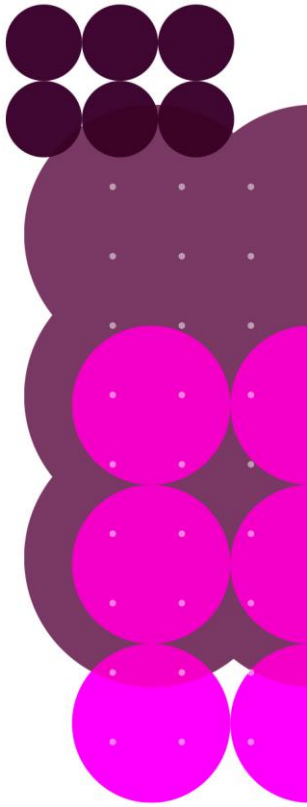
May 2025

Strategic Spatial Energy Plan

Methodology appendices

NESO
National Energy System Operator

Contents



Appendices overview

The appendices for the SSEP methodology expand on the main chapters with relevant contextual information, reasoning and references.

Each appendix is listed in the following table, together with the chapter it relates to in the publication. For explanations of the technical language in the methodology, refer to our glossary in Appendix 13.

Number	Chapter	Appendix title
1	Foundations	Stakeholder engagement approach
2	Foundations	Societal engagement approach
3	Foundations	Other strategic plans and policies
4	Foundations	SSEP monitoring and evaluation
5	Foundations	Quality assurance
6	Prepare	Technologies considered
7	Prepare	Development of the analytical approach
8	Prepare	External Markets
9	Model	Robustness testing for output sensitivities
10	Publish	SEA monitoring and implementation plan
11	N/A	Consultation feedback response
12	N/A	Additional changes and clarifications
13	N/A	Glossary

Appendix 1: Stakeholder engagement approach

In this appendix we provide further detail on our stakeholder engagement activities. We will:

- **Gain expert input into our modelling** engaging stakeholders with experience of spatial plans to inform the SSEP.
- **Meet statutory consultation requirements for the Strategic Environmental Assessment (SEA), Habitat Regulations Assessment (HRA) and Marine Conservation Zone (MCZ) assessment** as outlined in the government guidance for SEA, HRA and MCZ/Marine Protected Areas (MPA) legislation.
- **Challenge and review our developing pathways with experts.** Stakeholder feedback will be considered in choosing the pathways which are presented to the UK Energy Secretary. We will compare trade-offs within the different pathways so that we can ensure our final pathway is robust and tested with stakeholders.
- **Gather specialised data from the stakeholder groups,** which could inform and improve the quality of the plan. We will verify the robustness of the data.
- **Align with existing spatial plans,** working with spatial planning stakeholders to facilitate compatibility between the SSEP and other spatial plans, particularly those embedded in planning policy.
- **Have an agreed approach to coordinate sharing and exchange of information with spatial planning stakeholders.** To geospatially model the marine area in the SSEP, we are collaborating with The Crown Estate. By doing this, we are utilising its whole of seabed evidence base to enable us to access the best available data and align on where future offshore wind and other technologies should be located on a zonal basis. In addition to The Crown Estate's usual England and Wales remit, this will cover Scotland through collaboration with Crown Estate Scotland and the Scottish Government.

Appendix 2: Societal engagement approach

Further detail on our societal engagement approach is as follows.

The general public

As part of our engagement planning, we have conducted societal research representative of Great Britain (GB) by demographics and location. This is designed to reach a cross-section of those living in GB, to ensure a broad spectrum of views is considered.

Our engagement with the general public includes:

- **Societal opinion survey** - The survey, delivered by an independent organisation, asked high level questions on the right balance of developing energy infrastructure based on topics such as financial cost, negative environmental impact, positive economic opportunities and local social value to help us understand the views of different segments of society in different locations. The survey has a large sample size of over 9,000 respondents and will reflect the views of society both at a GB level, and at a national level across Wales, Scotland and England. This data collection will shape our decision-making process and create a context for all other engagement. It will also inform a societal assessment process, which will provide an assessment of societal views on potential pathways. As the SSEP is developed, we may carry out additional societal opinion research to further explore the views of different elements of society.
- **Focus groups** - We have held focus groups to gather qualitative views. These focus groups have enabled us to explore and analyse further the quantitative information in the opinion survey, ask specific questions and gain participants' views on developing energy infrastructure. Where we find conflicting views or require a deeper understanding of responses from the survey, either society-wide or in certain parts of GB, we are using focus groups to investigate further.
- **Engagement campaigns** - Where appropriate, we will consider social media and other technologies to engage, inform and educate people about the SSEP.

Societal forums

Although not considered as 'energy organisations' in the traditional sense, some societal interest groups are interested in the energy trilemma because it impacts or contributes to their purposes or goals. Such groups bring diverse perspectives to the conversation, so we will ensure our engagement with them represents a broad spectrum of economic, demographic and environmental interests across GB. Our early work has indicated relevant groups are in the following societal sectors:

Figure 20: Overview of interest groups

These interest groups can support the SSEP's creation and direction, either through their unique perspectives on the energy sector or by representing a wide cross-section of GB communities who would not typically participate in more traditional engagement methods.

These groups all have an interest in the energy transition and experience it in different ways, so it is important we give them a voice in the SSEP. We will seek to understand what they perceive to be of most value and consider how that should influence the development of the SSEP.

The following criteria will define the specific societal groups we engage with:

- They have participants/members across more than one geographical region.
- They are non-statutory.
- They are non-decision-making.
- They have an interest in the future energy system.
- They have an influence in discussions on the future energy system.

The primary way we will engage with interest groups will be through societal forums, each focused on one of the societal sectors in Figure 20. The purpose of the forums is to provide insight on the development of the SSEP while listening to and acting upon feedback to influence and to contribute to the evolution of the SSEP. Depending on how these discussions and the SSEP evolve, we may need to meet certain groups more frequently than others.

Societal forums will allow interest groups to be involved in, and be aware of, the development of the SSEP at an early stage. Where appropriate, they will have access to the information, data and feedback being used to develop the plan. This will enable interest groups to come to a considered and informed view on strategic energy planning, and what it means for them and who they represent.

Through the societal forums, interest groups will also be able to provide feedback on the data sources and research outcomes we are using to inform the SSEP and help us make sure data is considered appropriately. Where appropriate, interest groups will also be able to input into the modelling process, reviewing outcomes and contributing to modelling activity.

While some members of societal forums may have similar views, the aim of the forums is not to reach a consensus but to share insights, feedback and knowledge from that sector. While each forum's focus may be different, each will do the same work. Members can share insight and feedback on a range of issues, irrespective of which forum they belong.

Representatives of stakeholders on societal forums will sit on the Societal Interest Working Group, which forms part of the SSEP governance structure.

Our initial view is that the societal sectors in Figure 20 will provide the broad spectrum of societal views that will help achieve the aims of the SSEP. However, we will continue to monitor the success of our engagement activity. The structure of our engagement with societal groups may evolve during the preparation of the SSEP. Additionally, we will look for efficiencies for us and our stakeholders by integrating or combining our engagement with other NESO or industry projects and bodies where appropriate.

Campaign groups

Society, and in particular local communities, often have strong views on the development of specific infrastructure projects. While the SSEP will not consider the benefits or impacts of individual energy projects, we want to engage with people who take an active role in influencing the development of projects across GB.

Through campaign groups, we can reach some of the most active groups in GB who will engage in the conversation and share feedback to support the development of the SSEP. A consistent issue raised by campaign groups is that they have not been engaged early enough in the process to have strategic influence. We will engage with a selection of campaign groups so they can voice their concerns and positive arguments for consideration in the SSEP's development.

These groups will be a mixture of organisations that support or challenge infrastructure projects. They will include groups for or against certain energy sources being developed, as well as groups advocating the energy transition.

Our engagement will include established groups, plus new groups we expect to be formed through the energy transition. Some of these groups are geographically based and have a local interest in where infrastructure is placed, while others support or oppose a particular technology.

We will also engage appropriate business groups who advocate for and have a strong interest in GB adopting new, sustainable and secure energy sources and which support investment that creates jobs and wealth. Only by hearing a balanced view of campaigning opinions will we be able to reach an accurate understanding of these parts of society.

Due to the nature of the campaign groups, we are not expecting to reach a consensus. For example, a campaign group may be against a particular technology type, while another campaign group will be advocating for it. However, we will listen to these different views, considering them alongside the other stakeholder and technical data as we make decisions. The views of all society are important to the development of the SSEP, but there are trade-offs and difficult decisions that need to be made. These will be explained in an open and transparent way.

Engagement methods

We plan to engage a selection of these groups via online forums, organised based on the needs of the SSEP. At these forums, we will share updates on our plans and request feedback in both written and verbal form during and after these sessions.

As with the societal groups, we will engage with a selection of campaign groups to ensure a broad representation of perspectives. However, we will continue to monitor engagement and may amend the groups and groupings during the lifecycle of the SSEP. We will also look for efficiencies for both NESO and our stakeholders by combining our engagement with other NESO or industry projects and bodies where appropriate.

Politicians and government

Political representatives and groups are important to aid society's understanding of infrastructure development and articulate local and regional perspectives.

Government already has a formal role in the SSEP, so this engagement will focus more on hearing the opinions of politicians who do not hold national government office, but do represent society at regional, constituency or local government levels.

We will engage with politicians or their representatives at different levels to ensure they have the important facts available to them and their views, and the views of those they represent, are understood. Hearing from politicians with an expertise or high interest in the energy sector, as well as politicians engaged in regional and local matters, will help ensure a full view of opinions.

We will engage with politicians and government through a series of events such as meetings, presentations and webinars.

Host areas

Host areas are the areas of GB identified in the SSEP as being best placed for energy infrastructure development. While all parts of GB will be considered, it is likely some areas will see clusters of projects, a high number of projects or have energy infrastructure projects for the first time.

Engagement with host areas will build on our early engagement with regional community representatives, where we will share early outputs from our work and engage in discussions to better understand regional sentiment towards new energy infrastructure. The SSEP will provide the host areas with their first understanding of proposed energy infrastructure. To support communities, we will develop an engagement framework that will help these areas understand the process, guide them on how to participate and influence and ensure ongoing engagement throughout the lifecycle of the developments.

The SSEP will use the information and intelligence it has received from all its sources to understand which areas would most benefit from this engagement. This could include other engagement carried out by NESO and its other strategic projects, such as Regional Energy Strategic Plans (RESPs). Because of the nature of the process, we will only be able to confirm these areas and engage with them further into the SSEP's development.

We will establish an engagement structure with host areas for them to understand the process, how decisions have been made and how they can influence developments in their area. The SSEP will establish new structures, or work with those already in existence, to enable conversations across energy and societal stakeholder groups that could influence the SSEP and future developments.

Given the likelihood that many small areas (in the context of a strategic GB plan) will seek this engagement, we plan to work with local, national and regional representatives and stakeholders to prioritise resources to areas of greatest need. Our approach will be continually reviewed to ensure it is fit for purpose and effective, reflecting and implementing continuous improvement.

As a strategic plan, the SSEP will not be able to give certainty to communities about what projects will be developed and specifically where. However, it will explain GB's likely needs and what this may mean for a geographic area.

Our experience from previous infrastructure development projects from different sectors tells us there are key themes that host areas like to see throughout the development lifecycle. These include:

- **Clarity of developments and who is responsible for their development** - As mentioned previously, the SSEP will not be able to give certainty to communities about which projects will be developed in their area. As the likely first contact with these communities, the SSEP will develop channels of communications with areas.
- **Co-design of the developments** - Host communities often say they would like a voice in the shaping of the proposals. The SSEP will consider the views of society at a

strategic level and create a structured conversation for society and developers to build upon. This will rely upon developers and community stakeholders actively engaging in the process.

- **An opportunity to outline the trade-offs** – Those which are acceptable to local communities.

We plan to establish two types of forums in areas identified as the best locations for energy infrastructure. The forums will bring together societal representatives who have an interest or influence in the development of projects. The purpose will be to:

- communicate the factors that resulted in these host areas being selected
- prepare host areas to contribute actively to and participate in our consultation
- establish a framework for host areas to understand and engage with the SSEP and the projects that will follow
- give host areas an opportunity to feedback on how plans could be made more acceptable and valuable to them

The forums are:

Host Area - Plans and Projects Forum

A regional forum where political, societal, developer and community stakeholders can hear about and discuss likely requirements in a structured, controlled environment as they progress through their development lifecycle.

These will be created where there is a need based on significant levels of proposed energy infrastructure.

Host Area – Social Value Forum

A forum where political, societal, developer and community representatives can hear about and discuss the social value benefits that will be delivered, as well as trade-offs that would make plans and projects acceptable to local communities.

NESO and other energy organisations are developing other strategic plans for GB's energy transition. Ensuring clarity and understanding around these is essential when engaging with communities, so we will consider all of these and focus on delivering the best outcome for stakeholders.

Overview of process

The outputs of engagements with each group will differ. For that reason, we will run separate sessions.

Table 6: Overview of engagement with stakeholders

Who	Society	Politicians and government	Interest groups	Campaign groups	Host areas
Who is involved in this group	Society as a whole, which encompasses all people across GB	Parliament, politicians and representatives	Representatives of sectors that reflect a societal interest	People who proactively campaign about energy and energy infrastructure and their impacts on the world and its population	Areas where development of infrastructure is optimal
Why we are speaking to them	We want to hear from a cross-section of society to see if there are differences in their views on SSEP	For them to represent their constituents' political views. We need to provide politicians with the right information, relevant to them, so they can influence the SSEP and support and defend plans as part of their role with constituents	These groups have some direct interest in energy transformation and, by proactively engaging with them, we hope to hear their views and give them voices in the debate	We would like to engage with these groups to hear their points of view	By engaging, we can explain the reasoning for decisions made and get further local community feedback on plans and what they would like to see developed

Table 6 (continued): Overview of engagement with stakeholders

Who	Society	Politicians and government	Interest groups	Campaign groups	Host areas
What we are telling this group	Information on the plans – the need, the benefits, the timelines	Information on the plans, with particular emphasis on security, economic and environmental considerations	Information on the plans relevant to their interest – the need, the benefits, the timelines	General overview of information about the SSEP and how they can shape it	Information on how the SSEP is being developed, how they can shape it, and the options they have to co-create and influence it
What we would like to know	Are there any differences in how different parts of society value the elements that SSEP could have an impact on?	Get their views as part of feedback. Do they have all the tools they need to engage with constituents? Do they have local or GB wide objections or comments?	Sentiment and overall feedback, which will shape our plans. Do they have any concerns relevant to their sector that we should know about?	Sentiment and overall feedback, which will shape our plans	What trade-offs are acceptable? How do they feel about the various costs and benefits offered?
How we capture feedback	• Quantitative survey, giving statistically relevant cross-section of the country • Qualitative focus group sessions • Public consultation	• Feedback during the engagements or in writing • Public consultation	• Attendees will feed back in the forum sessions • Pre-engagements to segment interest groups • Public consultation	• Attendees will feed back in the forum sessions • Public consultation	• Attendees will feed back in the forum sessions • Public consultation

Capturing feedback: How we will input societal feedback into our plans

The views and feedback we receive from societal stakeholders will contribute to the societal component of the spatial evaluation. However, our engagement with society will be wider and be considered more broadly in the development of the SSEP. We will conduct societal opinion research and engage a representative cross-section of societal interest groups and political representatives to contribute to an SSEP that considers the views of society.

We anticipate that feedback will be wide and varied. Individual areas and groups will have their own unique interests, points of view and values. It will be highly unlikely for there to be a single 'societal view' from which the SSEP can be developed. However, we will take all feedback into consideration and use that to inform our decision-making.

There will be opportunities to input and feedback at different stages of the development of the SSEP. These will include:

- this methodology document, which was consulted on a representative sample GB-wide opinion survey
- the societal forums and campaign group engagement, described earlier in this appendix
- host area engagement, described earlier in this appendix
- a public consultation held on the draft SSEP (see Chapter 6 - Consult), with stakeholder information provided through webinars, information materials and images

This public feedback will be considered alongside feedback from other stakeholders, plus environmental, technical and spatial use considerations.

To create transparency around the process, the SSEP will publish a summary of the feedback received. It will include supporting evidence of how the plan has incorporated feedback and reasons preventing specific themes of feedback being acted upon.

Once the SSEP has been published, we will continue engagement with the selected host areas as the outputs are understood and delivered by other stakeholders.

Appendix 2.1: Governance and working group memberships

The following section provides details on membership of our governance groups and stakeholder working groups.

Expert Advisory Group (EAG)

Current EAG membership is outlined in this table:

Table 7: EAG membership

Working Group	Representative member organisations
Environmental	Royal Society for the Protection of Birds (RSPB) and The Wildlife Trust
Land Use Spatial Planning	Department for Environment, Food and Rural Affairs (Defra)
Marine Use Spatial Planning	Marine Management Organisation (MMO) and The Crown Estate (TCE)
Industry	Scottish Renewables and Cadent

The EAG member is representing their respective working group and not their organisation. The Office of Gas and Electricity Markets (Ofgem), the Department for Energy Security and Net Zero (DESNZ), Welsh and Scottish governments are also observers of the EAG. Sitting under the EAG referred to in the previous governance section, there are several stakeholder working groups as described in Chapter 2 - Foundations. Their membership is listed in the following section.

Environmental Working Group

Membership organisations include:

- Welsh Government
- Scottish Government
- DESNZ
- Defra
- Environment Agency
- Cadw
- Natural Resources Wales
- Historic Environment Scotland
- NatureScot
- Historic England
- Natural England
- Joint Nature Conservation Committee (JNCC)
- Scottish Environment Protection Agency (SEPA)
- MMO
- The Wildlife Trust
- RSPB

Land and Marine Use Spatial Planning Working Groups

Land Use Spatial Planning Working Group:

- Ministry of Housing, Communities and Local Government (MHCLG)
- Defra
- Welsh Government
- Department for Science, Innovation and Technology (DSIT)
- Planning Inspectorate
- Ministry of Defence (MoD)
- Scottish Government
- DESNZ

Marine Use Spatial Planning Working Group:

- Defra
- Welsh Government
- Scottish Government
- DESNZ
- North Sea Transition Authority (NSTA)
- MMO
- Crown Estate Scotland (CES)
- TCE
- MoD

Industry Working Group:

- Electricity North West
- National Grid Electricity Distribution
- Northern Powergrid
- SP Energy Networks (Electricity Transmission)
- SSEN Distribution
- UK Power Networks
- National Grid Electricity Transmission (NGET)
- SP Energy Networks (Electricity Distribution)
- SSEN Transmission
- Cadent
- Northern Gas Networks
- SGN
- Wales and West Utilities
- National Gas
- UK Energy Research Centre (UKERC)
- Royal Academy of Engineering
- Hydrogen Scotland
- Hydrogen UK
- Scottish Renewables
- Solar Energy UK
- Association for Decentralised Energy (ADE)
- BEAMA
- British Hydropower Associate (BHA)
- British Ports Association
- Energy Networks Association
- Energy UK

- Institute for Gas Engineers and Managers
- Nuclear Industry Association
- Renewable Energy Association (REA)
- Renewable UK
- Renewable UK Cymru
- Tech UK

Societal Interest Working Group

Representatives from societal forums will sit on the Societal Interest Working Group.

This will comprise representatives from societal forums. A list of interest groups participating in these forums can be found in Figure 20.

Appendix 3: Other strategic plans and policies

Consultation with stakeholders including the devolved governments has clarified the role and importance of strategic UK and nation-level spatial plans, policies and programmes that NESO needs to consider. We have outlined our approach to national, regional and sub-national plans in the following section.

National plans – As outlined in the commission, following the publication of the SSEP, the Scottish Government will consider whether it would be appropriate to amend the National Planning Framework 4, National Marine Plan or sectoral adopted marine plans. The Welsh Government will explore the relationship between the SSEP and Future Wales: The National Plan and the Welsh National Marine Plan. Therefore, national level plans will be taken into account for the evaluation framework as appropriate. Additional UK, GB and devolved nations' strategies and other information may also be considered as required, particularly where these documents are relevant to the evaluation framework approach.

Regional and local sub-national plans – It is anticipated that sub-national regional and statutory plans (such as the London Plan and local development plans) are more appropriate to consider during future planning stages. They are important because some regional and local scale matters could still contain elements of national interest or significance. To cater for this, where appropriate, these matters will be picked up at a strategic level through national planning policy and plans.

Here is a brief overview of the strategic plans, policies and programmes:

- **The National Planning Policy Framework** – Published in December 2024, it outlines the UK Government's planning policies for England and includes a framework for locally prepared plans for housing and other developments in a sustainable manner.

- **National Policy Statements (NPS)** – The suite of twelve designated NPS set out the national need for certain types of major infrastructure for different sectors, as well as the main criteria for judging the acceptability of projects. These apply to England and in some circumstances Wales. For the energy sector there are six:
    - Overarching NPS for energy (EN-1)
    - NPS for natural gas electricity generating infrastructure (EN-2)
    - NPS for renewable energy infrastructure (EN-3)
    - NPS for natural gas supply infrastructure and gas and oil pipelines (EN-4)
    - NPS for electricity networks infrastructure (EN-5)
    - NPS for nuclear power generation (EN-6)
    - NPS 6 is intended to be replaced by an updated version (EN-7) by the end of 2025, as is the NPS for renewable energy infrastructure (EN-3)
- **The Land Use Framework** - Published by Defra, it aims to support the delivery of multifunctional, resilient and productive landscapes in England to meet the ambitious targets for enhancing the environment, delivering net zero and supporting food security.
- **National Planning Framework 4 (NPF4)** – Published in February 2023, it is a national spatial strategy for Scotland, tied together with a set of national planning policies. The plan sets out spatial principles, regional priorities and national developments.
- **Future Wales – National Plan 2040** – This is the national development framework for Wales and has development plan status.
- **Planning Policy Wales (PPW)** – Published in February 2024, it comprises the land use planning policies of the Welsh Government. It considers how the planning system contributes to the delivery of sustainable development and improves the social, economic, environmental and cultural wellbeing of Wales.
- **The UK Marine Policy Statement** – Published in March 2011, it is a framework for preparing marine plans and considering decisions impacting the marine environment. It seeks sustainable development in the UK marine area and will be integral to the development of the SSEP.
- **Defra's Marine Spatial Prioritisation Programme** – This enables the UK Government to deliver on its commitments in English waters, including offshore wind targets, to help achieve net zero, along with developing marine nature recovery and supporting sustainable fisheries. To deliver this work, a cross-government programme board has been established.
- **Scotland's National Marine Plan (2015) (NMP)** – This provides a comprehensive overarching framework for all marine activity in Scottish seas. It sets out a policy framework to help determine if new or existing marine activity is environmentally or economically sustainable and suitable for the area. It serves as the primary guide

to decision-making on the use of marine space and resources in Scotland. This is currently being updated and a new plan NMP2 will be published soon.

- **Sectoral Marine Plan for Offshore Wind Energy (SMP-OWE)** – Published in 2020, it identified sustainable plan options for the future development of commercial-scale offshore wind energy in Scotland, including deep water wind technologies. It covers both Scottish inshore and offshore waters. This is currently being updated and a new SMP-OWE2 will be published soon.
- **The Initial Plan Framework (IPF)** – Published in 2022, it outlined the process for development of the Sectoral Marine Plan for Offshore Wind Innovation and Targeted Oil and Gas Decarbonisation. It helped identify areas suitable for the future development of offshore wind for smaller innovation projects, and projects targeting the electrification of oil and gas infrastructure in Scottish waters. This is part of Scotland's decarbonisation and transition to net zero. This framework will be replaced by the new SMP-OWE when adopted.
- **Welsh National Marine Plan (2019)** – This sets out the Welsh Government policy for the next 20 years for the sustainable use of Welsh seas.

These planning frameworks, government programmes and policy statements must be considered while developing and understanding the spatial constraints. Where possible, we will seek consistency and compatibility between existing spatial plans and policies. Further details on the development of our spatial evaluation approach and the principles for alignment are outlined in Section 3.4 of Chapter 3 - Prepare.

Appendix 4: SSEP monitoring and evaluation

In addition to NESO assurance, we will develop a monitoring and evaluation process with DESNZ and Ofgem. This will consist of:

Monitoring

- **Oversight of progress and the key risks to SSEP delivery**, primarily achieved through existing reporting and other core processes such as risk management.

Evaluation

- **Identifying and synthesising process lessons** from the design and conduct of the analysis which produces the SSEP, especially important due to the programme's novel nature. We will be responsible for this evaluation and will use it to inform future iterations of the SSEP and other analysis programmes and projects.
- **Evaluating objectives** to understand the outcome or impact of the SSEP against the shared goals in the commission and whether changes should be made to

future iterations of the SSEP to better support those objectives. This will be conducted following the final SSEP publication.

The Analytical Evidence Advisory Group (AEAG), and subsequently the SSEP Committee, will receive the outcomes of the monitoring and evaluation process. The SSEP Committee may authorise changes in delivery strategy because of the findings.

Appendix 5: Quality assurance

Due to its complexity and the potential impact of the results, the SSEP will be subject to high levels of assurance across all aspects of the programme. This will encompass both programme delivery and technical assurance.

The former covers all aspects of how the SSEP programme is set up and delivered. The latter covers the design, implementation and usage of the modelling process, drawing principally upon the guidance in HM Treasury's *The Aqua Book*[1].

The two processes have differing roles and requirements and so are described separately here. However, since there are dependencies between them, both will be covered in a single integrated assurance plan and coordinated collectively.

Our assurance will be conducted using the NESO 'three lines of defence' structure:

- **First line of defence** – Internal programme activity to ensure plans and processes are of a high standard, kept up to date and are adhered to.
- **Second line of defence** – Oversight from the NESO Strategic Energy Planning (SEP) portfolio and other NESO subject matter experts.
- **Third line of defence** – Oversight from an independent third party.

Relationship with other functions

The design and execution of the integrated assurance plan will interface with the SSEP governance model. Assurance activity will form a key part of the programme delivery strategy and activities. It will be captured in the master schedule, supported by a robust monitoring and evaluation process.

References

The SSEP integrated assurance fully meets the requirements of the following:

- *The Aqua Book: guidance on producing quality analysis*[1]

[1] HM Treasury, *The Aqua Book: guidance on producing quality analysis* (2015) - gov.uk/government/publications/the-aqua-book-guidance-on-producing-quality-analysis-for-government

- *Government Functional Standards GovS 002: Project Delivery*[2]
- *Government Functional Standards GovS 010: Analysis*[3]
- *Orange Book: Management of risk – Principles and Concepts*[4]
- *The Green Book – Appraisal and evaluation in central government*[5]
- *The Magenta Book – Guidance on evaluation*[6]
- *Infrastructure and Projects Authority: assurance review toolkit*[7]
- *Implementing integrated assurance for major projects*[8]
- *Energy security and net zero modelling: Quality Assurance (QA) tools and guidance*[9]

Programme delivery assurance

The first line assurance will be delivered by the SSEP programme team, which will use key programme processes effectively. These include:

- verification processes designed in accordance with NESO and/or UK Government policy requirements, including:
    - data management
    - risk, assumption, issues, dependencies (RAID)
    - cost control
    - lessons learnt
    - procurement
- health checks to assess maturity across all key functions, conducted biannually as a minimum

[2] Infrastructure and Projects Authority and Cabinet Office, *Government Functional Standard GovS 002: Project Delivery* (2018) - gov.uk/government/publications/project-delivery-functional-standard
[3] Government Analysis Function, *Government Functional Standard GovS 010: Analysis* (2021) - gov.uk/government/publications/government-analysis-functional-standard--2
[4] Government Finance Function and HM Treasury, *Orange Book* (2013) - gov.uk/government/publications/orange-book
[5] HM Treasury, *The Green Book* (2022) - gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government/the-green-book-2020
[6] HM Treasury and Evaluation Task Force, *The Magenta Book* (2011) - gov.uk/government/publications/the-magenta-book
[7] Infrastructure and Projects Authority and Cabinet Office, *Infrastructure and Projects Authority: assurance review toolkit* (July 2021) - gov.uk/government/collections/infrastructure-and-projects-authority-assurance-review-toolkit
[8] Infrastructure and Projects Authority and Cabinet Office, *Implementing integrated assurance for major projects* (June 2011) - gov.uk/government/publications/implementing-integrated-assurance-for-major-projects
[9] Department for Energy Security and Net Zero, *Energy security and net zero modelling: Quality Assurance (QA) tools and guidance* (February 2024) - gov.uk/government/publications/energy-security-and-net-zero-modelling-quality-assurance-qa-tools-and-guidance

- deep dives into areas identified as a concern or identified as treatment plans for risks or issues
- quality checks and review of all products and outputs

The second line assurance will be delivered from outside the programme team by other bodies within NESO. The wider SEP Portfolio Office, responsible for managing programmes across our strategic energy planning initiatives, will lead and provide assurance of:

- programme controls
- programme reporting
- programme maturity
- status of documents
- recruiting and qualifications
- cost control

This will provide confidence that controls are effective and the SSEP is delivering in line with expectations and agreed specifications.

As per our governance structure, there will be specified milestones in the programme schedule:

- stage gates in the programme lifecycle with defined entry and exit criteria
- assurance checks prior to the release of key deliverables, including quality control of these deliverables

The SEP Portfolio Office has the option to conduct deep dives into areas identified as a concern or develop treatment plans for identified risks or issues. Other NESO functions, such as Internal Audit, may also support.

The third line assurance will be provided by an independent third party, competitively procured, which will assure the programme is being managed as part of the SEP portfolio.

Technical assurance

Technical assurance will also be delivered through the three lines of defence structure, providing external peer review and audit as per *The Aqua Book* guidance for programmes with the highest degree of risk and complexity. The technical assurance of the modelling employed by SSEP will utilise a QA log to track and review validation, verification and sensitivity analysis to ensure scenarios and results are robust.

The first line assurance will maintain key documents such as a centralised master data and assumptions list (MDAL). Some of these documents and processes will be assured via programme delivery assurance.

Second line assurance will utilise internal subject matter experts in our assurance team. NESO's Chief Economist will provide process oversight, including chairing our AEAG. This is the external governance forum with UK, Scottish and Welsh governments and Ofgem that

oversees the analytical and modelling process, including SSEP quality assurance and reporting. The Chief Economist's office will also review our economic modelling assumptions.

Third line assurance will engage an independent third party. Competitively procured on behalf of the SEP portfolio, this specialist provider will perform an assurance role on SSEP processes, modelling and the resulting analysis. Areas externally assured will be the draft SSEP consultation, economic and spatial modelling (including model verification and validation) and spatial evaluation data.

Appendix 6: Technologies considered

In this appendix, we describe the various energy technologies that are being considered in the SSEP analysis. All of these technologies are fully integrated into the economic modelling and their volumes and locations optimised across the 17 modelled zones.

We will however, focus on spatially optimising a subset of the technologies, which are described as being out of scope for spatial optimisation.

In-scope technologies for spatial optimisation

Solar

Solar energy is a key part of DESNZ's strategy to enhance the UK's energy security and net zero ambitions, so the SSEP will spatially optimise and assess solar electricity generation connected to the transmission and distribution networks. Rooftop solar will not be spatially optimised as it is embedded in the distribution network and interacts with domestic electricity demand rather than responding to electricity market signals.

Offshore wind

The SSEP will spatially optimise offshore wind, both fixed bottom and floating. The UK Government will significantly increase the deployment of offshore wind to meet its Clean Power 2030 and net zero targets. To achieve the latter, the Climate Change Committee concluded the number of new offshore wind installations each year would need to be trebled in the UK.

Nuclear

The SSEP will spatially optimise nuclear power, both conventional large (GW) and small modular reactors. Advanced modular reactors (AMRs) will not be included in the economic modelling or spatial optimisation in this SSEP as they are currently considered novel and innovative technologies. However, they may feature in future iterations of the SSEP. Siting of nuclear reactors is currently determined by the National Policy Statement

(NPS) EN-6, which identifies pre-assessed nuclear sites for new nuclear power stations expected to be deployed by the end of 2025.

DESNZ is developing new criteria for siting nuclear power post-2025 through a new NPS EN-7 to provide more flexibility in the site selection process. This will include small modular reactors (SMRs) and traditional nuclear plants. The draft EN-7 does not identify potentially suitable sites but does recognise that the sites identified in EN-6 are likely to remain attractive for new nuclear development.

Onshore wind

Onshore wind is a key part of the GB's energy mix and has a role to play in reaching the UK's net zero target. The SSEP will spatially optimise onshore wind and assess against impacts on environmental, society and other spatial uses. In 2024, the UK Government published a policy statement on onshore wind, revising planning policy to place it on the same footing as other energy developments. It has reinstated large-scale onshore wind into the Nationally Significant Infrastructure Project regime and has committed to revising the relevant NPS for quicker determination of projects.

Hydrogen

The SSEP will spatially optimise hydrogen production, hydrogen to power, and hydrogen storage. Transport of hydrogen is included in the economic modelling and considered by the Technical Engineering Design Requirements.

Hydrogen could significantly shape the future of decarbonisation of the energy system and could also provide flexible energy. Hydrogen electrolysers could form a large source of demand that could operate flexibly given the right incentives and help balance the energy system and manage constraints. It is also expected to play an important role in longer-duration energy storage and could support decarbonisation of sectors that are hard to electrify. The role of hydrogen in decarbonising industry, transport and heat has not yet been firmly established. Key policy decisions on the future of hydrogen are outstanding.

The hydrogen strategy published by the government in 2021 (updated in 2023) highlights opportunities around hydrogen for the UK based on its geography, geology, infrastructure and capabilities. The SSEP can provide evidence on spatial opportunities for hydrogen and possible policy options to inform government decision-making.

Energy storage

We will spatially optimise transmission and distribution network connected short-term storage and long-duration energy storage (LDES) in the SSEP. Energy storage helps offset the hour-to-hour variability of renewables and facilitate the electrification of transport and heat. Electricity storage can help us balance the system at a lower cost and maximise the usable output from intermittent renewable generation.

The government is developing a policy framework to enable investment LDES beyond hydrogen and carbon capture utilisation and storage (CCUS) and has recently published a long-duration electricity storage cap and floor scheme to enable investment in LDES technologies. Electricity storage can be provided by a range of technologies like liquid air

electricity storage, compressed air electricity storage and flow batteries. Most LDES technologies are still considered nascent. Pumped hydropower is one of the most widely used grid-scale storage technologies worldwide and has unique geographical and geological requirements and long asset lifetime.

Power and hydrogen production with CCUS

The SSEP will spatially optimise hydrogen production and power with CCUS. CCUS will play an important role in providing flexibility to the energy system, alongside achieving wider 2050 net zero targets. Beyond 2030, commercial deployment of CCUS is expected to increase to support the Climate Change Committee's *Sixth Carbon Budget*.

Bioenergy with carbon capture and storage (BECCS)

The SSEP will spatially optimise new BECCS infrastructure, with possible consideration of retrofitted plant. As outlined by groups including the Climate Change Committee (CCC) and the International Energy Agency (IEA), greenhouse gas removal technologies such as BECCS technologies can play a significant role in supporting net zero targets through the delivery of negative carbon emissions with the co-benefit of producing low-carbon electricity. Power BECCS has the potential to provide removals that are needed to offset the residual emissions from hard-to-decarbonise areas, while delivering valuable low-carbon electricity to the system.

Interconnectors

The SSEP will optimise point-to-point interconnectors in terms of the connecting zone in GB, the connecting overseas market, the capacity of the interconnectors and the timing of the commissioning of each interconnector.

Unabated gas

The SSEP will spatially optimise generation of unabated gas-fired generation. Unabated gas-fired generation is used to provide flexibility and resilience to the energy system. To ensure security of electricity supply, unabated gas capacity will continue to be needed on the system throughout the 2030s, until low-carbon, long-duration flexible technologies have been deployed at scale. There is a need to carefully consider the phase-out of gas in a decarbonised energy system beyond 2030, to account for a range of future weather projections where there might be lower-than-expected supply from other sources and the availability of low-carbon alternatives.

Data centres

The SSEP will spatially optimise a small amount of flexible data centres against different demand profiles. The input demand profile forecasts demand across all sectors of the economy, including the commercial sector. Demand growth in this sector will include future growth in data centres. The sector is expected to grow significantly due to increases in artificial intelligence (AI) and quantum computing. The level of growth in data centres has the potential to drive a substantial range in energy demand in the future. As the policy landscape around data centres is evolving, there is an inherent uncertainty around their future growth beyond 2030 and where they will be located. This creates challenges

around robust data available for future growth of data centres, which we will carefully consider.

The following section is a summary of stakeholder feedback on each of the three data centre options:

Option A: The SSEP carries out sensitivity testing around demand growth and does not spatially optimise the location of any data centres

Stakeholders suggested that a sensitivity analysis of how much increased capacity could be enabled in areas where data centres already exist, along with the identification of additional new zones and feasible connection scales, would be more helpful. Stakeholders highlighted concerns around robust modelling due to challenges with predicting future demand.

Other stakeholders challenged the benefits of Option A and if it provided any additional insights compared to the pathways in the *Future Energy Scenarios (FES) 2024*. They highlighted the limitations of aggregate modelling in Option A, stating that without spatial optimisation, it risks generating inaccurate recommendations, potentially resulting in sub-optimal network investments and increased system costs.

Option B: Spatially optimise a small volume of flexible data centre demand (1-2 GW)

Stakeholders highlighted that spatially optimising all data centres was not realistic due to the limits around locational flexibility. They emphasised the need for industry consultation to inform the underlying assumptions and emphasised the importance of multiple modelling scenarios with a range of data centre demand to reflect the uncertainties and the evolving landscape. This enables measurable system benefits by spatially optimising a small portion of data centres while incorporating stakeholder input to improve assumptions and methodology. Stakeholders recognised the value in spatial optimisation, without which modelling risks generating inaccurate recommendations potentially leading to sub-optimal network investments and increased system costs. Spatial optimisation is crucial to strategically locate data centres for system benefits.

Option C: Spatially optimising data centre demand in one of the modelling scenarios

Many stakeholders questioned the reasoning behind optimising data centres in only one modelling scenario. They were keen to understand interactions with the government's new AI opportunities action plan and supported considering data centres comprehensively. While timelines for the government's AI growth zones do not align with the SSEP, we are exploring inputting in other ways.

Multiple modelling scenarios

The majority of stakeholders preferred to have multiple modelling scenarios with a range of data centre demand to reflect the uncertainties and the evolving landscape. They believe this approach mitigates some uncertainties but does not fully address the lack of robust data, potentially leading to inaccurate modelling scenarios. They highlighted the importance of adaptability over time and refining modelling scenarios as some of the decisions emerge. Challenges around other policy uncertainties like planning, the Review of Electricity Market Arrangements (REMA) and other market decisions were mentioned.

They emphasised the importance of testing a range of demand backgrounds to minimise risks associated with overbuilding or underbuilding grid capacity.

Technologies out of scope for spatial optimisation

Please note that technologies out of scope for spatial optimisation will be included in the economic modelling, resulting in a holistic pathway.

Small-scale flexible electricity demand

Certain small-scale demand such as EV storage, smart heat pumps, smart white goods and domestic lithium-ion batteries are expected to provide flexible electricity demand in the future. For example, vehicle-to-grid (V2G) technology would deliver power back to the grid, turning EVs into energy storage systems. V2G chargers are small scale. It would be challenging to aggregate and assess them at a strategic level. The SSEP is a strategic plan and therefore would not be able to assess accurately or effectively the location of domestic small-scale flexible demand zonally. We will not be spatially optimising small-scale flexible demand such as electric vehicle (EV) storage as these technologies can be widespread and deployed by consumers anywhere in GB, which brings challenges to effective geospatial modelling. EV storage will be included in the economic modelling. Heat networks will also not be spatially optimised. Heating demand from electricity or hydrogen will be considered in the overall demand projections.

Wave and tidal

Wave and tidal energy are emerging technologies and volumes in development are currently very low. The cost of wave and tidal energy is bespoke to projects and is challenging to consider at a plan level. For this reason, the SSEP will not spatially optimise the location of wave and tidal energy projects in the first iteration. As policy and technology advances, wave and tidal energy could be considered in future iterations of the SSEP.

Energy from waste (EfW)

The principal purpose of EfW plants is to reduce the amount of waste going into landfill and recover energy as electricity, heat or fuel. The government's net zero strategy outlines that emissions from EfW represent a significant part of residual emissions from the power sector. However, EfW can reduce net emissions compared to disposal in landfill. Utilising the waste heat produced from EfW facilities increases their efficiency and displaces the use of gas for heating, further reducing net emissions. Due to the distinctive drivers for EfW, the SSEP will not be spatially optimising the location of EfW facilities.

Biomethane and biofuels

These technologies will be explored during the economic modelling process and may be considered during sensitivity testing.

Appendix 7: Development of the analytical approach

Appendix 7.1: Analytical approach for spatial evaluation and pathway options assessment

The analytical processes within the SSEP involve comprehensive evaluation of spatial and economic factors to ensure effective decision-making.

This includes assessing spatial constraints and opportunities (spatial evaluation), integrating these with economic considerations and evaluating the deliverability of various pathway options.

This appendix provides further detail on the analytical approaches that support the spatial evaluation and deliverability of pathway options. The approach for integrating spatial and economic considerations is described in Chapter 4 - Model.

The sources reviewed to inform development of the spatial evaluation approach were:

- Government resource - *The Green Book* (2022)
- Government resource - *Multi-criteria analysis: a manual*[10]
- Government resource – *The Green Book supplementary guidance on Multi-Criteria Decision Analysis*[11]
- Academic resource - *Project 11: Assessing Energy Pathway Impacts in the UK – Microeconomic Assessment Through Spatially Disaggregated Integrated Assessment Modelling*[12]
- Academic resource – *Natural Environment Valuation Online tool*[13]

[10] Ministry of Housing, Communities and Local Government (2018 to 2021), *Multi-criteria analysis manual for making government policy* (January 2009) – gov.uk/government/publications/multi-criteria-analysis-manual-for-making-government-policy

[11] Department for Energy Security and Net Zero and HM Treasury, *Green Book supplementary guidance: use of Multi-Criteria Decision Analysis* (2024) - gov.uk/government/publications/green-book-supplementary-guidance-use-of-multi-criteria-decision-analysis

[12] The UK Energy Research Centre, *Project 11: Assessing Energy Pathway Impacts in the UK – Microeconomic Assessment Through Spatially Disaggregated Integrated Assessment Modelling* - ukerc.ac.uk/project/assessing-energy-pathway-impacts-in-the-uk-microeconomic-assessment-through-spatially-disaggregated-integrated-assessment-modelling/

[13] University of Exeter, *Natural Environment Valuation Online tool* (NEVO) - exeter.ac.uk/research/leep/researchimpact/current-projects/nevo/

- Sector guidance - *Resource and Constraints Assessment for Offshore Wind: Methodology Report*[14]
- Case studies of framework applications

Options for evaluating spatial constraints and opportunities and assessing deliverability of pathway options were considered in developing the SSEP analytical approach (see Table 8, which includes a brief description of each option). To identify these options, we used criteria (Figure 21) informed by government guidance and a literature review of examples integrating environmental, societal and/or technical factors into decision-making processes. When identifying an appropriate analytical approach, no examples of other organisations or countries preparing a strategic spatial energy plan across both land and sea were found. Therefore, no direct comparative resources were available.

[14] The Crown Estate, Offshore Wind Leasing Round 4, *Resource and Constraints Assessment for Offshore Wind: Methodology Report* (September 2019) - thecrownestate.co.uk/media/3331/tce-r4-resource-and-constraints-assessment-methodology-report.pdf

Table 8: List of framework options considered

Framework Type	Description	Example
Spatial cost-benefit framework	Spatial cost-benefit modelling tools to integrate the analysis of prospective UK energy pathways with considerations relating to the value of the environment and society. Covers both integrated assessment models and independent spatial cost-benefit models for environment and society.	UK ERC: the ADVENT programme, Assessing Energy Pathway Impacts in the UK – Microeconomic Assessment Through Spatially Disaggregated Integrated Assessment Modelling.
MCA (multi-criteria analysis)	MCA establishes preferences between options against measurable criteria using simple scoring and weighting.	Department for Transport (2011): Detailed guidance on social and distributional impacts of transport interventions.
MCDA (multi-criteria decision analysis)	MCDA is a form of MCA, but with a stronger emphasis on an explicit process for scoring and weighting using stakeholders and experts.	The Crown Estate: Site Selection Methodology, Leasing Rounds 4 and 5.
Impact-based scoring	Impact-based qualitative scoring looks to assess and score the potential impacts of different options on environmental and community receptors. An options scorecard can be used to assess impacts based on relevant questions.	Natural England: EBN (Environmental Benefits from Nature), 2021.
Constraints mapping with black-red-amber-green (BRAG) rating	Spatial constraints mapping seeks to provide an assessment based on avoiding significant environmental, societal and technical spatial constraints. Outputs are qualitative only and based on a ranking system (black-red-amber-green (BRAG) or similar).	ESO: Holistic Network Design (HND) and HND Follow-up Exercise (HNDFUE).

Each option was reviewed in detail. To help with decision-making, a comparison of how each option performed relative to each of the criteria was conducted. Performance was ranked on a broad scale ranging from highly negative to highly positive.

	Robustness and transparency of approach	Relevance	Resources and data to implement	Acceptability	Applicability in SSEP process
Spatial cost-benefit	++	+	--	+/-	+/-
Multi -criteria analysis	+	++	++	+	++
Multi -criteria decision analysis	++	++	-	++	++
Impact based qualitative	+	+	+	-	--
Impact based qualitative constraints mapping with BRAG ratings	-	+	+	-	--

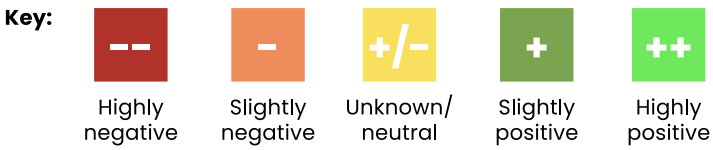


Figure 21: Comparative matrix of framework option performance against criteria

Key assessment outcomes of each option

Table 9: Summary of assessment of framework options

	Advantages	Limitations	Overall assessment
Spatial cost-benefit framework	Consistent with *The Green Book* and (if feasible) would be able to integrate environmental costs and benefits with energy economic modelling.	Models tend to focus on limited set of environmental impacts. Non-monetised impacts, particularly societal, would be missed. Significant resources required to develop appropriate models.	Not recommended for first iteration of the SSEP but longer-term potential for consideration.
Multi-criteria analysis	One of the most used approaches, can integrate economic, societal and environmental data, quantitative and qualitative. Simple to apply, also very applicable for use in GIS tools.	Lack of transparency around weighting. In its simplest form, not recommended by *The Green Book*.	Highly recommended for spatial evaluation if a modified approach to weighting and criteria selection is introduced.
Multi-criteria decision analysis	Like MCA, but more robust due to approach to weighting used, for example swing weighting or Analytical Hierarchical Processing (AHP). *The Green Book* recognises MCDA as suitable for where impacts cannot be easily monetised. Elements of this approach are particularly helpful when the criteria or objectives to assess the deliverability of a pathway are not directly comparable (for example, cost against spatial impact) and the perspectives of multiple stakeholders need to be considered.	Requires significant time and resources for weighting and scoring process. Swing weighting and AHP ultimately are based on expert judgement.	Theoretically recommended for spatial evaluation if time available for AHP/swing weighting. However, extensive time and resources required. Elements of this approach can be applied to assess deliverability of pathway options against economic and spatial factors which are not directly comparable and considers stakeholder perspectives.
Impact based qualitative	Aligns with *The Green Book* as it defines impact pathways for environmental and societal outcomes that can be used to assess significance of impact.	Best suited to specific options appraisal, where impacts can be qualitatively assessed to provide a comparison against each option.	Not recommended as more targeted to an options appraisal stage and does not provide the required spatial information.
Spatial constraints mapping with BRAG ratings	The approach is based on consistent information using publicly available environment and community spatial datasets.	The BRAG requires subjective judgement for the assessment process, which makes this less transparent and replicable.	Not recommended as BRAG ratings can lack transparency and outputs not well aligned with SSEP needs.

The selected spatial evaluation approach

Out of the options assessed, the MCA emerged as the most favourable option, performing positively against all the evaluation criteria and outperforming other methods. The MCA approach demonstrated strength in the following criteria:

- **Relevance** - The MCA model is widely used for integrating economic, social and environmental data.
- **Resources and data** - The MCA approach is relatively straightforward to apply, with no specialist software required.
- **Applicability** - The MCA approach is highly applicable, particularly within GIS spatial mapping and planning tools. It is well-suited for the SSEP's purposes, allowing for the integration of primary data and stakeholder engagement.

While the spatial cost-benefit analysis performed well in terms of robustness, aligning with *The Green Book*, it faced challenges in integrating complex environmental, societal and technical factors within a cost-benefit framework. The MCDA performed well in terms of acceptability due to its robust approach to weighting, but it requires extensive expert engagement for correct application.

To enhance the MCA approach and address the limitations associated with it identified in *The Green Book*, modifications are proposed to address the criteria of robustness and transparency. This includes documenting the approach thoroughly, defining clear criteria and employing an evidence-based approach to scoring with stakeholder involvement. By addressing these modifications, the MCA approach can improve its performance in terms of robustness and acceptability within the SSEP.

The selected approach to assessing pathway deliverability

Building on our modified MCA approach, we will use an additional analytical method to evaluate the deliverability of pathways. This assessment will consider spatial and economic factors at the pillar level. This will happen after spatial and economic optimisation in the modelling process as described in Section 4.2.4 of Chapter 4 - Model. The analytical approach was informed by the options assessed and is suitable for:

- **Comparing objectives/criteria** – The analytical approach is appropriate where criteria for assessing pathway deliverability are not directly comparable (costs and spatial impacts). We have outlined an approach that enables us to rank pathways in terms of deliverability.
- **Stakeholder input** – Stakeholders, through our working groups and forums, will have the opportunity to explore potential trade-offs between pathway options, which introduces more transparency and robustness in the process.

This approach to assessing pathway deliverability employs more of the analytical approach for option appraisals recommended by *The Green Book*.

The description of how we will assess pathway option deliverability in the modelling process is described in Section 4.2.4 of Chapter 4 - Model.

Appendix 7.2: Documentation and communication of the spatial evaluation

To ensure transparency throughout the spatial evaluation process, we will focus on maintaining documentation and effective communication throughout.

This includes documenting the methodology, data information and evaluation results in a clear, comprehensive manner.

This methodology provides a detailed explanation of the steps to be taken, the criteria used, and the specific approaches or techniques employed during the evaluation.

We will also document the sources of data used in the evaluation, including information on data collection methods, data quality assessments and any relevant data limitations. This documentation will help stakeholders and decision-makers understand the foundation of the evaluation and the reliability of the data used.

Furthermore, effective communication of the findings and recommendations will be crucial, particularly in the body of the evaluation. We will strive to present the results in a clear and accessible manner, using visualisations and plain language explanations to enhance understanding. We will tailor the communication to the needs and preferences of different stakeholders, ensuring the information is effectively conveyed to all relevant parties.

By documenting the methodology, data sources and results and by effectively communicating the findings and recommendations, we aim to maintain transparency throughout the spatial evaluation process. This will promote trust, allow for informed decision-making and enable stakeholders to understand the basis of the evaluation and its implications.

Appendix 7.3: Identifying and selecting relevant spatial factors for spatial evaluation

To conduct the spatial evaluation, it is essential to identify and consider the relevant spatial factors for assessment.

The process of identifying and selecting spatial factors involved a systematic and comprehensive approach to ensure the inclusion of relevant and reliable information. This needs to be acceptable to a broad range of stakeholders to ensure that consideration has been given to a wide range of factors for each technology in question. Representative, non-exhaustive examples of spatial factors are shown in Table 10:

Table 10: Spatial factors example

Spatial factors - examples			
Feature	**Object**	**Activity**	**Process**
Woodland	Roads	Mining	Flooding
Slope/topography	Buildings	Fishing	Erosion
Water resources	HV cables	Tourism	Sedimentation

The first step involves conducting a needs assessment to determine the spatial factors relevant to the optimum placement of in-scope infrastructure. This assessment consists of engaging with stakeholders, consulting experts and reviewing existing literature and reports to identify the critical themes and sub-categories of spatial factors that would be required as part of a comprehensive, fair and transparent evaluation. A literature review was conducted into academic publications, industry reports, government publications and other credible sources to identify datasets that would be relevant to situating energy infrastructure. A list of the existing studies, reports and databases reviewed included those sources listed in the following section:

- National planning policy documents including, Scotland's National Planning Framework 4[15], Planning Policy Wales[16], England's National Planning Policy Framework[17] and the DESNZ Nationally Significant Infrastructure Projects: National Policy Statements[18]
- *UK Marine Policy Statement*[19], *Scotland's National Marine Plan*[20]

[15] Scottish Government, *National Planning Framework 4* (2023) - gov.scot/publications/national-planning-framework-4/
[16] Welsh Government, *Planning Policy Wales* (2024) - gov.wales/sites/default/files/publications/2024-07/planning-policy-wales-edition-12.pdf
[17] Ministry of Housing, Communities and Local Government, *National Planning Policy Framework* (2023) - assets.publishing.service.gov.uk/media/669a25e9a3c2a28abb50d2b4/NPPF_December_2023.pdf
[18] Planning Inspectorate, *Nationally Significant Infrastructure Projects: National Policy Statements* (2012) - gov.uk/guidance/nationally-significant-infrastructure-projects-national-policy-statements
[19] Department for Environment, Food and Rural Affairs, *UK Marine Policy Statement* (2011) and guidance from 1 January 2021 (2020) - gov.uk/government/publications/uk-marine-policy-statement
[20] Scottish Government, *Scotland's National Marine Plan* (2015) - gov.scot/publications/scotlands-national-marine-plan/

- Government plans, strategies and objectives including HM Government's *Environmental Improvement Plan*[21], *Future Wales: The National Plan 2040*[22] and *The Environment Strategy for Scotland*[23]
- Examples of large-scale strategic plans, including the *UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4)*[24], *Environmental Report*[25]
- Spatial modelling resources and examples, including the Geospatial Commission (part of the Department for Science, Innovation and Technology), National Land Data Programme
- Energy sector examples including:
    - *Celtic Sea Floating Offshore Wind Leasing Round* 5[26]
    - *Marine Approach*[27]
    - *The Crown Estate and the Electricity System Operator mark a new chapter to accelerate journey to net-zero, nature-positive energy future*[28]
    - *Offshore Wind Leasing Round 4: Summary Stakeholder Feedback Report*[29]
    - *Offshore Wind Leasing Round 4: Resource and Constraints Assessment for Offshore Wind: Methodology Report*[30]
    - *Offshore Wind Leasing Round 4: Regions Refinement Report*[31]

[21] Department for Environment, Food and Rural Affairs, *Environmental Improvement Plan* (2023) - gov.uk/government/publications/environmental-improvement-plan
[22] Welsh Government, *Future Wales: The National Plan 2040* (2019) - gov.wales/future-wales-national-plan-2040
[23] Scottish Government, *The Environment Strategy for Scotland - The Environment Strategy for Scotland: vision and outcomes* (2020) - gov.scot/publications/environment-strategy-scotland-vision-outcomes/
[24] Department for Business, Energy and Industrial Strategy, *UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4)* (2022) - gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-4-oesea4
[25] Department for Business, Energy and Industrial Strategy, *UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4)* (2022) - gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-4-oesea4
[26] The Crown Estate, *Celtic Sea Floating Offshore Wind Leasing Round 5* - thecrownestate.co.uk/our-business/marine/round-5
[27] The Crown Estate, *Marine Approach* - thecrownestate.co.uk/our-business/marine/marine-overview
[28] The Crown Estate, *The Crown Estate and the Electricity System Operator mark new chapter to accelerate journey to net-zero, nature-positive energy future* (December 2023) - thecrownestate.co.uk/news/the-crown-estate-and-the-electricity-system-operator-mark-new-chapter
[29] The Crown Estate, *Offshore Wind Leasing Round 4: Summary Stakeholder Feedback Report* (September 2019) - thecrownestate.co.uk/media/3332/tce-r4-summary-stakeholder-feedback-report.pdf
[30] The Crown Estate, *Offshore Wind Leasing Round 4: Resource and Constraints Assessment for Offshore Wind: Methodology Report* (September 2019) - thecrownestate.co.uk/media/3331/tce-r4-resource-and-constraints-assessment-methodology-report.pdf
[31] The Crown Estate, *Offshore Wind Leasing Round 4: Regions Refinement Report* (September 2019) - thecrownestate.co.uk/media/3330/tce-r4-regions-refinement-report.pdf

- *Assessment of onshore wind and solar energy potential in Wales*[32]
- *Holistic Network Design Follow-Up Exercise*[33]

Stakeholder engagement played a crucial role in refining and identifying further datasets for consideration through workshops and meetings. Stakeholders across the four spatial evaluation pillars were invited to provide input on the types of data they deemed important for excluding, constraining or favouring the technologies in question. This engagement helped ensure a wide range of perspectives and expertise were considered in the selection of datasets.

Experts in the field of energy planning, environmental assessment, socioeconomic analysis and other relevant domains were also consulted to gain insights into the most appropriate datasets for the assessment. Their expertise and knowledge helped in identifying data sources, datasets and indicators widely recognised and accepted within the field. Through this extensive literature review and consultation process with stakeholders and subject matter experts, a comprehensive list of potential spatial factors was developed.

To create a refined list of inputs represented by suitable datasets, the following data selection criteria will be followed:

- **Data is available with national coverage** - Suitable national-scale datasets are available for use as part of the geospatial analysis. Datasets do not need to be created or collated from multiple sources such as combining data held by individual local authorities.
- **Data, or equivalent representation, is available for England, Scotland and Wales** - This criterion aims to minimise bias within the geospatial model by ensuring consistency in the availability of datasets across the devolved nations. If datasets are not available for all nations, equivalent datasets representing similar features are acceptable. For example, Agricultural Land Classification (England), Predictive Agricultural Land Classification (Wales) and National scale land capability for agriculture (Scotland) can be used as equivalent representations. Datasets that are embedded in relevant national planning policies and/or development plans, such as wild land unique to Scotland, are also considered relevant for inclusion in the SSEP.
- **Data is available at a strategic scale** - Point source data is not considered appropriate for inclusion as these data points cannot be accurately represented within the spatial context of the SSEP and are avoidable at a local level. Given the use of hexagon grid cells as part of the geospatial analysis, the inclusion of point source data is not considered appropriate. Point source data representing features that require a notable buffer zone and cannot be easily avoided at a local level

[32] Welsh Government, *Assessment of on-shore wind and solar energy potential in Wales* (2019) - gov.wales/assessment-shore-wind-and-solar-energy-potential-wales
[33] National Grid ESO, *Holistic Network Design Follow-Up Exercise* (November 2022) - neso.energy/document/270851/download

may be included. An example of this is a listed building, where a buffer can be applied to account for potential impacts on the setting of the asset.

- **Data quality is suitable for the purposes of the SSEP** - The suitability of data is assessed based on the dimensions outlined in the UK *Government Data Quality Framework*[34]. The framework identifies six core data quality dimensions: completeness, uniqueness, consistency, timeliness, validity and accuracy. When evaluating data quality, it is important to consider user needs and make trade-offs when necessary. It may not always be feasible to achieve optimal data quality, but efforts should be made to ensure that it is fit for purpose. This may involve making trade-offs between different dimensions of data quality to ensure it is as suitable as possible for the SSEP.
- **Relevance** - Datasets must be relevant for inclusion in the SSEP. While some spatial factors may be suitable for inclusion in other spatial frameworks or plans, their relevance to the scope of the SSEP needs to be considered. Spatial factors are deemed suitable for inclusion if the presence of the feature could impact the potential acceptability of at least one of the infrastructure types within the scope of the SSEP.

Figure 22 summarises the criteria to develop a refined list of datasets which are assessed for inclusion as follows:

- Datasets assessed as 'green' across all five criteria categories are considered suitable for inclusion.
- Datasets that receive at least one 'red' ranking are determined to be unsuitable for consideration in the SSEP.
- Datasets that receive 'amber' rankings against at least one criterion category may still be suitable for inclusion in the spatial evaluation. In such cases, trade-offs and the availability of other information for the spatial evaluation will be considered on a case-by-case basis to determine their suitability for use. The justification for including or excluding datasets that receive 'amber' rankings will be documented.

It is noted that datasets considered unsuitable for inclusion in the spatial evaluation, such as those that have limited spatial coverage, may still be considered within the broader SSEP; for example, as a contextual 'overlay' for information purposes only.

[34] UK Government, *The Government Data Quality Framework* (December 2020) - gov.uk/government/publications/the-government-data-quality-framework/the-government-data-quality-framework

Criteria category	Criteria		
Data available with National coverage	Data currently available with consistent National coverage	Dataset has only partial coverage or requires collation from multiple sources	Dataset not currently available
Data (or equivalent representation) available for England, Scotland and Wales	Datasets or clear equivalents available for England, Scotland and Wales	Dataset limited to England, Scotland and/or Wales, but embedded in relevant national planning policy	Dataset limited to England, Scotland and/or Wales, and not embedded in relevant national planning policy
Data available at strategic scale	Polygon/line data available at strategic scale	Point data requiring large buffers	Point data requiring no/limited buffers and therefore likely avoidable at local level
Data quality is suitable for the purposes of the SSEP	Data suitable. For example, official statistics, Government published or widely accepted as valid, based on creation date or date of latest update	Data may be suitable. For example, experimental statistics, academic study and so on	Data not suitable. For example, insufficient quality for statistical analysis, considered invalid or inaccurate based on creation date or date of latest update and so on
Relevance to decision-making	Of relevance for decision-making relating to at least one infrastructure type at strategic level	Of relevance for decision-making relating to at least one infrastructure type at local level	Unlikely to influence decision-making for any infrastructure type
Key	**Data suitable**	**Data may be suitable**	**Data not suitable**

Figure 22: Criteria to develop refined list of datasets

Appendix 7.4: How spatial evaluation pillars and categories are considered in the spatial evaluation

Consideration of technical engineering design requirements within the spatial evaluation

For the purposes of the SSEP, technical engineering design requirements can be defined as 'the operational factors that need to be in place for in-scope energy generation infrastructure to function correctly over time'. This means that they include, for example, adequate wind resource for wind farms, but also access to the strategic road network so turbine components can be transported for construction and maintenance along with proximity to existing energy network infrastructure. Other examples include adequate solar radiation levels for network-connected solar panels and for a minimum viable footprint in terms of land needed for a grid-scale solar farm. These are also 'spatial opportunities', as described in Section 4.2.3 of Chapter 4 - Model. They can, to varying degrees, support the potential siting of in-scope infrastructure.

Our technical engineering design requirements approach is underpinned by the need to consider strategic-scale efficiency and operational factors of in-scope energy infrastructure at a strategic plan level rather than assessing project-scale factors, which are more appropriately considered through the regional and local planning and consenting processes.

The approach will also seek, wherever possible, to account for relevant and emerging technology improvements of in-scope energy infrastructure within the planning period. For example, advancements could improve efficiency and reduce the minimum level of viable land taken for each generation technology. In doing so, the approach seeks to optimise land and sea use. This means maximising compatibility and complementarity with other spatial uses and minimising conflict with them based on a mitigation hierarchy.

Suitable technical engineering indicators for consideration within the geospatial analysis were identified and subdivided into five main categories:

- resources
- terrain and seabed
- resilience to hazards
- access to transport
- proximity to energy network

Consideration of other spatial uses within the spatial evaluation

The SSEP will consider cross-sectoral demand on land and sea so that future decisions can accurately reflect energy requirements and enable effective decision-making. While the SSEP is not intended to be a cross-sectoral plan, assessment of land and sea in relation to energy infrastructure cannot be carried out in isolation. This must also consider

wider government policies on land use including (but not limited to) food production, transport, water supply and fisheries. We will consider water usage and availability for in-scope technologies to help determine the suitability of locating assets zonally, spanning over the lifetime of the assets.

The spatial evaluation is part of the evidence base for the SSEP. As such, it informs the objectives of the SSEP and is not intended to be used to assess sectors other than energy.

Key principles for alignment

Wherever possible, we will seek to integrate SSEP marine and terrestrial planning with other spatial plans by:

- ensuring consistency and compatibility where possible between the SSEP and existing spatial plans (single sector and cross-sectoral) in England, Wales and Scotland for energy infrastructure, as well as other government programmes such as Defra's Land Use Framework and Marine Spatial Prioritisation Programme
- adopting a strategic, zonal level approach that does not make site-specific recommendations, nor seek to resolve trade-offs and prioritisation decisions between sectors at an individual project level
- liaising with respective responsible authorities and other sectoral stakeholders for terrestrial and marine spatial planning (including plan development, implementation and review stages) so we can leverage strengths and opportunities and identify emerging challenges early
- ensuring a transparent evidence base and sharing best practice and available data where relevant and appropriate (including The Crown Estate's Whole of Seabed evidence base) to maximise consistency in planning and decision-making
- considering interactions between land and sea policies to provide a holistic view of spatial demand for energy infrastructure
- considering cumulative environmental effects of multiple sectors through processes such as the SEA, HRA and MCZ assessment

Selected spatial uses indicators

Suitable other spatial uses indicators for consideration within the geospatial analysis were identified and subdivided into five main categories:

- utilities and services
- primary production
- urban and transport
- minerals and waste
- defence

Consideration of environmental factors within the spatial evaluation

The spatial evaluation will form the basis of how environmental factors are integrated into the SSEP. The following sections provide a high-level overview of how environmental aspects will be considered.

The mitigation hierarchy, as illustrated in Figure 23 and set out in planning guidance across the UK, follows an order for which the impacts of development should be considered and addressed. This aligns with the environmental principles of prevention, precaution and integration. The spatial evaluation will focus on the first two stages of the mitigation hierarchy which are most relevant to the SSEP.

Figure 23: Mitigation hierarchy

We will first use geospatial analysis to verify that key environmental constraints, which we call spatial exclusions, can be avoided. We will then look for suitable developable areas that minimise or reduce risk of harm to environmental features or factors, which will form the spatial constraints.

Due to the strategic nature of the SSEP, the approach to considering mitigation and compensation will also need to be strategic. The SEA, HRA and MCZ assessments (where required, if likely significant effects are identified or if there is derogation) will look to consider environmental mitigation and compensation on the draft SSEP at a high level. Any measures identified will be broad to reflect the strategic nature of the plan. Bespoke mitigation and compensation will be considered, where necessary, at the project level, where impact pathways can be developed in detail as part of the consenting process.

Selected environmental indicators

Suitable environmental indicators for consideration within the geospatial analysis will be subdivided into five main categories:

- ecology and biodiversity
- cultural heritage and historic environment
- geology and soils
- water
- landscape

The environmental indicators will include spatial constraints such as statutory and non-statutory designated sites or features, highly sensitive habitats and areas of environmental risk.

We will also consider sites or features which have been identified as important in meeting the UK, Scottish and Welsh governments' environmental objectives, such as those suitable for habitat restoration and enhancement. These areas will need to be avoided, or the interaction with them minimised, to avoid undermining UK, Scottish and Welsh governments' environmental objectives.

Consideration of societal factors within the spatial evaluation

The views and feedback we receive from societal stakeholders will be used to populate, test and calibrate the metrics used in the spatial evaluation as described previously. The focus will be on how societal groups may perceive potential infrastructure in non-specific settings or references.

We anticipate that feedback will be wide and varied and individual areas and groups will have their own unique interests, points of view and values. It will be impossible for there to be a single 'societal view' from which the SSEP can be developed. However, we will take all feedback into consideration and use that to inform our spatial evaluation and decision-making.

Selected societal indicators

Suitable societal indicators for consideration within the geospatial analysis were identified and subdivided into four main categories:

- recreation and tourism
- employment
- health and wellbeing
- community and visual amenity

For all spatial evaluation pillars, metrics related to each indicator will be included within the geospatial analysis. Specific metrics will also be developed specific to each technology type to reflect their individual risk profiles. For example, each technology will have different environmental and engineering risks.

Our metrics will also consider any differences in policy and data availability between the devolved governments and between marine and terrestrial environments. To prevent unjustifiable prioritisation of one area over another, consistency is an important factor in the selection of metrics and has been carefully considered in the spatial evaluation. See Section 3.4 of Chapter 3 – Prepare and Appendix 7 for more detail.

Appendix 8: External Markets

This section details the background behind the options we considered in our approach to modelling external markets, summarised in Section 3.3.13 of Chapter 3 - Prepare.

1. Explicitly modelling the plant list

For neighbouring markets, we will explicitly model the plant list. This approach enables us to derive a dynamic price that can adjust based on interactions with other markets, such as flows to and from GB. Additionally, the price can vary depending on different inputs to the model, such as changes in fuel prices. Having a dynamic price is crucial for accurately modelling interconnector flows.

We have chosen not to pursue the alternative of using predetermined market prices. These prices would be derived from a prior simulation where the plant lists are modelled and the resulting market price output for each external market would then be fixed as input for future runs. This method would lead to reduced run time, since we do not need to model all the plant lists in external markets.

However, the drawback with this method is that as GB imports or exports from an external market, the prices remain static, leading to inaccurate flow representation. Since we will be optimising the build out of new interconnectors in the economic modelling, it is important to accurately model interconnector behaviour.

Therefore, we will explicitly model the plant list for countries connected to GB or where new interconnectors are being considered. For markets not connected to GB, the benefits of explicit modelling do not justify the increased run time. Consequently, all other markets will use predetermined prices.

2. Using a predetermined capacity expansion pathway

For all external markets, we will use a predetermined capacity expansion pathway, which means the growth of each technology in these markets is fixed in the model. Alternatively, we could start with a reduced capacity for each plant type, set at the 2030 value, and then allow the economic modelling tool to optimise the build out of new plants in each market.

The modelling simulation tool optimises the entire system. If we were to optimise the expansion of external markets, it would be optimising for GB plus the external markets. Consequently, decisions would be made in the best interest of the whole system, but not necessarily in the best interest of GB. For instance, it might determine that building numerous plants in GB and exporting the electricity to other markets is optimal. This would mean that GB would bear the majority of the costs and, even though the overall whole system is better off, GB individually may not be.

The results of optimising the expansion of external markets could also have political implications. For instance, it might be optimal to build more plants in France and then

import the electricity to GB. However, it would not be possible to enforce or encourage any construction in an external market, making it unreliable for GB's build out. Therefore, any results obtained in this manner would need to be verified and tested for robustness to see if they are viable and meet GB's security of supply requirements. Additionally, the data available for external markets is limited and less detailed than the GB data. For instance, we will not conduct geospatial analysis for external markets or divide these markets into zones as we do for GB. Moreover, optimising the expansion of additional markets significantly increases the run time, which reduces the time available for running results and analysing them. This also leaves less time for performing sensitivity analysis.

A drawback of using a predetermined capacity expansion pathway is its lack of variability, which can be inaccurate in certain situations. For instance, in a modelling scenario where one technology is made significantly cheaper, it is reasonable to expect that this would also apply to external markets and be reflected in their build out. Therefore, we will adjust the capacity growth pathways for specific modelling scenarios as needed. Additionally, we retain the option to run the capacity expansion for external markets for sensitivities (if required) or to create our own capacity growth pathways for use in other sensitivities. For the base runs, therefore, we will use a predetermined capacity expansion pathway for all external markets.

3. Using the same pathways as FES 2025

Outside of specific modelling scenarios or sensitivities as mentioned earlier, we will use the same capacity expansion pathways for external markets as those used by FES 2025. This approach uses the *Ten-Year Network Development Plan* (*TYNDP*[35]) as the foundation and employs capacity expansion to develop certain modelling scenarios out to 2050.

Appendix 9: Robustness testing for output sensitivities

This section provides more detail behind the process of testing robustness, as described in Chapter 4 - Model.

If, for example, the initial modelling outputs recommend a significant volume of a certain type of generation, then this will be the first focus of our output sensitivity analysis. In this case, there are several options (although the following list is not exhaustive) for how we could carry out sensitivity analysis:

- Limit the maximum capacity or maximum build rate that is allowed for the given technology. This is useful in determining what the alternative(s) are.

[35] ENTSO-E, *Ten-Year Network Development Plan* - tyndp.entsoe.eu/

- Increase the cost of the given technology. The magnitude of the increase required to cause a decrease in the capacity of the given technology by a certain amount is a very good measure of the robustness of the original recommendation.
- Decrease the cost of other technologies until they displace the given technology. This is a good measure of the robustness of the cost assumptions of the given technology.

In each case, we may use any or a combination of any of these options. Each time a sensitivity is run, the economic modelling simulation tool will find the optimum outcome. Therefore, once we have run all the sensitivities we wish to test for the modelling scenarios, we will have many outcomes.

The method shown in Figure 24 will be used to combine the components (zonal capacity of a given technology) of these outcomes.

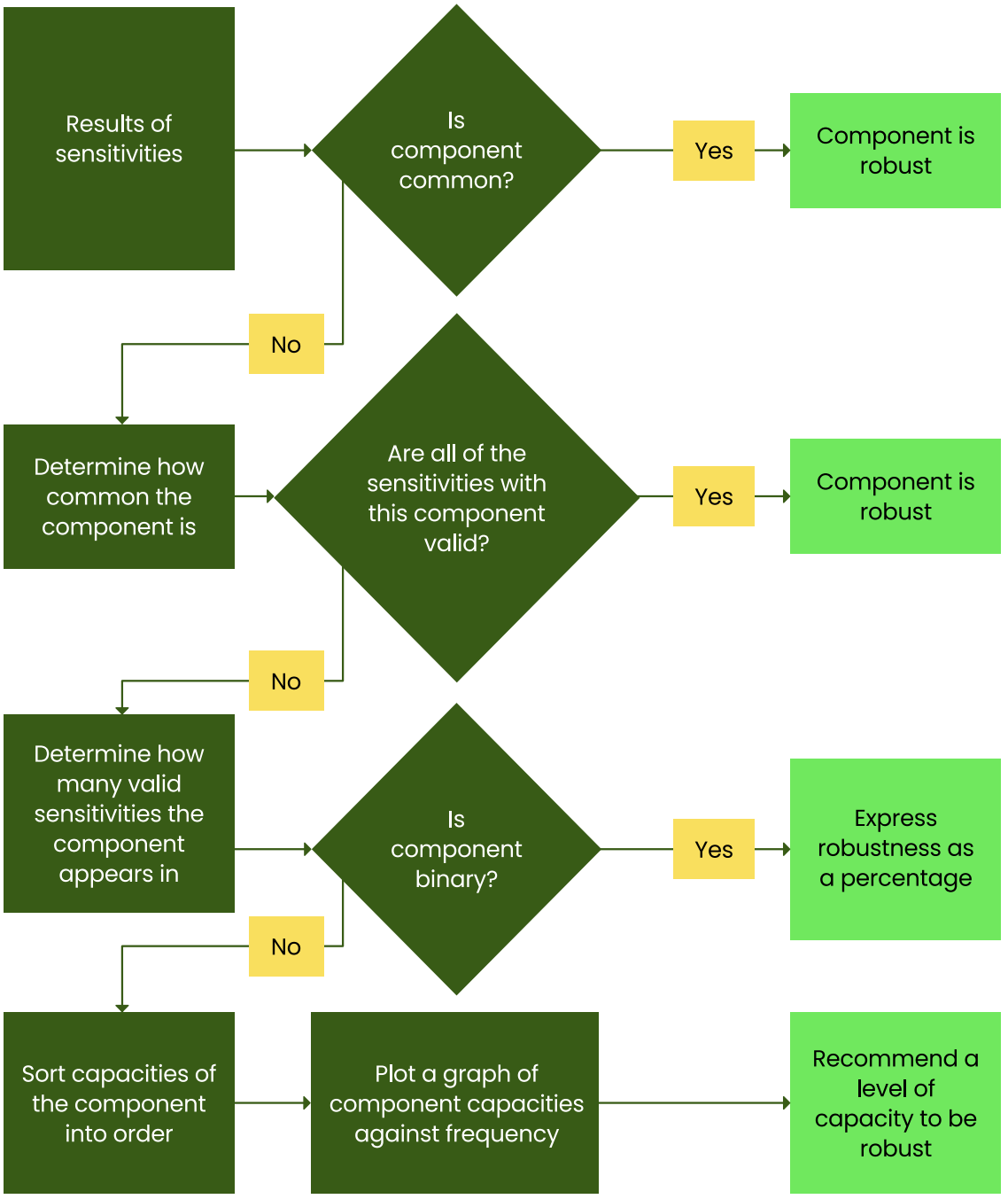
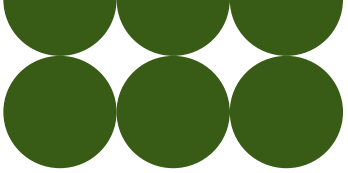


Figure 24: Determining the robustness of components

The input to the process is the results of all the sensitivities for the modelling scenarios (that is, the outcomes). If the component appears in all the sensitivities that have been considered, we will consider this robust. However, this is a very unlikely situation that will probably only occur in a very small number of binary components (for example, large nuclear stations). If the component is not common to all sensitivities, then the next step is to determine how common the component is.



At this point, we will consider the validity of each output sensitivity. It is likely that some of the sensitivities that have been considered will be too extreme. These sensitivities will be excluded from this analysis as they would skew the results if they were included.

The validity of a sensitivity may also be questioned if a number of sensitivities have been conducted with very similar changes. For example, if sensitivities investigating an increase in the capital cost of solar generators where the cost was increased by 19%, 20% and 21% had been run, it would be inappropriate to include all three as valid sensitivities. The differences between them are very small and they would likely have very similar outcomes. The categorisation of whether a sensitivity is valid or not is inherently subjective; however, the reason that this method has been chosen is that it removes the requirement to assign probabilities to sensitivities, reducing the problem to a simpler question of binary validity.

In most cases, not all output sensitivities will be considered valid. In these cases, the next step is to filter out the invalid sensitivities. The final stage depends on whether the component is binary or not. An example of a binary component is a large nuclear station, which can be either built or not built. Most components could have any capacity (within certain minimum and maximum build limits) and will therefore be non-binary.

If the component is binary, then it will either appear or not appear in each output sensitivity outcome. The robustness of the component will then be expressed as the percentage of sensitivities in which it appears.

If the component is non-binary, then the capacities of the component built in each sensitivity will be sorted into order. We will plot them on a graph against the frequency that a given capacity is equalled or exceeded.

Once this has been done, we will determine the robustness level for the component. This will be done in a similar way to how the validity of sensitivities is determined. A frequency level that is deemed credible will be chosen and the associated capacity increase will become the ‘robust’ level.

Once the ‘robust’ level has been chosen for all components, this will be run through the economic modelling simulation tool for one final optimisation. This is because simply summing all the ‘robust’ level capacities for all components will not necessarily combine into a coherent, holistic outcome.

The minimum and maximum build limits for each non-binary component will be adjusted according to the frequency graph. With the ‘robust’ level as a mid-point, the slope of the frequency curve as capacity is increased and decreased and used to determine the new minimum and maximum build limits. The result of this final optimisation will be a universally optimised outcome where all the components are within a tolerance around their ‘robust’ level (that is, the pathway for that modelling scenario).

Comparing components across modelling outputs

Once we have modelling outputs for all modelling scenarios, the components that make up these can each be evaluated in the other modelling scenarios. This helps understand the level of risk involved when making decisions. As there will be a large number of

components to consider, only the components that have the largest impact on the modelling outcome will be evaluated in this stage.

The component being evaluated will be forced in an optimisation simulation in our economic modelling tool, the outcome will be sub-optimal and therefore will have a higher total cost. The risk will be quantified as the regret of pursuing an optimal component of a pathway for one modelling scenario against another modelling scenario. The regret value is the difference in total cost between the optimum output for the modelling scenario and the total cost of the revised outcome. This approach must be used with care as there may be cases where the policy decisions that formed two modelling scenarios are so divergent that applying an optimum component from one modelling scenario in the other modelling scenario may not be credible. The process flowchart is outlined in Figure 25.

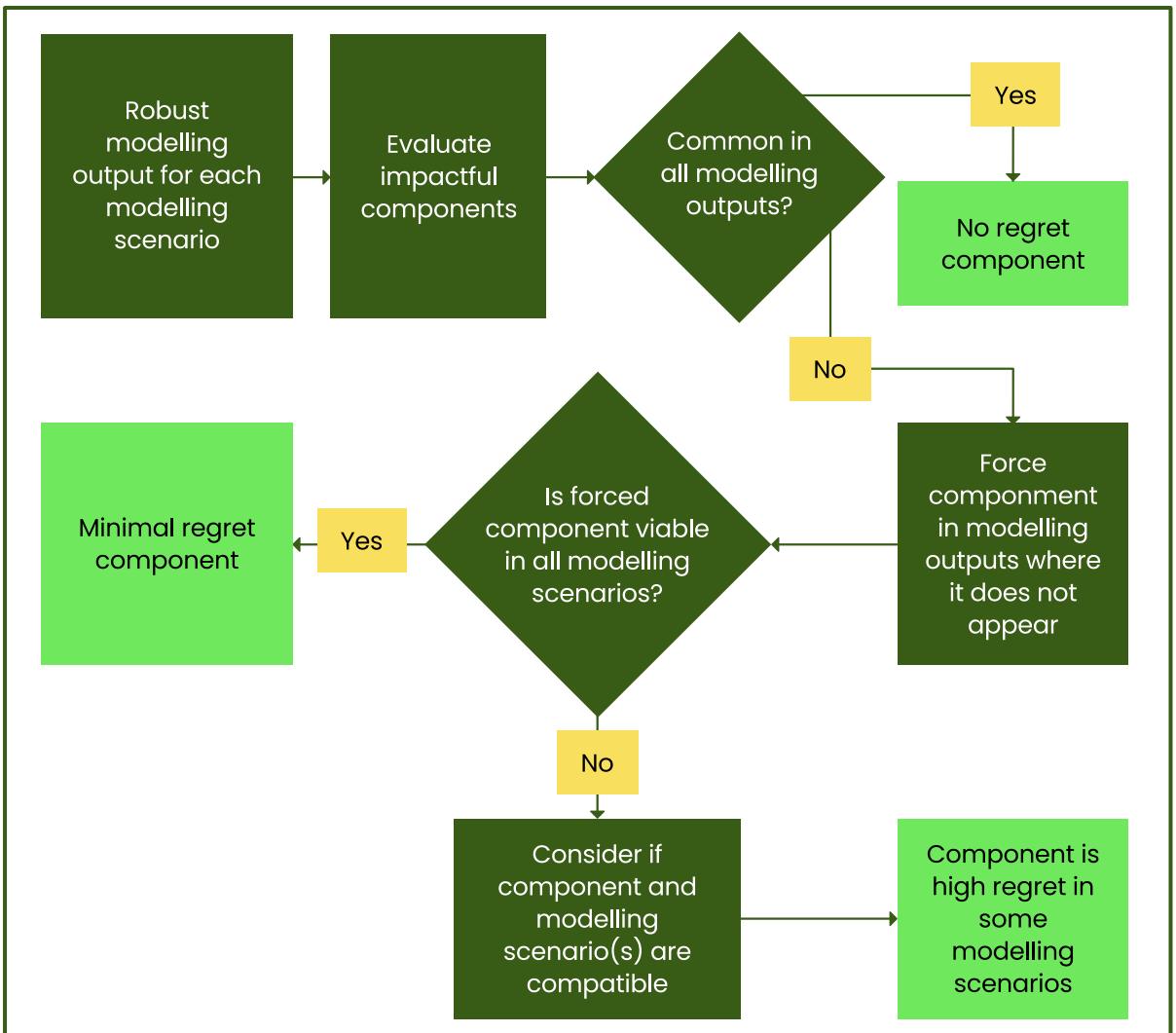


Figure 25: Comparing components across modelling outputs

Appendix 9.1: Deliverability assessment at pillar level

This section provides more detail on how we determine impact ranges and our approach to swing weighting as part of the deliverability assessment.

Through our iterative modelling approach, we establish a range of impact outcomes which help determine the low (0) and high (100) impact ranges described in Section 4.2.4 of Chapter 4 - Model:

1. **Highest observed impact on spatial factors, informing the lowest cost of meeting forecast demand in the economic model:**
    - This allows the economic model to place generation and storage infrastructure anywhere that is not excluded and does not consider spatial constraints.
2. **Lowest observed impact on spatial factors, informing (alongside other economic modelling tool inputs) the highest cost of meeting forecast demand in the economic model:**
    - This forces generation and storage infrastructure into areas with the least impact on spatial constraints, which may not align with the optimal economic zones in our economic modelling.
3. **Optimised balance of impact on spatial factors and cost of meeting forecast demand in the economic model:**
    - This iteratively identifies a balance between economic factors (cost of moving generation and storage between economic zones) and spatial factors (optimising a spatial threshold for overall spatial constraint) to meet forecast demand.
    - The balanced impact on economic and spatial factors will fall between the extremes established in outcomes 1 and 2.

Deliverability, and subsequently any required weighting[36] at the pillar level, would be derived from analysis and engagement with stakeholders and from societal research. This process would consider the following factors:

- the identified, quantitative, potential impact on each pillar determined through our spatial suitability approach (objective)
- the relative difference between the most and least deliverable options on each pillar (subjective)

[36] Swing weighting is a process used to derived weights for criteria, considering the relative difference between the best and worst performing option on each pillar and how important that difference is in relation to the desired outcome. Pairwise weighting involved directly comparing two criteria at a time to determine which is more important and by how much.

- how important stakeholders consider that difference to be in relation to the deliverability of the energy system

We intend to assess each modelling output for deliverability in terms of economic and spatial factors. As such, swing or pairwise weights will only be determined against modelling outputs that are not considered to be deliverable. Stakeholders have invested time and resources to support the creation of robust modelling outputs through the identification of indicators, spatial exclusions and scoring spatial constraints and opportunities. Therefore, we will take a reserved approach to applying weighting and will only do so if necessary and in consultation with stakeholders.

Applying these steps in assessing and optimising (if required) deliverability introduces robustness and transparency in the pathway development process and ensures that key trade-offs are identified to facilitate informed decisions on a final pathway.

Appendix 10: SEA monitoring and implementation plan

Regulation 17 of the English and Welsh SEA Regulations and Section 19 of the *Environmental Assessment (Scotland) Act 2005* require the responsible authority to monitor the significant environmental effects of the implementation of the plan.

The purpose of this is to identify unforeseen adverse effects at an early stage so remedial action can be taken.

SEA monitoring evaluates the sustainability performance of the plan and its compliance through its implementation. It also checks whether the effects predicted in the SEA occur as envisaged or whether unforeseen issues arise.

Monitoring can help evaluate whether the SSEP is fulfilling its core objectives of delivering sustainable development and providing a high level of protection of the environment. The information gathered through monitoring will inform the review and preparation of subsequent iterations of SSEP and the plans and projects that sit within them, thus better influencing future planning decisions.

In response to this, an SEA Monitoring and Implementation Plan will be prepared at adoption of the SSEP. The document will set out an approach to monitoring, which will:

- prioritise monitoring requirements
- set clear roles and responsibilities for monitoring
- develop specific thresholds and key performance indicators where monitoring shows intervention is required

- suggest how preferred environmental outcomes can be cascaded down to other plans associated with the SSEP (for example, the Centralised Strategic Network Plan), as well as individual projects
- set out the approach to adaptive management which ensures the plan can be reviewed where appropriate, including through later iterations of the SSEP

Appendix 11: Consultation feedback response

This appendix provides a comprehensive overview of the feedback received from stakeholders on the SSEP draft methodology. It details how we have considered and acted on the main feedback themes to inform the development of the final methodology.

Overall, 42% of respondents found the draft methodology appropriate and capable of meeting the SSEP requirements. Many of the comments were to request clarifications or to provide recommendations for consideration in the final SSEP methodology and its ongoing development.

Key themes identified include:

- the need for a coordinated approach to strategic planning
- clarification on what is and is not within the scope of the SSEP
- integration of environmental considerations
- importance of stakeholder engagement
- approach to spatial evaluation and economic modelling

Introduction and background

In December 2024 and January 2025, we conducted a consultation to gather insights and feedback on our proposed SSEP methodology. The feedback we received was invaluable in helping us understand the perspectives of our stakeholders and shape the SSEP.

Thank you to everyone who took the time to provide feedback and help us enhance the SSEP methodology. Simultaneously, we consulted on our Centralised Strategic Network Plan (CSNP) high level principles and the transitional Centralised Strategic Network Plan 2 (tCSNP2) refresh methodology. These documents are available under projects and

publications on our Strategic Planning page[37].These documents were promoted on our website, through our working groups and a webinar[38] open to all interested parties.

The consultation generated 137 responses from organisations and individuals. Participants included national and local governments, transmission owners, distribution networks, energy industry experts, interest groups, advisory bodies, community groups and members of the public. Together, they provided a breadth of valuable feedback and insight about our draft methodology.

Since the consultation closed on 20 January 2025, we have assessed all comments and, where appropriate, updated the methodology to make changes and clarifications. These are described in the following section. In addition, we have also made further changes based on stakeholder feedback and developments in our thinking since the publication of our draft methodology. These additional changes and clarifications are listed in Appendix 12.

Key themes

Strategic planning and coordination

Many respondents supported our strategic planning approach, emphasising the need for coordination with other plans and policies to address the country's energy needs. It was requested that further clarification on the interactions between the SSEP and regional, local and GB-wide energy planning is provided.

National and local plans

Based on consultation feedback, we have updated Section 2.8 of Chapter 2 – Foundations to clarify the role and importance of strategic GB policies and programmes that we need to consider.

In April 2025, Ofgem published its policy framework decision for the role of RESPs. NESO will be responsible for the development of RESPs for Scotland and Wales and nine regions in England. We will be working with a wide range of stakeholders across the three nations to help understand future energy needs and to set out where strategic investment by energy distribution networks will be required.

RESPs will be engaging with stakeholders including local councils, energy providers, networks and communities to develop 'bottom-up' plans. As a strategic plan, the SSEP will not specify individual projects, nor will it deal with local area plans, the latter of which will be considered as part of RESPs. We acknowledge that early engagement with local authorities, planning bodies and other stakeholders is essential to ensure that the SSEP and its role are understood.

[37] NESO, Strategic Planning - neso.energy/what-we-do/strategic-planning/strategic-energy-planning-sep-publications-consultations-and-updates

[38] NESO, Strategic Planning Webinar (December 2024) - neso.energy/what-we-do/strategic-planning/strategic-energy-planning-sep-publications-consultations-and-updates#Consultations-webinars-and-next-steps

Cross-strategic plan interactions

The relationship between the CSNP, RESPs and the SSEP will be iterative, with each plan interacting and updated regularly. The final SSEP methodology document now includes expanded details on how the SSEP interacts with other relevant NESO Strategic Energy Plans (SEP), found in Section 2.8 of Chapter 2 – Foundations.

Scope of the SSEP

Many respondents to the consultation asked for greater clarity on the SSEP's scope, including clarity on its primary focus and areas for future iterations. Suggestions were made to include natural gas from the start for a whole system approach, incorporating hydrogen and emerging technologies.

Scope

A revised Section 1.3 of Chapter 1 – Introduction now clarifies what is and is not within the remit of the SSEP. High-level milestones have also been added to enhance understanding and visibility across different SEP plans. The first SSEP will be a GB-wide plan, mapping potential zonal locations, quantities and types of electricity and hydrogen generation and storage infrastructure, to help accelerate and optimise the transition to clean, affordable and secure energy across GB. In taking a zonal approach to locations, the SSEP will not identify or recommend specific projects to be delivered.

Whole system approach

As specified in the commission, the first iteration of the SSEP will focus on electricity generation and storage, including hydrogen assets. In the future, the SSEP could include other types of energy, like natural gas, considering lessons learned from the first iteration and wider UK, Scottish and Welsh government policy.

Environmental considerations

Stakeholders praised the SSEP's focus on environmental protection while aiming for net zero. They regarded it as a key opportunity to enhance biodiversity, nature recovery and natural capital strategically. Feedback indicated strong support for incorporating an SEA and HRA into various stages of the SSEP. This integration is viewed as crucial for ensuring that energy infrastructure developments have minimal environmental impact. The necessity to incorporate environmental assessments, such as SEA, HRA and MCZ assessments into the planning process was stressed alongside integrating the mitigation hierarchy (a description of which is provided in Appendix 7.4). Respondents highlighted the importance of maintaining high levels of stakeholder engagement throughout to guarantee comprehensive and transparent assessments.

Assessment of environmental interactions

We have updated Section 2.6 of Chapter 2 – Foundations to set out how we will assess the potential environmental impacts of the strategic energy infrastructure options, pathways and draft SSEP through an MCZ assessment, in addition to an SEA and HRA. MCZs in English, Welsh and Northern Irish territorial and offshore waters are designated under the *Marine and Coastal Access Act 2009 (MCAA)*. Marine Protected Areas (MPA) in Scottish

territorial waters are designated under Section 1 of the *Marine (Scotland) Act 2010* and under the *MCAA 2009*. Together, they provide protection for a range of important marine habitats, species and geological formations across GB waters.

These environmental assessments will be informed by work already underway or completed on relevant plan-level assessments. Due to the strategic GB-wide nature of the SSEP, the plan-level assessments relevant for consideration will be at a regional or national level. These will be identified during the SEA scoping and HRA evidence gathering and MCZ assessment screening stages. We will engage with the plan-level assessment owners during the relevant stages of the SSEP to make sure our approaches are coordinated and consistent. Section 2.6 of Chapter 2 – Foundations has been revised to elaborate on the SEA, HRA and MCZ assessment processes, their interaction with the SSEP development stages and to provide a high-level overview of each phase. Additionally, a new visual representation has been included to illustrate the alignment of the SEA/HRA with the SSEP development stages. We will include the MCZ assessment process in this visual in future iterations.

Biodiversity policy

One of the UK, Scottish and Welsh governments' key environmental commitments is to ensure habitats for wildlife are left in a measurably better state than they were before. The Scottish Government has set out a national planning policy to protect biodiversity, reverse biodiversity loss, deliver positive effects from development and strengthen nature networks in the terrestrial domain. The National Planning Framework 4 also extends to the marine environment when considering renewable energy developments offshore. The Welsh Government is promoting the adoption of Net Benefits for Biodiversity (NBB) and in England it has been made mandatory for developments to achieve Biodiversity Net Gain (BNG). We will work with stakeholders to understand the potential ways in which the SSEP may help support biodiversity policy across the three governments. We are also aware of developments in Marine Net Gain (MNG) and will similarly work with stakeholders to understand the implications as the SSEP develops further.

Stakeholder engagement

Respondents appreciated the transparency and engagement opportunities throughout the development of the draft methodology to date. Many found the planned webinars and meetings helpful, with the level of detail appropriate, informative and well presented. The inclusive approach through the establishment of an Environmental Working Group (EWG) was particularly welcomed.

Stakeholders welcomed the breadth, inclusivity and structure of our approach to stakeholder, societal and community engagement, while suggesting that any public consultations take heed of the Gunning Principles. Overall, stakeholders welcomed the breadth and depth of our societal research, but asked for further clarity as to how it would impact the evaluation framework and the SSEP as a whole. In general, respondents welcomed our proposed use of artificial intelligence (AI) to ensure that a diversity of views and opinions are considered during the development of the SSEP. Using AI will help us to process large volumes of feedback quickly and accurately, ensuring that no valuable insights are overlooked, and to identify patterns and trends within the feedback that might

not be immediately apparent to human reviewers alone. However, several stakeholders raised concerns about the ability of AI to understand context and nuance, highlighting the importance of human review and validation.

It was suggested we broaden out the scope of engagement as well as engage a wider range of energy industry stakeholders beyond the current Industry Working Group. Recommendations were made for more active engagement with local communities, especially in potential host areas, recreational land users, investors and detailed consultations with statutory environmental consultees. Stakeholders requested more opportunities to consult during the development of pathways, rather than the one pathway chosen by the UK Energy Secretary as part of the draft SSEP consultation. Some respondents felt that the consultation period for the draft methodology was too short with the time allocated for stakeholders and the public to review and respond to the proposed plan being inadequate.

Wider industry engagement

The commission provided a very clear governance structure. However, some stakeholders questioned the membership of these groups as being too narrow. We continuously review our working group membership and see benefit in expanding our Expert Advisory Group, which performs the important role of bringing together our stakeholder working groups and the external governance groups. A full list of members of our working groups are available in Appendix 2.1.

We have updated Section 2.4.2 of Chapter 2 – Foundations to reflect the extent of our engagement, including our ongoing and regular activities with the energy industry. Alongside our SSEP-specific working groups and forums, we are using existing NESO forums and industry networks, such as Task and Finish Groups, to engage with developers. In response to feedback, we are committing to running technical webinars for industry stakeholders throughout the development of the SSEP to ensure a wider reach. Additional details of these webinars can be found on our website[39]. To ensure we are engaging the right people at the right time, we will seek regular feedback from the working groups that approaches are timely, transparent and accessible, as well as conducting an ongoing stakeholder mapping exercise so we engage with the most appropriate stakeholders at the right time in the process. We have also provided clarification on how we will balance the range of views from stakeholders to inform our decisions.

Host areas

During the development of the SSEP, we will provide early opportunities for communities to have their say on strategic planning that may be relevant to them. Our final methodology reinforces our commitment to help these areas understand the process and signpost them to how they can engage and influence the developments in their area.

[39] NESO, Strategic Planning - neso.energy/what-we-do/strategic-planning/strategic-spatial-energy-planning-ssep

The Gunning Principles

Based on stakeholder feedback, we will adopt the Gunning Principles in planning and delivering our engagement and consultation activity. The Gunning Principles are designed to make consultation fair, accessible and worthwhile. More information on these principles can be found in Section 2.4.1 of Chapter 2 – Foundations.

Artificial Intelligence

In Section 6.2.3 of Chapter 6 – Consult, we have provided more information on how we will use AI in practice. When we make decisions on the SSEP, AI will help ensure that the voices of all stakeholders are heard and considered. However, AI will not be used to make decisions autonomously, but serve as a tool to enhance, rather than replace, human judgement and support decision-making. All feedback received from stakeholders on the SSEP will be read and reviewed by a human in both its raw and summarised forms. We will regularly review our use of AI in interpreting stakeholder responses, and we will be able to track any stakeholder insight identified by AI to its original source.

Societal research

In Sections 2.5.2 of Chapter 2 – Foundations and Appendix 2, we have clarified where and how societal research will be considered in the development of the SSEP. Societal research will gather the views of different demographics and segments of society across GB. Our 9,000-sample opinion survey is supported by a series of focus groups, split both regionally and demographically, allowing us to further analyse and understand findings from the opinion survey. This survey will inform a societal assessment process, which will provide insight into societal views on potential pathways to support and inform pathway decision-making as part of the evaluation framework. This assessment will be considered alongside the outcome from expert working groups and societal and community stakeholders having their say on modelling outputs. Together, by considering a range of perspectives and the potential impact of pathways on various regions, communities and sectors of society, we can gain an understanding of their potential acceptability. This will help to ensure a comprehensive and inclusive societal appraisal of the pathways.

Pathways

The commission is clear that the UK Energy Secretary will choose the pathway to be used for the draft SSEP consultation We have considered stakeholder feedback carefully and, in the context of the commission, we will share information on the outputs of the modelling with our expert working groups, societal and community stakeholders. This will provide greater transparency as well as the opportunity for additional input on the development of the pathway options to be presented to the UK Energy Secretary. Section 5.3.1 of Chapter 5 – Appraise has been updated to reflect this change. The pathway options presented to the UK Energy Secretary will also be the alternatives assessed under the SEA Reasonable Alternatives Assessment, which will be included in the SEA Environmental Report. This will provide some level of detail on the pathway options used to select the draft SSEP and transparency on their environmental impacts.

Spatial evaluation

Many respondents agreed that the methodology outlined in the consultation document represented a logical approach to a complex spatial planning process. Stakeholders appreciated the transparent and open approach, which included clearly outlining the datasets used and encouraging participation in defining the assessment criteria. The proposal to adopt a systematic, evidence-based scoring and weighting approach was particularly welcomed in relation to the multi-criteria analysis (MCA) process.

Some respondents requested clarification on the integration of different elements of the spatial evaluation approach within the SSEP methodology, emphasising the importance of environmental and societal factors. The focus on identifying suitable geographic areas for each of the technologies in scope was viewed positively.

Several groups emphasised the necessity of adhering to *The Green Book* principles to quantify socio-economic impacts effectively, suggesting that this would allow for a clearer understanding of the plan's true impact and facilitate structured appraisal of alternatives. It was recommended that opportunities for co-optimisation of energy infrastructure with other infrastructures are incorporated into the spatial evaluation model, including the development of spatial prioritisation criteria for co-located projects to enhance efficiency and minimise environmental impact.

Our approach to spatial evaluation

We have enhanced our MCA approach to identify where and how weighting may be applied if required, with a focus on stakeholder involvement to ensure transparency and robustness. The updated approach also assesses the deliverability of pathways against spatial and economic factors. This method places a stronger emphasis on an explicit process for scoring and weighting using input from stakeholders, which aligns more closely with *The Green Book* and improves transparency. An updated detailed description of the assessment of pathway deliverability can be found in Appendix 7.1.

Co-location

We recognise that an increasing number of developers are considering co-location options during their project development. To identify strategic opportunities for the co-location between different energy technologies, we are developing a matrix to consider the most likely pairings of technologies that can co-locate as part of the spatial optimisation stage. More information on this approach can be found in the updated Section 3.3.4 of Chapter 3 – Prepare.

Economic modelling

There is support for incorporating spatial and environmental analysis alongside economic modelling, ensuring alignment with long-term climate ambitions.

Some respondents suggested that the draft methodology was imbalanced towards economic modelling, with a need for greater consideration of spatial and environmental aspects. Recommendations included ensuring equal consideration of all pillars and addressing the needs of future consumers.

There were suggestions for a greater focus on high-value energy sources rather than low-cost options, highlighting the potential of technologies such as wave and tidal energy. Some comments indicated concerns that the methodology might understate the costs and risks of delivering a net-zero energy system, particularly in relation to transmission network, carbon capture and storage and hydrogen technologies. Clarification was requested on how intraday valuation and scenarios involving carbon capture, utilisation and storage (CCUS) and hydrogen would be integrated into the economic modelling tool, PLEXOS. While PLEXOS is recognised as a market-leading tool, respondents noted its limitations, such as focusing on least-cost outcomes without considering broader economic considerations. It was requested that further clarity be provided on our approach for modelling Offshore Hybrid Assets (OHAs), including explanations on the links with the Holistic Network Design Follow-Up Exercise (HNDFUE, which provides recommended network designs for connecting offshore wind in a coordinated way) and other NESO strategies.

Modelling

PLEXOS is an established tool within NESO and has been used to deliver analysis with similar use cases as our SSEP modelling requirements. The tool can also model interactive components of the energy system, such as electricity and hydrogen, which is a key feature of our modelling.

It features the ability to make new asset build decisions within the model, co-optimised across electricity supply, storage, network and hydrogen supply, storage and network, which is the main objective of the SSEP. Furthermore, these build decisions can be checked against operability and security of supply requirements through detailed modelling against multiple demand and renewable patterns. Noting its limitations, it is designed in our process to evaluate energy system costs and will be supplemented by our further analysis of the other SSEP pillars.

We have updated Section 3.3.9 of Chapter 3 – Prepare to make it clear that our economic modelling simulation tool will be used to model both zonal and whole system requirements. It can consider the needs of the whole system, while balancing zonal constraints and import/export limitations. Specific technologies such as CCUS and hydrogen production and supply can be modelled in detail in this modelling tool, making it ideal to capture the dynamics of a future energy system. The modelling will deliver a whole system solution while balancing zonal opportunities and further energy network requirements to make full use of GB's renewable potential.

Offshore hybrid assets

In response to comments received, we have updated Section 3.3.12 of Chapter 3 – Prepare to include clarity on our approach for modelling non-radial connections (for example, the offshore network). For Offshore Hybrid Assets (OHAs), we have reviewed how they will be considered in the SSEP. While they are out of scope for the core modelling, we will consider OHAs within the SSEP through sensitivity analysis. In areas where offshore wind generation and interconnectors are found to be in proximity to one another, we will explore the effect of placing an OHA there. We can compare the output with and without this OHA and analyse the impact across different aspects. It is important to note that the CSNP will take

the outputs from the SSEP and explicitly explore OHAs within the modelling. OHAs may also be a consideration for optimisation in future iterations of the SSEP.

Consideration of spatial pillars

To ensure consideration is given to all spatial pillars alongside economic aspects, all spatial considerations will be carefully identified, assessed and appropriately applied in the modelling and creation of the SSEP. Stakeholders will be actively involved in this process.

Iteration and optimisation are key to our modelling, refining outputs from spatial and economic models to achieve deliverable outcomes. Sensitivity testing balances economic costs against spatial suitability to find optimal outcomes.

We have set out that each potential pathway will be evaluated for deliverability across economic and spatial pillars, ensuring impacts remain within acceptable limits. This approach ensures no single aspect is disproportionately affected, achieving a balanced integration of economic and spatial considerations.

Data centres

After seeking feedback on several options within the consultation, we will spatially optimise a small volume of data centres in different demand projections (presented in the consultation as option B).

While most stakeholders expressed a preference for option C (as set out in the draft methodology), it was caveated with the recognition of uncertainty around future growth, which would make a more detailed assessment and sourcing of robust data challenging.

Our decision therefore most closely reflects wider stakeholder views to test a range of scenarios for data centres to reflect the uncertainties associated with their future growth beyond 2030, but acknowledging there is insufficient data available or certainty on the future direction of travel to go further.

SSEP baseline

Overall, while there is support for the baseline approach, respondents have highlighted the need for clarity and adjustments to ensure the methodology accurately reflects the current and future energy landscape.

Based on feedback from key stakeholders, we will expand the SSEP baseline to align to a greater extent with our approach to connections and include projects which have regulatory funding. This includes projects which hold a Contract for Difference (CfD), capacity market contract, an interconnector cap and floor arrangement, designation to receive funding through the nuclear Regulated Asset Base (RAB) model or merchant interconnector approval. This allows us to address specific feedback regarding interconnectors and nuclear projects with the use of justifiable and known criteria. It also provides the opportunity to capture projects of strategic importance.

Accessibility

Overall, feedback indicated the SSEP draft methodology document was clear and well-written, with suggestions for minor improvements to readability and presentation. There was support for using more interactive maps and regularly publishing underlying data tables as the SSEP develops.

Feedback highlighted some important issues to consider for future publications, including that there was insufficient time given to respond and that the documents were lengthy yet lacked the desired detail in some areas. It was requested to reduce sector-specific acronyms and jargon where possible to make the consultation more inclusive.

We recognise that the SSEP is a crucial yet complex process to communicate to stakeholders with varying levels of knowledge and understanding. We are dedicated to ensuring the material is as accessible as possible to a broad audience. We understand the advantages of incorporating visual materials and interactive mapping where feasible; therefore, we will explore various formats such as video shorts, infographics and webinar recordings throughout the development of the SSEP. We will ensure that the plan follows general best practice when it comes to meeting accessibility requirements. We will also consider the layout and structure of the NESO website to improve access to information and materials.

Welsh language

A suggestion was made for NESO to work with the Welsh Language Commissioner at the earliest opportunity to understand its responsibilities to the Welsh language when preparing the plan. We acknowledge this feedback and are in the process of developing a Welsh Language Policy with support from the Welsh Language Commissioner in relation to our external engagement and publications.

Summary

We are grateful for the valuable feedback we have received and are committed to making the necessary adjustments to ensure the success of the development of the SSEP. Your continued input is crucial in helping us improve and refine these processes collaboratively. You can find details of the next steps and opportunities to engage in our final methodology on our website: neso.energy/what-we-do/strategic-planning/strategic-energy-planning-sep-publications-consultations-and-updates#Consultations-webinars-and-next-steps.

Appendix 12: Additional changes and clarifications

In addition to the changes described in Appendix 11, we have also made further changes based on stakeholder feedback and developments in our thinking since the publication of our draft methodology consultation in December 2024. These are summarised in the following table.

Item	Chapters and sections	To provide additional clarity, we have:
Groups and methodology updates	Chapter 1 - Introduction, Section 1.2 and Chapter 2 -Foundations, Section 2.3.1	Clarified governance groups and process for methodology updates.
Consultation process	Chapter 1 Introduction, Section 1.2 and Chapter 2 - Foundations, Section 2.4.1	Summarised the consultation process and signposted to the Consultation Feedback Response in Appendix 11.
Local plans/policies and heat networks	Chapter 1 - Introduction, Section 1.3	Some stakeholders expressed that the SSEP could better incorporate local plans and policies, such as heat networks. We have clarified that the SSEP is a strategic energy plan, which means it will not detail individual projects or address local area plans. These aspects will be considered within RESPs.
SSEP timeline	Chapter 1 - Introduction, Section 1.4	Updated the timeline to include more high-level SSEP milestones.
SEA and HRA interaction	Chapter 2 - Foundations, Section 2.6.4	Added a new visual which explains how SEA and HRA interact with the SSEP development stages, plus more granular detail on these elements.
Climate change	Chapter 2 - Foundations, Section 2.6.7	Built upon our existing climate change content.

Iteration of modelling streams	Chapter 4 - Model, Section 4.2	We have expanded upon and revised the modelling flow diagram (Figure 13) and descriptions to make it more accessible.
Deliverability	Chapter 3 - Prepare, Sections 3.2.6 and Chapter 4 - Model, Section 4.2.4	Expanded upon our deliverability proposals and how we will develop pathways.
Demand Side Response (DSR)/flexibility	Chapter 3 - Prepare, Section 3.3.6	Clarified how DSR and consumer-led flexibility will be reflected in the modelling.
Technologies considered	Chapter 3 - Prepare, Section 3.3.3	Clarified the status of technology types.
Economic zones	Chapter 3 - Prepare, Section 3.3.10	Provided more detail on how zones were derived.
External Markets	Chapter 3 - Prepare, Section 3.3.13	Clarified our approach to modelling external markets within the SSEP. This includes explicitly modelling the plant list of neighbouring markets and the use of predetermined capacity expansion pathways for all external markets, which will be the same as those from FES 2025.
Existing natural gas infrastructure	Chapter 3 - Prepare, Section 3.3.14	Addressed repurposing existing gas network.
Weather and security of supply	Chapter 3 - Prepare, Section 3.3.15	Updated the rationale for weather data used.
Sensitivity testing	Chapter 4 - Model, Section 4.2.4	We have provided a more detailed sensitivity testing plan and explained how it will test robustness of decisions across a range of modelling scenarios.
Trade-offs	Chapter 4 - Model, Section 4.2.4 and Chapter 5 – Appraise, Section 5.3.1	Expanded on the concept of trade-offs and provided more clarity through the deliverability assessment at pillar level.
SEA reasonable alternatives	Chapter 5 – Appraise, Section 5.4.1	Included a section on the SEA reasonable alternatives assessment.

Other strategic plans and policies	Appendix 3 and Chapter 2 - Foundations, Section 2.2	Clarified our approach to national and regional marine plans.
Stakeholder working groups	Appendix 2.1	Provided a full list of organisations involved in stakeholder working groups.
Societal working groups	Appendix 2.1	Provided information on the membership of the societal working groups.

Appendix 13: Glossary

Term	Definition
Alternating current	Electricity transmission in which the voltage varies, resulting in a current flow that periodically reverses direction. In GB, the direction is reversed 50 times each second, which is known as a frequency of 50 Hz.
Bioenergy with carbon capture and storage (BECCS)	Bioenergy with carbon capture and storage (BECCS) technologies can combine the conversion of sustainable biomass, biogas and biogenic wastes into electricity, heat, hydrogen or fuels while also capturing a high percentage of the CO_2 emissions contained in that biomass in long-term storage in geological sequestration.
Boundary	The transmission system is split by boundaries that cross important power-flow paths where there are limitations in capability or where we expect additional bulk power transfer capability will be needed.
Capacity	The maximum rated power output of an electricity generation technology, usually measured in kilowatts (kW), megawatts (MW), gigawatts (GW) or terawatts (TW).
Capital expenditure (CapEx)	Funds used by a company to acquire and upgrade assets. For example, energy infrastructure technology and equipment, engineering, procurement and construction (EPC) and site acquisition.

Centralised Strategic Network Plan (CSNP)	A longer-term strategic assessment of transmission network needs, primarily for the transfer of energy across electricity transmission, gas transmission, and hydrogen, initially to 2050 but with a rolling 25-year time horizon. It will assess options for achieving the net zero target and select optimal projects for a shorter term delivery, and a longer term range of potential projects for future delivery.
Co-location	Defined as 'a situation where multiple energy developments, activities or users co-exist in the same place by sharing the same footprint or area'.
Component	A capacity for a given technology, on a zonal (or inter-zonal for transmission assets) level. For example, 5 GW of onshore wind capacity in zone 1. Components can be binary or non-binary, with an example of a binary component being a nuclear power station, which is either built or not built. Most components are non-binary.
Crown Estate Scotland (CES)	A public corporation that manages the rural, coastal and marine assets, as well as other commercial property, which form the Scottish Crown Estate. As part of this, CES is responsible for the leasing of seabed offshore in Scotland.
Decarbonisation	The process of removing carbon emissions, such as those generated by fossil fuels, from our economic and social activities.
Demand	The amount of electrical power that must be generated at any given time to supply homes and businesses.
Department for Energy Security and Net Zero (DESNZ)	UK Government department focused on the energy portfolio, formerly part of the Department for Business, Energy and Industrial Strategy (BEIS). DESNZ is responsible for delivering security of energy supply, ensuring properly functioning energy markets, encouraging greater energy efficiency and seizing the opportunities of net zero to lead the world in new green industries.
Derating factors	Measure the reliability of a given technology during stress events.

Distribution network operators (DNOs)	A company licensed to distribute electricity in the UK. These companies own and operate the system of cables and towers that bring electricity to our homes and businesses.
Economic zones	The geographical representation of an area of land which generation and demand fall within for the purposes of our economic modelling.
Electrical boundary capability	The maximum amount of electricity that can flow through a boundary. As new reinforcements to the network are built, this capability may be increased, allowing more electricity to flow across the boundary.
Electricity Ten Year Statement (ETYS)	An annual NESO publication that shows the likely future transmission requirements of bulk power transfer capability of the national electricity transmission system.
Electrolysis	The process of using electricity to split water into hydrogen and oxygen. This reaction takes place in a unit called an electrolyser.
End-member	Identifies the extreme of a spectrum or a range within a dataset. For instance, the economic impact of highest and lowest cost.
Energy infrastructure	Electricity generation and storage infrastructure, including hydrogen assets, which will be spatially co-optimised in the first iteration of the SSEP.
Energy network	All interconnected infrastructure used for transmission and distribution of energy and/or energy sources.
Environmental baseline	Provides the evidence base on which the key issues to be addressed via the Strategic Environmental Assessment are identified, as well as against which impacts of the plan can be assessed.
Environmental guiding principles	Underpinned by the environmental principles outlined in recent UK, Scottish and Welsh governments' policy statements. For the SSEP, the most relevant are prevention, precautionary and integration.
Framework	Helps identify zonal locations suitable for energy infrastructure.

Future Energy Scenarios (FES)	A range of credible pathways for the future of energy out to 2050.
Generation	The process of generating electric power from sources of primary energy.
Geographic information system (GIS)	Consists of integrated computer hardware and software that stores, manages, analyses, edits, outputs and visualises geographic data.
Gigawatt (GW)	A unit of power. 1 GW = 1,000,000,000 watts.
Greenhouse gases	Gases in the atmosphere that absorb and emit radiation within the thermal infrared range.
Grid connection	The linking of an electrical generation or energy storage system to the main electrical grid.
Habitats Regulations Assessment (HRA)	A process that determines whether development plans could negatively impact local plans on a recognised protected European site beyond reasonable scientific doubt.
High voltage alternating current (HVAC)	AC power transmission at voltages above 110 kilovolts (kV).
High voltage direct current (HVDC)	DC power transmission at voltages above 110 kilovolts (kV).
Holistic Network Design (HND)	Provides a recommended onshore and offshore design that can facilitate the UK Government ambition for 50 GW of offshore wind in GB by 2030.
Infeed	The provision of power from generators onto the National Electricity Transmission System.
Infeed loss risk	The level of power loss the electricity transmission system must be able to sustain for an unexpected loss of power infeed to the transmission system, which, for example, could be due to a power station suddenly disconnecting. This helps prevent an imbalance between the supply and demand of electricity.

Interconnector	A high-voltage electricity cable that connects the electricity systems of neighbouring countries. In GB, an interconnector typically consists of undersea cables to a neighbouring European country, which allows for the trading and sharing of surplus electricity between the two.
Landing point	The location where a submarine or other underwater cable makes landfall.
Long-term phase (LT)	The module in PLEXOS we call Capacity Expansion. While optimising various components (such as capacity and technology), PLEXOS also solves the problem of how to dispatch generation to meet demand. This process is referred to as 'capacity expansion' modelling.
Loss of load expectation (LOLE)	The number of hours a year where there is a shortage of generation relative to demand and the system operator must take extraordinary measures to keep the system operating normally.
Megawatt (MW)	A unit of power. 1 MW = 1,000,000 watts.
Modelling scenario	A series of inputs to the economic modelling process, primarily linked to assumed policy decisions. For example, favouring heat pumps or hydrogen for domestic heating.
Modified Multi-criteria analysis (MCA)	Our approach for evaluating spatial factors. It is a method used to assess multiple criteria to inform a decision, encompassing constraints and opportunities associated with environmental, social, economic and technical engineering design factors. Modifications to the approach include documenting the approach thoroughly, defining clear criteria and employing an evidence-based approach to scoring with stakeholder involvement.
National Electricity Transmission System (NETS)	Otherwise known as the electricity transmission network, which spans across GB. It comprises a mixture of overhead cables, underground cabling and subsea cables. The size of these assets is 400 kV, 275 kV and 132 kV. They are all linked together via substations across the country that then connect separately owned generators, storage, interconnectors, large demand and distribution systems.
National Energy System Operator (NESO)	A public corporation that plans and operates Britain's electricity and gas networks and drives the transition to net zero.

National Policy Statements (NPS)	Statutory documents published in accordance with the *Planning Act 2008*.
Network constraint	A situation where energy is restricted in its ability to flow between two points, for example, due to capacity or voltage limitations.
Network constraint costs	The cost of taking balancing actions to redispatch generation to prevent unacceptable network flows across parts of the network that have limited capacity. These consist of actions to decrease generation output in one part of the country and actions to increase generation output in a different part of the country.
Offshore Hybrid Assets (OHA)	An electricity connection between two countries which also connects another form of offshore generation. For example, instead of individual wind farms connecting one by one to the shore, offshore hybrid assets will allow clusters of offshore wind farms to connect all at once, plugging into the energy systems of neighbouring countries. OHAs are also referred to as multi-purpose interconnectors.
Ofgem	The UK's independent National Regulatory Authority, a non-ministerial government department. Its principal objective is to protect the interests of existing and future electricity and gas consumers.
Operational Expenditure (OpEx)	Costs directly related to the normal, everyday running of a company. They include things that are essential to keep core operations going, such as employee salaries, asset maintenance, monitoring and control systems, energy and utility costs and land and site costs.
Outcome	A list of components that should be built for a given modelling scenario or sensitivity.
Overhead lines	Electrical cables used for transmitting electrical power that are strung high above the ground between towers or pylons.
Pathway	The final, holistic outcome of all of the assessment stages.
Pillars	Encompass economic, societal, environmental, other spatial uses and technical engineering design requirements.
Pillar categories	A subset of a spatial evaluation pillar representing a key theme or topic. For example, within the 'environment' pillar, categories

	include ecology and biodiversity, landscape and cultural heritage and historic environment.
Pillar indicators	A feature or characteristic, the presence or scale of which can be measured using a metric. For the SSEP, indicators relate to spatial constraints (negative) and opportunities (positive) for developing generation and storage infrastructure. For example, a national nature reserve (constraint) or a grid connection point (opportunity).
Pillar sub-categories	Subdivisions of categories that group together indicators with common features.
PLEXOS	An energy market simulation engine used for economic modelling in the SSEP.
Sensitivity	A sensitivity is a change (or number of changes) made to the initial input data of a modelling scenario, which is then re-optimised to test if it provides a different outcome.
SSEP baseline	The starting point for the SSEP. It will consist of network and generation included in the UK Government's *Clean Power 2030 Action Plan*, plus connection projects that have various forms of regulatory funding.
SSEP policy framework	A series of parameters that provide a structure for the modelling, ensuring it achieves the desired outputs.
The Crown Estate (TCE)	An independent commercial business, created by an Act of Parliament. It owns and manages a diverse portfolio of UK buildings, shoreline, seabed, forestry, agriculture and common land assets across England, Wales and Northern Ireland. TCE own whole of seabed, a geospatial evidence base for the English and Welsh sea, known as the best available geospatial model for this area.

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NESO has prepared this report pursuant to its statutory duties in good faith and has endeavoured to prepare the report in a manner which is, as far as reasonably possible, objective, using information collected and compiled from users of the gas and electricity systems in Great Britain, together with its own forecasts of the future development of those systems.

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