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

	Option 1	Option 2	Option 3

[40] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/493712/Impact_Assessment_-_Extending_competitive_tendering_in_the_GB_electricit___.pdf

[41] Note that these figures are onshore only. Including for offshore network competitions could significantly raise these figures.

[42] This range is based on central scenarios 2 to 4 included in the 2016 IA, with prices adjusted to 2020 figures, then rounded to the nearest 50.

[43] To note, as indicated in Chapter 3 of the consultation document, 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.

Scenario	Low	High	Low	High	Low	High
Costs						
Cost of asset purchase (*redacted*)	-	-	-	-	-	-
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
Electricity transmission network competitive procurement cost savings	80	300	80	300	80	300
Net Present Value (£m)	**140**	**2,700**	**90**	**3,200**	**-800**	**3,000**

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.

Sensitivities

64. 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 powers 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, 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.

65. In central analysis, we assumed the improved "whole system" decision making would result in savings of between 1% to 5%, whilst the improved facilitation of network competition was assumed to increase the benefits of competition in electricity transmission by between 25% and 50%. To test the chains of reasoning included above, an illustrative "worst-case"

scenario is presented where: there are no benefits from improved competition or 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 competition benefits are improved by 50% and 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, 0% competition saving)	**Central: Low** (Low demand, 1% whole system saving, 25% competition saving)	**Central: High** (High demand, 5% whole system saving, 50% competition saving)	**Best Case** (High demand, 10% whole system saving, 50% competition saving)
Option 1	-140	140	2,700	5,700
Option 2	-270	90	3,200	6,700
Option 3	-1,200	-800	3,000	6,500

66. 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 £2,700-3,200 million to £5,700-6,700 million. 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.

67. 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 there are no assumed benefits from competition.

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%

68. 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 (such as transmission networks) and exclude any competition benefits. When considering the potential for improved competition and 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.

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

Unmonetised Costs and Benefits

Costs

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

Increase SO to TO transaction costs

71. 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[44] 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.

72. 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.

Familiarisation and Learning costs

73. 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 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;[45]

    - 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

[44] 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.

[45] 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.

- 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.

74. 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.

Benefits

Improved advice to government

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

76. 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.

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

78. 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

79. 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.

80. 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.

81. 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

82. 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'.

Increased innovation

83. The FSO could explicitly be charged with removing barriers to new technologies and business models, meaning that lower cost pathways to net zero will become available to us that would be otherwise shut down by prescriptive system rules that do not leave room to try new things.

84. 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

85. This consultation is also considering whether there is 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[46], 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.

Risks, Uncertainties and Assumptions

Risk and Uncertainties

Increased inefficiency of the SO under the FSO (Organisational design dependent)

86. 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.

87. A 2019 paper by NERA[47] compared the performance of network operators based on their organisational design (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. 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.

Increased uncertainty in governance structure

[46] 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

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

88. 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.

Cost overrun and delays

89. 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.

Reduced accountability

90. 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

91. 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.

Creation of a "single view" of the energy system

92. 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.

93. 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.

Optimism bias

94. 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.

Unknown uncertainties

95. 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

96. There are several assumptions made throughout quantified analysis.

97. 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. For example, it assumes that network costs scale linearly with demand.

- **Assumption 3:** For hydrogen, it is assumed that the cost of the hydrogen network is £2 million /TWh, this is based on a previous Baringa model[48].

- **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.

98. When considering the benefit from improved facilitation of competition:
    - **Assumption 5:** It is assumed that current SO arrangements result in sub-optimal realisation and facilitation of competition, due to a perceived conflict of interest in SO decision making and lack of whole system oversight. The 'loss' of competition saving are assumed to be between 25% to 50% based on FTI analysis. This is tested in sensitivities however significant uncertainty remains.

99. When considering the loss of operational synergies that would occur in gas between the GSO and GTO under option 3:
    - **Assumption 6:** This analysis directly replicates FTI analysis produced for Ofgem and therefore inherits their assumptions, listed in their report[49]. 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.

100. Across all options:
    - **Assumption 7:** 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.

101. There is also an assumption across all benefits listed this:
    - **Assumption 8:** 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

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

103. 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.

[48] Not publicly available

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

104. The transition to a FSO may also have social impacts on current employees. 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[50]. 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. We are also considering the wider societal impact that the FSO may have through its future roles and the extent of its advisory and decision-making responsibilities. A full understanding of the potential for these social impacts is still being developed, with responses sought at consultation.

Distribution of Impact

105. An initial assessment of the distributional impacts across groups and time is detailed in table 5. 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. However, no assessment of distributional impacts is exhaustive and several impacts are dependent on questions of organisational design, funding and implementation decisions that are still under policy development.

Table 5: *Distribution of impacts over groups and time*

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 implementation.	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. [51]
FSO	On-going costs Familiarisation and learning costs	Revenue streams (i.e., BSUoS)	For the purposes of our assessment, benefits are assumed to begin in 2026.

[50] To note – the Public Sector Equalities Duty will require an analysis of how policy impacts groups with protected characteristics

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

	Potential capital cost of implementation (if the FSO is to be privately owned)	Incentive scheme revenues (i.e., Information Quality Incentive) Future RAV growth. Enhanced roles and responsibilities	
HMG	Internal resource costs Legal, financial and consultancy costs Potential 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 potential capital cost of implementation are assumed to take place 2021-2026. Benefits expected to accrue over longer timeframe, post 2026.
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.
Health and Safety Executive	Internal costs of reviewing gas safety case		Expected to occur prior to implementation of FSO.
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	Improved trust in SO decisions. Reduced barriers to participation	Familiarisation and learning costs illustrated as occurring

	government policy consultation process. Familiarisation and learning costs	More belief in fair consideration of their network solution proposals. Increased opportunities for innovation. More responsive energy system to changing needs.	from 2026[52], 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)	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[53] 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.

Direct Business Impact

106. As noted in table 5, 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 government consultation. However, BEIS considers these impacts 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[54], 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 104.a.- 104.d..

    b. *The net impact of the measure is expected to be an increase in [effective] competition (for example, 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.*

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

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

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

Comment: Central estimates included in this Impact Assessment place the present value of pro-competitive effects as between £80 million -£275 million for electricity alone. In gas and hydrogen, there are currently no plans to introduce competition, however this consultation is testing the extension of competition to gas assets with stakeholders.

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, 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 (for example, 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 £810 million to a net benefit of £3,500 million. However, the preferred option is expected to result in a net benefit of between £140 million to £3,500 million. 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)

107. BEIS's Business Population Estimates[55] listed in tables 6 and 7 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.

108. 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 6 - 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%

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

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 7 - 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 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%

109. 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. The implementation workstream is currently considering options to minimise adverse effects from the transition to an FSO, with consultation seeking stakeholder input.

110. 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 falls more greatly on SME firms, such as 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.

111. 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. The long run impact of intervention is intended to facilitate net zero at least cost meaning a lower bill impact to all end users.

Summary

112. Delivering net zero will bring significant challenge for the electricity and gas systems. Not only does it require the full 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 important and bringing 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 operator (SO) will require both high levels of engineering capability, and the organisational design, incentives and accountability to act impartially in the best interests of consumers.

113. Currently the electricity system operator (ESO) and gas system operator (GSO) are owned and operated under National Grid Plc. This creates a potential conflict of interest in the ESO and GSO since National Grid Plc also owns and operates both the electricity transmission network (in England and Wales) and the gas transmission network (in Great Britain) and therefore may be subject to potential conflicts of interest towards transmission network solutions or when facilitating competition. Given the information asymmetry that exists between Ofgem and the SO, it is not possible to fully regulate against this perceived conflict of interest whilst maintaining some autonomy for the SO to make decisions on the complex needs of the system. This perceived or actual conflict of interest that cannot be fully mitigated through regulation creates a barrier to the SO taking on the required new roles and responsibilities required to deliver net zero.

114. To remove this potential conflict of interest, options consider the creation of an independent future system operator (FSO). This independence from all other parts of the energy sector helps to ensure the FSO is impartial. This enables enhanced roles and responsibilities to be assigned to the FSO, allowing for improved “whole systems” decision making and facilitation of competition and network innovations. For electricity, all options considered carry over current ESO functions and only differ by the extent to which enhanced electricity roles are assigned to the FSO. For gas, there is greater variation between options as to which GSO functions are assigned to the FSO due to the current integrated nature of GSO and gas transmission operation (GTO) functions making the unbundling of the GSO more costly.

115. For electricity, quantified costs and benefits find a positive net present value across all three options considered under central scenarios with the primary benefit coming from reduced electricity system costs due to greater ‘whole systems’ decision making. For gas, the integrated nature of GSO and GTO functions creates a greater cost of separation including the potential loss of operational synergies whilst benefits are also expected to be smaller due to the declining usage of natural gas infrastructure only being partially offset by greater hydrogen usage across all scenarios considered, leaving less scope for cost savings from a ‘whole systems’ view. Under the unfavourable central scenario, this results in the costs of fully unbundling the GSO from the GTO (option 3) outweighing expected benefits.

116. However, quantified analysis only monetises some of the key costs and benefits and relies on several assumptions to provide illustrative results. Therefore, these must be in tandem with non-monetisable costs and benefits such as the greater trust in the advice provided by the FSO. Furthermore, breakeven analysis reveals that the magnitude of benefits required to generate a net-present value of zero are small relative to the size of the system and likely achievable.

Annex 1: Monitoring and Evaluation

Monitoring and Evaluation

117. Our strategic objective of this intervention, subject to consultation and ministerial decision, is to establish an FSO able to drive progress towards net zero while maintaining energy security and minimising costs for consumers. An FSO able to do this will need to be given appropriate roles in the energy system and have the necessary characteristics to fulfil them effectively. These roles, functions and characteristics are summated in brief in paragraphs 8 and 9 above, however described in full detail in chapters 3 and 4 of the consultation document.

    We believe that an independent FSO that has such roles, functions and characteristics should help us realise the four key intended outcomes in which monitoring and evaluation should intend to help assess progress towards:

    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.

118. By achieving these policy objectives and the intended outcomes, intervention sets out to achieve the overarching strategic objective via the logic mapping set out in the Theory of Change listed in annex 1, graph 1.

119. A full monitoring and evaluation plan will be developed ahead of a final stage impact assessment. This is likely to detail the indicators for measuring the success of these objectives, the necessary data requirements to do this and benchmark progress. It is likely this plan will also include a description of the evaluation aims, approach and timeline. It is also expected that a mix of both quantitative and qualitative indicators will be used to inform progress due to the difficulty in baselining performance and measuring intangible concepts such as the ‘perception’ of conflicts of interest. The Public Sector Equality Duty may also be included in evaluation or considered separately.

ANNEX 1: Graph 1: Theory of Change