June 2025

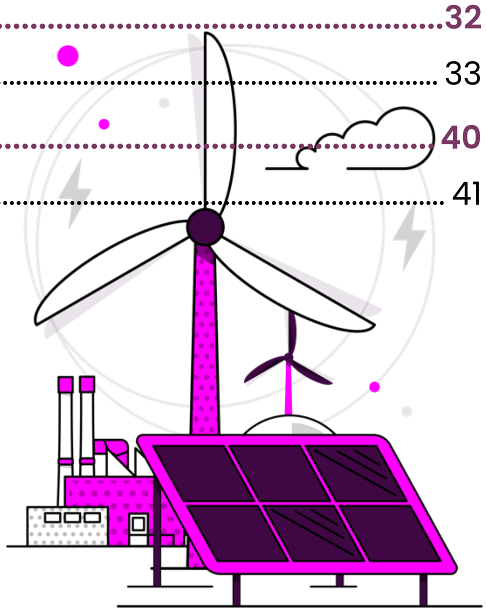
# Centralised Strategic Network Plan (CSNP)

## Draft methodology appendices

NESO
National Energy System Operator

# Contents





# 1. Appendix A: Stakeholder

Stakeholder definitions

# Stakeholder definitions

| Stakeholder type | Definitions |
|---|---|
| **Government and regulatory** | Ofgem, DESNZ, Welsh and Scottish governments, local/regional and national governments, and other formally established organisations or individuals that are publicly funded to deliver a public or government service. |
| **Licensed parties – network owners** | Network owners comprise of Transmission Owners - licensed parties that establish, own and operate electricity transmission network in Great Britain (GB); the 'NTS System Operator', National Gas Transmission, the licensed party that owns and operates the natural gas transmission system in GB; as well as certain other third parties. |
| **Energy Industry** | Industries involved in the production (onshore and offshore), processing, conversion, and sale of energy. This includes fuel extraction, manufacturing, providing energy, and ownership of energy infrastructure and large energy users. |
| **Research bodies** | Groups who are working on the development of new technology or approaches that could provide new capability to the network. For example, universities or other research institutions. |
| **Environment** | Type one: Statutory stakeholders<br><br>Type two: Non-statutory stakeholders (organisations or individuals) who have a high interest, actively campaign, or strategise for environmental awareness and protection and highlight the importance of protecting the environment and wildlife. |
| **Community representatives and societal interest groups** | Individuals, groups, consumers, organisations, or businesses that have an interest in energy or the impact this has on the community, a specific region or at a national level with different societal dimensions. |
| **Land and marine** | Brings together individuals, organisations, or businesses acting along, that own, use or have an interest or concern with policies or plans for onshore or marine territories such as fisheries. |

# 2. Appendix B: Resilience risks

Environment risks

Operational risks

# Environmental risks

Table 1: Environmental risks

| Risk | Description | How is this risk currently managed? | Considerations for Network Planning and CSNP |
|---|---|---|---|
| **Severe storm** | Storm force winds and lightning<br>**Networks:**<br>Storm force winds and lightning damage overhead lines. This results in network faults and the subsequent loss of demand) and generation.<br>**Security of supply:**<br>Storm force winds exceed the safe operation limits of windfarm. Wind generation is reduced. | **Networks:**<br>• Overhead lines are designed and constructed in accordance with a range of legislation, British standards and technical specifications.<br>• Engineering Technical Report 132[1] provides guidance on how to improve the resilience of overhead lines to vegetation related faults.<br>**Security of supply:**<br>• NESO's Electricity National Control Centre (ENCC), can procure additional generation in anticipation of reduced wind output. | **Networks:**<br>• Understand the impact of a severe storm on transmission assets.<br>• If it is likely that transmission faults will become more common, this should be considered by the SQSS review / changes to overhead line standards.<br>• Any changes to SQSS or standards should be incorporated into CSNP modelling.<br>• Network companies must ensure that any technical solutions comply with SQSS / standards etc.<br>**Security of supply:**<br>• Ensure future generation mix (and spatial distribution of generation) can cope with loss of a generation type and still deliver required capacity and ancillary services, without significant network constraints. (Ancillary services are the services |

[1] ENA_ET_132_Extract_180902050423.pdf

| Risk | Description | How is this risk currently managed? | Considerations for Network Planning and CSNP |
|---|---|---|---|
| | | | necessary to support the transmission of electric power from generators to consumers).<br>• Stress test different generation mixes (and spatial distribution of generation) as part of CSNP modelling.<br>• An SQSS review result in holding additional margin for planning or operational requirements or expanding 'adverse conditions'. |
| **Flooding / sea level rise** | Flooding can arise from a range of sources including the sea (sea level rise and coastal flooding), rivers (fluvial flooding) and the ground (pluvial flooding).<br>**Networks:**<br>Substation equipment is damaged by floodwater which results in faults and the subsequent loss of demand (customers) and generation.<br>**Security of supply:**<br>Generation plant is damaged by floodwater which results in the loss of generation. | **Networks:**<br>• Network operators conduct flood risk assessments for assets located in flood risk areas or in areas near the coast.<br>• The Engineering Technical Report provides guidance on how to improve the resilience of substations to flooding. Flood protection measures are installed at assets considered at risk.<br>• All grid and primary substations are protected to a 1:1000-year flood risk. For any new substation site, the general approach to protecting plant and equipment, | **Networks:**<br>• Network companies to ensure that they use the latest flood maps when developing options / designing solutions.<br>**Security of supply:**<br>• NESO should ensure future generation mix (and spatial distribution of generation) can cope with loss of generation type and still deliver required capacity and ancillary services, without significant network constraints.<br>• Stress test different generation mixes as part of CSNP modelling. |

| Risk | Description | How is this risk currently managed? | Considerations for Network Planning and CSNP |
|---|---|---|---|
| **Coastal / fluvial erosion** | Increased rainfall / sea level rise leads to erosion at cliffs and riverbanks, removing the ground material.<br>**Networks:**<br>Erosion to riverbanks removes the ground material support to cables and pipes, exposing them. This results in faults and the subsequent loss of demand (customers) and generation.<br>**Security of supply**:<br>Land in the vicinity of offshore cables landfall points and their associated substations is displaced. This leads to the loss of interconnector demand / supply. | will be to construct the site, or install the plant and equipment, above any potential flood levels.<br>• Where flood / erosion mitigations cannot be implemented, existing assets may be relocated.<br>**Security of supply:**<br>• Loss of complete substations due to flood is not currently considered a securable event under SQSS planning or operations. | |
| **Drought** | Abnormally low rainfall results in a shortage of water.<br>**Networks:**<br>Ground shrinkage leads to instability to the structures built on top. This results in | **Networks:**<br>• Overhead lines and underground cables are constructed in accordance with a range of standards and technical specifications which consider different ground types. | **Networks:**<br>• Understand the impact of drought on transmission assets.<br>• If it is likely that transmission faults will become more common, this should be considered changes to asset standards. |

| Risk | Description | How is this risk currently managed? | Considerations for Network Planning and CSNP |
|---|---|---|---|
| | network faults and the subsequent loss of demand (customers) and generation.<br>**Security of supply:**<br>Water supply restrictions are put in place which limit the amount of water that energy assets can abstract from water sources. This results in a loss of generation. | • Policies are in place to monitor and inspect overhead networks.<br>• Underground cable specifications have been reviewed, and more stringent test conditions have been introduced for joints. Design standards will be updated as necessary.<br>• Cables laid at deeper depths are less susceptible to ground movement. However, cables installed at deeper depths are not able to radiate heat as efficiently reducing cable ratings. If ground movement risk increases in the future regional cable depths may be required.<br>**Security of supply:**<br>• Generators can store limited amount of water onsite.<br>• The ENCC can procure additional generation from assets that are not dependent on water for cooling. | • Any changes to standards should be incorporated into CSNP modelling.<br>• Network companies must ensure that any technical solutions comply with standards etc.<br>**Security of supply:**<br>• NESO should ensure future generation mix (and spatial distribution of generation) can cope with loss of generation type and still deliver required capacity and ancillary services, without significant network constraints.<br>• Stress test different generation mixes as part of CSNP modelling. |

| Risk | Description | How is this risk currently managed? | Considerations for Network Planning and CSNP |
|---|---|---|---|
| **High temperatures and heatwaves**<br><br>**Low temperatures, ice and snow** | There is an extended period of hot / cold weather relative to the expected conditions.<br>**Networks:**<br>Overhead lines / cable circuits / transformers / switchgear overheat or fault reducing capacity and life expectancy. In some cases, asset failure occurs resulting in the subsequent loss of demand (customers) and generation.<br>Wildfires in the vicinity of overhead lines result in network faults and the subsequent loss of demand (customers) and generation.<br>Operational telecommunication systems can also be disrupted, resulting in a loss of network control or generation.<br>**Security of Supply:**<br>Some generators would stop generating if temperatures | **Networks:**<br>• Assets are built and operated in compliance with a range of standards and specifications that take operating conditions and ambient temperatures into account.<br>**Security of supply:**<br>• The ENCC can procure additional generation from assets that are not affected by high / low temperatures. | **Networks:**<br>• Understand the impact of extreme temperatures on transmission assets.<br>• If it is likely that transmission faults will become more common, this should be considered changes to asset standards.<br>• Any changes to standards should be incorporated into CSNP modelling.<br>• Network companies must ensure that any technical solutions comply with standards etc.<br>**Security of supply:**<br>• NESO should ensure future generation mix (and spatial distribution of generation) can cope with loss of generation type and still deliver required capacity and ancillary services, without significant network constraints.<br>• Stress test different generation mixes as part of CSNP modelling. |

| Risk | Description | How is this risk currently managed? | Considerations for Network Planning and CSNP |
|---|---|---|---|
| | exceed or go below certain temperatures. This leads to loss of generation.<br>Increase in customer demand to cope with high / low temperatures. This can lead to transformers overloading, tripping and a loss of demand (customers) and generation. | | |

# Operational risks

Table 2: Operational risks

| Risk | Description | How is this risk currently managed? | Considerations for Network Planning and the CSNP |
|---|---|---|---|
| **Loss of critical national infrastructure** | There is a loss of a critical transmission asset or transmission connected energy asset e.g. loss of offshore cable / substation.<br>This leads to an instantaneous loss of supply / demand and results in disruption to customers. | • The SQSS dictates the level of network reinforcement required for assets that connect to significant amounts of generation / demand. | • NESO should ensure that the future transmission network can cope with loss of a critical asset and still deliver required capacity and ancillary services, without significant network constraints. |
| **Full national electricity transmission system failure** | There is a cascade failure across the national electricity transmission system (NETS). This results in a nationwide loss of power. | • System planned / operated in accordance with SQSS to reduce likelihood of significant outages.<br>• NESO procure Electricity System Restoration Services from generators to restore network in event of the NETS's failure. | • NESO should explore the cost / benefit of re-reinforcing specific boundaries to reduce the likelihood of this risk. |
| **Partial national electricity** | There is a cascade failure across the national electricity | • System planned/operated in accordance with SQSS to reduce likelihood of this risk. | • NESO should explore the cost/benefit of re-reinforcing specific boundaries to reduce the likelihood of this risk. |

| | | | |
|---|---|---|---|
| **transmission system failure** | transmission system leads to a regional loss of power. | | |
| **Instantaneous loss of generation / demand** | There is an instantaneous loss of generation/demand leading to an imbalance between supply and demand. This leads to Low Frequency Demand Disconnection relays being triggered and customer disconnections. | • The SQSS dictates that NESO should procure sufficient reserve and response services to deal with the largest loss (generation and demand).<br>• The Frequency Control and Risk Report assesses how much reserve, and response should be procured to minimise the risk of customer disconnections. | • No additional considerations required. |
| **Long term loss of generation / gas supply** | There is a loss of supply, leading to an imbalance between supply and demand. This leads to customer disconnections. | • The gas network should have sufficient storage to deal with the highest demand expected once in 20 years.<br>• Diverse generation mix. | • Ensure the future generation mix (and spatial distribution of generation) can cope with loss of generation and still deliver required capacity and ancillary services, without significant network constraints.<br>• Stress test different generation mixes as part of CSNP modelling. |

# 3. Appendix C: Assessment framework (electricity)

Options assessment framework proposals

Scoring characteristics of deliverability sub-criteria

Scoring characteristics of operability sub-criteria

# Appendix C.1: Options assessment framework proposals

## Appraisal framework selection

**As part of the CSNP methodology development NESO has reviewed a range of assessment approaches that involve multi criteria analysis and selected the framework that is most suitable for the CSNP process.**

According to the HMT Green Book, Multi Criteria Decision Analysis (MCDA)/Multi Criteria Analysis (MCA) methods should only be applied to short list options derived from a long list and the preferred option should be selected from the short list based solely on economic grounds (Economic Cost Benefit Analysis (CBA)). NESO will eliminate some GB designs based on their performance against the five assessment criteria to arrive at a short list of GB designs that align with the collective goals of wider stakeholders. In alignment with the HMT Green Book, the final selection of the preferred GB design from the short list will be based on economic grounds.

NESO has evaluated various decision-making frameworks, including MCA and more structured MCDA methods to progress from a GB network design long list to a short list. Further details and a comparison of these frameworks are provided here.

Our selected solution incorporates Economic and ECDO filtering at the GB network design level. NESO believes this solution is the most favourable option for the CSNP, as it performs well on transparency, robustness, stakeholder input and resource requirements. This approach does not prioritise any specific ECDO criteria, thereby avoiding the challenge of assigning different weighting to the criteria, which can be particularly difficult when trying to achieve stakeholder consensus.

As a filtering approach, it is simple and transparent. It applies ECDO qualitative criteria to eliminate designs that are non-feasible or exceed agreed impact thresholds, or to select all options ranked in the top 'N' positions for every criterion. This methodology can be applied at each main ECDO criteria level or sub-criteria level.

In this way, the selected approach enables the consideration of cumulative GB-wide impacts across economic, environmental, community, deliverability, and operability factors.

## Summary of appraisal frameworks considered

Various assessment frameworks were considered for assessing the GB designs. Table 3 offers a concise overview of each framework, highlighting their advantages and disadvantages. It also includes a summary of the overall assessment, detailing the rationale behind recommending or not recommending each framework for the CSNP. This information is provided to give stakeholders essential context and background when reviewing the draft methodology.

Table 3: List of framework options considered

| Framework | Description |
|---|---|
| **1. CBA with current economic approach** | NESO's existing economic assessment tools provide a reliable basis for evaluating costs and feasibility.<br>This method already largely aligns with HMT Green Book approach (Cost Benefit Analysis) for selecting the preferred option from the option short list.<br>Conducting ECDO analysis during filtering in the options funnel is assumed to capture the material ECDO impacts.<br>It has less resource requirements.<br>It is a transparent process.<br>Formalised and robust ECDO assessment is required during the filtering process in the options funnel.<br>Cannot demonstrate the application of ECDO at the GB design level assessment and hence ignores the cumulative impact of options across the ECDO criteria.<br>No opportunity for stakeholder input on ECDO criteria at the GB design level.<br>**Overall Assessment:** Not recommended for the CSNP as this approach cannot assess the cumulative ECDO impacts at the GB design level. |
| **2. Economic and ECDO filtering** | Directly supports ECDO assessment at the GB-design long list stage, enabling whole-system impacts across environmental, community, deliverability and operability factors to be considered<br>Simple and transparent – applies ECDO to remove designs that are non-feasible or surpass agreed impact thresholds or to select all options ranked in the top 'N' positions in every criterion.<br>Does not express a preference for any criteria hence avoids the challenges in having to agree on weighting for different criteria.<br>Aligns with HM Treasury Green Book. Can be applied at both individual sub-criteria level and at the main ECDO criteria level. The latter requires aggregating scores to the assessment criteria level.<br>Formalised ECDO assessment at the GB design level is required and may need aggregation at the assessment criteria level.<br>Clear steps are needed to describe how the filtering is applied.<br>May not reduce the number of options in the short-list to a sensible number, potentially requiring more time and resources for the CBA stage.<br>**Overall assessment:** Preferred approach for the first iteration of the CSNP |
| **3. MCA with expert judgement** | Directly supports ECDO assessment at the GB-design long list stage, enabling whole-system impacts across environmental, community, deliverability and operability factors to be considered.<br>Enables qualitative and incomplete criteria to be incorporated into decision-making, leveraging professional expertise to fill knowledge gaps where there is insufficient structured and consistent information.<br>Limited transparency due to potential for subjectivity.<br>Requires a robust process for expert input. |

| | |
|---|---|
| | Requires consensus among stakeholders for scoring and weighting of criteria.<br>Not recommended by HM Treasury Green Book in its simplest form.<br>**Overall assessment:** Not recommended for the CSNP as robustness and transparency are key requirements for the decision-making process. |
| **4. MCDA** | Comprehensive and transparent process.<br>Ensures all relevant ECDO criteria are formally scored, with trade-offs clearly documented.<br>Aligns with HM Treasury Green Book.<br>By following a formalised process, this approach reduces subjectivity and ensures consistency in evaluating options.<br>A facilitated process brings together diverse stakeholders, ensuring their perspectives are considered and promoting consensus.<br>A structured process requires more time, resources and dedicated participation from stakeholders.<br>Sufficient, comparable data must be available across all criteria and options to ensure fair and unbiased scoring.<br>Given the detailed analysis required, the number of options considered must be limited to maintain efficiency and transparency.<br>**Overall assessment:** Not recommended for the first iteration of the CSNP due to its resource-intensive nature and the need for extensive expert engagement.<br>However, it holds potential for application in subsequent CSNPs because of its robust approach to weighting the different criteria and sub-criteria and transparent overall approach. |

Each of the above framework options was reviewed in detail. To help with the decision-making, a comparison of the framework options against a number of key criteria is presented in table 4 below.

Table 4: Comparison of framework options

| | Transparency | Robustness | Resource and data requirements for implementation | Cumulative impact of ECDO criteria | Alignment with HMT Green Book | Stakeholder Input | Applicability in CSNP 1 |
|---|---|---|---|---|---|---|---|
| **1. CBA with current economic approach** | +++ | +++ | +++ | --- | +++ | --- | --- |
| **2. Economic and ECDO filtering** | +++ | ++ | + | ++ | +++ | ++ | +++ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **3. MCA with expert judgement** | --- | --- | + | ++ | ++ | ++ | -- |
| **4. MCDA** | +++ | +++ | --- | +++ | +++ | +++ | + |

# Appendix C.2: Scoring characteristics of deliverability sub-criteria

This section outlines scoring characteristics for the deliverability sub-criteria to score the individual network reinforcement options. These details are intended as guidance for option developers. Scores will range from 0 to 5, with detailed explanations provided for all scores within this document. Once the score tables are fully defined and agreed upon—through working groups, internal and external governance—they will be published on the NESO website along with various other guidance documents.

This guidance does not require that every point describing the characteristics for each score be satisfied to assign a score. Instead, it serves as a guideline to minimise subjectivity. Option developers are expected to use this guidance to score reinforcement options, applying engineering judgment and narratives to justify their scores. This allows NESO to perform checks or moderation if necessary.

## Technology readiness level (TRL)

Technology readiness refers to the maturity of technologies used in transmission network reinforcement, assessing their industry familiarity, operational experience, and deployment track record to determine their feasibility for large-scale implementation. The TRL of some assets can be referenced by using online sources such as IET 'cost and characteristics' or ENTSOE 'Technopedia'.

Table 5: Technology readiness scoring framework

| Sub-criteria | Technology readiness |
|---|---|
| **Score** | **Scoring characteristics** |
| **0** | **No risk/lowest risk**<br>• Fully operational for 5+ years, demonstrating exceptional reliability in real-world environments with minimal failures or issues.<br>• Seamlessly integrates with existing infrastructure, requiring no adaptation or customisation for deployment.<br>• Comprehensively tested in real-world conditions, meeting industry standards and regulatory requirements, with no untested aspects.<br>• Technology readiness level of 8 or 9 |
| **1** | **Very low risk**<br>• Operational for 3-5 years, with consistent performance in relevant environments and minimal issues.<br>• Minimal customisation required for integration with existing systems, ensuring ease of deployment. |

| | |
|---|---|
| | • Extensive testing in real-world conditions, meeting all required standards and regulations.<br>• Technology readiness level of 8 or 9 |
| **2** | **Low risk**<br>• Operational for 1-3 years, with limited issues in relevant environments, showing moderate reliability.<br>• Can integrate with minor adaptations or adjustments needed during deployment.<br>• Rigorous testing conducted in controlled environments and some real-world testing, meeting basic standards.<br>• Technology readiness level of 7+ |
| **3** | **Moderate risk**<br>• Operational for 1 year or less, with limited operational history or experience in similar environments.<br>• Requires significant customisation and adaptation for integration with existing systems, leading to deployment challenges.<br>• Some real-world testing, mostly conducted in controlled environments with some untested aspects.<br>• Technology readiness level of 6+ |
| **4** | **High risk**<br>• Operational history in highly limited environments with limited experience in similar applications.<br>• No seamless integration with existing systems, requiring major customisation or adaptation.<br>• Minimal testing, with no validation in real-world conditions or against regulatory standards.<br>• Technology readiness level of 5+ |
| **5** | **Very high risk**<br>• No operational history, with no proven success in any environments.<br>• Incompatible with existing systems, requiring extensive customisation and redesign to deploy.<br>• No testing or validation conducted, with no alignment to industry standards or regulations.<br>• Technology Readiness Level of ≤4 |

## System access

Integration of the reinforcement options will require transmission network outages during different construction phases. These outages may have less or greater impact on other system users (depending on whether mitigation is possible to reduce supply loss) on delivering the option to the agreed date. System access evaluates the risk impact by assessing the estimated outage plan for critical infrastructure.

Critical infrastructure is considered as any elements that would place more than NETS SQSS permitted supply capacity loss (SQSS section 3) or circuits of more than 1000 MW capacity that would restrict significant generation output. Circuits greater than 1000 MW rating will be at voltages higher than 200 kV. Outages at 132 kV or lower are to be considered where supply capacity greater than permitted in the NETS SQSS will be put at risk.

The wider system impacts at the early planning stage will be unknown and require further sensitivity studies during later detailed design.

Table 6: System access scoring framework

| Sub-criteria | System access |
|---|---|
| **Score** | **Scoring characteristics** |
| **0** | **No risk/lowest risk**<br>• Outage of non-critical assets<br>• Minimal disruption expected, with alternative routes or redundancies accounted for.<br>• Planned works align well with system access windows, minimising risk to operations. |
| **1** | **Very low risk**<br>• Up to 6 months of outages on some critical infrastructure(s)<br>• Some short-term disruptions may occur, but the plan allows flexibility to manage them.<br>• Good alignment with system access planning, with minor refinements needed. |
| **2** | **Low risk**<br>• 6 to 12 months of outages on critical infrastructure(s)<br>• Mitigation plans are outlined but not fully detailed, relying on assumptions that may change.<br>• Potential for moderate disruptions, requiring adjustments in system access planning. |
| **3** | **Moderate risk**<br>• 12 to 15 months of outages on critical infrastructure(s)<br>• Mitigation strategies are unclear or depend on unproven assumptions, increasing uncertainty.<br>• Risk of considerable disruption, with potential delays in securing system access. |
| **4** | **High risk**<br>• 15 to 18 months of outages on critical infrastructure(s)<br>• High uncertainty around outage impacts, making it difficult to predict system access requirements.<br>• Mitigation strategies are weak or not clearly defined, leading to potential system instability.<br>• Significant risk of prolonged disruption, requiring major interventions. |
| **5** | **Very high risk**<br>• More than 18 months of outages on critical infrastructure(s)<br>• Severe lack of planning confidence regarding outage impacts and system access constraints. |

| Sub-criteria | System access |
|---|---|
| | • No or very challenging mitigation strategies, leading to high likelihood of significant network disruptions.<br>• Outages may be prolonged or difficult to manage, with unknown potential operability issues. |

## Design and construction complexity

Design and construction complexity refers to the challenges associated with both the design and construction of transmission network reinforcement options. For design, it includes factors such as the capacity and scale of the reinforcement option, the interdependence of components, network configuration, and the requirements for consenting and planning while considering the proposed delivery date. For construction, it involves challenges related to site accessibility, managing multi-phased projects, and coordinating concurrent construction activities while considering the proposed delivery date.

Table 7: Design and construction complexity scoring framework

| Sub-criteria | Design and construction complexity |
|---|---|
| **Score** | **Scoring characteristics** |
| 0 | **Lowest complexity**<br>• The project involves small upgrades such as reconductoring or hotwiring, without the need for new lines or substations, and utilises existing bays.<br>• Minimal network modifications are required, and all components are fully standardised and widely available.<br>• Project approval process is straightforward.<br>• The project site is easily accessible and has stable terrain with no major land stabilisation or deep foundation work required anticipated.<br>• Minimal stakeholder engagement required. |
| 1 | **Very low complexity**<br>• Project may involve new overhead line using existing substations and bays and/or minimal uncertainties exist in design, integration and construction.<br>• Mostly standard components are used, with minor adaptation required.<br>• The approval process is straightforward, with minor risks involved.<br>• The project site is easily accessible, with only minor infrastructure upgrades required.<br>• Stakeholder engagement is straightforward. |
| 2 | **Low complexity**<br>• Project may involve new substations and/or FACTS devices (e.g., series compensation, SVCs) and/or some uncertainties exist in design, integration and construction.<br>• A mix of standard and custom components is used.<br>• The project site has no major accessibility issues, but some level of additional land stabilisation or foundation work required. |

| Sub-criteria | Design and construction complexity |
| --- | --- |
| | • Approvals are expected within a short timeframe, with low risks. |
| 3 | **Moderate complexity**<br>• Project may involve onshore HVDC links, converter stations and/or considerable uncertainties exist in design, integration and construction.<br>• Some bespoke components are required.<br>• Project site has some accessibility issues requiring infrastructure modifications and presents some challenging terrain.<br>• Stakeholder engagement is complex with multiple parties involved.<br>• Lengthy approval process with moderate risks. |
| 4 | **High complexity**<br>• Project may involve offshore three-ended HVDC links, subsea cables, offshore converter platforms and/or major uncertainties exist in design, integration and construction.<br>• Some bespoke/niche components are required.<br>• Project site has major accessibility issues or in a remote highly constrained area requiring special accessibility solutions.<br>• Stakeholder engagement is highly challenging involving conflicting interests.<br>• Challenging and lengthy approval process with high risks. |
| 5 | **Very high complexity**<br>• The project may involve a multi-terminal offshore HVDC system with extensive new transmission lines and/or extreme uncertainties exist in design, integration and construction (i.e. multiple subsea cable crossings).<br>• Bespoke complex technology assets.<br>• Severe integration risks requiring significant level of testing and validation.<br>• Project is in a severely constrained area requiring significant transport modifications.<br>• Stakeholder engagement is highly challenging, with no clear resolution timeline leading to lengthy approval process. |

# Supply chain

Supply chain considers the availability of critical components, supplier capacity, and logistical challenges influencing the timely and efficient delivery of materials for the transmission network reinforcement option.

Table 8: Supply chain scoring framework

| Sub-criteria | Supply chain |
| --- | --- |
| **Score** | **Scoring characteristics** |
| 0 | **No risk/lowest risk**<br>• Essential components are readily available, or component lead times pose no risk to the delivery of the project. |

| Sub-criteria | Supply chain |
| --- | --- |
| **Score** | **Scoring characteristics** |
| | • Only standard, widely available components are required.<br>• Suppliers are reputable and compliant with quality control processes.<br>• Components are manufactured in factories located in the UK or Europe. |
| **1** | **Very low risk**<br>• Essential components can be procured and delivered within 6 months, with minimal risk of delays.<br>• The project requires at least 1 specialised component (e.g., custom switchgear or protection systems).<br>• Suppliers and sub-suppliers are reputable and compliant with quality control processes.<br>• Components are manufactured in factories located in the UK or Europe. |
| **2** | **Low risk**<br>• Essential components may take up to 12 months to be procured and delivered due to increased global demand and manufacturing backlogs.<br>• The project requires 2-3 specialised components (e.g., custom switchgear or protection systems).<br>• Suppliers and sub-suppliers are reputable and compliant with quality control processes.<br>• Components are manufactured in factories located in the UK, Europe, or North America. |
| **3** | **Moderate risk**<br>• Essential components can take 12-18 months to be procured due to high demand and manufacturing delays.<br>• The project requires 4-5 specialised components (e.g., custom transformers, bespoke switchgear).<br>• Suppliers and sub-suppliers are reputable but may not adhere to all quality control processes.<br>• Components are manufactured in UK, Europe, or North American factories but core materials are sourced globally. |
| **4** | **High risk**<br>• Essential components could take 18-24 months to be procured due to significant global supply chain disruptions.<br>• The project requires more than 5 specialised components (e.g., bespoke components, prototypes).<br>• Suppliers and sub-suppliers are less reputable and lack proper quality control processes.<br>• Components are manufactured in factories globally with core materials sourced globally. |
| **5** | **Very high risk**<br>• Essential components may take 24 months or more to be procured due to severe global supply chain challenges.<br>• The project requires many specialised components, which may involve prototyping or developing new technologies. |

| Sub-criteria | Supply chain |
|---|---|
| **Score** | **Scoring characteristics** |
| | • Suppliers and sub-suppliers are not reputable and lack quality control processes.<br>• Components are manufactured in factories globally with core materials sourced globally. |

## Interactivity

Interactivity refers to challenges arising from inter-scheme dependencies, shared infrastructure requirements, cascading delays, and simultaneous constructions. For example, a new circuit option may depend on a different option that delivers a new substation to which the new circuit will connect. Both options have heavy dependence on each other, and there may be additional options, including customer connections, that are linked together, making them highly interactive. With greater interactivity comes higher risk issues with the interdependent options.

The interactivity scoring needs to look at all known network reinforcement schemes, including, but not limited to, enabling works, asset replacement works, and wider network reinforcement works.

Table 9: Interactivity scoring framework

| Sub-criteria | Interactivity |
|---|---|
| **Score** | **Scoring characteristics** |
| **0** | **No/lowest complexity**<br>• No interactions or outage-related interdependencies with other projects are identified.<br>• Infrastructure sharing is optimised, with no overlap with other projects or potential for cascading delays.<br>• Does not interfere with the design and construction of other projects. |
| **1** | **Very low complexity**<br>• Dependencies between 1-2 schemes are identified.<br>• Some sharing of infrastructure is required, but the risk of cascading delays is minimal, and the coordination is manageable.<br>• Minor conflicts in scheduling with simultaneous construction with other projects, but can be resolved without major adjustments to timelines. |
| **2** | **Low complexity**<br>• Dependencies between 3-4 schemes are identified.<br>• Infrastructure sharing with other parallel projects is required, and there is some risk of cascading delays or interruptions if not carefully managed.<br>• Multiple schemes are scheduled concurrently, and there may be some logistical challenges or small delays. |
| **3** | **Moderate complexity** |

| Sub-criteria | Interactivity |
|---|---|
| **Score** | **Scoring characteristics** |
| | • Dependencies between 5-6 schemes are identified.<br>• The sharing of infrastructure is complex, with potential for cascading delays or disruptions, requiring extensive planning and ongoing adjustments.<br>• Several schemes need to be scheduled at different times, as simultaneous construction could lead to significant delays if not managed correctly. |
| **4** | **High complexity**<br>• Dependencies between 7-8 schemes are identified.<br>• Shared infrastructure presents a serious risk of delays or interruptions if not continuously monitored and managed.<br>• Coordinating multiple schemes is challenging, with significant scheduling conflicts and potential delays affecting overall timelines. |
| **5** | **Very high complexity**<br>• Dependencies over 8 schemes are identified.<br>• Shared infrastructure is a critical factor, with high risk of significant delays or project failures if any issues arise.<br>• Significant overlap in construction schedules leads to high potential for delays, requiring constant monitoring and adjustments. |

# Appendix C.3: Scoring characteristics of operability sub-criteria

This section outlines scoring characteristics for the operability sub-criteria to score the individual network reinforcement options. These details are intended as a guidance document for option developers. Scores will range from 0 to 5, with detailed explanations provided for all scores within this document. Once the score tables are fully defined and agreed upon—through working groups, internal and external governance—they will be published on the NESO website along with various other guidance documents.

This guidance does not require that every point describing the characteristics for each score be satisfied to assign a score. Instead, it serves as a guideline to minimise subjectivity. Option developers are expected to use this guidance to score reinforcement options, applying engineering judgment and narratives to justify their scores. This allows NESO to perform checks or moderation if necessary.

## Protection and control integration complexity

Assessment of an option's complexity with integration into protection, control and monitoring or other physical systems, conducted through knowledge-based assessment.

Table 10: Protection and controls integration complexity scoring framework

| Sub-criteria | Protection and Control Integration Complexity |
|---|---|
| **Score** | **Scoring Characteristics** |
| **0** | **No/Lowest Complexity**<br>Minimal or standard replacement of Protection and Control assets, such as:<br>• Reconductoring existing circuits and upgrades to existing protection systems.<br>• Thermal re-proofing of AC overhead line<br>• Hot Wiring of AC overhead line. |
| **1** | **Very Low Complexity**<br>Installation of new standard Protection and Control assets, such as:<br>• New AC overhead line at same voltage level to either end of the substations.<br>• New AC overhead line with standard CT/VT protection system (i.e. surge protection devices, over current & over voltage protection)<br>• Overhead line AC upgrade to a higher voltage level (e.g. 275kV to 400kV) |
| **2** | **Low Complexity**<br>New Protection and Control system for a standalone controllable asset, such as: |

| | |
|---|---|
| | • AC line with new Quadrature Boosters (QBs) / phase-shift transformers, inductors/reactors for AC voltage control<br>• New series compensation.<br>• AC Harmonic Filters.<br>• Point-to-point HVDC link with standard DC/AC protection system. |
| **3** | **Moderate Complexity**<br>New Protection and Control system coordinating with multiple controllable and monitoring assets, such as:<br>• New overhead line protection system integration with single/multiple operational tripping scheme.<br>• Distribution network operator stakeholder involvement for upgrade to protection system/automation at transmission/distribution boundary. |
| **4** | **High Complexity**<br>New Protection and Control system for complex HVDC options, such as:<br>• Multi-terminal HVDC links.<br>• HVDC ultra fast disconnector and load commutation switch<br>• High order DC voltage control system. |
| **5** | **Very High Complexity**<br>New Protection and Control system for complex HVDC systems integrated via offshore hubs, such as:<br>• An offshore AC hub inter-connecting with multiple HVDCs<br>• |

## Network operation complexity

Assessment of an option's real-time operation needs associated with analysis tool requirements and business processes to operate the transmission system safely and securely, conducted through knowledge-based assessment.

Table 11: Network operation complexity scoring framework

| **Sub-criteria** | **Network Operation Complexity** |
|---|---|
| **Score** | **Scoring Characteristics** |
| **0** | **No/Lowest Complexity**<br>No or minimal changes required for existing operation analysis tools, such as:<br>• Upgrading rating of existing AC overhead line between two existing substations, no change to voltage levels between two substations<br>• Updating network models used by the existing operation analysis tools |
| **1** | **Very Low Complexity**<br>Business as usual changes required for existing operation analysis tools, such as:<br>• Upgrading existing substations for addition of new AC overhead line circuits & new QBs, inductors/reactors, which requires updates to controllers (voltage/short circuit ratio) algorithms used by the existing offline analysis tools.<br>• New single or double AC overhead line between one or two new substations<br>• Addition of new series compensators.<br>• Integrating new circuit protection system with existing operational tripping scheme at either side of the substation |
| **2** | **Low Complexity**<br>New function(s) required to be developed for existing operation analysis tools, such as:<br>• An optimal dispatch function of multiple intra-GB HVDCs under pre-fault and post-fault network conditions |
| **3** | **Moderate Complexity**<br>A new offline analysis tool required to be developed, such as:<br>• A new offline thermal & voltage analysis tool (e.g. for voltage, thermal, or fault-levels) or new components of analysis tools required to model AC circuits, new substations, or multiple HVDC links |
| **4** | **High Complexity**<br>• Multiple offline analysis tools for (e.g. for voltage, thermal, or fault-levels) & new business procedure(s) required to operate the option across multiple departments/teams (e.g. new business processes and, tools or resources required for network operation planning. |
| **5** | **Highest Complexity**<br>• Development of new analysis tool(s) to help with the configuration and operation of complex options, such as an Electromagnetic Transients (EMT) tool to analyse control interaction risks among inverter-based technologies.<br>• New analysis tools to facilitate real-time operations. |

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| | • Modelling multi-terminal HVDC link(s) with a master controller algorithm to analyse operation challenges.<br>• Complexity with new analysis assessments & processes to model and plan the operation of the option. |

## Scalability and adaptability

Scalability and adaptability consider the design's ability to expand for future capacity needs, integrate additional energy sources, and adapt to emerging technologies or innovations, and evaluate the risk of obsolescence.

Table 12: scalability and adaptability scoring framework

| Sub-criteria | Scalability and adaptability |
|---|---|
| **Score** | **Scoring characteristics** |
| **0** | **No/lowest risk/complexity**<br>• Clear provisions are made for future expansions, system upgrades, and the incorporation of new technologies in the long term.<br>• The design incorporates the latest technologies and is adaptable to future technological advancements without significant reinvestment.<br>• The risk of obsolescence is very low, with the system remaining relevant and efficient for decades without requiring significant updates. |
| **1** | **Very low risk/complexity**<br>• The design allows for integration of emerging technologies, but certain upgrades or replacements may be required for full compatibility.<br>• Some provisions are made for future upgrades, but new developments may need re-planning or investments in emerging technologies.<br>• The risk of obsolescence is relatively low, but the design may require minor adaptations to stay relevant in the future. |
| **2** | **Low risk/complexity**<br>• The infrastructure can accommodate emerging technologies, but substantial changes may be needed to integrate them effectively.<br>• Future expansion and technological integration will require careful planning and investment, with parts of the system being potentially challenging to update without major overhauls.<br>• The risk of obsolescence is moderate, as certain system components may become outdated, requiring future redesigns or replacement. |
| **3** | **Moderate risk/complexity**<br>• Emerging technologies can be integrated, but this would require major modifications or replacements of key components, leading to long delays.<br>• Future upgrades may require a complete redesign of certain aspects of the infrastructure.<br>• There is a high risk of obsolescence, with some system elements likely becoming outdated sooner, requiring costly updates. |
| **4** | **High risk/complexity** |

| Sub-criteria | Scalability and adaptability |
|---|---|
| **Score** | **Scoring characteristics** |
| | • Major technical hurdles exist for adapting to emerging technologies, requiring large-scale updates or potentially new infrastructure.<br>• The design does not provide an easy pathway for future expansion or technological integration without significant intervention and cost.<br>• The risk of obsolescence is high, with many parts of the infrastructure likely to be outdated before their intended life span, requiring expensive replacement. |
| **5** | **Very high risk/complexity**<br>• Adapting to emerging technologies is extremely difficult and would require overhauling much of the system, leading to extensive downtime and high costs.<br>• There are no clear provisions for future expansion or technological adaptation, and the infrastructure is unlikely to support future needs without major investments or complete redesigns.<br>• The risk of obsolescence is very high, and the infrastructure may become obsolete quickly, requiring near-total replacement within a short period. |

# 4. Appendix D: Glossary

Glossary

# Glossary

| Term | Description |
|---|---|
| AC: Alternating current | Is a type of electrical current, in which the direction of the flow of electrons switches back and forth at regular intervals or cycles. In Great Britain, the direction is reversed 50 times each second, which is known as a frequency of 50 Hz. |
| ANCAR: Annual Network Capability Assessment Report | NGT publication of current and future capability requirements of the NTS with the last version of this being published in June 2024. |
| AONB: Areas of Outstanding Natural Beauty | An area of countryside in England and Wales which has been designated for conservation due to its significant landscape value. |
| Assessment Criteria | Encompasses economic, environmental, community, deliverability, and operability criteria for the assessment of network reinforcement options and GB designs. |
| Balance Sheets | FES net zero pathways and Counterfactual are transformed into demand day forecasts that can be processed within SCT for analysis within SIMONE. |
| BCR: Benefit Cost Ratio | Is a financial metric used to evaluate the feasibility and profitability of a project or investment. It is calculated by dividing the total expected benefits of a project by the total expected costs. |
| BM: Balancing Mechanism | NESO's primary tool to balance supply and demand on GB's network. The BM is used to buy and procure the right amount of electricity required to balance the system minute by minute, and second by second, to balance supply and demand in real time. |
| Boundary | A boundary splits the system into two parts, crossing critical circuits that carry power between the areas where power flow limitations may be encountered. |
| BRAG: Black, red, amber and green | BRAG refers to a colour-coded level of risk that has been assigned to various elements of a project. |
| Busbar | Busbars distribute power to various connections inside a substation. They allow different circuits to be connected and disconnected, as required for system operation. |

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| Capacity | The maximum rated power output, usually measured in kilowatts (kW), megawatts (MW), gigawatts (GW) or terawatts (TW). |
| Capex: Capital expenditure | The investments a company makes to acquire, improve, or maintain long-term assets. |
| CATO: Competitively appointed transmission owner | An entity competitively appointed to construct, own, and operate part of the GB electricity transmission network. |
| CBA: Cost-benefit analysis | A method of assessing the benefits of a given project in comparison to the costs. This tool can help to provide a similar basis for all projects to be considered. |
| CfD: Contact for Difference | Is a key mechanism within the UK's energy strategy, aimed at incentivising investment in low-carbon electricity generation for consumers. |
| $CO_{2e}$: CO2 equivalent emissions | Is a metric used to compare the emissions of greenhouses gases based on their global warming potential (GWP). $CO_{2e}$ represents the amount of $CO_2$ that would have the same warming effect as a given amount of another greenhouse gas. |
| Constraint | A situation where energy is restricted in its ability to flow between two points, for example, due to thermal or voltage limitations. |
| Constraint (gas network) | A gas constraint can be defined as the inability to flow gas on or from the NTS; these are referred to as entry and exit constraints. |
| Constraint costs | The cost of taking balancing actions on the electricity transmission system which redispatch generation to prevent unacceptable conditions across parts of the network. |
| Consumer costs | Costs that will be recovered through the public's domestic energy bills. |
| CSNP framework | The CSNP framework will encompass a range of different processes and outputs. It will include the publication of system requirements, a roadmap of potential longer-term options, as well as a plan of projects for delivery. |
| DC: direct current | Electrical current that flows consistently in one direction. |
| Demand | The amount of electrical power that is being used by consumers. |
| Demand Adjuster Tool (DAT) | The tool that rebalances zones to undertake demand sensitivity network analysis. |

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| DESNZ: Department for Energy Security and Net Zero | 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. |
| Detailed design | Includes consenting, planning, and construction stages of project development. |
| ETYS: Electricity Ten Year Statement | A NESO publication that shows the likely future transmission requirements of bulk power transfer capability of the national electricity transmission system. |
| FES: Future Energy Scenarios | NESO's range of credible pathways for the future of energy out to 2050. |
| Fossil fuels | A hydrocarbon-containing material such as coal, oil and natural gas, formed naturally in the earth's crust from the remains of dead plants and animals that is extracted and burned as fuels. |
| GB design | The combination of electricity transmission reinforcements or commercial arrangements. |
| Generation | The sources of electrical power from a diverse range of resources. |
| GNCNR: Gas Network Capability Needs Report | As NESO, we hold a gas system planner licence in addition to our electricity system operator licence.<br><br>GNCNR, first published in December 2024, outlined the network capability on the NTS in relation to the natural gas supplies and demands from the Future Energy Scenarios (FES) pathways. National Gas uses the system needs identified in the GNCNR to develop network reinforcement options. |
| GOA: Gas Options Advice | The GOA document evaluates reinforcement investment proposals from NGT SPOP to meet the NTS capability requirements highlighted in GNCNR. |
| GW: Gigawatt | A unit of power. 1 GW = 1,000,000,000 watts. |
| GWP: Global warming potential | Is the measure of the impact on the climate of various greenhouse gases. |
| HILP: High Impact Low Probability Events | Events which, if they were to materialise, would have a substantial impact on the safety, security, and/or resilience of the GB energy system, at a national level. |
| HM Treasury Green Book | The Green Book is the government's guidance on options appraisal and evaluation. It supports proper consideration of the costs, benefits, and trade-offs of alternative options for delivering policy objectives. The Green Book uses the five-case |

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| | model as outlined in the business case guidance for projects and programmes. This is the government's recommended framework for developing business cases. |
| HND: Holistic Network Design | Provides a recommended onshore and offshore design that could facilitate the UK Government's ambition of 50 GW of offshore wind in GB by 2030. |
| HRA: Habitats Regulations Assessment | A process that determines whether development plans could negatively impact local plans on a recognised protected European site beyond reasonable scientific doubt. |
| HVAC: High voltage alternating current | AC power transmission at voltages above 110 kilovolts (kV). |
| HVDC: High voltage direct current | DC power transmission at voltages above 110 kilovolts (kV). |
| Inertia | The kinetic energy stored in spinning parts of synchronous power generators that helps to stabilise the system. |
| Interconnector | A high voltage cable that connects the electricity systems of neighbouring countries. |
| MCA: Multi Criteria Analysis | Is a form of appraisal, comprising various classes of methods, techniques, and tools, with different degrees of complexity, that explicitly consider multiple objectives and criteria in decision-making problems. |
| MCDA: Multi Criteria Decision Analysis | An analytic method used to select from or rank a set of choices where these can be assessed against delivery on a range of criteria or performance objectives, while providing a clear rational structure for the decisions to be taken. |
| MCZ: Marine Conservation Zone | A Marine Conservation Zone (MCZ) is a type of Marine Protected Area (MPA) in England, Wales, and Northern Ireland, but are referred to in Scotland under the umbrella MPA term. These areas protect the seabed and marine organisms living there by preventing or limiting environmentally damaging activities. |
| MPA: Marine protected area | These areas protect the seabed and marine organisms living there by preventing or limiting environmentally damaging activities. |
| NETS: National Electricity Transmission System | The electricity transmission network in GB which comprises a mixture of overhead cables, underground cabling, subsea cables and associated substation equipment – the size of these assets varies from 400kV, 275kV, and 132kV. |

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|---|---|
| Network model for voltage analysis | An electrical network model of the GB transmission network suitable for voltage analysis, including planned network developments agreed with the transmission network owners and an agreed generation and demand background. The model is built using STCP22-1. |
| Network option | Is the proposed option to meet network needs for a future hydrogen network. |
| Network reinforcement option | A proposed asset or commercial arrangement which could improve the electricity network's function. |
| NGT: National Gas Transmission | Is the owner and system operator of the NTS. |
| NOA: Networks Options Assessment | A NESO-run process that makes recommendations to TOs regarding which projects to proceed with to meet future network requirements as designed in the Electricity Ten Year Statement. |
| Nodal pricing | An alternative to the current national wholesale electricity price. It would use small pricing zones (potentially down to the consumer level) where the prices in individual zones would be based on the costs of producing and supplying energy in that area. |
| NPV: Net Present Value | Is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. |
| NSP: Network services procurement | It opens new opportunities for the industry to offer solutions to meet system needs across constraints, stability, and voltage. It helps reduce the need for new network build and includes our stability and voltage markets. |
| NTS: National Transmission System | Is the network of high-pressure gas pipelines, compressor stations, and other above-ground assets that transport gas from entry to exit points. |
| Ofgem: Office of Gas and Electricity Markets | It is the GB'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. |
| OHA: Offshore hybrid assets | It combines interconnection with other forms of offshore generation, providing the potential for coordination and efficiency benefits compared to standalone point-to-point connections. |

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| OPEX: Operational Expenditure | The cost required to operate and manage assets and enable commercial agreements. |
| REMA: Review of Electricity Market Arrangements | A government policy to review electricity market arrangements to identify reforms needed to transition to a decarbonised, cost effective, and secure electricity system. |
| Resilience | A resilient gas network has the ability to recover from unexpected and unforeseen circumstances. Preventative measures such as supplementing assets with backup units contribute to a higher resilience. |
| RIIO: Revenue = Incentives + Innovation + Outputs | It is the framework used by the regulator Ofgem to ensure the energy sector provides a safe, reliable service that delivers value for money to consumers. |
| SCT: Scenario Creation Tool | It is the tool that creates load duration curve demand days to be analysed within SIMONE for current and future NTS network planning. |
| SEA: Strategic Environmental Assessment | A systematic process aimed at integrating environmental, social, and economic considerations into the development of policies, plans, and programs. It helps to ensure that sustainability is prioritized and that potential environmental impacts are assessed early in the planning process. SEA enhances public participation in decision-making and aims to protect the environment while promoting sustainable development. |
| SIMONE: Simulation and Optimization on Networks | Is the hydraulic modelling software that NESO uses for current and future NTS network planning requirements. |
| SPOP: Strategic Planning Options Proposal | Is NGT's proposal of NTS reinforcement options to be evaluated by NESO. |
| SQSS: Security and Quality of Supply Standard | It sets out the criteria and methodology for planning and operating the National Electricity Transmission System onshore and offshore. |
| SSSI: Site of Special Scientific Interest | Is a protected conservation area in England that has features for special interest, such as wildlife, geology or landform. |
| Stability | It is the inherent ability of the system to quickly return to acceptable operation following a disturbance. The term is used to describe a broad range of topics, including inertia, system strength, and dynamic voltage. |
| System costs | The underlying costs of building, maintaining, and operating infrastructure to provide energy and services. |

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| TPC: Transmission Planning Code | Is NGT's approach to planning and developing the NTS in accordance with their duties as a gas transporter and other statutory obligations. |
| TO: Transmission Owner (onshore) | The licensed companies that operate and maintain the onshore infrastructure within GB, namely National Grid Electricity Transmission (NGET), Scottish & Southern Electricity Networks Transmission (SSEN) and SP Transmission plc. |
| Zonal pricing | An alternative to the current national wholesale electricity price. It would use regional pricing zones where the prices in individual zones would be based on the costs of producing and supplying energy in that area. |

# 5. Legal notice

Legal notice

# Legal notice

For the purposes of this report, the terms “NESO”, “we”, “our”, “us” etc. are used to refer to National Energy System Operator Limited (company number 11014226).

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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