Guidance

Future Energy Pathways Guidance

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This Future Energy Pathways Guidance Document is issued by Ofgem[1] pursuant to licence conditions C15 of the Electricity System Operator Licence and C10 of the Gas System Planner Licence (Future Energy Pathways). It is directed at the National Energy System Operator (NESO) as the designated Independent System Operator and Planner[2] (henceforth 'the licensee').

The purpose of this document is to set out instructions and guidance on the process, content and timeframe for producing the Future Energy Pathways Methodology and the Future Energy Pathways.

Cross references to conditions of the Electricity System Operator Licence and Gas System Planner Licence are to those versions of the licences published on 28 March 2024 in the "National Energy System Operator (NESO) licences and other impacted licences: statutory consultation"[3]. These cross references are subject to change following a statutory decision and publication of the final version of these licences.

[1] References to the "Authority", "Ofgem", "we", "us" and "our" are used interchangeably in this document. The Authority refers to GEMA, the Gas and Electricity Markets Authority. The Office of Gas and Electricity Markets (Ofgem) supports GEMA in its day to day work

[2] See Part 5 of the Energy Act 2023 for further detail (https://www.legislation.gov.uk/ukpga/2023/52/part/5)

[3] National Energy System Operator (NESO) licences and other impacted licences: statutory consultation | Ofgem

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1. Introduction

Background and overview

1.1 To meet the UK's net zero targets, the energy system will need to go through radical change over the coming decades, with a significant increase of renewable generation connecting to the electricity transmission system. There is significant uncertainty around the timing, location, size and technology type of many of the large-scale changes in generation and demand. This presents particular challenges to planning and building the significant network investments required to match demand and supply.

1.2 In light of these prospective changes to the energy system, beginning in 2021, Ofgem undertook a review of transmission network planning. In November 2022, Ofgem decided that National Grid Electricity System Operator[4] henceforth referred to as 'the licensee' or 'NESO', will be responsible for creating a new Centralised Strategic Network Plan (CSNP).[5] The aim of the CSNP is to provide an independent, coordinated, and longer-term approach to energy network planning in Great Britain to help meet the government's net zero ambitions.

1.3 The Future Energy Pathways (FEP) - formerly 'the Future Energy Scenarios'[6] (FES) – is a separate but now related publication to the CSNP. The FEP, analogous to the current FES, is the modelling of pathways for future changes in the demand and supply of energy. For the CSNP, the licensee will also need to model future demand and supply of energy, identifying wider network needs for the electricity transmission network, gas transmission and the proposed hydrogen network at the national level. NESO will also be producing a Strategic Spatial Energy Plan (SSEP) that looks at optimal generation sitting across Great Britain, but the FEP's additional range of analysis will also be used to support CSNP modelling.

1.4 Previous versions of the FES contained four scenarios, presented as equally credible outcomes for the energy system. These scenarios were used by stakeholders across the energy industry to inform national and regional policy, support investment decisions and energy network development. The licensee also

[4] It is expected that, upon designation as the Independent System Operator and Planner, National Grid Electricity System Operator will change its company name to National Energy System Operator (NESO).
[5] Decision on the initial findings of our Electricity Transmission Network Planning Review, November 2022
[6] https://www.nationalgrideso.com/future-energy/future-energy-scenarios-fes

used the FES for electricity transmission network planning with data from the FES used to produce the Electricity Ten Year Statement[7] (ETYS) that identified transmission network capacity needs. From this, electricity Transmission Owners (TOs)[8] responded with a range of options to reinforce the network. These proposals were assessed by the licensee through the NOA process. The licensee then published a recommendation to 'proceed', 'hold' or 'stop' specific investments. These processes are all subject to change as part of the development of the CSNP.

1.5 With the licensee now having new responsibilities for strategic planning, strategic pathways, instead of illustrative scenarios, need to be produced to be more directive about the type and scale of investment needed to meet 2050 net zero targets. The current requirement for the licensee to produce energy scenarios does not contain sufficient specifics to meet this need, as to how the methodology should be developed – nor was there any further Guidance provided to support that obligation. To ensure that the expectations of scope and content of the new FEP are clear to all stakeholders, as well as NESO, we have created this new Guidance document to ensure the new FEP is developed in such a way as to meet the new requirements.

1.6 This FEP Guidance Document is an associated document to NESO's Electricity System Operator (ESO) Licence and Gas System Planner (GSP) Licence setting out Ofgem's expectations in specific areas, particularly for the FEP Methodology (henceforth 'Methodology'), such as for process, content, and approach to stakeholder engagement. This is informed by our previous consultations[9].

1.7 The Methodology will be a document, required via the licences and developed and maintained by the licensee, to publicly detail the licensee's methodology for creating the FEP outputs. The Methodology will be subject to Ofgem approval. Following receipt and consideration, Ofgem may give a direction to the licensee that the Methodology requires further development. If this is done, then such direction will include the date by which the licensee is required to submit a revised Methodology to Ofgem for approval.

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[7] https://www.nationalgrideso.com/research-and-publications/electricity-ten-year-statement-etys

[8] National Grid Electricity Transmission (NGET) in England and Wales, Scottish Power Transmission (SPT) in central and the south of Scotland, and Scottish Hydro Electric Transmission (SHET) in the North of Scotland.

[9] https://www.ofgem.gov.uk/consultation/consultation-future-system-operator-supply-and-demand-modelling

Context and related publications

1.8 Centralised Strategic Network Plan. In November 2022, Ofgem decided that the licensee will be responsible for creating a new Centralised Strategic Network Plan (CSNP).[10] The aim of the CSNP is to provide an independent, coordinated, and longer-term approach to energy network planning in Great Britain to help meet the government's net zero ambitions. Licence conditions C12 of the GSP Licence and C17 of the ESO Licence (Centralised Strategic Network Plan) sets out the licensee's network planning objectives and obligations[11]. See the related CSNP Guidance[12].

1.9 Consultation on Future System Operator Supply and Demand Modelling. In May 2023 we consulted on proposals for the first stage of the CSNP which concerns how the licensee would model future energy demand and supply.[13]

1.10 Strategic Spatial Energy Plan. In November 2023, the UK government confirmed that a SSEP will form the generation-sitting basis for future network planning[14]. The SSEP is intended to set out the optimal location of new energy assets to meet forecast demand and our net zero targets. We are working with the Department for Energy Security and Net Zero (DESNZ) to support the government's commission for the licensee to produce the first SSEP. Once a SSEP has been produced it should inform the requirements of the transmission network set out in the first CSNP. We expect that the licensee will adopt the SSEP as a key input in its CSNP Methodology in line with UK government's decision. For resilience, the FEP will need to be created in such a way that its outputs (future demand and supply modelling) may complement or substitute for SSEP inputs for the CSNP energy modelling, where a greater level of detail is required.

[10] Decision on the initial findings of our Electricity Transmission Network Planning Review, November 2022
[11] https://www.ofgem.gov.uk/consultation/national-energy-system-operator-neso-licences-and-other-impacted-licences-statutory-consultation
[12] [Add weblink when published]
[13] https://www.ofgem.gov.uk/consultation/consultation-future-system-operator-supply-and-demand-modelling
[14] https://www.gov.uk/government/publications/electricity-networks-transmission-acceleration-action-plan

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1.11 In subsequent chapters of this FEP Guidance Document, we set out our expectations on how the licensee must develop their Methodology, including how we expect them to conduct engagement with stakeholders as part of its development. The licensee is required under licence conditions C10 of the GSP Licence and C15 of the ESO Licence to develop the Methodology in accordance with this document, and to comply with any other related licence requirements prior to submission to Ofgem for approval. The licensee must ensure that their collaboration and engagement with others in the context of the FEP is in line with this FEP Guidance Document.

2. Developing the Methodology

Chapter summary

Over eight sections, this chapter sets out the principal guidance for the creation and implementation of the Methodology by the licensee.

Section 1 - Develop a set of strategic pathways to net zero

2.1 The licence conditions, at sections C15.3(c) and (d) and C10.3(c) and (d) of the ESO and GSP licence respectively, set out the requirements to model and develop multiple, longer-term strategic pathways and a single short-term pathway.

2.2 Due to outstanding government policy decisions on a range of energy generation choices, the initial short-term pathway may only be of a few years. Reaching a longer single pathway - perhaps ultimately of around 7-12 years - may take several iterations. The licence conditions have provided the licensee with flexibility to amend the length of this pathway over time, subject to our approval. Conditions C15.3(d) and C10.3(d)of the ESO and GSP licence respectively allow for the licensee to determine the time period of the single pathway for each FEP as part of its methodology development with stakeholders.

2.3 Pathways are intended to show what 'must' happen across the sectors to enable net zero. Compared to the previous scenarios produced under the FES, we expect pathways to be specific about the type, timing, location, and scale of investment needed, rather than illustrate how possible changes in consumer or generation developments could lead to net zero being achieved. The pathways must allow the licensee to indicate if a policy target or ambition is projected to be met, including with commentary on factors outside the licensee's control.

2.4 Pathways must represent a whole system approach, including all energy vectors though we understand this will evolve as licensee modelling capability develops and data becomes available. The Methodology must include the licensee's approach to achieving a robust whole system approach and how this is expected to evolve over time.

2.5 As part of developing the Methodology, subject to Ofgem approval, the licensee must consult with stakeholders on:

(1) the length of the short-term pathway(s); and

(2) what conditions would be required to move to a longer-term single pathway (eg the outcome of the Government's 2026 decision on the role of hydrogen for heat).

2.6 Further, within the Methodology, the licensee must set out:

(1) how/if to factor in market indicators, supply chain considerations and financeability;

(2) how to factor in progress against government targets;

(3) an improved approach to sensitivity and stress-testing, including reviewing its assumptions against outturns and learning lessons to improve its forecasts. Any extreme market events must be dealt with through the treatment of high-impact, low-probability events (see Section 4). The licensee must also demonstrate how this contributes to the development and justification of the single pathway, when adopted; and

(4) the approach to ensure a robust whole system approach is taken, including review and adaptation over time.

Section 2 - Type of pathways, and presentation of non-delivery of net zero futures

2.7 The licence conditions, at C15.13(d) and C10.13(d) of the ESO and GSP licence respectively, set out the requirements for all pathways to meet legally binding carbon reduction targets. The licensee must consult with stakeholders on the optimum number of pathways.

2.8 As part of the Methodology, the licensee must consult on how to present information on the counterfactual, showing the limitations of current policy decisions and how this would result in failure to meet legally binding carbon reduction targets.

2.9 The licensee must develop a separate counterfactual narrative, supported by data, showing the potential network development, economic and financial implications of falling short of timely progress towards legally binding carbon reduction targets. This must include analysis of delays in one sector/vector upon others. The licensee must set out in the Methodology their choice and rationale for the counterfactual presented, but we expect it will be illustrative of the likely pathway if further necessary developments do not occur.

2.10 The licensee must meet the requirements set out in Section 6, regarding transparency, ensuring that information sharing with stakeholders is sufficiently adequate to provide opportunities for discussion of the robustness of the underlying data.

2.11 Each pathway must clearly articulate which interim carbon budget or regional targets, are met. There is no requirement for each pathway to meet all interim targets.

2.12 The approach that the licensee will take to meeting these commitments must be set out in the Methodology for our consideration.

Section 3 - The time horizon for pathways

2.13 Consistent with legally binding carbon reduction targets, the requirement for longer term pathways to run to 2050 has been set out in the licence condition, including at C15.3(c) and C10.3(c) of the ESO and GSP licence respectively.

2.14 The licensee must set out in their Methodology the criteria for extending the pathways beyond 2050. These criteria must be subject to consultation with all stakeholders.

2.15 Pursuant to C15.17 and C10.17 of the ESO and GSP licence respectively, Ofgem may approve the Methodology (which will include the criteria set out in the preceding paragraph) or give a direction to the licensee that the Methodology requires further development.

2.16 Given the lifetime of assets, it is foreseen that a moving window, eg of 25 years, will be required.

Section 4 - Treatment of high-impact, low-probability events

2.17 The licensee must ensure that their underlying data model for production of the pathways is capable of stress testing a range of pathways against high-impact, low-probability (HILP) events. This will ensure that the pathways are appropriately robust against HILP events that could affect demand, supply, or cause damage to assets.

2.18 In addition, their model must be capable of incorporating, and testing against, extreme data ranges for HILP events to support the licensee's strategic planning role, as per the licensee's duty under s.171 of the Energy Act 2023 to provide

advice, analysis or information on receipt of a request from government or the Authority. Such modelling must identify consequences across the energy sector.

2.19 The licensee must undertake forward-looking stress tests, exploring credible risks and deviations from the pathways, to inform decisions on the appropriate risk appetite for system need. The resulting system planning must not be done solely on the basis of the extreme ranges used.

2.20 The licensee must set out the HILP events they will consider as part of the Methodology. Such events may include extreme changes in, or effects of, the following (non-exhaustive):

- Gas prices
- Cyber security
- Climate change and extreme weather
- Government policy
- Global market fundamentals

2.21 The licensee must consult on the approach and parameters of their stress testing for HILP events, including appropriate uncertainty ranges. The licensee must consider how it maintains consistency and alignment with approaches utilised across the wider sector by working with government, Ofgem, Met Office, industry and others. This includes:

- consistent use of metrics and indicators
- using forward looking approaches and data which considers the future profile and impacts to the system of the HILP events
- the use of appropriate time horizons and scenarios
- using best available data, including incorporating data from other sectors
- considering both qualitative and quantitative approaches to stress testing

2.22 This analysis must be published as part of the FEP.

2.23 The licensee must set out in their Methodology their process for developing this capacity.

Section 5 - Incorporating network constraints into the modelling

2.24 The licensee's pathway modelling must factor in electricity network constraints, and the associated impacts on generation in the near term but model an unconstrained network in the long term.

2.25 Network constraints here are narrowly defined as thermal limitations, ie load on the network. Other issues such as seabed/land availability, planning, community acceptability and connections are important but out of scope.

2.26 Network constraints must be modelled at both transmission and distribution levels. Such modelling must be capable of informing current and future infrastructure requirements, highlighting opportunities (or limitations) for other energy vectors or solutions to relieve electrical constraints, eg hydrogen or flexibility markets.

2.27 The licensee must include its assumptions on where and why constraints have been included in the modelling as part of its Methodology, having engaged with stakeholders.

Section 6 - Improvements to transparency in analysis and outputs

2.28 The licensee must ensure they are transparent about the datasets used to create pathways, how pathways are established and how they are reviewed. The licensee must use its best endeavours to act in accordance with Data Best Practice Guidance[15] when designing and sharing pathways.

2.29 Input and output data, models, and algorithms used in modelling should be treated as Presumed Open[16] and be subject to an Open Data Triage process, only restricting access when there is a specific and clear reason not to publish the data. By default, we expect information to be published. Where information is not published, the licensee must share with the Authority, as part of its Methodology

[15] See Condition C3 (Digitalisation) of the ESO and GSP Licences for further detail. The latest version of the Data Best Practice is included within the following decision - https://www.ofgem.gov.uk/decision/decision-updates-data-best-practice-guidance-and-digitalisation-strategy-and-action-plan-guidance

[16] Presumed Open: The treatment of Data Assets, their associated Metadata and Software Scripts used to process Data Assets as Open Data, subject to Open Data Triage. Definition from Data Best Practice Guidance https://www.ofgem.gov.uk/decision/decision-updates-data-best-practice-guidance-and-digitalisation-strategy-and-action-plan-guidance

submission, the relevant Open Data Triage documents justifying why the licensee has chosen to not publish.

2.30 The licensee must demonstrate and explain how its key decisions are taken, including the process for considering stakeholder feedback. This must include development of a robust process to consider and demonstrate how any significant changes in assumptions are identified and addressed between iterations of the FEP.

2.31 The licensee must be clear with stakeholders about how their potentially sensitive data will be used, to enable them to make better decisions about what can be shared and how.

2.32 The licensee must share data in a usable format for stakeholders, in such a way as to enable them to conduct their own operational and investment planning forecasting. Shared data must support third party engagement in the network planning process and must be consulted upon.

2.33 The licensee must consult on their audit process.

2.34 The licensee must publish a timetable (including scope) for meeting Section 6 of this Guidance and provide updates on progress made.

2.35 The licensee must set out in their Methodology their process for developing the internal capacity to meet Section 6 of this Guidance.

Section 7 - National and regional outputs

2.36 The licensee must ensure the FEP provides granular outputs, providing pathways for all regions to show demand and supply factors (eg via the Distribution Future Energy Scenarios (DFES)), and spatial and local area energy plans).

2.37 The licensee must provide pathways for each region (eg North Scotland, Central Belt, South Scotland) as well as those industrial hubs with high generation and/or demand. The licensee will propose and define the exact number and scope of regions as part of its Methodology development with stakeholders. The licensee must also define what constitutes an 'industrial hub' for the FEP and consult stakeholders on this in their Methodology.

2.38 The licensee must set out the iterative process the modelling will use to integrate the roles and outputs of the FEP, CSNP, DFES and Regional Energy Strategic Planners (RESPs).

2.39 The feedback loop with the RESPs must ensure that the regional pathways, produced by the licensee in the FEP, do not inadvertently promote one region over another, which may have subsequent impacts on investment. If in their respective modelling, there should be major discrepancies in input or output data between the licensee and the Distributed System Operator at the Grid Supply Point level (based on their different data sources and assumptions), the licensee (as creator of the RESPs) must create a framework of internal checks to resolve any such discrepancies in the data used, or the assumptions made. This framework must be included in their Methodology, along with the process for feedback and interaction between the development of the RESP and the FEP.

Section 8 - Timing of FEP publications

2.40 It is envisaged that the CSNP will be published once every three years. To facilitate the possible data feed-in of energy modelling from the FEP to the CSNP, the licensee must publish a 'major' FEP publication 18 months to two years prior to the main CSNP publication. Annual 'minor' FEP updates may be published in the years between major versions, if the licensee determines that a significant change has occurred in the intervening period.

2.41 The licence conditions (C15.18 and C10.18 of the ESO and GSP licence respectively) provide the ability for major FEP publications to also take place outside of the planning cycle if this is needed. The licensee must consult with stakeholders on the criteria for triggering a major update out of cycle and set this out as part of its Methodology. Through the licence conditions, the licensee may seek approval from Ofgem for a major update out of cycle.

2.42 This is subject to the introduction of a SSEP cycle that will inform and constitute an important part of the energy modelling of the CSNP. Once the SSEP is settled, the licensee must engage further with its stakeholders on the optimum timing of any further FEP publications for usage outside of the CSNP process.

2.43 The licensee must set out, in the Methodology, the process and criteria for adjustments to the planned publication cycle – with any changes subject to Ofgem approval.

3. Wider requirements

Section summary

In chapter 3, broader requirements and considerations for the licensee to undertake the development and implementation of the Methodology, required to deliver the FEP, are set out. This includes expectations for stakeholder engagement, compliance, methodological approval, change control and continuous improvement.

Stakeholder engagement for Methodology

3.1 In developing its Methodology, we expect the licensee to consider at what stages stakeholder engagement will be required, how best to mobilise stakeholders and to set out their plans in advance for our timely consideration. This must be done in an open, transparent and collaborative way.

Compliance

3.2 The licensee is required under C15.2 and C10.2 of the ESO and GSP licence respectively to comply with this document, and any other related licence requirements, when preparing its Methodology and prior to submission to Ofgem for approval.

3.3 The licensee must ensure that their collaboration and engagement with others in the context of the FEP is in line with this FEP Guidance Document.

Final Methodology approval

3.4 The Methodology will be subject to approval by Ofgem. To facilitate this, development timelines must be shared in good time to agree review gateways along the path of development and to be involved in regular discussions with the licensee. Ultimately, the licensee must provide us with the written final Methodology, allowing at least four weeks for review prior to our decision.

Change control and continuous improvement

3.5 Developments in the timing or status of relevant policy areas, such as the SSEP, connections or code reviews, may well lead to a change in the modelling requirements and outputs required, to maintain alignment.

3.6 Over the longer-term, further modelling capability and adaptation will necessarily be required. Before each successive FEP cycle, the licensee must review the previous Methodology and consider any improvements to better facilitate the achievement of the licensee's objectives and obligations.

3.7 The licensee must submit all proposed amendments to the Methodology and the form of the FEP publications to Ofgem for approval in accordance with licence conditions C10 of the GSP Licence and/or C15 of the ESO Licence before implementing any changes.