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Ofgem Review of GB System Operation

Conclusions on gas

10 March 2021

Purpose / Structure

The purpose of this presentation is to provide an overview of the conclusions from the **Review of GB energy system operation** that are relevant for gas.

This presentation is structured as follows:

Summary

Introduction

1. **Energy system changes** required to achieve net zero;
2. **Roles and functions the GB electricity and gas SOs** could be required to perform to facilitate net zero;
3. **Suitability of the current arrangements for the future system operation requirements** we have identified; and
4. **Potential options** for alternative system operation models.

Summary

- Achieving the UK's legislated **target of net zero emissions by 2050** represents an **unprecedented challenge for the energy system and economy**
  - → Radical change is required to the gas system to achieve the net zero targets (eg how we heat our homes, how we build the networks)
  - → Challenges and uncertainty associated with this are in many ways greater than in electricity (decarbonisation pathways uncertain, hydrogen will play a role, but what type/where, what implications it will have for the system…)
- **The systems are becoming increasingly integrated. Whole-system / cross-vector approach to energy system planning will be key**: Both the ESO and GSO will have to look beyond the electricity and gas systems and increasingly consider the energy system's interaction with wider heat, transport and potential future hydrogen networks to enable whole system optimisation and deliver right outcomes for consumers
- **Impartial advice across a broad range of decarbonisation issues will be key for a successful transition to net zero**.
  - → This is particularly true for gas system planning, which needs to be independent, ie free and perceived to be free of conflicts of interest. (eg strategic decisions on hydrogen)
  - → There is strong stakeholder support on this point, similar discussions and recommendations currently ongoing in the EU
- Current SO arrangements in gas are different to those in electricity: the GSO and GTO are fully integrated in one entity (NGGT).

Summary

- **<u>The fully integrated TO/SO model</u>**:
  - creates significant potential for real or perceived asset ownership conflicts of interests
  - may constrain the GSO's ability to drive forward net zero and provide impartial, technical advice on the future of the gas system and the decarbonisation of heat
  - has the potential to bear greater risk and cost than the current electricity model (where certain mitigations exist).
- **Change is needed**. Modelling suggests **significant consumer benefit** of changing the current arrangements and separating the GSO functions out of NGGT (FTI's hydrogen scenario).
- **Interviews and qualitative evidence indicate support for moving to a more independent SO with enhanced functions**.
- **However, there are the following complexities in untangling the current gas model:**

  → **Safety risks,** including changes to the gas Safety case

  → **Loss of operational efficiencies** from removing control centre functions from NGGT (difficult to quantify due to uncertainty over the future decarbonisation pathways).

  → **Implementation costs** that would be greater and changes would take longer to implement compared to electricity (given legal separation), including the potential need for new GTO-GSO licences/codes to be developed.

  → Overall, **uncertainty over the net benefits** of such action (removing control centre functions), which is reflective of uncertainty over the gas decarbonisation pathway.

Summary

- **These complexities mean** that a two-phased approach of:
  - separating out **strategic planning** and market development functions for the gas system first (and combining them in an ISO), and
  - reconsidering separation of the short-term GSO functions (ie control centre operations) at a later date

  can create consumer benefits in the medium-term while minimising costs and risks to consumers.

- Such a two-phased approach will ensure independence in network planning as well as enable benefits from combining gas system planning functions with electricity, ie whole system planning, building whole system thinking and capabilities.

- The development **of ESO roles over the last decade and insight from the decarbonisation challenges currently facing the ESO have aided us in identifying potential net zero ESO roles**. There is **greater uncertainty over how the gas system will decarbonise** which is reflected in the gas net zero system roles and functions identified in the report.

Introduction

Context

- ESO became legally separated from NG Plc April 1st 2019.
- Ofgem had intended to review legal separation over the course of 2020/21.
- Review of SO ownership and governance arrangements accelerated because of:
  1. Concerns the whole system is not being properly taken account of following the black out of August 9th 2019
  2. Net Zero legislation is game-changing for energy system - likely to place increased demands on System Operation in terms of planning, coordinating and managing the system to keep costs down and ensure security of supply.
- Consideration of gas incorporated into review scope given forward-looking nature of the work

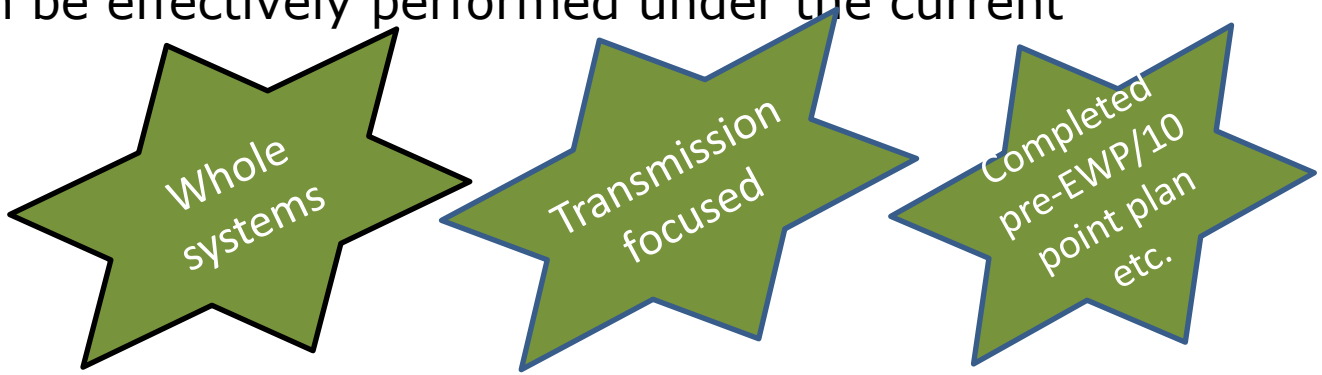
Objective of our review was to consider what is required to deliver a net zero energy system and the role of the System Operator in facilitating this.

Scope of the review covers: 1) the energy system changes required to achieve net zero; 2) the roles and functions the GB electricity and gas SOs could be required to perform to facilitate net zero; 3) the suitability of the current arrangements for the future system operation requirements we have identified; and 4) potential options for alternative system operation models.

Approach and method

Approach:

- Identify energy system changes and change requirements for achieving net zero by reviewing established scenarios (e.g. CCC, FES)
- Identify (broad) roles and functions we think the System Operator are well place to perform given expertise and experience
- Assess whether these roles and functions can be effectively performed under the current framework.
- Consider and assess alternative models.
- Conclusions.



Method:

- Qualitative evidence - interviewed over 30 key industry experts and stakeholders. Sought views of those with experience in GB system operation, other jurisdictions and other relevant sectors.
  - More than **one third of the interviewees provided views on gas**
- Quantitative evidence - employed FTI Consulting to undertake a quantitative analysis of the issues.
- Assessment - internal assessment of options, including alternative legal and financial models.

1. Energy system changes required to achieve Net Zero

We have identified nine consistent themes in terms of the likely energy system changes and technologies associated with the transition to net zero

To deliver the energy system changes required for net zero at least cost, a number of key actions and mechanisms ("system change requirements") will be required to manage uncertainty and complexity throughout the transition.

→ System adequacy and operability
→ Increased flexibility
→ Adaptive testing
→ Consumer engagement
→ Coordination and collaboration across an increasingly integrated energy system
→ Access to open and transparent data
→ Early policy decision-making and a supportive regulatory framework

2. Future SO Roles and Functions

In considering the future roles and functions of the System Operators, **interviewees identified the need for**:

- A step-change in **whole-system planning and operation**, with increased coordination between the SO and DNOs/DSOs to enable whole-system optimisation
- The SOs to take on a **greater role in system planning** (across electricity and gas and onshore, offshore and cross-border networks), including **driving forward competition** in the delivery of network and non-network solutions
- The creation of **deep, liquid flexibility markets** that incorporate all generation and make balancing services available to all parties
- A continual **evolution in short-term system operation** to manage increasing complexity – including maximising the potential of digitalisation, developing strategies for co-optimising across energies, and ensuring local approaches to heat and transport support whole-system integrity
- Mechanisms that allow for **greater data sharing, collaborative thinking and knowledge** transfer
- The SO to embody a **clear leadership position** above the TOs and DNOs to keep the industry unified throughout the transition
- Greater **proactivity in updating industry codes** (e.g. Grid Code).

→ The electricity and gas SOs have a **unique and vital role to play in facilitating net zero**.

→ **Real-time system balancing experience is crucial for effective energy system planning**

→ **There is a strong case for enhancing the roles and functions of the SOs to harness their position and build upon their expertise**.

2. Future SO Roles and Functions

Our report considers how the **roles and functions of the SOs could develop** across the following three broad categories:

1. **control centre operations**
2. **market development and transactions**, including coordination of industry codes and standards, and
3. **whole system insight, network planning and coordination**.

- Impartial advice to Government/Ofgem/Industry is an output of the above roles.
- Coordination and cooperation across vectors, whole-system thinking, operating and managing a highly complex and digitalised energy system → skills/knowledge/tools (not a role)

The roles and functions we list as enhanced and new functions are **high level** as the report is a strategic, direction-setting report.

We have considered **other (wider) changes and Ofgem's work**, including Net Zero and Decarbonisation plan, BEIS - Ofgem consultation on reforming the energy industry codes, Offshore transmission network review, etc.

2. Future SO Roles and Functions: Control Centre operations

Current Roles:

- **Gas:** GNCC utilises linepack to balance the system throughout the day, **performs day to day operation and network control functions by utilising NGGT's assets**. Operates under a safety case of the HSE, acts as a residual balancer (the main responsibility is on shippers to balance)

Differences between gas and electricity

Safety case

- Physical characteristics of gas and the gas transmission network means there is an inherent safety risk of over-pressurisation.
- If pressure gets too high, this could result in the safe operating limits of the physical pipelines being exceeded and the risk of rupture.
- Such an event could lead to loss of supply in a large area of direct offtakes, including GDNs. In gas, the GNCC works to maintain safe operating pressures to enable all users to put gas on and take gas off the NTS. The GSO therefore operates under a **safety case supervised by the HSE**

Operational synergies between the GTO and GSO

- Operational synergies between the GSO and GTO functions are a key feature of gas system operation.
- Gas system is managed almost exclusively though the operation of physical transmission network assets and, less frequently, through market trading.
- This is due to the GSO and GTO functions being integrated within the same company and physical characteristics of the gas system
- Integration of GTO and GSO functions enables the GSO to optimise and coordinate between its **commercial control room** actions and the **short-term operational actions** the GTO can take to balance the network

2. Future SO Roles and Functions: Control Centre operations

Future Roles – Enhanced Functions:

- Electricity and **gas control centre operations** expected to become increasingly complex, with the challenges associated with balancing a low carbon system efficiently requiring new approaches, skills, capabilities and systems
- SOs' control centre capabilities will need to develop to manage this increasing complexity efficiently:
  - effective use of **data and digitalisation**
    - enabling data transfers between parties and ensuring data is collected and available in sufficient detail to enhance its value and promote efficiency
    - Data digitalisation, machine learning and artificial intelligence will be key in improving CC functions
    - effective development and running of world class digital infrastructure → highly capable IT systems, data hub?
  - **development of a whole system mind-set**
    - Establishing an effective whole system mind-set will be a key requirement for all SO roles and functions
    - the SOs will need to manage the energy system's increased dependence on flexibility, work with distribution
    - the SOs' expertise in control centre operations as an important input for testing dependencies between technologies (eg electrolysers and heat pumps), between vectors (eg electricity, biogas, hydrogen) and the real-time effects of moving to renewable gases

2. Future SO Roles and Functions: Market development and transactions

Current Roles: *GSO has an important but less expansive role, when compared with electricity, in facilitating gas markets. There is less certainty over future gas market development and transaction functions as the way in which heat and heavy industry, for example, will decarbonise, depends on forthcoming policy decisions.*

- **Gas**: management/coordination of Network Gas Supply Emergencies/National emergencies, providing articulation of network investment needs or non-investment (commercial) needs and providing information to enable investment and operational decisions, and providing the platform for gas shippers to buy and trade capacity to flow gas on the NTS, running capacity auctions and operating the energy balancing cash-out arrangements, management of connection regime etc.

Future Roles – Enhanced Functions:

- Market design changes could affect SOs' current functions in developing markets and transactions (eg pricing of carbon, optimal settlement times for energy trading etc). Approaches to facilitating cost-effective solutions to balancing a low carbon system will need to evolve
  - **Gas**: consider new services/products for 'gases' to enhance the availability of system flexibility
  - **Both**: - Adopt a whole system mind set when assessing and enabling different technologies
    - The SOs should assess and proactively advise on the potential impacts of significant policy change, + enable improvement

Future Roles – New Functions:

- **Governance of industry codes and standards**
  - Potentially a greater role in the governance of the detailed technical rules of the system (change will be required across industry codes, technical standards and data standards).
  - The future SO could take on a data governance function (data hub)

2. Future SO Roles and Functions: Whole system insight, network planning and coordination

Current Roles:

- **Gas:** Conducts annual planning cycle (concludes with GTYS), Provides GB input in EU TYNDP, runs the Network Capability Assessment process and options analysis, Manages connections on to the transmission networks

Future Roles – Enhanced Functions

- Future gas system and gas network development will be influenced by strategic policy decisions
- The GSO may have to take on new functions to manage and coordinate across multiple green and natural gas networks which may be owned and operated by different parties and include different geographic boundaries and participants
- Natural gas will continue to be a key fuel in the 2020s and possibly beyond if used in conjunction with CCUS.
- Future GSO functions will need to include forecasting, planning and developing the future gas networks in a way that enables the best-value technologies and solutions for substituting natural gas to come forward

- A **more complex, whole system approach to energy system planning** will be required
- **Enhance the electricity and gas SOs' current roles to include greater responsibility for strategically planning and coordinating the development of the electricity and gas networks** (including onshore, offshore, interconnectors and distribution networks where relevant)
- Facilitating **whole system planning and assessment** - develop strategies that allow the SOs to identify and consider cross-system opportunities that could provide new tools and approaches for system operation and planning.

2. Future SO Roles and Functions: Whole system insight, network planning and coordination

New Functions

- **Gas:** GSO takes on new responsibilities in network planning, development and design. (eg network design functions to enable coordination and direct network development).
- We have identified two potential options:
  - **(1) Establish a process similar to the NOA for the gas system**.
    - The future GSO would continue to work with the ESO to identify long-term system needs as part of the FES and provide a framework in which multiple parties (eg multiple TOs, GDNs) and providers could participate and provide solutions to gas system needs, including network and non-network solutions.
    - GSO scrutinises TO investment plans, including new investment in hydrogen-proof pipelines, compressors etc, and recommend against asset replacement works proposed by the TOs
  - **(2)** GSO identifies system needs, assesses a range of options to meet these requirements and then **mandates the TO(s), DNOs and other developers** to **build, decommission and upgrade the network** in line with its assessment. To do so, the GSO would need to work in close collaboration with the TOs' planning teams or contain planning teams that have the expertise to deliver relevant TO responsibilities

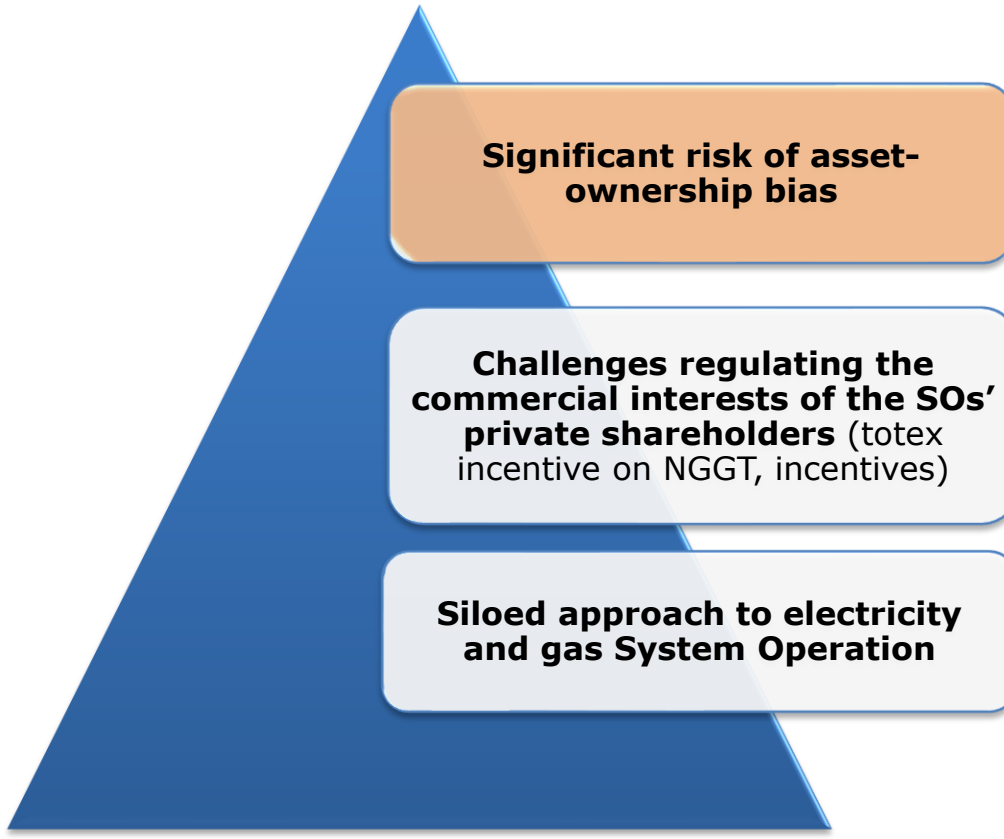
3. Suitability of the current arrangements for the future system operation requirements

- Multiple stakeholders agreed that **current arrangements act as a barrier to the SOs' taking on enhanced and new roles**, in particular enhanced coordination, network planning and strategic and advisory roles.

- The magnitude of the barriers is expected to increase as the SOs are required to:
  - Coordinate and make trade-offs across a wider array of networks, technologies and vectors to enable effective whole-system optimisation
  - Take on increasingly strategic and advisory roles, which do not lend themselves to efficiency targets and need to be undertaken in the public interest.

- Current SO performance and interview evidence indicates that **barriers in the current SO framework can already influence performance in existing roles.**

Barriers to effective current and future System Operation



3. Suitability of the current arrangements for the future system operation requirements

Asset ownership bias most relevant for gas (based on FTI's analysis):

- Benefits from removing the asset ownership bias in gas considerable, but significantly lower than in electricity.
- Estimated ranges indicate a potential £0.8 billion cost and a £0.4 billion benefit from separation of the GSO functions from NGGT from now until 2050 (scenarios on the basis of the assumed reduction in expenditure on the gas network due to lower demand for natural gas (which lowers the estimated benefits of separation))

	Benefits / Costs from separation	FTI – Natural gas only (falling demand)
Benefits	Removing asset ownership bias	From £0.04-0.74bn
	Removing potential bias in competitive procurement	na
	Synergies from combined SO activities (electricity, gas, heat)	Qualitative
	Reaching NZ faster (incl independent advice)	Qualitative
Costs	Loss of operational synergies	From £(0.43)-0.04bn
	Implementation costs of separation	From £(0.41)- (0.35) bn
	Safety implications	Qualitative – arising from suboptimal vs integrated org.

3. Suitability of the current arrangements for the future system operation requirements

- Potential magnitude of net benefits to consumers from addressing the asset ownership conflict appears significant in the case of electricity (estimated net benefits of £0.5-£4.7bn from removing the asset-ownership conflict in electricity network planning alone) and there is a strong case for considering fundamental changes to the governance and ownership of the ESO.
- The case in **gas is less certain** due to :
  - (i) uncertainties in the future of the gas network and scale of required investment for net zero (FTI estimated new investment for hydrogen could reach £18.9 bn) and
  - (ii) the potential loss of operational synergies from integrated GTO-GSO functions in system balancing.

- Overall, we conclude there to be a **case for considering fundamental change to the governance and ownership of NGGT** given:
  - Potential significant **benefits associated with removing conflicts of interest** that would otherwise constrain the development of the GSO's network planning functions, including enabling independent advice to government on new technologies and advice to government on the decarbonisation of gas and timely decommissioning of any redundant gas network assets.
  - Potential significant efficiency benefits in removing real or perceived conflicts of interest from the GSO's potential market design functions.
  - This conclusion is supported by the upper end of the FTI modelling, their consideration of an alternative high-hydrogen future and stakeholder interview evidence.

4. Potential options for alternative system operation models

Option	Degree of separation	Vector
Status Quo – SO arrangements in place at end of RIIO-2.	**None.** Reflects the current legal separation regime for electricity and fully integrated nature of NGGT.	Electricity, gas
Strategic planning body: Model separates a range of strategic and planning roles from National Grid plc with control centre operation functions performed by TOs.	**Considerable.** Current and future SO roles functions related to market development and transactions, and whole system insight, network planning and coordination separated. Only short-term system operation functions affiliated with National Grid group.	Electricity, gas
ISO (full) SO companies are no longer a part of National Grid group.	**Complete.** Separation of all current and future SO roles and functions.	Electricity, gas, electricity and gas combined

- **Network planning** functions in gas could include, but not be exclusive to: long-term forecasting, long-term network planning and leading on the network capability assessment process.
- Less certainty about the **gas market facilitation functions**/ how they will develop – to be reviewed as it may be more appropriate for them to remain with NGGT.

4. Potential options for alternative system operation models

1) Refining the status quo can improve consumer outcomes but is not enough

- RIIO-2 will improve consumer outcomes but will not fully resolve the current structural constraints that can undermine the SOs' ability to perform new/enhanced functions and coordinate and adapt to system change.
- Potential significant system-wide and consumer benefit from SOs taking a leading role in net zero means refining current arrangements is not a viable long-term solution.

2) A fully Independent System Operator (ISO) can enable and coordinate an integrated, flexible energy system

- While potentially **greater benefits could be realised by separating all gas functions**, there are complexities in untangling the current gas model and the future of the gas networks is much less certain.
- We therefore recommend key strategic planning functions are made independent of NGGT (and combined in an ISO).
- Combing key electricity and gas functions would allow an 'energy SO' to establish a genuine whole-system approach and drive forward innovative cross-system solutions to minimise costs.
- As the system will undergo further dramatic change, we believe **the question of gas control centre operation functions should be considered** once there is greater certainty over the future of the gas system and heat decarbonisation.

Added complexities include: **Safety risks, Loss of operational efficiencies** from removing control centre functions from NGGT (difficult to quantify due to uncertainty over the future decarbonisation pathways. **Implementation costs** that would be greater and changes would take longer to implement compared to electricity (given legal separation), including the potential need for new GTO-GSO codes to be developed. Overall, **uncertainty over the net benefits** of such action (removing control room), which is reflective of uncertainty over the gas decarbonisation pathway.

Conclusions and Next Steps

- **Net zero and decarbonisation already create significant challenges for our energy system** and wider economy.
- System Operation should be a vital tool in overcoming these challenges by enabling the optimisation of the energy system.
- This requires the System Operator to take on new and evolving functions and lead a whole-system approach to decarbonising the energy system.
- However, the existing ownership structure inhibits the ability to give the System Operator new and enhanced functions and impedes its ability to effectively deliver some existing roles vital for the transition.
- Modelling suggests **significant consumer benefit** in changing the current arrangements, however **complexities in untangling the current gas model** mean that separation of control centre operations should be reconsidered later. Only strategic planning and market development functions for the gas system should be separated out of NGGT and combined with an ISO.
- **Next steps**:
  - We will work with the Government to consider the appropriate roles, functions and responsibilities for a future SO, including whether it should include short-term GSO functions
  - Further work is required to set out the underlying legal and governance models/trade-offs.
  - **Government will be consulting on the institutional arrangements governing the energy system in 2021, including system operation.**

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- **working with Government, industry and consumer groups to deliver a net zero economy at the lowest cost to consumers.**
- **stamping out sharp and bad practice, ensuring fair treatment for all consumers, especially the vulnerable.**
- **enabling competition and innovation, which drives down prices and results in new products and services for consumers.**

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