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Siemens plc
Power Technologies International
Sir William Siemens House
Princess Road
Manchester M20 2UR

1 October 2024

Re: Regional Energy Strategic Plan policy framework consultation

Siemens welcomes the opportunity to respond to Ofgem's consultation on Regional Energy Strategic Plan (RESP) Policy framework. We believe this consultation is an important step toward developing a regional approach that enables the efficient, reliable, and sustainable decarbonization of the UK's energy system.

As a global leader in energy technology and infrastructure, Siemens is committed to driving innovation in the energy sector. We have extensive experience in delivering solutions across the entire energy value chain, from generation to transmission and distribution, with a focus on digitalization and decarbonization. Siemens continues to support the UK's net-zero ambitions by developing technologies that enhance grid resilience, flexibility, and efficiency.

Our experience in adaptive planning projects in different countries allows us to provide a holistic perspective on the challenges and opportunities presented by the proposed policy framework.

We have provided detailed responses to the consultation questions in the attached document and would be happy to engage in further discussions on any of the points raised.

Thank you for considering our submission, and we look forward to supporting Ofgem in the development of this vital policy framework.

Sincerely,

Narasimham Arava,
Principal Power System Consultant
Siemens
Nara.Arava@Siemens.com

Response to consultation questions

Q1. What are your views on the principles (in paragraph 2.8) to guide NESO's approach to developing the RESP methodology? Please provide your reasoning.

As outlined in the consultation document, irreducible uncertainties about how the future energy system might evolve play an important role in energy infrastructure expansion planning. There are many plausible scenarios about the long-term energy system evolution as a result of uncertainties about the integration of new technologies, the impact of climate change and the evolution of energy demand.

Current scenario-based planning approaches, based on a few (typically four) scenarios are insufficient to capture the real long-term uncertainty for expansion planning of energy infrastructure. These approaches lead to high risks of capacity bottlenecks in energy infrastructure, stranded assets and diminishing stakeholder support as a result of the limited long-term uncertainty assessment. Moreover, many stakeholders with different interests are affected by an energy infrastructure planning decision. Current planning approaches also fall short of enabling engagement of stakeholders as a result of limiting capability to incorporate stakeholders' visions on the future energy system.

The combination of irreducible uncertainties and many affected stakeholders with different interested qualifies expansion planning of energy infrastructure as a Decision Making under Deep Uncertainty (DMDU) problem. As argued above, current planning methodologies have limitations in supporting DMDU. Planning methodologies that effectively support DMDU problems need to comprise the following capabilities [1]:

1. **Exploratory modelling** – the capability to explore many what-if-scenarios
2. **Adaptive plan creation** – the resulting plan alternatives need to be adaptive. The plan need to be changed depending on how the future unfolds.
3. **Collaborative stakeholder approach** – to enable support for the final planning decision, the affected stakeholders should be engaged seriously in the planning process.

The following in paragraph 2.8 developed principles to guide NESO's approach align with the capabilities to effectively support Decision Making under Deep Uncertainty.

A. **Be place-based**. Location specific uncertainties can significantly impact the energy infrastructure expansion plan. Moreover, stakeholders affected by the planning decision live in the local/regional area. Therefore, this place-based principle makes sense.
B. **Be whole system**. By coordinating energy infrastructure across vectors, uncertainties are reduced resulting in a societal more effective and efficient energy infrastructure expansion plan. Hence, this principle supports effective expansion planning.
C. **Be proactive**. In the explanation of this principle, it becomes clear that the methodology should lead to an adaptive plan. This is fully in line with one of the core principles an effective support method for DMDU rests on. Therefore, we agree with the stated principle. However, we suggest renaming this principle to 'be adaptive'. This directly emphasises the requirement to use / develop a methodology that leads to an adaptive plan.

It makes sense to ask for net zero pathways/scenarios. If that is meant by 'be vision led', we agree. However, to our opinion, the principle 'be vision led', as it is stated in the document, could lead to a more deterministic methodology in which only a (relatively) few preferred long-term futures/pathways will play an important role. The reality is that many different plausible and socially attractive pathways/scenarios are possible. The to be developed methodology to guide strategic expansion planning of energy infrastructure should consider this.

In paragraph 3.12, it appears that 'pathways' differ from scenarios in the sense that pathways comprise a limited number of desirable futures towards net zero while scenarios comprise more futures. It seems that a limited number of pathways is preferred given the proclaimed advantage of providing acceleration of investments ahead of need. Implicitly, it is suggested that working with many scenarios will not lead to the advantage of providing acceleration of these investments. We think that this is not correct. Siemens has developed (initially together with other organizations) the Adaptive Planning method (based on [2]) that is based on the principle of iteratively stress testing of energy infrastructure investment plans in a wide range of scenarios. In this process, different alternative expansion plans are created with corresponding performance robustness performance levels. In the final stage of this strategic planning process an adaptive strategic expansion plan is chosen that provides certainty for investors in energy infrastructure on the short-term, while the deep uncertain nature of the energy system evolution is addressed well. On the longer term, various adaptive investments are part of the plan. Depending on how the energy system evolution unfolds, these adaptive investments are triggered or not. The adaptiveness of the created plans aligns with the expressed need for an adaptive approach (see for example paragraph 3.11). For illustration, in the case study in [2], 10,000 scenarios were used to stress test the integrated expansion plan of energy infrastructure. Stress testing of possible investment plans in many scenarios does not reduce acceleration of investments ahead of need compared to a planning method that uses a limited number of pathways.

Specifying only a limited number of long-term pathways leads to a high risk that future infrastructure expansion plans will not effectively support the local/regional energy transition. This will likely not lead to the strategic planning objective 'transition to a net zero energy system in a cost effective manner' (stated in paragraph 2.5). Using many scenarios as input for the strategic expansion planning process, as in the Adaptive Planning process, significantly reduces this risk.

Moreover, using many long-term scenarios, in contrast to the use of a limited number of pathways, enables proper engagement and support of diverse stakeholders. All stakeholder visions about future scenarios can be incorporated in the set of scenarios that is used to stress test candidate expansion plans. In this way, the transparency of the planning process is enhanced and consequently more support for the planning decision will arise.

From the above we therefore suggest to replace the principle 'be vision led' by the principles 'embrace net zero', 'exploratory modelling' and 'be transparent'.

'Embrace net zero' ensures that all scenarios used in the planning process lead to net zero in 2050.

'Be exploratory' directly guides NESO to develop / use a planning methodology in which short- and long-term irreducible uncertainty will be embraced and the required capability of 'exploratory modelling' is applied.

The principle 'be transparent' will also add value, to our opinion. In a collaborative stakeholder process, (robustness) performance metrics of strategic expansion plans for integrated energy infrastructure should be determined that reflect the local/regional vision about the trade-offs of planning alternatives. In case diverse stakeholders are really engaged in the planning process, support for the final chosen plan will be higher compared to a more individual approach. Furthermore, diverse visions about long-term scenarios can be incorporated in the planning process.

In summary, we recommend the following principles to guide RESP methodology development:

A. Be place-based
B. Be whole system
C. Be adaptive (content is similar to 'be proactive', however the focus is shifted to the need to create an adaptive plan)
D. Be net zero
E. Be exploratory: this is the capability to enable stress testing of an investment plan in many scenarios, which is required for effective support of DMDU
F. Be collaborative: this is required for effective support of DMDU as it enhances the support of multiple stakeholders for the final planning decision.

Q2. Do you agree that the RESP should include a long-term regional vision, alongside a series of short-term and long-term directive net zero pathways? Please provide your reasoning.

A long-term regional vision about how the energy system could change towards net zero in 2050 is important to include in the RESP. As explained in the answer on Q1, we think that the RESP should comprise many scenarios for the short- and long-term. These possible scenarios in the RESP should be aligned with the visions of the stakeholders affected by the strategic network decisions.

Below, we will work out a limited illustrative example of plausible scenarios to support our argumentation for creating many scenarios instead of a limited number of pathways. In this example we take South Scotland as an example RESP region. The RESP objective is to create short- and long-term scenarios to support the creation of strategic expansion plans for integrated energy infrastructure. This area is characterized by two cities (Glassgow and Edinburgh) and a rural area that is connected to the sub-132 kV electricity networks and the gas distribution networks.

Table 1 summarises possible changes of parts of the energy system that impact the transport capacity needs on distribution level. Each row represents a specific change dimension, which we call an external factor. A scenario that both represents a possible short- and long-term evolution of the energy system towards net zero can be generated by selection of a combination of values for each external factor. The total number of plausible scenarios is called the scenario space. This scenario space represents the short- and long-term uncertainty that needs to be considered in strategic network planning. Indeed, in our view, RESP delivers a scenario space per region.

The illustrative example in table 1 is by no means complete. It just serves to illustrate the vast uncertainty about the future evolution of a RESP region. In the developed scenario space in this example the total number of scenarios is 279,841 (23^4). All these scenarios are plausible and lead to net zero in 2050. Upfront selection of a limited number of directive pathways that represent the collection of desirable energy system futures is likely to lead to missing desirable plausible futures that could happen. If the strategic expansion plan is based on these limited number of pathways, it is plausible that socially desirable futures will be hindered by capacity bottlenecks in energy infrastructure. We argue that it is better to use more scenarios as input for strategic expansion planning to lower the risk of capacity bottlenecks and stranded assets. In the developed Adaptive Planning method we have proven that it is possible to use 10,000 scenarios in stress testing of a candidate investment plan [2]. So, the argument that it is not feasible to use many scenarios in the creation of a robust, adaptive plan is invalid.

Table 1: illustrative example of a scenario space for RESP-region South Scotland.

External factor	Value of external factor			
1.Building stock growth Glassgow	Fast and high volume scenario	Intermediate scenario	Slow and low volume scenario	No growth
2.Building stock growth location Glassgow	20/80% West/East of city	50/50% West/East of city	60/40% West/East of city	80/20% West/East of city
3.Industry transition Glassgow	Scenario 1	Scenario 2	Scenario 3	Scenario 4
4.Building stock growth Edinburgh	Fast and high volume scenario	Intermediate scenario	Slow and low volume scenario	No growth
5.Building stock growth location Edinburgh	20/80% West/East of city	50/50% West/East of city	60/40% West/East of city	80/20% West/East of city
6.Building stock growth villages	Fast and high volume scenario	Intermediate scenario	Slow and low volume scenario	No growth
7.Building stock growth location villages	20/80% West/East of region	50/50% West/East of region	60/40% West/East of region	80/20% West/East of city
8.EV volume growth	Fast and high volume scenario	Intermediate scenario	Slow and low volume scenario	No growth
9.Charging infrastructure development	90% centralized charging / 10% home charging	70% centralized charging / 30% home charging	30% centralized charging / 70% home charging	10% centralized charging / 90% home charging
10.Truck transport transition technology mix	90% electricity/10% hydrogen	70% electricity/30% hydrogen	50% electricity/50% hydrogen	30% electricity/70% hydrogen
11.Rooftop PV growth	Fast and high volume scenario	Intermediate scenario	Slow and low volume scenario	No growth
12.Heat transition technology evolution built environment	First hybrid boilers, later heat pumps	Immediate change towards heat pumps	Mix of waste heat, geothermal heat and heat pumps	Hydrogen boilers
13.Heat transition pace built environment	Fast scenario	Intermediate scenario	Slow scenario	No growth
14.Data centre growth	Fast scenario	Intermediate scenario	Slow scenario	No growth
15.Data centre growth location	Locational scenario 1	Locational scenario 2	Locational scenario 3	Locational scenario 4
16.Onshore wind growth	Fast scenario	Intermediate scenario	Slow scenario	No growth
17.Onshore wind growth location	Locational scenario 1	Locational scenario 2	Locational scenario 3	Locational scenario 4
18.Solar PV park growth	Fast scenario	Intermediate scenario	Slow scenario	No growth
19.Solar PV park location	Locational scenario 1	Locational scenario 2	Locational scenario 3	Locational scenario 4
20.Tidal electricity generation growth	Fast scenario	Intermediate scenario	Slow scenario	No growth
21.Tidal electricity generation location	Locational scenario 1	Locational scenario 2	Locational scenario 3	Locational scenario 4
22.Distributed green hydrogen growth	Fast scenario	Intermediate scenario	Slow scenario	No growth
23.Distributed green hydrogen growth location	Locational scenario 1	Locational scenario 2	Locational scenario 3	Locational scenario 4

Q3. Do you agree there should be an annual data refresh with a full RESP update every three years? Please provide your reasoning.

In general we agree. However, in case fast change occurs in the energy system, for example a faster uptake of rooftop PV as expected, then a full RESP update is legitimate instead of only an annual data refresh. It should be prevented that a full RESP revision is not done while it actually adds value to do given circumstances of significant changes in the energy system.

Q4. Do you agree the RESP should inform the identification of system need in the three areas proposed? Please provide your reasoning, referring to each area in turn.

Overall we agree. However, possibly the guidance should be more specific in order to develop a proper strategic planning process, associated support tools, and an effective link to the detailed network planning process. Therefore, we elaborate on our view of an effective strategic network investment process in more detail below.

In the consultation document the following three areas are proposed to inform the identification of system need (paragraph 3.20):

1. Providing consistent assumptions
2. Setting out the spatial context for capacity needs
3. Informing strategic network investment

Given the objective of identifying strategic network investment (paragraphs 3.23 and 3.31), it is necessary to conduct a coarse transportation / load flow analysis where the spatial context of possible developments of the energy system is essential. This also requires assumptions necessary to compute a peak load per scenario/pathway, similar to what is necessary for detailed network planning conducted by the network operators. In order to inform strategic investments, 'strategic optioneering' is also necessary. To sum up, the first two areas proposed to inform the identification of system need are required inputs for facilitating a modelling process that leads to informing strategic network investment.

Furthermore, providing consistent assumptions (first area) for getting more consistency in detailed network planning also supports a more effective coordinated network planning.

Figure 1 outlines our view of the strategic planning process and the relation with the detailed network planning. Providing consistent assumptions and setting out the spatial context for capacity needs are inputs for the modelling process that leads to informing strategic network investment. Without a modelling process it is not possible to inform on strategic network investment. The modelling process leading to strategic network investment requires the elements shown in table 2. Some of the elements listed in table 2 are not mentioned in the consultation document. We suggest to adjust guidelines in order to guide NESP methodology that leads to strategic network investments.

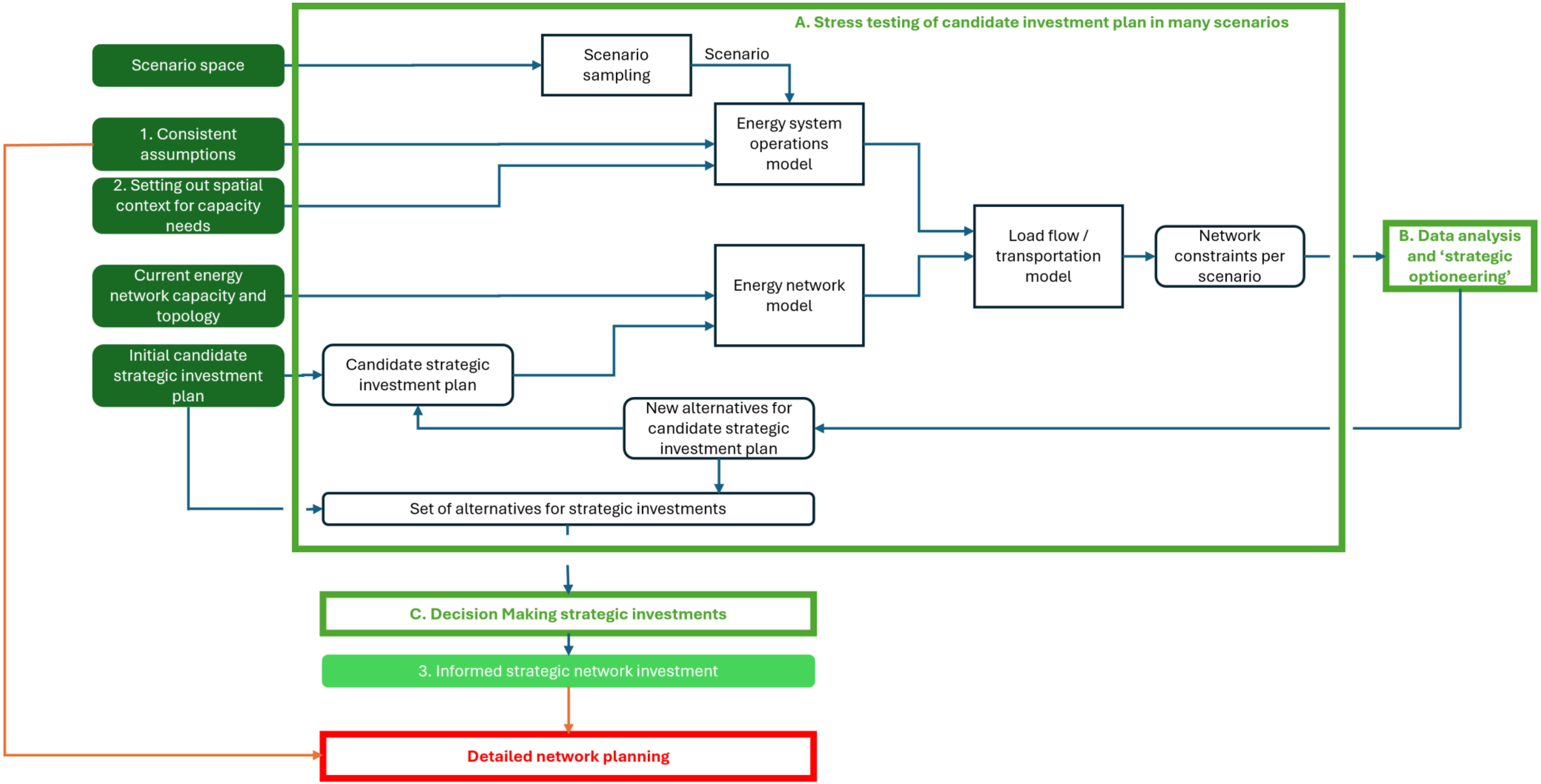

Figure 1: Siemens vision on RESP strategic modelling process: Adaptive Planning process, based on the principle of stress testing of investment plans

Table 2: required elements for the strategic modelling process leading to strategic network investment (see also figure 1)

Element	Functions
Scenario space	- Input for RESP stress testing process step
Consistent assumptions	- Input for RESP stress testing process step - Input for detailed network planning
Setting out spatial context for capacity needs	- Input for RESP stress testing process step
Current energy network capacity and topology	- Input for RESP stress testing process step
Initial candidate strategic investment plan	- Input for RESP stress testing process step
Scenario sampling model	- Required modelling capability for RESP stress testing process step
Energy systems operations model	- Required modelling capability for RESP stress testing process step
Energy network model	- Required modelling capability for RESP stress testing process step
Load flow / transportation model	- Required modelling capability for RESP stress testing process step
Data analysis and ‘strategic optioneering’	- Process to iteratively improve strategic robust, adaptive investment plans
Decision making strategic investments	- Selection process to select informed strategic network investment
Informed strategic network investment	- Output of RESP Adaptive Planning process - Input for detailed network planning

Q5. Do you agree technical coordination should support the resolution of inconsistencies between the RESPs and network company plans? Please provide your reasoning.

We agree that technical coordination is required. We also agree on the provided rationale for technical coordination.

Another essential point that is currently not mentioned as part of technical coordination is the **‘strategic optioneering’** required to develop alternatives for strategic investments (see figure 2). In Siemens’ view, it is necessary that experts from network operators participate in the process of ‘strategic optioneering’ within the RESP strategic modelling process. Active collaboration between RESP and network operators in this process will lead to better quality strategic investment alternatives. Moreover, this will facilitate the incorporation of informed strategic network investment into the detailed network planning process.

Q6. What are your views on the three building blocks which come together to form the RESP in line with our vision? Are there any key components missing?

We think that a **strategic modelling process** (see A,B,C processes and required additional input in figure 1) that leads to informed strategic investment is missing as a component. In this process, using models that enable stress testing of candidate investment plans is required. Furthermore, data analysis and 'strategic optioneering' is required to identify alternatives for robust, adaptive strategic investments. In this missing component, engagement of network operators is essential (providing network data, aligning modelling granularity, supporting strategic optioneering, decision making on strategic investment).

Q7. Do you agree with the framework of standard data inputs for the RESP? Please provide your reasoning.

We agree with the framework of standard data inputs. Furthermore, we think it is important that this standard evolves as new technologies develop and new data sources become available. It is logical to standardize the data, and it is also necessary to adjust the framework of standard data inputs over time.

Next to the posed data sources and types, it is important to include future possible technologies that could be integrated in the longer-term. To integrate these data, we suggest to use data from knowledge institutions like universities in the field of 'energy system development'. Only relying on market and government organisations for data input will not lead to a complete picture about how the energy system could evolve in the longer run.

Furthermore, we think that it is important to be flexible in terms of data input needs. In case stakeholders provide unexpected visions about future energy system development, NESO need to seriously consider these visions and incorporate these into the scenario space (see our answer to Q2). This leads to possible new data needs. In that case, it should be explored how the new data could be collected.

Q8. Do you have any suggestions for criteria to assess the credibility of the inputs to the RESP?

We think that ownership of data provision for RESP is important. For example, the network operators are responsible to provide energy network data. For other data collection, organizations should be made responsible and accountable for the provision of proper quality data.

Q9. Do you agree with the framework for local actor support? Please provide your reasoning.

We agree. We suggest to add **'improving planning processes'** to the last bullet in paragraph 3.56.

Q10. Do you agree with the purpose of the Strategic Board? Please provide your reasoning.

Yes, we agree with the purpose of the Strategic Board as outlined in the RESP policy framework. The Strategic Board plays a crucial role in facilitating regional energy planning by ensuring coordination, transparency, and alignment between local and national energy goals.

Facilitating Collaboration and Transparency

- **Purpose**: The Strategic Board is meant to bring together key regional actors, such as local authorities and network operators, to facilitate collaboration and provide a forum for aligning energy system planning with local and regional priorities.
- **Reasoning**: This approach ensures that local actors have a voice in energy planning, allowing for a more inclusive and place-based approach to decarbonization. By including various stakeholders, the Board can help balance technical expertise with local knowledge, fostering better decision-making and public acceptance of energy projects. It should be stimulated that there is regular interaction between the strategic board and the local actors to iteratively improve and adapt local priorities based on RESP guidelines.

Oversight and Coordination

- **Purpose**: The Strategic Board provides oversight in the development of the RESP, ensuring that the plan aligns with local needs while also supporting national decarbonization goals.
- **Reasoning**: Given the complexity of the energy transition, coordination across multiple sectors and regions is essential. The Strategic Board helps to ensure that investments and planning efforts are made in a coherent and timely manner, avoiding fragmentation and duplicative efforts.

Navigating Trade-offs

- **Purpose**: The Board's role in navigating trade-offs between competing energy projects, network infrastructure, and other spatial planning needs is essential to balancing different interests.
- **Reasoning**: Energy projects often involve difficult trade-offs between economic, environmental, and social factors. A forum where these trade-offs can be discussed and resolved transparently, under the guidance of a board with diverse representation, helps mitigate conflicts and supports more effective decision-making.

Accountability and Regional Focus

- **Purpose**: The Strategic Board ensures that the RESP reflects the unique characteristics of each region while aligning with national objectives. It acts as a body of accountability that brings local priorities into focus.
- **Reasoning**: Regional energy systems vary significantly in terms of infrastructure, renewable potential, and local policies. The Strategic Board ensures that the RESP incorporates these local specificities while maintaining accountability for achieving cost-effective and socially acceptable decarbonization of the system. This approach increases the likelihood of successful, tailored solutions across different regions.

Q11. Do you agree that the Strategic Board should include representation from relevant democratic actors, network companies and wider cross-sector actors in each region?

Yes, we agree that the Strategic Board should include representation from relevant democratic actors, network companies, and wider cross-sector actors in each region. This inclusive representation is crucial for ensuring that the RESP reflects diverse perspectives and addresses the specific energy, economic, and social needs of each region. Including representation from democratic actors, network companies, and wider cross-sector actors ensures that the Strategic Board has the necessary balance of accountability, technical expertise, and cross-sector insights to develop robust, regionally appropriate energy strategies. This holistic approach enhances the legitimacy of the planning process and ensures that energy systems are developed in a way that benefits both the local population and the broader transition to a low-carbon future. This enables support from different stakeholders affected by the decisions made by NGOs, small scale industry etc.

Q12. How should actors (democratic, network, cross-sector) be best represented on the board? Please provide your reasoning, referring to each in turn.

Democratic Actors (Local Government):

Representation:

- **Upper-tier authorities** in England (county, unitary, and combined authorities), and **unitary councils** in Scotland and Wales, should be represented.
- Local democratic institutions (e.g., local councils) should have a voice to ensure the alignment of energy system planning with regional priorities, spatial planning, and decarbonisation goals.
- Representation should be adjusted periodically to ensure democratic legitimacy.

Reasoning: Democratic actors represent the public interest and ensure local communities have a say in how energy systems evolve. Their participation provides a link between energy system planning and broader regional development strategies, ensuring that local decarbonisation targets, housing policies, and transport plans are aligned with energy investments. This helps ensure that energy projects are locally supported and meet the specific needs of each region. It is necessary to build this expertise in these institutions in the long term for the benefit of the local community.

Network Actors (Energy Companies and Infrastructure Providers):

Representation:

- **Network companies** (such as Distribution Network Operators (DNOs), Gas Distribution Networks (GDNs), and Transmission System Operators) should have seats on the board.
- These actors should provide **strategic optioneering capability, technical oversight** and offer input and engage on how the RESP will affect network planning, investment, and capacity.

Reasoning: Network actors have technical expertise and are responsible for the actual operation and expansion of energy infrastructure. Their participation ensures that energy system planning is realistic, technically feasible, and aligned with operational needs. They should play a prominent role in the process that leads to informed strategic network investment (see figure 1). Including them helps avoid disconnection between actual network capacity, strategic planning and detailed network planning. This ensures that investments in energy infrastructure are coordinated and optimized across electricity, gas, heat, and other energy vectors. This will also ensure that the strategic investment choices are supported by the network actors and this'll facilitate an effective detailed network planning process.

Cross-Sector Actors (Private Sector, Knowledge Institutes, Industry, Civil Society, NGOs):

Representation:

- Cross-sector representation should include **industry experts**, **businesses**, **non-governmental organizations (NGOs)**, and other relevant **community and environmental stakeholders**.
- Participation can be flexible, with specific actors included based on the unique needs of each region (e.g., heat networks, hydrogen projects, or local community energy initiatives).

Reasoning: Cross-sector actors bring innovative solutions, private investment, and insights into how energy systems intersect with broader societal and industrial needs. For example, businesses can help guide investment in new technologies, while NGOs can represent community interests, ensuring that the energy transition is socially inclusive and environmentally sustainable. Cross-sector actors also facilitate collaboration across industries, driving innovation and fostering holistic solutions to decarbonisation. As developments in other sectors, such as nature conservation, agriculture, and water protection also require land space, it is important to consider the impact of developments on land use. Spatial planning organisations should also be consulted during the RESP process.

In conclusion,

- **Democratic actors** ensure the RESP aligns with regional policy goals and local community interests.
- **Network actors** ensure the technical feasibility and operational alignment of energy planning with infrastructure.
- **Cross-sector actors** bring innovation, private investment, and ensure diverse stakeholder engagement, which is critical for addressing environmental and community concerns.

The combination of these three types of actors ensures that the RESP is well-rounded, locally informed, technically sound, and inclusive of diverse perspectives.

Q13. Do agree with the adaptations proposed for Option 1? Please provide your reasoning.

Yes, we agree with the adaptations proposed in Option 1 because they balance **regional population sizes**, enhance **coordination with energy infrastructure**, and maintain geographic and functional consistency.

Population Balancing:

- The division of larger areas, such as the North and Midlands, is aimed at creating regions with populations that are closer to the mean regional population size, ensuring more manageable and effective planning.

Alignment with Energy Infrastructure:

- By aligning regions more closely with DNO boundaries, the plan allows for better coordination of energy distribution and infrastructure investments, enhancing technical and operational efficiency.

Geographic and Functional Consistency:

- The amalgamation of smaller regions, like Western Gateway and Peninsula, helps to align economic and spatial planning, reflecting how these regions are already working together on infrastructure projects.

Q14. Do you agree with our assessment that Option 1 is a better solution than Option 2? Please provide your reasoning.

We think that option 1 is better than option 2 for several key reasons related to governance alignment, operational practicality, and regional representation.

Alignment with Existing Strategic Bodies:

- **Option 1** blends Sub-national Transport Bodies (STBs) and ITL1 boundaries, which reflects the current functional economic geographies and the institutional arrangements already in place.
- Many regions in England are already cooperating through STBs on infrastructure planning, particularly on transport and economic development. This existing alignment reduces the friction of introducing new governance structures, making implementation smoother.
- **Option 2** relies solely on ITL1 regions, which, while useful for statistical purposes, do not always align with current collaborative structures or economic regions, making coordination more challenging.

Improved Regional Representation:

- **Option 1** ensures more accurate representation of regional needs by splitting larger regions (such as the North and Midlands) where appropriate. This results in regions that are more balanced in terms of population size and energy demand.
- The adaptations in **Option 1** (e.g., splitting the North and Midlands) reflect the diverse energy needs and economic conditions across these sub-regions, whereas **Option 2** might lump areas with very different profiles together, which could dilute the effectiveness of planning and investments.

Practicality for Energy Infrastructure:

- **Option 1** aligns better with Distribution Network Operator (DNO) boundaries, making energy system planning and infrastructure development more practical and efficient. This enables better coordination with network operators and ensures that the energy infrastructure investments are tailored to actual operational zones.
- **Option 2**, based purely on ITL1 regions, does not account for the operational divisions within the energy sector, potentially complicating the integration of energy infrastructure and distribution planning.

Geographic and Functional Flexibility:

- **Option 1** is designed with flexibility in mind, incorporating regional boundaries that are more representative of actual socio-economic and geographic divisions. This flexibility allows for more place-based planning, crucial for the decarbonisation goals tied to local conditions, housing, and transport developments.

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- **Option 2** lacks this flexibility, as ITL1 boundaries are fixed and do not always reflect the real-world economic, social, and environmental contexts that affect energy planning.

Q15. Do you agree a single region for Scotland is optimal? If you think a two-region solution is better, do you agree the split should occur at the SSEN and SPEN DNO boundary? If not, please provide your reasoning and alternative option(s).

We think a two-region solution is better and here are some reasons in support of this solution.

Geographical and Demographic Differences:

- Northern Scotland (SSEN area) has unique challenges due to its sparse population, remote communities, and the need for specific infrastructure, such as off-grid solutions or microgrids for island regions.
- Southern Scotland (SPEN area), which includes more urbanized and industrial regions like Glassgow and Edinburgh, has different energy demands related to higher population density, urban energy efficiency projects, and industrial decarbonization.
- By splitting into two regions, energy planning could be more finely tuned to these geographic and demographic variations, ensuring better-targeted investments.

Tailored Energy Solutions:

- Renewable energy generation is concentrated in the Highlands and Islands (offshore wind, tidal, and hydroelectric power), which requires different types of infrastructure and investment compared to the Central Belt with its urban and industrial load centers.
- A two-region model allows each region to focus on the development of their distinct energy resources and tailor grid improvements and innovations to specific needs, such as better storage for renewables in the north or heat networks in the south.

Operational Efficiency for DNOs:

- By aligning with the SSEN and SPEN Distribution Network Operator (DNO) boundaries, each DNO can coordinate more effectively within a specific region, rather than trying to address vastly different needs in a single governance structure.
- The two-region model enhances operational efficiency by giving DNOs more focused oversight of regional grid constraints, potential network upgrades, and localized energy demand management strategies.

Targeted Investment and Development:

- Northern Scotland has more room to experiment with decentralised energy systems, such as community energy projects and microgrids, given its lower population density and renewable energy potential.
- Southern Scotland, with its urban focus, could concentrate on electric vehicle (EV) infrastructure, energy efficiency retrofits, and smart grid technology tailored to high-density living.
- Having two distinct regions would allow for better-targeted government and private sector investments based on the different needs and opportunities in each area.

In summary, a two-region model would allow for **more tailored energy solutions**, **enhanced stakeholder involvement**, and **better governance alignment** with existing energy distribution boundaries, while promoting **regional innovation** and **resilience**. The split at the **SSEN and SPEN boundary** provides a natural division based on current operational needs, ensuring that both regions can focus on their unique challenges and opportunities.

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