

Electricity Networks Commissioner – Companion Report Findings and Recommendations

June 2023



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1. About Energy Systems Catapult

Part of a world-leading network of innovation centres, Energy Systems Catapult was set up to accelerate the transformation of the UK's energy system and ensure UK businesses and consumers capture the opportunities of clean growth.

We are an independent, not-for-profit centre of excellence that bridges the gap between industry, government, academia, and research – with around 250 staff based in Birmingham with a variety of technical, commercial and policy backgrounds.

We take a whole system view of the energy sector – from power, heat and transport to industry, infrastructure, and consumers – helping us to identify and address innovation priorities and market barriers to decarbonise the energy system at the lowest cost.

To overcome the systemic barriers of the current energy market, we work to unleash the potential of innovative companies of all sizes. Helping them to develop, test and scale the products, services and value chains required to achieve the UK's clean growth ambitions as set out in the Industrial Strategy.

2. Introduction

In June 2022 the Electricity Networks Commissioner (ENC) was appointed and tasked with providing advice to Government on how to reduce the time it takes to deliver transmission infrastructure in Great Britain. The Commissioner has now delivered his report as a letter to the Secretary of State.¹

The Commissioner was supported in his efforts by Energy Systems Catapult (ESC). ESC undertook work focussed on building deep understanding of the current delivery process and how it might be improved, enabling options to be identified and recommendations for change to be prepared.

The purpose of this document is to summarise and present ESC's findings and recommendations. This ESC report is a companion report to the Commissioner's letter; the two should be read and considered together. The ESC findings and recommendations inform and complement those presented by the Commissioner and provide additional detail. Each of the Commissioner's areas of recommendation is supported by one or more of ESC's recommendations.

The document begins with a summary of the context and the transmission infrastructure delivery challenge. The method used in the work is then described and an overview of key themes is presented. Together these provide the foundation for recommendations that will enable a significantly improved delivery time of around seven years to be achieved. The document closes with comments about immediate actions and further work that would be beneficial.

In undertaking its work ESC engaged with academic, Government, industry, and other stakeholders. ESC would like to express its appreciation to this community of committed organisations and individuals. ESC gratefully acknowledges their significant contributions through direct engagement, the Advisory Board, the Consult and Review Group and stakeholder workshops:

- Department for Energy Security and Net Zero; Department for Levelling Up, Housing and Communities; Department for Education; Department for Environment, Food and Rural Affairs; Planning Inspectorate
- Scottish Government; Welsh Government
- Ofgem
- Climate Change Committee
- National Infrastructure Commission
- National Grid Electricity Transmission; Scottish Hydro Electric Transmission; Scottish Power Transmission
- National Grid Electricity System Operator

¹ Letter from the Electricity Networks Commissioner to the Secretary of State, June 2023

- The Crown Estate; Crown Estate Scotland
- BEAMA; Cardiff University; Electric Power Research Institute; Elexon; Energy Networks Association; Energy UK; EU Skills; GE Renewable Energy; Hitachi Energy; Imperial College London; Local Government Association; Morgan Sindall; Natural England; Natural Resources Wales; Neath Port Talbot Council; Renewable Energy Association; Renewable UK; Royal Academy of Engineering; Siemens Energy; The Association for Decentralised Energy; University of Bath; University of Strathclyde
- Powerlink Queensland Australia; Guidehouse Germany

ESC also acknowledges the valued work of the industry expert champions Tim Pick (UK Offshore wind champion), Jane Toogood (Hydrogen champion) and Simon Bowen (Interim Chair for Great British Nuclear (GBN)) and the publicly available reports on Offshore Wind² and on Hydrogen³.

² [Independent Report of the Offshore Wind Champion](#)

³ [Hydrogen Champion Report](#)

3. The Need for Action

The UK Government has committed to a fully decarbonised electricity system by 2035, subject to security of supply considerations, and to Net Zero by 2050⁴ (2045 in Scotland). Nearer term objectives include ambitions to deploy up to 50GW of offshore wind and to progress up to eight new nuclear reactors by 2030. In addition, there is an expectation for a five-fold increase in solar deployment of up to 70GW, by 2035.⁵ Electricity demand is expected to increase two-fold or more by 2050 as different sectors – including transport, heat and industry – electrify.⁶ Supporting this growth will require transformation of the energy system, including the electricity transmission network that will connect clean generation capacity to demand centres, many of which could be in distant locations. Transmission network build will be needed at an unprecedented scale and pace.

Development of new transmission infrastructure currently takes twelve to fourteen years and is often on the critical path for the connection of new generation. The UK has been successful in stimulating investment in generation from renewables but there has not been commensurate investment in transmission networks. This means that the 'queue' to connect to the transmission grid is extremely congested, with more than 230GW of generation projects in the connection queue (compared to c.80GW of generation currently connected).⁷ This has resulted in renewable energy developers and other connection customers receiving connection offers for the 2030s, slowing the energy transition.

National Grid Electricity System Operator (ESO) estimates that even with optimal reinforcement of the grid, annual constraint costs could rise from around £0.5-1 billion per year in 2022 to a peak of £2-4 billion per year around 2030.⁸ Part of the solution is connection reform for which the UK Government is developing an action plan, but this is not sufficient. New infrastructure is needed to support the increase in the number of renewable projects. In Great Britain, around four times as much new transmission network will be needed in the next seven years as was built since 1990.⁹

Similar issues are being faced and responded to around the world. An estimated \$21.4 trillion of investment will be needed worldwide by 2050. The US Inflation Reduction Act has assigned \$29 billion to electricity networks out to 2030, aiming to stimulate \$83 billion in investment in the same period.¹⁰ With the global move towards low-carbon electricity systems, there is fierce competition to secure essential supply chains, for example for high voltage cables, power transformers and High Voltage Direct Current (HVDC) equipment, and for skilled personnel.

⁴ [Plans unveiled to decarbonise UK power system by 2035](#)

⁵ [HMG British Energy Security Strategy 2022](#)

⁶ [Department for Energy Security and Net Zero \(2022\), Electricity Networks Strategic Framework: Enabling a secure, net zero energy system, Appendix 1: Electricity Networks Modelling, section 2.1,p 11.](#)

⁷ [National Grid Electricity Systems Operator \(2022\) GB Connections Reform](#)

⁸ [National Grid ESO \(2022\) Modelled Constraint Costs NOA 2021/22 Refresh – August 2022](#)

⁹ DESNZ Analysis Calculated based on transmission network project length data provided by the three Transmission Owners.

¹⁰ [Bloomberg NEF \(2023\). New Energy Outlook: grids](#)

The rapid transformation of the electricity system will require significant levels of investment but the impact on consumer costs will depend on other key components that make up energy bills, for example cost reductions resulting from moving away from fossil fuels. HM Treasury's Net Zero Review suggested that the average electricity bill in 2050 for a household with an electric vehicle and a heat pump could be broadly similar or even lower than the average electricity, heat and transport fuel costs for a household in 2019, where that household has an internal combustion engine vehicle and a gas boiler.¹¹ Decreasing the amount of time to build electricity transmission infrastructure means a growing variety and number of generation and demand customers will be able to connect to the grid more quickly and cost-effectively. This will enable consumers to be offered more ready access to the benefits that arise from electrification and use of low carbon technologies, thereby serving the needs of both consumers and the system as a whole. Other benefits will also arise; for example, more network capacity will mean that costs from constraining generation will be reduced, which will be reflected in consumer bills.

If there is commitment to development of the transmission grid to respond to the challenges and opportunities presented by decarbonisation of the power system, and the necessary investments are made, it is estimated that 50,000 to 130,000 additional jobs could be supported across the country. Investment in network infrastructure could contribute £4-11 billion to the economy.¹² The increased pace of rollout of renewable energy generation projects that a reinforced grid will allow, would also make the UK more energy independent, whilst helping protect consumers from volatile international energy markets.

The appointment of the Electricity Networks Commissioner reinforced the focus placed on timely and sufficient network investment and specifically how to significantly reduce the time taken to deliver transmission infrastructure. The Commissioner's work was intended to offer options to reduce the time by three years initially, and ultimately to halve the time taken. The Commissioner has responded on the basis that it is necessary and possible to achieve a delivery time of around seven years.

Options for change must build on existing efforts where these efforts are well-founded and ambitious, and there is alignment of objectives and implementation approaches. There is a significant body of work across the sector which reinforces the need for action, illuminates areas to be considered, and offers important contributions to achieving the goal of building transmission infrastructure more quickly and delivering energy system transformation more broadly.

¹¹ HM Treasury (2021), Net Zero Review Final Report, p. 56, <https://www.gov.uk/government/publications/net-zero-review-final-report>

¹² <https://www.gov.uk/government/publications/electricity-networks-strategic-framework> BEIS/OFGEM Electricity Networks Strategic Framework (2022) GVA, undiscounted, 2020 prices. Section 7 'Future employment & GVA impacts from onshore network investment' in 'Appendix I: Electricity networks modelling'.

Key aspects of some of these works are as follows:

- **Improving strategic planning:** Until recently, identification of need has been a slow, iterative, and case-by-case process. The Holistic Network Design (HND), published in July 2022¹³, provides a strategic blueprint for the coordinated connection of 23GW of offshore wind to the network by 2030. The HND will be followed by the Centralised Strategic Network Plan (CSNP), to be delivered in 2024-2025 by the new independent Future System Operator (FSO)¹⁴. The CSNP is intended to provide a blueprint for the whole transmission network to enable coordinated and accelerated network development, including alignment between onshore and offshore networks.
- **Streamlining planning consent:** A consultation on the revised energy National Policy Statements (NPS) has been published¹⁵. It proposes amendments to bring forward new transmission infrastructure by reflecting the importance of strategic network planning and clarifying presumptions, including for example, on when underground cabling may be used.
- **Expediting regulatory approval:** Ofgem plays a key role as the regulator of regional monopoly transmission network owners (National Grid Electricity Transmission (NGET) in England and Wales, and Scottish Hydro Electric Transmission (SHET) and Scottish Power Transmission (SPT) in Scotland). Ofgem's Accelerating Strategic Transmission Investment (ASTI) decision¹⁶ will speed-up c.£20 billion worth of key strategic transmission infrastructure projects for 2030 delivery.
- **Community acceptability:** Government is consulting on community benefits for network infrastructure¹⁷, so communities hosting transmission infrastructure can benefit from supporting their delivery.
- **Connections reform:** Connections are delayed by lack of physical network capacity, but speculative developments can also take up space in the connections queue. The UK Government is working with Ofgem and the transmission network owners to develop solutions and will publish a Connections Action Plan in the summer of 2023.

While these initiatives (and others) contribute to making progress in certain areas, they are not sufficient to achieve the needed improvement in the time it takes to deliver transmission infrastructure.

¹³ Holistic Network Design: <https://www.nationalgrideso.com/future-energy/pathway-2030-holistic-network-design/holistic-network-design-offshore-wind>

¹⁴ The creation of the FSO is being introduced through the Energy Bill, currently passing through the Houses of Parliament (<https://bills.parliament.uk/bills/3311>)

¹⁵ National Policy Statements: <https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-revisions-to-national-policy-statements>

¹⁶ <https://www.ofgem.gov.uk/publications/decision-accelerating-onshore-electricity-transmission-investment> December 2022

¹⁷ Community benefits for electricity transmission network infrastructure: <https://www.gov.uk/government/consultations/community-benefits-for-electricity-transmission-network-infrastructure>

The following issues should also be considered in establishing the path forward:

- **Citizen engagement:** The needs and preferences of citizens are not considered in a timely and effective way. People and the communities in which they live and work will be impacted by transmission infrastructure build. These impacts may be seen as negative (e.g., loss of visual amenity) or positive (e.g., economic opportunities) but in either case, there is a need for constructive engagement to ensure that citizens have the benefit of clear information to enable proper individual and collective assessment. Community benefits have a role to play in engagement, but do not in themselves satisfy the requirement.
- **Whole process transformation:** Efforts may feel ambitious individually, but they are largely constructed to address incremental improvement in a particular aspect of the end-to-end delivery process and do not account for interactions, inter-dependencies and trade-offs that will be required. Change needs to be transformative, not incremental. Strategic planning is required and must be accompanied by strategic delivery that coordinates these efforts and places them in a whole system context.
- **Skills:** There is an acknowledged shortage of skills in the organisations that are required to deliver existing programmes, let alone respond to the need for more infrastructure being delivered at an accelerated pace.
- **Wider transition decisions:** The focus on transmission infrastructure is both important and urgent, but not sufficient for achieving Net Zero. Generation, storage, distribution networks and demand are all relevant to the infrastructure discussion, although not within the scope of this study. As an example, to illustrate this dependency, distribution networks will also need to be significantly transformed to deliver low carbon electricity to consumers in a much more decentralised, distributed system. New transmission infrastructure is necessary to deliver this electricity to the distribution networks, but without the distribution networks being ready, it will not be possible to achieve the degree of decarbonised electrification anticipated.
- **Network asset utilisation:** The focus of this study is on the question of how to build transmission infrastructure more quickly. It is acknowledged that answering this question will be partly informed by other considerations which could enable faster connection of low carbon generation, including for example, the contribution of well-functioning flexibility markets, opportunities for use of grid-forming technologies or dynamic rating to increase capacity of existing infrastructure, deployment of storage to delay or avoid the need to build networks and application of digitalisation including Artificial Intelligence to enhance operations, amongst others.
- **Strategic coordination:** There is high risk that objectives for 2030, 2035 and 2050 will not be met unless concerted, courageous action is taken by strategically coordinated Government, regulator, industry and citizen efforts. The approach to achieving coordination is not yet established in practice although there are encouraging signs this need is accepted in principle.

Failure to achieve dramatic transmission build time improvements will jeopardise the statutory commitment to Net Zero, erode, rather than build energy security, and lead to

higher capital and operational costs to deliver energy services. In addition, there will be both direct and indirect economic and social impacts if clean energy is not available on a timely and affordable basis.

The required changes are profound and urgent. They impact policy, regulation, planning, technology, construction, and commercial environments. But these changes to improve delivery of GB transmission infrastructure are both possible and achievable if there is sufficient commitment and a sense of urgency.

4. Approach

Recommendations for change in the transmission delivery process should be based on a sound understanding of the current process, the findings from review and analysis of potential areas for improvement and insights from validation of potential changes with those who understand the realities of delivery well. The task of preparing recommendations requires a clear focus on achieving substantial, but realistic reduction in the time taken to deliver needed infrastructure whilst ensuring that good climate, economic and social outcomes can be achieved.

ESC used two complementary approaches to identify issues in the current process and potential interventions for change; these were carried out in parallel and allowed cross-validation of their respective findings:

1. Process mapping and identification of areas for improvement.
2. Understanding the minimum time required for each stage of the end-to-end process.

The process mapping approach developed a shared, deep understanding of the current process; analysed it; created intervention options; and iteratively matured interventions into recommendations. Each of these steps involved engagement with a broad community of stakeholders, through structured and informal workshops and bilateral meetings. The key steps followed in this approach are shown in Figure 4.1. The importance and value of stakeholder engagement is underscored; more than 200 stakeholders from across the sector were involved in this work.



Figure 4.1 Process mapping approach - key steps

The minimum process approach looked at the fastest method of delivery for different stages of the end-to-end process. It began by quantifying the estimated time it takes to physically construct a typical network reinforcement. This was established through a series of bilateral conversations with stakeholders from the supply chain, construction companies and TOs. The next step was to understand how to rearrange the remaining parts of the process to achieve the desired objective, with this understanding being validated and updated through a workshop with key stakeholders. The steps followed in this approach are illustrated in Figure 4.2.



Figure 4.2 Minimum process approach - key steps

4.1 Mapping the Process

Establishing a solid understanding of the current process for transmission infrastructure delivery was key to enabling identification of issues, potential opportunities for change and possible interventions. This understanding provided a baseline for engagement and for measuring potential improvements. Early in the project, key stakeholders and organisations, including the Transmission Owners (TOs), ESO, the planning bodies - Planning Inspectorate (PINS), Department for Levelling Up, Housing and Communities (DLUHC) and Scottish Government, the regulator (Ofgem) and the Department for Energy Security and Net Zero (DESNZ) were engaged and information on the current process requested.

The responses to the requests for information were analysed with the findings forming the basis of the first draft of a system process map. This end-to-end process map considered system interactions, where responsibilities lie, the rough time frame for interactions and reviews, artefacts produced as part of the process and bottlenecks.

The content of this map was validated and modified through a series of workshops with a broad range of stakeholders. This enabled an increasingly accurate version of the current process to be established and shared. Further workshops and one-to-one discussions with stakeholders also helped identify key challenges and issues in each step of the process. This content was captured and analysed.

This exercise enabled identification of potential improvements and efficiencies within the end-to-end process. Figure 4.3 shows a simplified high-level map of the current process. A more detailed version was used to explore issues and “bottlenecks” for each process activity and for each stakeholder(s) involved in the activity.

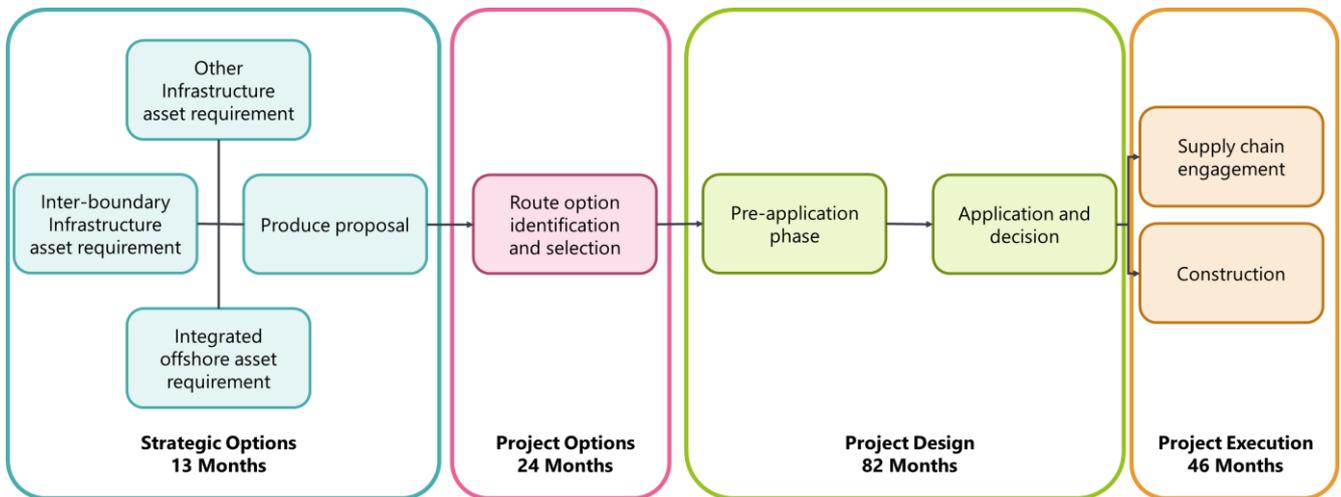


Figure 4.3 High level process map of current process

4.2 Identification of key themes

Review and analysis of the current process, and the insights offered by key stakeholders, allowed several key challenge themes to be identified. These themes shaped and formed a foundation for the work and for the task of considering options for change.

- Strategic plan:** There is broad recognition of how hard it is to make decisions given the complexity and uncertainty of energy system transformation. There is also recognition that this is made harder if an incremental, project based, siloed approach is followed. This has led to there being an appetite for a strategic approach manifested in a shared energy system strategic plan. A key aspect of this plan would be transformation of the transmission grid to support and enable system change. The strategic transmission plan should sit within a whole energy system plan that looks across the energy value chain, considers multiple vectors and sectors, addresses the roles of technology, markets, policy, regulation, innovation and people and accommodates interactions with other adjacent sectors where dependencies are particularly strong. Progress can be made in the absence of such a plan, but risks will be higher, pace will be slower and costs will be higher; these impacts will arise because interactions, dependencies and trade-offs will not be as visible or as well understood.
- Design standards:** The visual impact of new infrastructure on communities can often lead to local opposition to projects. New infrastructure should seek to be environmentally viable, satisfactory from a regulatory perspective and acceptable to citizens and communities. Design standards can play a role by offering clarity on what infrastructure might look like and potentially by opening opportunities for more meaningful discussion about choices. This could result in improved time to reach decisions and as well, potentially lessen disruption where use of standard approaches can help in the speed of construction. Transmission network project delivery would benefit by virtue of improvement in community dialogue and facilitation of design and approval activities.
- Regulatory approval:** The regulatory approval process has responded to the transmission infrastructure build challenge with measures to approve groups of

projects rather than giving approval on an individual project basis. This initial response has shown the value in this thinking and offers a foundation for further measures that will maintain the key objective of assuring that consumers receive value for money while achieving greater pace in infrastructure delivery. Infrastructure design standards are a good example of an intervention that could be helpful in this context; adherence to an endorsed design standard should facilitate approvals. The regulatory approval process has a strong interaction with the planning approval process; a system perspective could offer insight into the dependencies and trade-offs that are implied in that interaction and could reveal opportunities for change that would enable faster infrastructure delivery.

- **Planning Approval:** Planning and planning approvals are much commented on as key aspects of the transmission infrastructure delivery process. There is a tension between the need for infrastructure to support social and economic well-being and the impact that this infrastructure has on the environment, people and communities, in both the near and longer term. Failure to address and resolve this tension will jeopardise the journey to a Net Zero future by delaying electrification and the uptake of low carbon technologies. The objective should be to achieve the right balance wherein the best possible, albeit difficult choices are made, informed by the right information and constructive engagement with stakeholders. Planning sits at the centre of several decision-making processes including the regulatory approval process; land rights, and environmental assessment for example, and illustrates the value of taking a system perspective to support complex decision making.
- **Supply chain:** The scale of transmission infrastructure build will place unprecedented demands on supply chains for products and services in electrical, mechanical and civil engineering and other sectors. These demands will be international in scope as all countries seek to address their respective needs and commitments to Net Zero. There are several specific challenges in engaging with the supply chain including when and who engages; how to compete on the increasingly competitive global market; ensuring assets are available when needed and the risk of escalating costs, amongst others. Failure to address these challenges could delay build projects, result in higher project costs, or make certain projects undeliverable which in turn, would jeopardise achieving Net Zero objectives.
- **People and skills:** There is a growing need for people with a broad spectrum of skills to enable transmission infrastructure build; this need will become greater as the pace of infrastructure build increases. Additional professional and vocational skills are needed to serve many if not all aspects of the end-to-end process for transmission delivery. This is not just a matter of recruitment. It includes attracting, training, retraining, recruiting and retaining people, and doing so in a landscape where there will be fierce competition globally for skills. It will be important to create an environment where response to the requirement is valued and the potential social and economic benefits are understood by individuals and communities.
- **End-to end process:** The process for delivering transmission infrastructure involves many parties undertaking complex, interacting activities. However, currently this process is in reality, a collection of processes without any point of oversight or

coordination. An end-to-end process perspective, both in principle and practice, could help achieve pace and efficiency in delivery. This requires clarity in purpose and direction and in roles and responsibilities. Provision of oversight means that an entity has to be identified to provide it. It also means that mechanisms and incentives need to be in place to encourage alignment and coordination across stakeholders.

- Outage planning:** Work to connect new generators or reinforce the network requires outages to be taken on existing assets. These outages often involve major works meaning that emergency restoration of a circuit to service is not possible as the planned work must be completed first. Historically, outages that cannot be restored in an emergency have been planned cautiously to limit the risk of such outages combining with a fault outage(s) to compromise system security or lead to large constraint costs. As the programme of transmission infrastructure build grows, there will be a requirement to allow more projects access to the transmission network in shorter timescales. There is a need to understand how to plan and undertake outages so that risks to system security and the assurance of service delivery to consumers are balanced against the need for scale in building network capacity and pace in project execution.

It is important to emphasise that these themes are not independent of each other but rather, represent facets of a complex problem. The interactions and dependencies between them, and the trade-offs that can be implied are reflected in the recommendations. The key themes have been mapped to the current process in Figure 4.4 below. The mapping shows that some themes are impacting certain points within the end-to-end process which can slow down decisions and slow down moving onto the next step. Other themes impact across more of the end-to-end process and can slow down process through multiple steps.

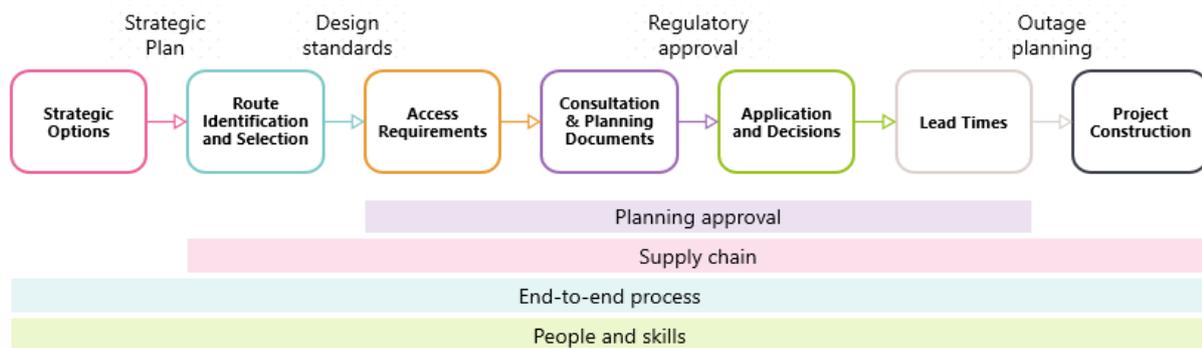


Figure 4.4 Mapping of themes against current end-to-end process

4.3 Creating options for change

The themes - both individually and in combination - were used to structure engagement and to organise the intervention ideas that were collected as part of stakeholder engagement exercises. The ideas were refined into draft options for discussion in a further series of workshops with stakeholders. The objective of the workshops was to have an open discussion on effective solutions while gathering additional ideas and options that could then be analysed and refined. This step enabled detailed conversations around risks

and opportunities but also offered a chance for stakeholders to think of different future solution options for the same problems. Eight workshops were held and over one hundred and fifty people attended representing fifteen different organisations involved within the end-to-end process.

The output from these workshops was then further elaborated before a thorough analysis of the impact of each option was explored. The main considerations for the analysis were:

- Impact on timescale.
- Ability to address the challenge.
- Ease of implementation.
- Organisational and societal implications.

Recommendations were drafted based around the themes and the insights and findings that emerged from engagement and analysis.

The outputs from the minimum process approach were used to review, test and update these recommendations. The resulting enhanced recommendations form the basis of a potential new process that would satisfy the challenge of significantly reducing the time taken to deliver transmission infrastructure.

4.4 Minimum process approach

The minimum process approach took a different perspective on the same problem, focussing not on process improvement, but on the minimum time needed to undertake an activity. It was intended to help strengthen and validate recommendations arising from the process mapping approach.

The minimum process approach consisted of two phases. The first phase was to understand what the minimum time could be for physically constructing transmission infrastructure. This was developed based on insights from interviews with a range of key supply chain stakeholders (e.g., construction and manufacturing companies).

The second phase involved a workshop with key stakeholders. The objective was to consider how the end-to-end process could be completed within seven years. The results of the workshop were then analysed and used to identify new recommendations and to update or validate the recommendations from the process mapping approach.

The minimum time for constructing transmission infrastructure was identified to be thirty months. In comparison, the process mapping approach identified the current construction period to take forty-six months. Figure 4.5 shows the process with this minimum construction time and all other parts of the process remaining the same as the current process. This reduces the end-to-end process time to one hundred and forty-nine months (more than twelve years), with a target to reduce it further to eighty-four months (seven years).

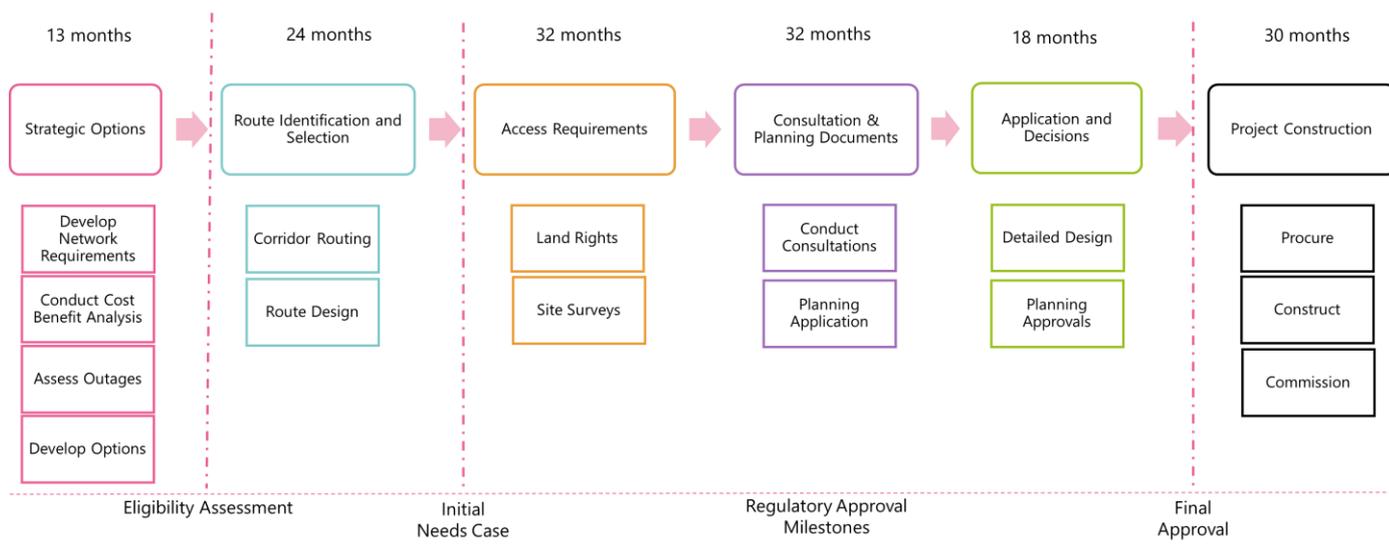


Figure 4.5 End-to-end process diagram with minimum project construction time

The following potential changes were considered as part of a response to the challenge to reduce the time for delivering transmission infrastructure to seven years,

- Remove a process.
- Make a process ex-ante or ex-post.
- Make a parallel process.
- Put more resource into a process to shorten the time it takes.
- Make a process more efficient.
- Redesign or integrate a process.

The resulting seven-year end-to-end minimum process was then discussed and validated in the stakeholder workshop noted above. The output of the workshop and bilateral conversations were then used to enhance the set of recommendations from the process mapping approach resulting in recommendations that incorporate thinking from two key perspectives on change.

4.5 The proposed new process

A new process that takes seven years from identifying the need for new infrastructure to building and commissioning it, was created using the two approaches described in the preceding sections. The new process and the recommendations required to achieve the time saving are shown in Figure 4.6. The recommendations are described in Section 5.

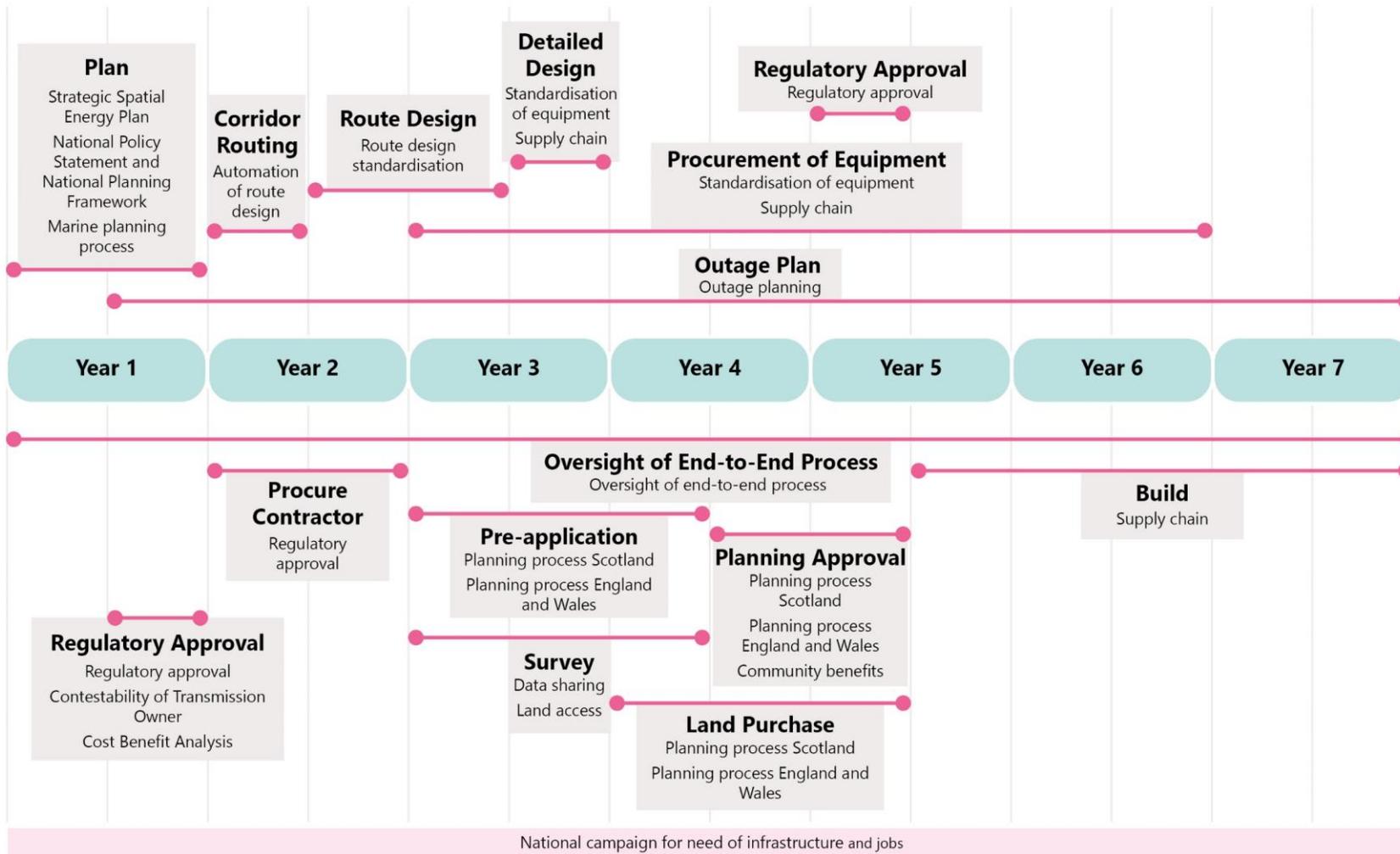


Figure 4.6 New seven-year process map and recommendations required.

Figure 4.6 maps at a high level, the scope of influence of each recommendation group to an activity in the process. For the process to be reduced to seven years, the full set of recommendations would need to be implemented. The implementation mechanisms and relationships between recommendations are further described in Section 5.

In the first-year certainty of need will be established early in the process through elements such as a Strategic Spatial Energy Plan (SSEP), National Policy Statements (NPS) and the National Planning Framework (NPF). This will allow for appropriate resourcing of design and appointment of contractors in the second year. TOs will also benefit from certainty arising from recommended changes in regulatory process and contestability. This certainty will also allow for earlier consideration and actioning in the outage planning process, thereby avoiding potential delays or conflicts in outages when they are required at the building stage.

The corridor routing stage has been optimised to six months; this is possible through use of meaningful automation while maintaining assurance of outputs through efficient involvement of technical experts. The route design process will be streamlined through standardisation which also facilitates and supports engagement with communities. Elements of the design will have been defined early and will be highly standardised. By the end of the second year, the supply chain can be engaged, and manufacturing slots can be booked in advance, reducing pressure in the procurement process. Given that the appropriate contractor has been procured, detailed designs can be finalised by the end of the third year.

Simultaneously, a streamlined pre-application process can occur informed by surveys available through simplified land access and data sharing mechanisms. Additional certainty, maximised standardisation, meaningful community engagement and national awareness will help expedite the planning approval process.

In this new process it is expected that approvals and land purchases will have been achieved mid-way through the fifth year allowing for an earlier build start and delivery within seven years.

5. Recommendations

Recommendations have been developed that are focussed on being realistic and ambitious. They are structured in groups based on the themes summarised in Section 4.2 and on issues identified within the themes. They reflect the insights gained through stakeholder contributions and challenge.

The recommendations are offered as a package. This reflects the interconnectedness between them needed to respond to the dependencies between the issues and the complexity of the challenge.

The recommendations are described and supported with commentary of how they could be implemented. Where possible, estimates of timeframes for implementation and cost implications have been included.

5.1 Strategic Spatial Energy Plan

Challenge:

ESO's Electricity Ten Year Statement (ETYS) provides a view of future electricity transmission system requirements and capability for the next ten years. Its Network Options Assessment (NOA) provides recommendations for which network reinforcement projects should go ahead and when. Both reports are published annually and recommendations for reinforcements are assessed and can be changed from, "proceed with reinforcement" to "hold". Such changes can delay projects starting and gaining a proceed signal from the regulatory approval process (i.e., Ofgem).

ESO's Holistic Network Design (HND) introduced a new way of planning the transmission network reinforcements required to meet the Government target of 50GW of offshore wind by 2030. A difference in this plan compared to the ETYS and NOA is that the recommendation for the need for each project will not be revisited in subsequent refreshes and updates. This has given TOs certainty on the need for each project.

The HND, along with the NOA 2021/22 Refresh, form the first transitional Centralised Strategic Network Plan (CSNP). The objective of the future CSNP is to plan holistically, onshore, offshore and across vectors. The second transitional CSNP will be the Holistic Network Design – Follow Up Exercise (HND-FUE) which is due to be published in 2023.

The challenge which underlies the planning process is creating sufficient certainty of need to enable progress at increased pace.

Recommendations:

SS1: A Strategic Spatial Energy Plan (SSEP) should be developed to bridge the gap between Government policy and Network Development Plans; the SSEP should be refreshed regularly. Government targets across the whole energy system would be spatially mapped across GB and over a time period of several years. For example, green hydrogen production targets would be translated into volumes in specific locations. This plan would create an overarching reference for many energy network plans such as the Centralised

Strategic Network Plan (CSNP), a hydrogen network plan, a Carbon Capture Utilisation and Storage (CCUS) plan and Regional Energy Plans (REP).

The process for preparing the SSEP should consider all options for achieving required outcomes. This should include, amongst others:

- the role of well-functioning flexibility markets that would help shape demand and thereby potentially reduce or delay the need for transmission reinforcement; this acknowledges the need to align with the interactions with Distribution Network Operators (DNOs) necessary to do this.
- the use of technologies such as grid-forming technologies or dynamic line rating (DLR) to increase capacity of existing transmission lines.
- deployment of storage to delay or avoid the need to build networks.
- application of digitalisation including Artificial Intelligence (AI) to enhance operations.

These interventions might facilitate quicker connection of low carbon generation.

SS2: A Marine Environmental Assessment (MEA) and offshore delivery routemap should be included as part of the Strategic Spatial Energy Plan (SSEP). Coordination and cooperation would be required between the FSO, Governments, The Crown Estate (TCE) and Crown Estate Scotland (CES) to support identifying seabed where offshore generation can be located along with required connection and transmission infrastructure. Preparation of the routemap would be led by TCE. It would coordinate the development of electricity, gas, hydrogen and CO₂ networks and other infrastructure to facilitate Net Zero.

SS3: Two Centralised Strategic Network Plans (CSNP) should be developed from the Strategic Spatial Energy Plan (SSEP) by the Future System Operator (FSO) – a shorter-term plan and a longer-term plan. The shorter-term plan should cover a ten-year period and be refreshed on a yearly basis. While recommendations suggested within this report are being implemented to achieve a seven-year end-to-end process, a shorter-term CSNP with a timeframe longer than ten years may be required to ensure all projects are identified in time to be delivered. The longer-term plan should cover a minimum of twenty-five years and be refreshed every five years. In the near-term there may be a need to refresh the plan more regularly due to changes in Government policy, learning gained through moving to new processes and as the pace of decarbonisation increases.

The CSNP should consider the role that other measures including well-functioning flexibility markets (and noted in Recommendation SS1) could play in delivering required outcomes.

SS4: Projects identified in the shorter-term Centralised Strategic Network Plan (CSNP) should become the baseline and the need for them should not be revisited in the next shorter-term CSNP. A Strategic Environmental Assessment (SEA), for onshore projects, and a Marine Environmental Assessment (MEA) (see Recommendation ME1: Marine Planning Process) for offshore projects, should be used as part of CSNP assessment. The inclusion of the environmental assessments can support endorsement of the CSNP by Ofgem and by Governments in the National Policy Statements (NPS) and National Planning Framework

(NPF) and remove the need for the Transmission Owners (TOs) to develop a needs case as part of the regulatory approval process.

SS5: The longer-term Centralised Strategic Network Plan (CSNP) should be used to support Transmission Owner (TO) engagement with the supply chain and evidence the scale of investment required over a longer time period. If lead times for some equipment e.g., cables, continue to increase, consideration should be given to how this longer-term plan can be used to bulk purchase equipment ahead of need identification in the shorter-term plan.

SS6: The longer-term and shorter-term Centralised Strategic Network Plans (CSNPs) are to be used to support long-term resource planning for all parties (e.g., Transmission Owners (TOs) and statutory consultees) within the end-to-end process. Each party in the end-to-end process should identify the skills and resources required to support delivery of the longer-term and shorter-term plans. Each party should work with the Department for Education (DfE) to identify training courses and university places needed to meet the skills and resources required. This activity should extend beyond identifying course numbers, it should include activities to attract people to these courses, from school years through to retraining of experienced workers.

Implementation:

SS1: The FSO would produce the SSEP working in close collaboration with the Department for Energy Security and Net Zero (DESNZ) and with the benefit of a flow of policy information that will come from DESNZ. The FSO will require additional resource to prepare the SSEP. Where policy gaps exist, or decisions need to be made that will influence the SSEP, these will be highlighted back to DESNZ for action. Consideration should be given to how uncertainties around the plan can support Government decision making. The cost of producing and managing the plan will include amongst other considerations, the costs of people, tools, stakeholder engagement activities and acquiring access to services from expert bodies. These costs will be offset by the benefits of increased certainty that will arise from the plan and the reduction in time to deliver new transmission infrastructure.

The cost of this activity could be expected to be of the order of a few millions of pounds per annum for the FSO, with some additional initial costs to establish the capabilities and their operation.

SS2: There would be a cost associated with carrying out an MEA, refreshing it as needed and integrating it with the SSEP. TCE has completed an environmental survey as part of the Celtic Sea leasing round which may provide a helpful reference on effort and cost. The cost of carrying out surveys is expected to be offset by the benefits arising from improving the quality of the CSNP and facilitating the plan being endorsed in the NPS and NPF (see Recommendation NP2: National Policy Statements and National Policy Framework). This endorsement is expected to support reducing the delivery time of projects by creating certainty and helping to gain early alignment of generation (and other interests) with network build activity.

The coordination of FSO, Governments, TCE and CES will require resource in the short-term to understand where suitable areas are located for offshore wind and transmission

infrastructure and how it can be coordinated with other offshore infrastructure required for Net Zero. It is expected that this increase of resources at the planning stage will be offset by an improved CSNP, more robust project proposals and reduced examination time for licensing. This arises by reducing the number of factors being considered during the planning stage. Recommendation ME1: Marine Planning Process supports this recommendation.

SS3: The development of the CSNP is currently being progressed by Electricity System Operator (ESO) and the first outputs are expected in 2025. It is expected additional resources would be required by the FSO, when it comes into operation, to create and manage two plans, including their periodic refresh. It may also be necessary to develop or acquire new toolsets and to gain access to expert parties to provide specialised input. These costs would be expected to lead to benefits, including savings realised by improved foresight to support business planning, facilitation of coordination of the parties, faster and more certain decision making, which should be reflected in reduction of the time taken to deliver new infrastructure.

SS4: Projects identified in the HND will not have their needs case revisited within the next iteration of the CSNP. As this method has been established and exercised in the HND it should be carried into subsequent versions of the CSNP. The benefit of doing this will be to provide certainty on projects and support engagement with the supply chain. Ofgem providing strategic oversight of the CSNP process will help remove the initial needs case from the regulatory approval process (see Recommendation RA1: Regulatory Approval). This will remove the initial needs case activity from the TO and Ofgem and create a time saving of around six months.

For the CSNP to be endorsed by Ministers under a revised NPS and NPF, environmental assessments will need to form part of the CSNP. An SEA would take several months to complete and needs to be updated regularly to feed into the annually refreshed, shorter-term CSNP. Consultations to update the NPS and NPF would need to happen which would take around nine months. The first CSNP is due to be published in 2025, providing sufficient time to carry out environmental assessments and update the NPS and NPF. Recommendations NP1 and NP2: National Policy Statements and National Planning Framework support this recommendation. Carrying out environmental assessments both onshore and offshore at the planning stage will incur a cost, both initially and in support of the refresh and update of the plans. It is expected this cost would be offset by the cost savings arising from the reduction in time for delivering new infrastructure. Other significant benefits will also arise in terms of certainty for supply chain development for example.

SS5: The TOs are actively engaging with the supply chain today. A longer-term plan will support this engagement and show the long-term needs for GB. Engagement on a programme of projects over a longer timeframe will support the supply chain with investing in additional capacity as they will be able to see a long-term order book. This recommendation supports Recommendation SC1: Supply Chain. This recommendation interacts with Recommendation CT1: Contestability of Transmission Owner as forming

long-term relationships with the supply chain becomes increasingly important to deliver needed outcomes such as easing constraints.

SS6: The availability of a longer-term plan will give the TO greater insight into the volume of work required in the future and will support near-term resource planning, training and recruitment. These are activities that should take place in all organisations involved in the end-to-end process. Information will need to be given to the DfE to support setting the right number of training and university places. Where new skills are required, organisations should work with the DfE and training providers to develop new courses. Consideration is required in the geographical location of training opportunities as this can support community acceptance of new infrastructure. There will be opportunities for organisations to expand their own training provisions alongside national initiatives, (e.g., TOs increasing the number of apprenticeships they offer covering new skills).

The cost of additional resources for all parties will be covered in different ways. The TOs will be able to use this information to understand the impact on future price control periods and agree with Ofgem the level of funding required. The TOs will also be able to understand the resourcing required by statutory consultees and funding that may be required to fund these parties to support planning applications. For Government bodies additional funding may be required from central or devolved Governments.

5.2 Route Design Standardisation

Challenge:

The design of new infrastructure and the visual amenity mitigations used within the transmission network design, can draw on different approaches and technologies; for example, different tower designs, use of indoor or outdoor substations and use overhead line (OHL) or underground cable. Rules and guidance set out in the National Policy Statements (NPS) and National Planning Framework (NPF) and the Holford rules¹⁸ can be open to interpretation by different parties. This can lead to differences arising in regulatory and planning approvals and the requirement for multiple route designs to be considered.

Community engagement is an important part of the planning approval process. There is a strong relationship between route design and visual mitigations and community acceptance. Transmission Owners (TOs), Ofgem, planning approval authorities or communities may not be clear on which parts of route design can change and what visual mitigations can be included to gain community acceptance. This can increase the time to engage with communities and gain planning approval. Ofgem can also disagree with measures taken to gain community acceptance leading to the TOs being required to redesign the route and apply for planning approval again or pay the difference in cost themselves. This has led to an increase in time taken in pre-application stage to try and avoid this situation.

¹⁸ The Holford Rules are guidelines used for the siting of new overhead line transmission lines.
<https://www.nationalgrid.com/sites/default/files/documents/13795-The%20Holford%20Rules.pdf>

Recommendations:

RD1: Electricity Transmission Design Principles (ETDP) should be created to provide greater clarity on the type of asset to be used in different environments. These Principles should be endorsed by Ofgem and Ministers and referenced in the National Policy Statements (NPS) and National Planning Framework (NPF). Guidance around the use of visual mitigations should be enhanced, clearly setting out when undergrounding and offshore routes are, or are not, appropriate. Guidance should include other visual mitigations such as the use of indoor and outdoor substations.

The environmental impact of different assets should be considered as part of the principles and guidance and should look to minimise the overall environmental impact. This would presume that overhead line (OHL) would be used for most of a route unless the criteria for visual mitigations were reached (e.g., undergrounding for areas of outstanding natural beauty).

The use of these principles (and related standards) would remove the need to create multiple route designs for the regulatory and planning approval processes, saving time and effort for the Transmission Owner (TOs), Ofgem, Planning Inspectorate (PINS) and Scottish Government. Standardising route design will support balancing national and local needs and concerns. This will be achieved by agreeing, outside of the end-to-end process, what design features are acceptable for local visual mitigation.

RD2: Engagement with communities hosting transmission infrastructure should be focused on the choices that they can influence. Communities should be given choices around the infrastructure they host where possible, within the design principles and guidelines set out within Recommendation RD1: Route Design Standardisation. For example, communities could be given choices around tower design or precise route design.

Clarity is required within the planning approval process on the weighting that should be given to community feedback and concerns. The Transmission Owner (TO) must make a prompt decision after consultation with communities to ensure the process is not delayed. If a local community objects to hosting the infrastructure or asks for further visual mitigations (e.g., undergrounding or offshoring), Planning Inspectorate (PINS) for England and Wales or the Scottish Government for Scotland, must make a decision on the trade-off between local and national interests.

Implementation:

RD1 & RD2: Updating the principles and guidance on route design will require a working group to be set up. This should be led by the Future System Operator (FSO) and include the TOs, Ofgem and Governments. Ofgem's involvement within the working group would be as an observer as they will need to endorse the design principles once created. A public consultation is likely to be required to ensure the views of local communities and interested parties are fully considered as part of the final principles and guidance. This is likely to take around two years, one year for the working group to update the existing Holford rules and guidance and a further year for consultation and any required further update.

A process for updating the ETDP will need to be implemented which could be led by the FSO. This will ensure that the design principles remain up to date and as community views and environmental impacts change, the principles can change with them. Flexibility of design will need to remain within the principles to support designing for the specific local environments as it may not be possible to account for all place-relevant factors.

Inclusion and endorsement of the design principles and guidance within the NPS and NPF will need to happen after the design principles have been prepared which means more time will be taken before they can be used within the planning approval process. Updating the NPS and NPF is set out in Recommendation NP1: National Policy Statements and National Planning Framework. Depending on the timing of updates to the NPS and NPF, endorsement of design standards could be included in a regular update. This endorsement will support reducing the pre-planning application stage of the process from eight years currently to two and a half years in the future. This is achieved by reducing the number of route design options considered and greater clarity on acceptable route design for planning approval. This will support Recommendations SP1 and SP2: Planning Process – Scotland and Recommendation EWP1: Planning Process – England and Wales.

Ofgem's endorsement of the design principles will be enacted as part of the regulatory framework update set out in Recommendation RA1: Regulatory Approval. This endorsement will contribute to the reduction of the pre-planning application stage, from eight years currently to two and a half. This recommendation would contribute to that by reducing the number of route design options considered and providing greater clarity on acceptable route design for regulatory approval.

This recommendation will need to be implemented to support Recommendation AR2: Automation of Route Design. Agreeing the design standards up front will support automating how the route is designed. Agreement of design principles will save time from the design, pre-application and planning approval processes by removing the need to design all elements of a route for each project. The time saved from automation and making design choices for the majority of the route, will allow more time to focus on local considerations and choices ensuring the route design choices minimise local environmental and visual impacts.

5.3 Standardisation of Equipment

Challenge:

The equipment required to build new or reinforce existing infrastructure must meet a strict set of standards. The standards used within GB are often different to those used across Europe and the rest of the world. This can lead to equipment manufacturers needing to meet GB specific requirements (e.g., the tower design used within GB compared to other European countries). The adoption of innovative solutions can be limited by the standards applied within GB (e.g., a tower design using less steel could be used across Europe but does not meet GB standards).

The equipment standards across the three Transmission Owners (TOs) in GB are not always the same. This can make the GB market even more challenging for equipment

manufacturers, as bespoke solutions can be required for different TOs, for the same type of equipment. There is an opportunity with new infrastructure build to introduce new, harmonised equipment standards.

The specification for an asset (e.g., a cable) is often not defined until the detailed planning stage. With the current lead times for the supply chain this can lead to delay in having equipment ready to start construction.

The challenge is to agree a level of standardisation that allows solutions to be built that accommodate genuine differences in requirements, but wherever possible provides access to the benefits of consistency within GB and with other markets. These potential benefits include speed of supply, diversity of supply, lower cost through economies of scale, and introduction of innovation, amongst others.

Recommendations:

SE1: A forum should be created between the Future System Operator (FSO), Transmission Owners (TOs), equipment manufacturers and Ofgem to review and update equipment standards used within GB. Its main aims would be to

- Standardise where possible equipment specification across TOs.
- Standardise equipment ratings to be used within project design (e.g., circuit breaker rating) to support moving away from bespoke ratings.
- Engage with and apply international standards where appropriate and beneficial.
- Seek and facilitate innovation that would be enabled by standardisation.

SE2: A process should be created to support and enable the work of this forum. This process should include a mechanism for Grid Code modifications to enable the update of equipment standards if required.

Implementation:

SE1 & SE2: Setting up a forum will require resources from the TOs, Ofgem and the FSO. This forum could be led by the FSO. Open engagement with the supply chain will be required, so as not to favour particular manufacturers, or larger manufacturers – Ofgem should oversee this to ensure competition is not adversely impacted. Ofgem's endorsement of the standards will be required to support regulatory approval and should form part of Recommendation RA1: Regulatory Approval.

The TOs own their equipment standards and they must adhere to codes and standards when creating them. It is possible to make changes to equipment standards but when considering innovative solutions, they may not meet Grid Code requirements. This means updating equipment standards may require modifications to the Grid Code. Designing a process to update the Grid Code as required will be an essential enabler to updating equipment standards, utilising international standards and deploying innovative solutions within GB.

The use of standard equipment should be endorsed through planning policies as there may be an impact on the amount of land required, access conditions or the environment. For example, a different tower design may have a slightly larger footprint.

The forum should look for early opportunities to standardise; however, this recommendation may take several years to implement. A forum will need to be created and standards updated before being applied to a project. Due to the lead times involved in the supply chain implementing these new standards, it is unlikely to support projects required for 2030 but could start to support projects delivering shortly after. Implementing a process for updating equipment standards and Grid Code should happen as matter of urgency as it will support increasing the number of manufacturers that could be used within the supply chain.

This recommendation combined with Recommendation RD1: Route Design Standardisation and Recommendation AR2: Automation of Route Design will help reducing the pre-application stage of the process. This recommendation will support the supply chain and development of long-term relationships, as discussed in Recommendation SC1: Supply Chain.

Developing, agreeing and maintaining these standards will require resources across all parties. This may be an increase of those already deployed in these organisations. There are likely to be testing and validation needs that will be in addition to those already used. Some of testing facilities may need to be built; others may be accessed through contract or other arrangements.

The cost of this effort will be offset by the benefits arising from improvement in the end-to-end process. This is due to having access to a more diverse supply chain (if there is alignment with other countries/markets) and moving projects from bespoke designs to standard ones. Using standards that are established in other markets will provide access to a wider pool of expertise, knowledge and experience that can be deployed in GB. This will support increasing the number contractors who are able to work in GB. Further benefits will arise in operations and ongoing evolution of networks assuming that standardisation will lead (over time) to more consistent operating and design practices.

5.4 Automation of Route Design

Challenge:

The identification of corridor routes during the design stage can take time and resource as multiple options need to be investigated and many data sources interpreted to find the most suitable corridor routes. Tools that can automate this process have started to be used by Transmission Owner (TOs) in the design process.

Following identification of the corridor route, the route design can start. This is where the exact route within the corridor is identified, and the type of asset used is decided (e.g., overhead line (OHL), cable). Redesign of the route can be required based on the results of community and statutory consultee engagement and environmental surveys which happen during the pre-application stage, thereby adding time and cost to projects.

Recommendations:

AR1: An automated corridor routing process should be adopted as standard practice. This will allow more corridor routing options to be considered than is possible without automation. A landscape architect would oversee the automated process and use the output to make a final decision on the corridor route. Regulatory and Planning approval processes will need to recognise and accept the use of this approach and supporting tools.

AR2: A route design process that uses the Electricity Transmission Design Principles (ETDP) should be adopted. A new tool should be developed that supports this process by supporting design of the location within the corridor route and selection of the type of asset (e.g., overhead line, tower, cable etc) that should be used. A design engineer would oversee the automated process and use the output to make a final decision on the proposed route design. Regulatory and Planning approval processes will need to recognise and accept the use of this approach and supporting tools.

Implementation:

AR1: Tools to automate corridor routing are currently being used by the TOs to support existing methods. The quality of the input data into the corridor routing tool is extremely important and the use of publicly available data will support replicability of the results. There may be shortfalls in data availability or quality which should be addressed as part of adopting automation as standard practice. Recognition of the use of automation would be required in planning approval process, the Development Consent Order (DCO)¹⁹ for England and Wales and Energy Consents²⁰ for Scotland, to ensure its use is acceptable during the planning approval stage.

AR2: To adopt automation of route design, the standardisation of route design (see Recommendation RD1: Route Design Standardisation) will need to be accepted and the ETDP will need to be created. During this time investment and development of a new tool capable of automating the route design process will need to happen. When the tool has been developed and the ETDP are available, a period of time will be required to include the design principles within the tool. The cost of developing a new tool is expected to be offset by the reduced time and resources required to carry out route design and from reducing the time needed within the end-to-end process. The planning approval processes will need to recognise the use of this tool, as described above in Recommendation AR1 implementation. This recognition is important as a single route design would be created, based on considering many options through the automated process, where today multiple route designs can be requested.

This recommendation would take longer to implement due to its dependence on the standardisation of route design and the need to develop a new technology solution. Early recognition by planning policies and Ofgem for the use of automation to create a single

¹⁹ <https://infrastructure.planninginspectorate.gov.uk/application-process/the-process/>

²⁰ <https://www.gov.scot/policies/energy-infrastructure/energy-consents/>

route design, would support early investment in developing the technology. Additional funding through the regulatory framework may be required to start this investment.

This recommendation along with standardisation of route design and equipment are required to reduce the pre-application planning stage from the approximately eight years at present, to two and a half years.

5.5 Regulatory Approval

Challenge:

The regulatory approval process is important for both Transmission Owners (TOs) and consumers. It protects consumers from excessive costs and gives TOs clarity on the certainty of their returns. Regulatory approval is given after planning approval has been granted with the review period taking up to six months. If Ofgem objects to a route design or visual mitigations, then the TO may not receive what it deems to be a sufficient return on all of its investment, or it will need to redesign some elements of the route and re-apply for planning approval, adding time to the process.

The regulatory approval process is aligned with the nature of the development of the energy system. Currently this is focussed on achieving the best possible outcomes by ensuring that assets are used effectively and efficiently; these outcomes are measured in terms of delivering services at lowest cost. As the energy system – including the transmission grid – is transformed in support of decarbonisation objectives, a new perspective will be required. This new perspective will look more to system optimisation rather than asset utilisation and account for the more decentralised, distributed architecture of the system. This will be supportive of the need to build infrastructure, a need that is being strongly signalled by issues such as the connections queue and escalating constraint costs. Outcomes will still be centred on consumers and lowest cost, but these may also address the mooted Net Zero mandate.

Recommendations:

RA1: Regulatory approval process should be removed from the critical path within the end-to-end process. To achieve this, reformulating the regulatory approval process in the following way would enable this to be achieved:

- The Centralised Strategic Network Plan (CSNP) should be endorsed by Ofgem and become the initial needs case for the programme of projects. Further regulatory approval should then not be required to justify project need. This is supported by Recommendation SS2: Strategic Spatial Energy Plan.
- The Electricity Transmission Design Principles (ETDP) should be endorsed by Ofgem. Regulatory approval would refer to these principles when assessing the route design and visual mitigations required. This is supported by Recommendation RD1: Route Design Standardisation.
- The use of standardised equipment (rather than bespoke equipment) should be considered when assessing cost and deliverability of projects. This is supported by Recommendation SE1: Standardisation of Equipment.

- The contestability of projects should be decided during the planning process to ensure the delivery body is identified when the CSNP is published. This is discussed in Recommendation CT1: Contestability of Transmission Owner.
- Cost benefit analyses carried out as part of Strategic Spatial Energy Plan (SSEP), CSNP and across the project lifecycle should consider whole project costs and benefits to consumers. This should include constraint costs, carbon and other benefits such as access to renewable generation. This is supported by Recommendation CBA1: Cost Benefit Analysis.
- Project costs should not be fixed at the beginning of the process due to supply chain constraints and variability on price of equipment. Flexibility and transparency should be built into the regulatory process to update project costs if required. Open book financial management could be considered.
- The community benefits payment system should be endorsed by Ofgem so that their cost can be reflected in the project cost, reducing the need to further justify them. This is supported by Recommendations: CB1 and CB2: Community Benefits.
- The current consultation²¹ to update the regulatory framework ahead of the next regulatory period should consider how best to measure efficiency of spend from the Transmission Owner (TO) and how the mechanism for cost recovery for the TO operates.
- The delivery incentives placed upon the TOs as part of Accelerating Strategic Transmission Investment (ASTI) are strengthened and expanded to include all of the TOs' involvement in the end-to-end process and are applied to all projects identified by the strategic plan.

RA2: Ofgem should be given Net Zero objectives to support the delivery of electricity networks to meet UK Government targets as provided within the Energy Bill currently in process²². The objective of being an economic regulator is retained and expanded to include wider societal benefits (e.g., access to cheaper renewable generation)

These recommendations are intended to create a trusting and transparent relationship between Ofgem and the Transmission Owner (TOs). They are also intended to support the TO with engaging with the supply chain early, making complex decisions at pace and accelerating the delivery of new infrastructure required.

Implementation:

RA1: Ofgem is currently consulting on different regulatory approaches that could be used during the next regulatory period²³. The recommendations offered in this report could inform the consultation and its findings and help shape the next regulatory framework.

²¹ <https://www.ofgem.gov.uk/publications/consultation-frameworks-future-systems-and-network-regulation-enabling-energy-system-future>

²² <https://publications.parliament.uk/pa/bills/cbill/58-03/0295/220295.pdf>

²³ <https://www.ofgem.gov.uk/publications/consultation-frameworks-future-systems-and-network-regulation-enabling-energy-system-future>

Change in the regulatory approval process is likely to comprise many changes implemented over a period of time as a coherent programme which responds to identified priorities. Care should be taken to understand, and where necessary act, on any implications for projects. Efforts should seek to minimise any delay to projects. Specific measures should be implemented to ensure that this period of change is well-structured and well-managed.

Taking regulatory approval off the critical path is expected to save around six months by removing the initial needs case and save a further six months by removing the final needs case. Endorsement of standard route design and equipment will support the time reduction expected from these recommendations in the pre-application stage. Changing the regulatory framework will support TOs in engaging and contracting with the supply chain earlier in the process and bringing forward activities such as detailed design.

RA2: Expanding Ofgem's objectives will require primary legislation. The inclusion of a Net Zero remit is understood to be included in the Energy Bill currently passing through Parliament and therefore further action may not be required if it reaches Royal Assent.

A change to the regulatory framework is expected for the next electricity transmission regulatory period, starting in 2026. There would be a risk to changing the regulatory framework for projects which are currently in flight, so careful consideration would be required. The ASTI arrangement has been introduced for 2030 projects identified in the Holistic Network Design (HND). A similar arrangement will be required for projects identified in the Holistic Network Design – Follow Up Exercise (HND-FUE), which follows the HND and is due to be published in 2023. It is recommended that the framework is implemented before 2026 and in time for the publication of the first SSEP and CSNP. The framework should be designed to address Net Zero objectives, support the TO in decision making, facilitate progress at pace and deliver the infrastructure required. The framework should enable Ofgem to play a strategic role and monitor the efficiency of the TOs to protect consumers interests.

5.6 Contestability of Transmission Owner

Challenge:

Competition to deliver and own onshore transmission network is being introduced by Ofgem, to protect consumer interests and reduce costs. Historically, critical national transmission infrastructure projects have not been contested giving the Transmission Owner (TO) certainty on the pipeline of projects they will be expected to deliver. New powers are being introduced by Government through the current Energy Bill to enable contestability of onshore transmission projects. Recently, exemption from contestability has been given through the Accelerating Strategic Transmission Investment (ASTI) initiative, with the Ofgem decision to do so taking around six months.

As efforts towards Net Zero accelerate, GB is increasingly required to compete with the rest of the world for equipment, skills and resources. In order to meet GB targets there is a need to engage with the supply chain and carry out long term resource planning. The

party responsible for acquiring needed resources will need certainty on the projects that it is to deliver.

Recommendations:

CT1: Onshore network contestability should be delivered in phases, when certain criteria have been met, (i.e., contestability should not be introduced to all projects at the same time). This is intended to support contestability of some projects in the first instance and suspend contestability of others until a set criterion is reached. Once reached, the next phase of projects will have contestability introduced to them. The criteria for contestability should be strictly designed and absolutely adhered to, to prevent the delay of critical national infrastructure required to meet Net Zero targets.

The biggest risk currently is the supply chain and the increasing global competition to secure manufacturing capacity for transmission equipment (e.g., cables). Long term visibility of projects and certainty for Transmission Owners (TOs) is required to secure manufacturing slots and acquire people and skills. Early engagement with the supply chain is required for the detailed design of most projects. The criteria for introducing contestability should include the constraint with the supply chain and the lead time for equipment.

It is recommended that the first phase (or group of projects) contestability is considered for, are offshore projects. This means that projects physically located offshore should be contested as part of the first phase while contestability of projects physically located onshore are not contested. Offshore projects have been identified for contestability due to there being multiple offshore transmission owners (OFTO) and opportunity to develop a new integrated offshore network.

For current offshore projects identified in Holistic Network Design (HND), Ofgem should urgently decide which projects could be contested and identify the delivery body. In the meantime, TOs should be strongly supported (e.g., pre-construction funding provided to progress route design) by Ofgem to progress the early development and feasibility activity.

A second phase of introducing contestability would be onshore projects that have a long lead time before they are required, to allow engagement with the supply chain. Consideration should be given to several projects being bundled together to allow a new entrant to engage and order at scale with the supply chain.

This phased approach means that the incumbent TOs would be responsible for delivering onshore reinforcements until contestability has been established and supply chain constraints, including equipment lead times and skills, have eased. Phasing contestability for onshore projects will support the TOs in engaging with the supply chain and securing resources and manufacturing slots.

With the ambition to halve the time it takes to build new infrastructure, any decisions on contestability should not add any time into the process. Decisions on contestability should be made at the same time as the strategic plan is created.

Implementation:

CT1: The criteria for contestability will be set by Government but Ofgem will have flexibility in how it is applied. As part of the ASTI framework some of the offshore reinforcements can still be contested; currently incumbent TOs are developing them. Engagement with the supply chain and detailed design of the solution will require the TO to be identified. These projects could be subject to contestability if it does not impact the delivery date. Ofgem should urgently identify the delivery body for these if there may be supply chain constraints. Further projects are expected to be identified in the Holistic Network Design – Follow Up Exercise (HND-FUE) which will be published in 2023. New offshore projects identified here could be subject to contestability. The competition process could be run by the Future System Operator (FSO).

It is expected time will be saved from the process by phasing contestability so that the incumbent TOs know what is expected to be delivered as the strategic plan is published. Time will be saved by Ofgem not needing to decide if projects should be exempt from competition and by avoiding delays with supply ordering equipment and resources.

5.7 Cost Benefit Analysis

Challenge:

At multiple points across the end-to-end process cost benefit analysis (CBA) of each project is undertaken. During the planning stage there is an option assessment; during regulatory approval there is a cost assessment; during outage planning there is a planning and impact assessment. Different methodologies are used for CBA analysis at different stages in the project lifecycle. In the planning and regulatory stages, the main aim is to consider the capital cost of the project. In delivery and outage planning stages the main aim is to understand constraint cost.

The main driver for CBA analysis is to protect consumers from paying too much for infrastructure and system balancing costs. As we move into a period of significant infrastructure build, quick delivery will provide benefit to consumers by enabling access more low carbon generation, reducing carbon and lowering constraint costs. The narrow criteria currently used within CBA analysis may not reflect whole project costs or wider economic and societal benefits from meeting Net Zero targets.

Recommendations:

CBA1: All cost benefit analyses (CBA) that are carried out across the end-to-end process should be reviewed and updated to reflect whole project costs and wider societal benefits (e.g., constraint and carbon costs) where possible. This will create a more holistic view of the costs and benefits of projects to facilitate decision making. For example, an offline network build option may have a higher delivery cost but reduce constraint costs due to a shorter outage requirement. The CBA would show the higher delivery cost is offset by a lower constraint cost and provide net benefits from delivering sooner and connecting low carbon generation.

Implementation:

CBA1: Updating the CBAs should be led by the owner of the CBA and endorsed by Ofgem. If a CBA sits across multiple parties, or multiple parties carry out the same CBA, then a working group should be formed, led by the Future System Operator (FSO), to agree the update to the analysis. Ofgem should oversee the programme of updating CBAs and input the societal benefits that should be included as part of their Net Zero remit (see Recommendation RA2: Regulatory Approval).

Updating CBA methodologies and associated tools is likely to take time, anticipated to be less than a year, depending on how many new factors are included and how complex the CBA becomes. There will be a reliance on data availability and the process for development of new or enhanced methodologies and potentially updates to or new CBA tools. The cost of updating CBAs would be offset by improved decision making by understanding whole project costs rather than trying to optimise individual elements.

Updating CBAs later in the process will potentially help projects already in flight, (e.g., costing the delivery plan and making decisions on outages); this is supported by Recommendation OP3: Outage Planning. Consideration should be given to making a series of incremental improvements rather than a single big change. This will support projects in flight and allow different methods to be tested before reaching an enduring solution. Careful implementation is required to ensure there is no detrimental impact on projects in progress. For example, a project that has created a delivery plan based on optimising delivery costs should not have a CBA applied to it that includes outage costs. This could lead to the delivery plan no longer being optimal for delivery and outage costs; redesigning the delivery plan to reduce outage costs may delay the project. The needs case for any project in progress should not be excluded from any updated CBA methodology.

The Centralised Strategic Network Plan (CSNP) is currently being developed by the Electricity System Operator (ESO). This is an opportunity to expand the CBA process used when identifying new projects. Understanding wider societal benefits at this stage will support decision making around the speed of delivery required. The update of this CBA will support projects delivering 2035 and later.

Updating CBAs will need to be endorsed and agreed by Ofgem, so they are recognised within the regulatory approval process (see Recommendation RA1: Regulatory Approval). Updating CBAs may require endorsement from planning approval policies as they may drive different requirements for route design and delivery.

The creation of an approved CBA methodology and its review will likely require a new team within the FSO. This cost can be estimated at over £10m for the first year, and in the £millions for the subsequent years.

The longer term societal, environmental, and economic benefits identified as part of the CBA will help counter these additional costs.

5.8 Planning Process - Scotland

Challenge:

The decisions on planning consent are devolved to Scottish authorities and Scottish Ministers, but the legislative framework for those decisions is a reserved matter, set out in UK legislation - the Electricity Act 1989. The process is viewed as having become outdated, being not well defined and causing delays to obtaining planning approval for critical national infrastructure. Within the process, there is a lack of clarity on expectations for applications and timeframes for responding to consultation. Updates to the Electricity Act 1989 are carried out by UK Government.

Public local inquiries are often triggered by planning authorities, leading to delays in obtaining planning approval for infrastructure projects. Within the public inquiry a wide range of issues can be examined which can extend beyond the objection to planning consent. Time, resource and expertise are required by all parties.

Recommendations:

SP1: The automatic requirement for a public local inquiry when the planning authority objects should be removed. An alternative process should be introduced that would allow Scottish Ministers to hear more about a specific issue raised by statutory consultees as an alternative to a public inquiry. For example, if a planning authority objected to a project based on visual impact alone, then a hearing could be called by the Minister to investigate this issue. This would provide a quicker alternative to consider specific issues. A public inquiry can still be called by the Minister, based on responses by all statutory consultees. This amendment to the Electricity Act 1989 should be progressed as a matter of urgency in the current Energy Bill passing through Parliament if further amendments to the bill are possible. This is required to support 2030 projects.

SP2: Further improvements should be made to the planning process to reduce the time taken to obtain planning consent to twelve months. Changes to the Electricity Act 1989 could be made or a new supporting process introduced. Changes should include, but are not limited to:

- Introduction of pre-application requirements to reduce the need for additional information requests. Pre-application requirements could include environmental surveys and community engagement.
- New application form stating what information is required for an application to be accepted.
- Clear roles, responsibilities and mandatory timeframes introduced for all parties involved including statutory consultees. This includes funding statutory consultees through the planning application fee to ensure responses are delivered within the consultation timeframe.
- Introduction of a process for variations which matches the process electricity generators use. Electricity generators are able to vary their design once planning approval has been granted, (e.g., changing the location of towers based on detailed

surveys). An equivalent process should be introduced for electricity transmission infrastructure.

Implementation:

Both recommendations would require primary legislation to make amendments to The Electricity Act 1989. It is strongly recommended that Recommendation SP1: Planning Process – Scotland, the removal of the mandatory trigger for public local inquiry from the planning authority and introduction of a hearing process, is added as a matter of urgency to the Energy Bill, currently passing through Parliament if further amendments to the bill are possible. This change is required to support projects currently in flight and those about to go through planning approval in Scotland, which are critical national infrastructure required to meet 2030 renewable energy targets.

A legislative vehicle would be required for Recommendation SP2 in order to make further amendments to the Electricity Act 1989. A primary legislation change can be achieved quickly if there is the drive to do so but typically it can take up to two years or more. To create a new process that would supersede the Electricity Act 1989, a new legislative act might need to be enacted which could take two years or more. For projects looking to deliver for 2030 and beyond, planning approval needs to be granted within twelve-months of the application being submitted. Acceleration of the legislative process will be required to make the necessary changes in time to support projects looking to deliver for 2030 and beyond.

Scottish Government administers the planning process and adequate resource is required to do so. Additional resource should be provided to Scottish Government in the very near term to work with the Transmission Owners (TOs) in the pre-application stage to help support their applications. Getting an application right first time will help to reduce the time taken to gain planning consent. This will support reducing the pre-application stage from approximately eight years to two and half years.

The needs case for a project can often be considered as part of planning approval. The endorsement of the strategic plan in the National Planning Framework (NPF) and National Policy Statements (NPS) will remove the need for this to happen as part of the planning approval process. This will support reducing the timeframe for planning approval to twelve months.

5.9 Planning Process – England and Wales

Challenge:

The time taken to obtain planning approval for an identified project has been increasing. Projects are taking around eight years in pre-application and one and a half years in the planning application stage. Some of the reasons this timeframe has been expanding are due to the need to design multiple options for the route, undertaking re-design to secure community acceptance and resource availability within Planning Inspectorate (PINS) and the statutory consultees.

The National Policy Statements (NPS) set out UK Government's policy for delivery of major energy infrastructure and are used within the planning approval process. These policy statements are currently being updated. The NPS can be interpreted differently by different parties making it difficult to design routes that satisfy these statements and regulatory approval requirements and respond community acceptance.

Recommendations:

EWP1: The twelve month fast-track approval process²⁴ should be used for approving all electricity transmission infrastructure in England and Wales. Current activities to streamline and shorten the process should be developed and applied as quickly as possible.

Implementation:

EWP1: The Department for Levelling Up, Housing and Communities (DLUHC) owns the National Strategic Infrastructure Process (NSIP) and is currently in the process of making improvements²⁵. Adequate resourcing and priority for this activity are required to support the quick delivery of these improvements. Funding for system improvement and standardisation of applications and assessment of them may be required.

PINS administer the NSIP process and adequate resource is required to do so. Additional resource should be provided to PINS to work with the Transmission Owners (TOs) in the pre-application stage to help support the application. Getting an application right first time will help to reduce the time taken to gain planning consent. This will support reducing the pre-application stage from eight years to two and half years.

Within the current NSIP improvement programme there is a provision to fund statutory consultees. Arrangements to fund statutory consultees and fix timeframes to respond within the planning approval process are required to support the twelve-month timeframe required for gaining planning approval.

The implementation of Recommendation RD1: Route Design Standardisation, will support the reduced timeframe for planning approval. Having rules and guidance set out allows the planning process to refer to these to check if they have been followed. This approach would facilitate the planning process considering more local issues identified by statutory consultees.

The needs case for a project can often be considered as part of planning approval. The endorsement of the strategic plan within the NPS (see Recommendation NP2: National Policy Statements and National Planning Framework) will remove the need for this to happen as part of the planning approval process. This will support reducing the timeframe for planning approval from eighteen months to twelve months.

²⁴ Section 3.6 <https://www.gov.uk/government/publications/nationally-significant-infrastructure-projects-nsip-reforms-action-plan/nationally-significant-infrastructure-action-plan-for-reforms-to-the-planning-process#reform-area-2-operational-reform-to-support-a-faster-consenting-process>

²⁵ <https://www.gov.uk/government/publications/nationally-significant-infrastructure-projects-nsip-reforms-action-plan/nationally-significant-infrastructure-action-plan-for-reforms-to-the-planning-process#reform-area-2-operational-reform-to-support-a-faster-consenting-process>

5.10 National Policy Statements and National Planning Framework

Challenge:

The National Policy Statements (NPS) for England and Wales and the National Planning Framework (NPF) for Scotland set out the Government objectives for the development of nationally significant infrastructure. They are referred to during the planning approval stage and projects must meet these objectives.

The National Policy Statements have not been updated in a number of years. A consultation to do so is currently in progress. The National Planning Framework for Scotland was updated in February 2023.

Recommendations:

NP1: The National Policy Statements (NPS) and National Policy Framework (NPF) should be updated regularly to support the need for new electricity transmission infrastructure. The NPS and NPF should be reviewed and updated every five years and allow for smaller changes to be made between the five-year updates.

NP2: The National Policy Statements (NPS) and National Policy Framework (NPF) should refer to and allow Ministers to endorse the Strategic spatial Energy Plan (SSEP) and Centralised Strategic network Plan (CSNP), as statements of the projects required for nationally significant infrastructure.

NP3: The Electricity Transmission Design Principles (ETDP) should be referenced and endorsed in the National Policy Statements (NPS) and National Policy Framework (NPF).

Implementation:

NP1: It is possible for UK Government and Scottish Government to set the timescale on which the NPS and NPF are updated. Consultation is required before updates can be made, which typically takes around nine months to complete. The NPF has recently been updated and the NPS is currently in consultation to be updated. These updates will support projects looking to deliver by 2030. Updating these documents regularly will continue to give strong support for the expansion of the electricity transmission network required to meet Net Zero targets. The cost of updating these documents is expected to be offset by supporting the reduction in time to deliver projects.

NP2: In order for the NPS and NPF to endorse the CSNP a Strategic Environmental Assessment (SEA) needs to have been completed. A Marine Environmental Assessment (MEA) will also need to have been completed as described in Recommendation ME1: Marine Planning Process. Both activities will have an additional cost associated with them. It is expected that this cost will be offset by reducing the planning approval timeframe and the earlier delivery of projects. This recommendation links with Recommendation SP3: Strategic Spatial Energy Plan.

NP3: The ETDP (incorporating route design standards) will need to be created and consulted on as outlined in Recommendation RD1: Route Design Standardisation. An

update may be required for these Principles to be included and endorsed in the NPS and NPF; this update may also require consultation. This amendment activity could fall in line with a regular update outlined in Recommendation NP1, but this process should not slow down endorsement of route design standards. Due to the time required to develop and implement this recommendation it will likely support projects delivering for 2035 and beyond. The use and recognition of these standards within the planning approval process should happen given their inclusion in the NPS and NPF.

5.11 Marine Planning Process

Challenge:

Many industries interact in the marine setting and must be coordinated, (e.g., fishing and shipping). The environmental impact can be challenging and costly to offset and some areas will potentially need to be avoided. Understanding the environmental impact and industry interactions often happens after a project has been identified. With the expected increase in the number of offshore cables required to reinforce the onshore transmission network, and deployment other energy infrastructure, there is a risk the environmental impact will be high and costly.

The marine licensing process is devolved across the UK, Welsh and Scottish Governments. Many offshore reinforcements will require multiple planning and marine licences which will add to project complexity.

Recommendations:

ME1: A Marine Environmental Assessment (MEA) should be used to inform the Strategic Spatial Energy Plan (SSEP). An offshore delivery routemap, which would be led by The Crown Estate (TCE), would coordinate the development of electricity, gas, hydrogen and CO₂ networks and other infrastructure to facilitate Net Zero. This will support the Future System Operator (FSO) and Transmission Owners (TOs) in understanding the viability of a project, its costs and delivery timeframe.

ME2: Proactive actions should be taken to ensure the licensing processes for England, Scotland and Wales are able to deliver in a twelve-month period. Actions may include process improvements, increased levels of resourcing and working with Transmission Owners (TOs) in the pre-application stage.

Implementation:

ME1: An MEA could be carried out and used within the strategic planning process. There would be a cost associated to carrying out this survey and it may need to be repeated regularly. TCE has completed an environmental survey as part of the Celtic Sea leasing round. TCE and Crown Estate Scotland (CES) could potentially carry out, share and update marine environmental surveys to be used within the end-to-end process. The cost of carrying out surveys is expected to be offset by improving the quality of the plan and facilitating the plan being endorsed by National Policy Statements (NPS) and National Policy Framework (NPF). There are also significant benefits in terms of risk mitigation.

The co-ordination of FSO, Governments, TCE and CES will require resource in the short-term to understand where suitable areas are located for offshore wind and transmission infrastructure and how it is coordinated with other offshore infrastructure required for Net Zero. It is expected that this increase of resources at the planning stage will be offset by an improved Centralised Strategic Network Plan (CSNP), more robust project proposals and reduced examination time for licensing. This is due to reducing the number of considerations made during the planning stage.

ME2: Additional resources should be allocated to marine licensing departments in England, Scotland and Wales to support process improvement activities. There is an expected increase in the number of projects requiring marine licences; making process improvements ahead of this increase will support achieving a twelve-month approval period. Additional resources may be required to work with TOs in the pre-application stage to ensure all information requested as part of the application is right first time and reduces the need for further requests for information. The cost of additional resource in the marine licensing departments is likely to be offset by reducing the time it takes to gain a marine licence and the overall impact on reducing the delivery time for new projects.

5.12 Community Benefits

Challenge:

Communities hosting national infrastructure do not always see a direct benefit for doing so. They are often faced with disruption during construction and left with visual impact once construction is complete. Communities may not see a direct link between connecting low carbon generation and local decarbonisation outcomes. Citizens may respond by strongly opposing projects.

Recommendations:

CB1: Guidance on community benefits which are the subject of a current consultation²⁶ should be delivered and adopted quickly. This guidance should clearly set out what Transmission Owners (TOs) are able to offer as community benefits and what can be recovered through the regulatory process.

CB2: Residents of properties close to new overhead lines should receive a defined direct payment. Communities should receive a set amount of money for new visible infrastructure they host. The benefit should be a defined value per kilometre of overhead line (OHL) or an appropriate amount for other visible infrastructure. This benefit would only be available for hosting OHL or other visible infrastructure, (e.g., substations).

Implementation:

CB1: There is a consultation on community benefits currently concluding by the Department for Energy Security and Net Zero (DESNZ). It is expected that the outcome of this consultation will be in place to support projects looking to delivery for 2030.

²⁶ <https://www.gov.uk/government/consultations/community-benefits-for-electricity-transmission-network-infrastructure>

CB2: There is a large difference in cost for OHL, underground cable and offshore cable. Underground cables cost between five and ten times more than OHL and offshore cables are more expensive again. Providing a community benefit set per kilometre of OHL is less costly than using an underground cable and will have a lower environmental impact.

To provide this benefit, a further consultation may be required to update the guidance on community benefits. Any value that is agreed will need to be reflected in the regulatory approval process and endorsed by Ofgem, Recommendation RA1: Regulatory Approval describes this.

The implementation of both recommendations is intended to support community engagement. It is anticipated to support reducing the pre-application time to two and a half years.

The costs of these recommendations will depend on final benefit agreed. In each case, this will be realised through the avoided costs by installing a cheaper technological solution (i.e., OHL rather than undergrounded lines) and/or by delivering the asset quicker and avoiding congestion costs. A more sophisticated cost-benefit analysis will be required on a project-by-project basis as the technological choice will not always be as clear as being between under-grounding and over-grounding. The scheme design will need to be well designed with a transparent methodology which clearly shows how the value of the benefit has been calculated.

There will likely be other indirect benefits from these payments for the host community. This benefit will support local communities economically, depending how it is deployed. For example, if it was used for the installation of low carbon community owned generation, or local heat networks, this could translate into lower energy bills in addition to responding to community commitment to Net Zero.

5.13 Data Sharing

Challenge:

Data is a critical asset in enabling the transmission infrastructure delivery process. This data includes spatial, environmental, economic, social, technical and commercial data. It is collected by many parties, used by these parties for their respective purposes and has associated with it, varying degrees of commercial sensitivity. Data is not routinely shared meaning there is duplication of effort in its collection, maintenance and governance and risk of inconsistency between parties who are relying on different versions of the same data to convey information about matters of shared interest or decision making. Assumptions and compromises are by necessity made about data availability, quality, completeness and currency.

As an example, an environmental survey can be required by the Transmission Owner (TO) for planning approval and can be repeated by the contractor building the asset. Surveys are often repeated by parties so they can have confidence in the data they are using to make decisions on risk and financial matters.

The current data management approach is not appropriate if the transmission infrastructure delivery process is to be accelerated.

Recommendations:

DS1: Coordinated data sharing amongst the parties should be established (where currently not happening), matured and mandated, with leadership for implementing this in practice assigned to the Future System Operator (FSO). This will include establishing the necessary governance mechanisms, platforms, tools, obligations, processes and practices. These should draw on well-established data industry practice as well as previous efforts in the energy sector (Ofgem Data Best Practice Guidance²⁷ for example) and current initiatives such as Government's Energy Digitalisation Strategy and Action Plan²⁸, the Digital Spine²⁹ amongst others. Clarity will be required regarding what data is needed by whom and for what purpose so that priorities can be drawn.

Implementation:

DS1: The FSO should develop a Minimum Viable Product (MVP) data catalogue based on a survey of existing datasets that are used and prioritise those that are most likely to be duplicated or from which the benefits of sharing could be most readily realised. This catalogue should use industry standard meta-data to facilitate access and use.

The FSO should then work with industry and other stakeholders and experts to extend the data catalogue to be a more functional data environment for the sharing of data and for aligning the capability provided with the end-to-end process change and the emergence of new requirements and digital techniques. Depending on the future of the 'Digital Spine' project, it is possible that it will be able to contribute to or align with this work. It is noted that the data needed extends beyond traditional energy system data to include other data such as geological, environmental, economic and social data for example, which suggests that it may be helpful to consider other supportive initiatives with a view to possible integrations.

The parties involved will need to agree on where responsibility for data quality and completeness rests and where liabilities lie if decisions are made on inadequate data. This should be addressed as part of programme of work to build a robust data environment and service and may need to be supported by licence or code changes. This environment and service should be provided on a sustained basis by the FSO.

It is expected to take additional resource within the FSO to develop and establish the digital infrastructure and governance for coordinated data sharing. The suggested data catalogue will be an important first part of the effort required. This catalogue can develop in sophistication over time, but it should be possible to establish an initial version in a time scale that will be helpful to projects for delivery by 2030.

²⁷ [Data Best Practice Guidance v1.pdf \(ofgem.gov.uk\)](#)

²⁸ [Energy Digitalisation Strategy and Action Plan](#)

²⁹ <https://www.gov.uk/government/publications/energy-system-digital-spine-feasibility-study>

Ongoing development will see the MVP catalogue, and other tools and processes, implemented and in addition, will see the scale of the content increased and the intensity of use grow. In building this capability it should be possible to draw on existing initiatives and systems to provide the foundation. This leaves a key challenge enabling the effort to identify and include the data sets themselves. A comprehensive data sharing capability is likely to be available to support projects beyond 2030.

This recommendation is supportive of enabling the flow of information amongst stakeholders to enable good decision making and is of particular importance to enable automation of corridor routing and design processes Recommendations AR1 and AR2: Automation of Route Design.

5.14 Land Access

Challenge:

Access to third party land is required when designing and building new infrastructure. Access is needed to survey the land to ensure it is suitable and to carry out environmental surveys when designing routes. Land needs to be purchased or wayleaves put in place. Access to land is required for the lifetime of the asset for maintenance and future upgrade or replacement.

During the design process voluntary access to land is often refused, requiring a warrant to be issued. Obtaining a warrant takes time and resources from the Transmission Owner (TO) and from the court system. To obtain planning approval land purchase must be completed or wayleaves need to be in place. Compulsory purchase and necessary wayleaves are sometimes required which extends the time to obtain planning approval. Wayleaves to access land for maintenance and replacement can expire or land can change owner. There is a risk that new landowners can ask for higher compensation to agree a new wayleave.

Recommendations:

LA1: The Transmission Owners (TOs) should be given the same statutory powers as other utilities to be able to access land for surveys when voluntary access has not been given. This would allow the TO to access land to carry out surveys required during the route design phase.

LA2: Compensation for wayleaves and purchase of land, voluntary and compulsory, should be set at a national level. A transparent methodology for the amount of compensation should be set up and used when negotiating land purchase and wayleaves. The same methodology would be used when renegotiating wayleaves.

LA3: Further work is required to understand impact of more changes being made to the current land purchase and wayleave process, both voluntary and compulsory. Areas of consideration should include, but are not limited to:

- How to introduce a variation process to allow for small changes from the original land purchase or wayleave. This would allow for small changes once construction has started if a more efficient or less impactful option is identified and reduce the need to go back through the process of land purchase or obtaining a wayleave.

- How to set timeframes for compulsory purchase and necessary wayleave process.
- How the land right and wayleave process sits alongside planning approval and how planning approval could be granted without land rights and wayleaves in place.

Implementation:

LA1: Primary legislation will be required to amend the Housing and Planning Act-2016 to give TOs additional statutory powers to access land. A legislative vehicle would need to be found for this amendment. It can take around two years to make a primary legislation change but this can vary.

In order to support projects that are currently in the route design phase, and are looking to deliver for 2030, the timeframe to implement this recommendation needs to be accelerated. This will enable time saving in the route design phase. It is also expected there will be a reduction in the burden of obtaining a warrant for the TO and for the court system and thereby represent a cost saving.

LA2: There are two options for implementing this recommendation: guidance or a statutory code of compensation. The first option of issuing guidance is unlikely to require any legislative changes. There would be a cost of setting up and agreeing guidance, but this is likely to be offset through shorter negotiation times and potentially lower land purchase and wayleave costs. It will take around six months to set up the methodology and then potentially another nine months for consultation, so it would be possible to set up this guidance in time for some projects looking to deliver for 2030.

The second option is to create a statutory code of compensation like the telecoms industry has. It is likely to take longer to establish this as primary legislation will be required. A possible approach would be to set up guidance as soon as possible while at the same time looking to make the primary legislation change. Making a statutory code of compensation would support the delivery of projects and manage project costs during construction and on an enduring basis. There have been instances of wayleaves lapsing due to a new landowner and the compensation requested being higher than originally agreed. A statutory code of compensation would help manage the longer-term costs of access to equipment for maintenance.

LA3: Further work is required in this area to understand what needs to change, why it needs to change and how to make the change. A working group, formed and directed by the Energy System Delivery Board (ESDB)³⁰, with TOs, Future System Operator (FSO), Department for Energy Security and Net Zero (DESNZ), Department for Levelling Up, Housing and Communities (DLUHC), Planning Inspectorate (PINS) and Scottish Government participation should be set up to look at what further changes could be made to the land purchase and wayleave processes, both voluntary and compulsory, to support accelerating the delivery of nationally critical infrastructure. Examples from other utilities and best practice should be considered as part of this working group.

³⁰ Please refer to the Commissioner's letter or to Section 7 of this report

5.15 Supply Chain

Challenge:

The supply chain - being able to purchase equipment and services - is becoming more and more constrained. The UK is not alone in trying to decarbonise its electricity system; one result is that supply chains are becoming increasingly competitive on a global scale to secure the equipment and engineering services required.

The lead times for some equipment can be as much as seven years and lead times for many materials and equipment are increasing. The supply chain is looking for greater certainty on the size and content of the order book from Transmission Owners (TOs) and often require upfront payments to secure manufacturing slots. The introduction of the pre-construction budget in Accelerating Strategic Transmission Investment (ASTI) has supported engagement by being able to pay the supply chain earlier in the process.

The challenge is aligned with design and approval processes. The detailed design process is carried out by a contractor following regulatory and planning approval. At this stage equipment will be selected that meets the specification of the route design and the design is optimised. For equipment with a long lead time this will add delay into a project as it has been identified so late in the process. Following the detailed route design some variation to the planning approval may be required. This can mean going back through the planning approval process adding cost and delay to a project.

Recommendations:

SC1: The Transmission Owners (TOs) should form long term relationships with the supply chain and look to book slots and bulk purchase equipment when possible. This approach is moving away from engagement on a project-by-project basis and looking at long term programme of projects that have been identified by the Strategic Spatial Energy Plan (SSEP) and Centralised Strategic Network Plan (CSNP). Long term engagement and contracts should also be put in place for engineering services from detailed route design to construction.

SC2: Contractors, who will carry out the detailed design work, should be procured earlier in the design process. Detailed design work on the routing and a bill of materials should be completed as soon in the process as possible to facilitate the purchasing of equipment with long lead times. Detailed design at this stage will support the planning approval application and reduce the need to seek further approval if the detailed design varies from the original route design.

SC3: Further work and collaboration is required between the Transmission Owners (TOs), supply chain and government to understand how manufacturing capability could be developed in the UK. Further investigation is required around procurement rules and how equipment manufactured in the UK can remain in the UK.

Implementation:

SC1: In order to support the TOs in forming longer term relationships with the supply chain, Recommendation CT1: Contestability of Transmission Owner needs to be

implemented. The TOs require much more certainty on what they will be expected to deliver and by when, to form meaningful relationships with the supply chain. Long-term certainty on the portfolio of projects will allow the TO to purchase equipment and services on a programme level and have confidence to spend on securing manufacturing slots. Without this certainty TOs will not be in a position to secure the supply chain and project delivery is likely to be delayed and cost added. This recommendation will support projects identified in the Holistic Network Design – Follow Up Exercise (HND-FUE), which is due to be published this year, and any subsequent projects.

SC2: The introduction of pre-construction funding in ASTI has supported the adoption of this approach. Removing the regulatory approval process from the critical path, Recommendation RA1: Regulatory Approval, will further support the adoption of detailed design earlier in the process. Moving the detailed design to happen before the planning approval is expected to save six months in the end-to-end process. It is also expected to support time savings by being able to order equipment earlier in the process. It is expected to reduce the need to seek further planning approvals for any variation in the route design identified in the detailed design. The time to implement this recommendation will be based on the time to implement a new regulatory approval process, noting that temporary measures may be used before a new process is adopted.

SC3: A working group should be set up between TOs, supply chain and Government to understand what further actions could be taken to help ease supply chain constraints and bring manufacturing capability to the UK. It is suggested that procurement law is an area where further investigation is required.

5.16 National Campaign on the Need for Infrastructure and Jobs

Challenge:

Whilst there is some public acknowledgement of the need for renewable generation to support decarbonisation, there is very limited understanding of the electricity transmission infrastructure required to connect it. There is a need to engage with local communities impacted by the infrastructure when designing it and when applying for planning approval. Frequently these impacts are seen as negative. Communities can be averse to new infrastructure and ask for visual mitigation measures like undergrounding or offshoring without fully understanding the implications of these options.

The impacts of new infrastructure can also be positive. To support the decarbonisation of the electricity network a range of jobs and skills will be required. Skills range from construction, environmental science, planning to engineering. There is a need for more people to work in these areas across all organisations involved in planning and building electricity infrastructure. These jobs, and the economic and social benefits that arise from them, could provide opportunities for people in the local communities affected by infrastructure build.

The key challenge is ensuring there is understanding of the relationship between transmission infrastructure build and achieving good climate, economic and social outcomes.

Recommendations:

NC1: A Government-led national information campaign should be started on the need for electricity infrastructure and how this can lead to good outcomes for people and the communities in which they live and work. This should include how this need can lead to job opportunities for them and their families. This campaign could be like that used by the armed forces. The advertising campaign should show why new electricity transmission infrastructure is required to connect renewable energy to where it is needed. The campaign should also highlight the range of different job opportunities available such as engineering, environmental science, planning and construction, amongst others.

NC2: An independent website, possibly hosted by the Institution of Engineering and Technology (IET) or a similar organisation, should be set up to provide information to the public on:

- The need for electricity infrastructure. This should provide information in addition to that in the advertising campaign and should be easy to understand as well as informative.
- The different types of infrastructure and their environmental impacts and why different types of infrastructure are used. This should include an explanation on the cost and environmental impact of using overhead line (OHL), underground cable and offshore cable.
- Infrastructures needs as expressed in a simplified version of the Strategic Spatial Energy Plan (SSEP) and Centralised Strategic Network Plan (CSNP) to give context to why infrastructure is needed in a particular area and provide a forward look to further projects that may come to the area.
- Jobs and careers available within the industry. The website would host the information on jobs and careers suggested as part of Recommendation NC3.

The website should become a 'one stop shop' to find easy to understand information on electricity infrastructure and related jobs. The website should be used when engaging with local communities to give impartial information to them. The website can also be used by the wider community interested in electricity infrastructure.

NC3: Information on all types of careers and opportunities should be provided in a variety of ways to appeal to different age groups; examples include use of profiles of real people, videos, content creation to appeal to younger audiences, using influencers and animations. Links to training schemes and qualifications required should be included so that at any point in your career it is possible to see what is required to enter the industry. This is intended to give information on green jobs in a variety of ways that speaks to different age groups including primary and secondary-school aged children. This recommendation is linked to Recommendation NC2 describing where this content could be hosted.

Implementation:

NC1: Funding would be required to run a national campaign; this would likely come from Government. “Light touch” national campaigns, can cost approximately £15-20million a year. This cost may not be directly offset against a specific benefit, but it is expected to be offset by improved community engagement, access to needed skills and accelerated delivery of projects.

The TOs have started to create campaigns that show why new infrastructure is required and could be used as part of the campaign. It is expected a campaign could be delivered in under a year and support projects required for 2030.

NC2 and NC3: There would be a cost to set up and maintain a new website with funding likely to come from Government. If the website is used to advertise job opportunities and training courses and university degrees, then a fee to do so could be used to support ongoing maintenance costs of the website. An alternative would be for many organisations to sponsor it including government departments. Creating content, such as videos and photos, could be activity undertaken by the different organisations involved in the end-to-end process. For example, a Transmission Owner (TO) may wish to let a small group of employees create videos showing the work they do from working in the control room to climbing to the top of a tower. An environmental surveyor may wish to share photos of the animals they find while on the job.

To create easy to understand materials on the SSEP and CSNP is an activity that could be carried out by the Future System Operator (FSO) and form part of the materials they would produce when publishing plans. There is existing information on the different types of infrastructure that the TOs have created which could be used as an early version of a website. It is expected that this type of information could be gathered quickly to create a website that could be used to support projects for 2030.

A centralised up to date website can cost approximately between £10m-£16m to set up. This cost is a sum of staff, infrastructure, and software costs. The per site visit cost is a useful measurement to understand the value of the website. The engagement and resources would help achieve community acceptance and also allow for better targeting of national skill gaps.

5.17 National Review of Skills and Jobs

Challenge:

The engineering and technician skills shortage has been a challenge for several years. It is expected that this challenge will grow as we need to build more electricity infrastructure. Competing on a global market for these skills and resources is expected to become harder as more countries look to decarbonise and expand their electricity networks. The issue is broader than technical skills. With an increasing number of projects, the skills shortage is starting to impact across a broad spectrum of disciplines, in professional and vocational roles and jobs at all levels. There have been a number of Government and industry groups that have tried to tackle this issue, but it remains and is becoming a constraint on delivering Net Zero.

Recommendations:

SJ1: Government should fund and lead an urgent review and work with industry and academia to identify the skills gaps and actions required to attract, recruit and retain the large workforce needed to deliver Net Zero. The actions identified should look to address short-term constraints along with actions to tackle the long-term need to ensure the skills shortage can be addressed on a sustained basis. The requirements for transmission infrastructure delivery should be treated as a priority.

Implementation:

A working group should be set up with Government, Future System Operator (FSO), Transmission Owners (TOs), supply chain and other organisations struggling to attract the required resource. The purpose of the group would be to create an action plan to address skills and resources in the short term and in the long term. The group should consider actions such as visas for individuals that could fill current skills gaps, university and training places for a range of skills and long-term actions to encourage entry into the electricity industry. The working group should be set up by the Energy System Delivery Board (ESDB), Recommendation OE1: Oversight of the End-to-End Process. The action plan should be monitored by this group and support its delivery.

The Recommendation CT1: Contestability of Transmission Owner interacts with this recommendation. If the TOs have more certainty on the size of the programme of work they will need to deliver, they will be in a stronger position to invest in people and training in the long term. Without this certainty measures will be short term and project-by-project focused. It will become increasingly difficult to compete on a global market for the skills and resources required to meet our Net Zero targets and may ultimately place them at risk. There is an opportunity for Government to facilitate the adoption of green jobs by the UK workforce.

This recommendation supports Recommendation NC3: National Campaign on the Need for Infrastructure and Jobs. The careers section of the recommended campaign website can be used to advertise opportunities identified through this review.

5.18 Oversight of the End-to-End Process

Challenge:

There are many parties involved in the end-to-end process for delivering transmission infrastructure. Different parties have different roles, responsibilities, objectives and licence conditions. There is no incentive for the parties to act in a coordinated way nor are there any mechanisms to encourage, enable or support them in doing so. There is no clear accountability for any party to deliver at speed and there are many dependencies between the parties on the actions of others.

Transmission infrastructure build is only one part of the energy system transformation that is needed to achieve Net Zero, but it is critical. Lack of an end-to-end process places the efforts of all parties at risk and jeopardises Net Zero.

Recommendations:

OE1: The Government should establish an Energy System Delivery Board (ESDB) to monitor and drive delivery of the electricity transmission network delivery programme required to meet Net Zero. The Board would have a whole energy system remit, but its initial efforts would be focussed on transmission infrastructure. The Board should be chaired by a Minister, with representation from Ofgem, Future System Operator (FSO), Transmission Owners (TOs) and other relevant stakeholders required. As recommendations are implemented and the delivery process for building new infrastructure improves, the need for this Board may change or reduce.

OE2: The Government should establish a Change Management Committee (CMC) as part of the Energy System Delivery Board (ESDB) to initiate and facilitate the changes that will be required. This includes determining and overseeing implementation of the governance and institutional changes that will be needed to support and enable the recommendations to be progressed. Change management functions should be established by Ofgem, Electricity System Operator (ESO) (as part of it becoming Future System Operator (FSO)) and the Transmission Owner (TOs) for the same purpose and work closely with and report to the CMC.

Implementation:

OE1 & OE2: Establishing and operating the ESDB and CMC will take time and resource within Government. Other organisations will require time and resource to create support functions and to participate in and engage with the ESDB and CMC. These groups are not intended to become a burden on organisations. They are intended to create an environment where ideas can be exchanged, direction is provided, progress can be monitored, and challenges and barriers quickly escalated and resolved.

The time and resource overhead of these boards is expected to be offset by the benefits of alignment amongst key stakeholders, clarity on needed changes and the roles and responsibilities for implementing them, and the potential to implement the recommendations more quickly and efficiently. This in turn should increase the likelihood of success of the recommendations delivering on the seven-year ambition. It is expected these functions and the processes they use can and should be set up quickly and offering support within the next six months.

Further comments on governance and institutional arrangements can be found in Section 7.

5.19 Outage Planning

Challenge:

The outage plan facilitates access to the network in order to carry out maintenance, add new infrastructure and make upgrades to the network. With an increasing number of transmission infrastructure projects needing to access the network, the outage plan will become congested and could become a delay to project delivery.

When assessing an outage, the cost of securing the operational integrity of the network (e.g., managing voltage) and the costs of constraints are considered. Constraint costs may

be incurred during an outage due to the reduction in network capacity for generation in some areas. If the system cost is too high to secure the outage, then it can be delayed until system conditions, (e.g., less windy, more optimal outage/generation background) are less onerous. With an increasing number of outages required in the future, a delay on one project may impact the delivery of others by changing the outage plan.

During the detailed design stage, the impact on the overall outage plan, such as the ability to provide further system access, or the constraint cost element of securing outages, are not always considered. The delivery of the project is currently optimised from a construction point of view without appreciating the overall system operational costs. For example, an offline build of part of the line and a short outage may have higher construction costs but much lower outage constraint costs, providing an overall more economical solution.

Outage plan optimisation is essential to maximise the amount of system access that can be granted at any single point in time and minimise the cost to consumers. System access to plant, assets and equipment is planned closely with system users so that outages (i.e., those that affect transmission, distribution, generation) are aligned and access maximised, whilst maintaining system security. Changes in start and/or end dates of a single outage can lead to knock on impact to other outages which were aligned with the first one. This can lead to sub-optimal alignment of outages, increased balancing costs or delays to outages. Minimising, changes to outage plans, particularly in the short-term, allows much greater optimisation of the system, and in turn, system access. A more firmly settled outage plan built across short, medium and long-term time horizons, for all foreseeable outages, will be a key enabler of the transformation of the power system.

Recommendations:

OP1: Review and regular update of the guidance for the type of outages that can take place at different times of the year should be undertaken. For example, an outage with an emergency return to service (ERTS) of greater than twenty-four hours may be permitted in winter where the system risk is deemed acceptable, following a transparent risk assessment process. This is intended to provide more balance between outages in summer and winter and allow more outages to be agreed throughout the year, where the system risk is deemed acceptable.

OP2: The Electricity System Operator (ESO) should investigate use case where operational rules can be relaxed to allow outages to go ahead, for example, relaxing network security from network minus 3 circuits (N-3) to network minus 2 circuits (N-2) during the right conditions. An impact assessment can be carried out to identify when it would be appropriate to relax security standards. For example, a double circuit can be taken out of service if there is a local impact to demand following a fault, but not if it causes a widespread system issue. This is intended to find specific cases where rules can be relaxed, rather than a general relaxation of rules.

OP3: The Electricity System Operator (ESO) should be involved in long-term outage planning during the route design stage. The ESO should provide guidance and input advising on the overall system benefits of different build approaches, which may require a more expensive asset build (offline) but results in a lower whole system cost when constraints are considered. This is intended to give visibility of outage costs to the Transmission Owner (TO) when planning the project delivery and to give the ESO visibility of the project costs for different outage arrangements.

OP4: The Electricity System Operator (ESO), in collaboration with industry, should lead a review of existing arrangements for outage planning (including, transmission outages, relevant distribution outages and generation outages) in the short, medium and long-term to develop actions to:

- Improve the timely identification of all outage requirements and their coordination.
- Drive down the number of foreseeable changes to those outage plans to improve greater certainty for stakeholders.
- Provide a stronger medium and long-term focus to support the development of medium/long-term solutions to system access whilst minimising short term change and those impacts on an optimal system access plan.

Implementation:

OP1: A risk-based approach has been applied over the past winter to facilitate more outages. Cooperation between the ESO and TOs has facilitated this change. To meet 2030 targets this approach can continue and updates to the System Operator Transmission Owner Code (STC) laying out the methodology can support this. Resources and effort from the ESO and TOs would be required to implement this approach, including its design, validation and on-going review.

OP2: The ESO would investigate which operational rules could be relaxed and the use cases for when there would be a benefit to do so. The Security and Quality of Supply Standards (SQSS) sets out the operational standards to be followed, and a deviation from them may be required. A deviation and a trial of relaxed standards would be required ahead of changes made to SQSS. A trial could be undertaken ahead of the increase in outages expected for 2030 projects. A model to assess the impact-related risk would need to be developed and resource from the ESO required to implement and apply the model. If it is found that SQSS modifications would be beneficial, there would be a requirement to progress a formal change.

OP3: Cooperation between the TOs and the ESO will be required during the delivery planning process. Additional resource will be required from the ESO to support this. A new methodology for evaluating project costs will be required that takes account of delivery costs and constraint costs. Ofgem will need to update the methodology they use when evaluating project costs to support a whole project cost. Resources from ESO, TOs and Ofgem will be required to support this and to undertake development and deployment of a new cost analysis method.

OP4: Cooperation between the TOs, system users and the ESO will be required during the delivery planning process. Additional resource will be required from the ESO to support this. Resources from ESO, TOs and users will be required to develop an action plan.

Outage planning is a risk to the delivery of projects for 2030 and beyond; getting system access and co-ordinating projects will become increasingly difficult to manage. These recommendations do not provide a direct timesaving in the end-to-end process and instead are intended to help manage the risk of delivery. Greater visibility and certainty of the outage plan will support projects making decisions and managing delivery.

6. Achieving the Seven Year Ambition

The challenge of reducing the time taken to deploy transmission infrastructure is complex, with many interactions and dependencies between the activities that comprise the end-to-end process and between the stakeholders tasked with delivery. Today's process shown in Figure 4.3 illustrates the many activities and their sequencing. The themes described in Section 4.2 highlight the issues being faced and help structure the response to the need for change.

The recommendations which are organised into groups around these issues, allow a new process to be proposed as shown in Figure 4.6. This new process could allow the ambition of delivering new transmission infrastructure in seven years to be achieved. However, this requires treating the recommendations as a coherent package. They have been developed and designed in this way, acknowledging the high degree of interconnectedness between them. It is possible to deploy recommendations separately but realising the desired timesaving and other beneficial outcomes will be compromised.

An example that illustrates the positive interactions between recommendations is the role that the Strategic Spatial Energy Plan (SSEP) can play in improving cost benefit analyses, which creates more certainty in the approval process, that in turn allows for more timely booking of manufacturing slots with the supply chain. The SSEP will also enable development of insight into the requirements and approach needed for building required skills.

The relationship between the groups of recommendations and the new process is shown in **Error! Reference source not found.** This figure also shows the reduction in time taken to deliver new transmission infrastructure.

Adopting this set of recommendations and associated processes will take some time to achieve; explicit change management will be required. Setting up a Change Management Committee (CMC) (see Section 7) should be addressed as a matter of urgency. The CMC would oversee, monitor and take corrective actions to ensure recommendations are adopted as quickly as possible and are delivering the expected outcomes.

Implementing change will not deliver a new seven-year process immediately; it is expected to take some time to deliver the full benefits of these recommendations. Figure 6.1 shows initial thinking on how long each of the recommendations may take to implement and become effective.

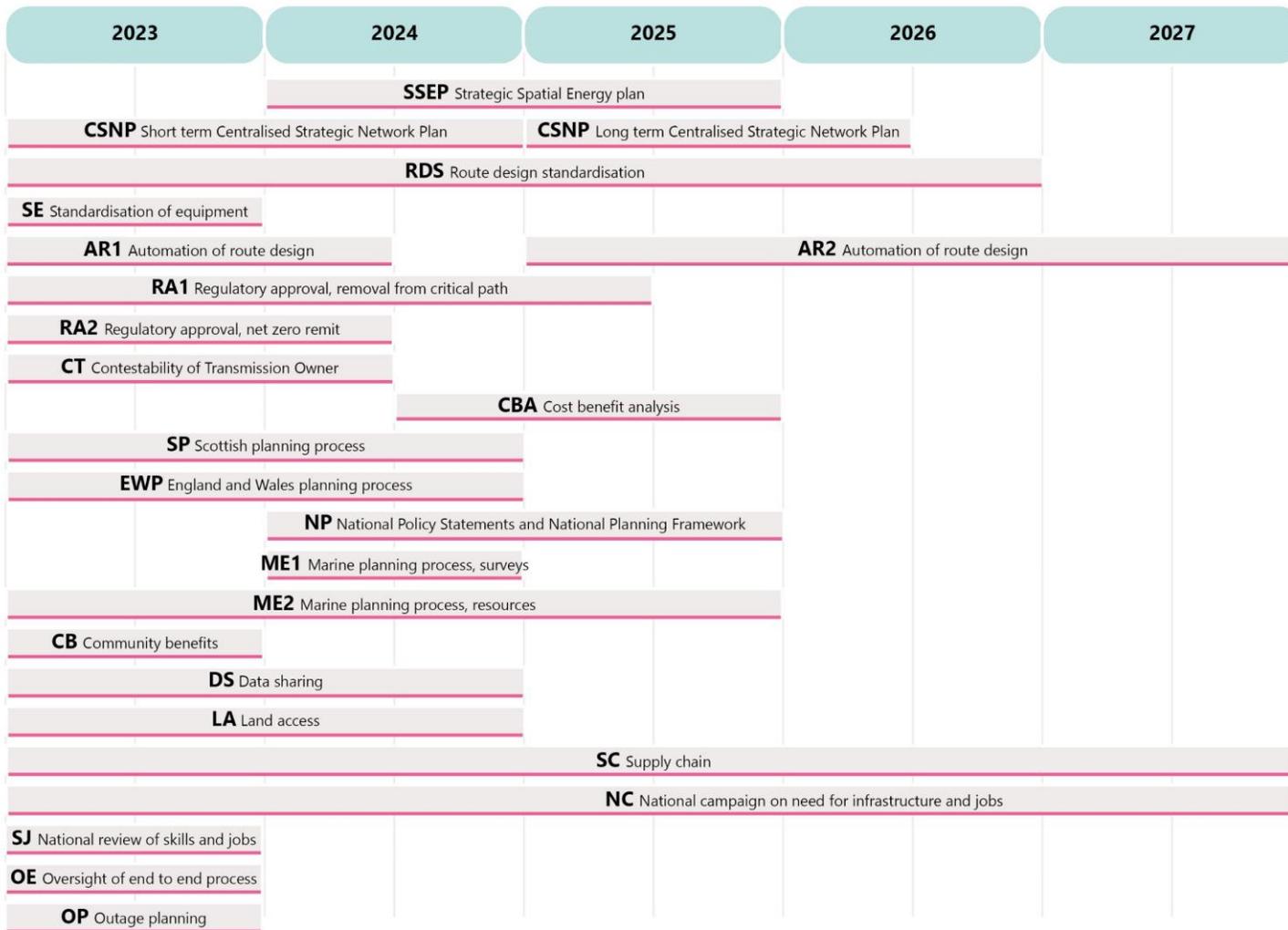


Figure 6.1 Timeframe to implement recommendations

The SSEP is foundational for the new end-to-end process. With this in place, network plans, such as the Centralised Strategic Network Plans (CSNPs) can be developed. The first CSNP is due to be published in 2025. This is an opportunity for new processes to be adopted for all projects and gives a two-year timeframe to progress and implement the recommendations offered in this report. Changes to regulatory approval and endorsement of the plans in the National Policy Statements (NPS) and National Planning Framework (NPF) should be prioritised.

The creation of the SSEP and the longer-term CSNP need to be progressed at pace to support the Transmission Owners (TOs) engaging with the supply chain. Building long-term relationships will require a clear pipeline of projects. If these plans are not delivered until 2026 or beyond then forming these important relationships, and promoting an increase in manufacturing capability, will be delayed impacting projects today and in the future.

Implementation of route design principles is likely to be challenging and will require consultation. Enhancing and clarifying rules currently used today is vital to reduce the time spent designing multiple route options. Progress should be made quickly to align with the CSNP being published in 2025. A method of continuous improvement and refinement should be adopted to further enhance the principles to support automation. Design standards and automation of route design underpin the halving ambition. Reaching the seven-year ambition will rely on Governments, TOs and communities agreeing on design principles and investment in automation.

Reforming the regulatory approval process, including cost benefit analysis, is required ahead of the next regulatory settlement period starting in 2026. Interim arrangements, like Accelerating Strategic Transmission Investment (ASTI), will need to be kept for Holistic Network Design (HND) and Holistic Network Design – Follow Up Exercise (HND-FUE) projects. A new regulatory framework should be put in place for projects identified in the first CSNP in 2025. To support projects identified in HND-FUE a decision on the contestability of transmission owner and how contestability will be phased in is needed as a high priority. Delay to this decision will delay the TOs in engaging with the supply chain and risk delaying the delivery of critical national infrastructure.

The timeframe for planning approval and marine licences needs to reduce to twelve months for projects looking to deliver for 2030 and beyond. Making changes to the England and Wales process is expected to take around two years; every effort should be made to accelerate this. Making changes to the Scottish planning process will require primary legislation. Unless these changes are made urgently, projects required for meeting 2030 offshore wind targets will face delay in obtaining planning approval. Proactive actions need to be taken to ensure the marine licensing process in England, Scotland and Wales can deliver in a twelve-month period.

The NPS for England and Wales and the NPF for Scotland will require updates by 2025 to reference the SSEP, CSNP and the Electricity Transmission Design Principles (ETDP). Regular updates to these documents and guidance on community benefits will be required to support continuous improvement of the end-to-end process.

Granting further statutory powers to the TOs to access land should be accelerated to support projects delivering for 2030. There will be an immediate benefit of time and effort saved from making this change.

Carrying out a national information campaign on the need for electricity transmission infrastructure and carrying out a review of jobs and skills required, are activities that could and should be delivered quickly.

7. Call for Action

The recommendations offered seek to respond to the urgency of the need to deliver transmission infrastructure more quickly and are believed to provide collectively a coherent approach for progress to be made and ambitious outcomes to be delivered.

What are the immediate next steps?

- Government should receive and give urgent attention to the recommendations, establishing a Change Management Committee (CMC) as part of the Energy System Delivery Board (ESDB) charged with progressing their implementation. The ESDB and CMC are described below and in the Commissioner's recommendations. Implementation should be approached on the basis that the recommendations are a cohesive set that work together to deliver needed outcomes.
- Government should commit resources to enable the CMC to be established and become operational quickly.
- The CMC should undertake detailed review and if necessary, carry out further study of the recommendations, and deliver a plan for moving forward. This plan would establish priorities and sequencing, consider roles and responsibilities, and identify required resources and processes.
- The CMC should work with Government, Ofgem and other key stakeholders to determine and agree the governance and institutional arrangements that will drive energy system transformation.
- The CMC should work with Government, Ofgem and other key stakeholders to place delivery of the recommendations as a priority in the whole energy system governance and institutional arrangements.

What considerations should be taken into account in undertaking these next steps?

- Immediate actions should be taken to consolidate current programmes and initiatives and understand how these individually and collectively help build the strategy that supports and responds to emerging requirements and the pursuit of Net Zero. This should include developing an understanding of how these align or integrate with the recommendations. Specific alignment between the Offshore Wind, Hydrogen and Transmission expert recommendations should be an early part of this.
- All efforts in this regard must be mindful of the need to include the whole energy system with the transmission grid being a first (and critical) use case.
- The stakeholder community needs to be brought together to support this work and help ensure there is alignment of purpose and direction.

An important enabling condition

New governance and institutional arrangements will be needed to deliver energy system transformation successfully. These arrangements should be whole energy system in perspective, scope, mandate and powers if good decisions are to be made that account for increasingly numerous and complex system interactions, dependencies and trade-offs. This

perspective responds to the fact that the system will cease to be top-down and linear within individual vectors – it will be distributed, decentralised, multi-dimensional and changing at an accelerated pace. Traditional approaches will not be sufficiently aware or agile.

The Commissioner's recommendations respond to what is broadly accepted to be an urgent need but acting at pace should not be allowed to lead to arrangements being established that are limited to transmission infrastructure delivery. This would create the risk of issues arising later. Arrangements should be shaped around the whole energy system with transmission infrastructure delivery being the first priority. This does not mean that all governance and institutional arrangements need to be fully specified and implemented before transmission can be addressed.

Achievement of milestones such as a decarbonised power system by 2035 may require a period of special arrangements to deliver needed pace. These should be subject to continuous review and may change or relax if/when it becomes clear that targets and statutory requirements are going to be met.

A proposed framework for progressing discussion on governance and institutional arrangements

Governance and institutional arrangements must enable many parties to make complex decisions, often with enduring consequences. Their transformation should align with that of the energy system on its journey to a Net Zero future, but do so in a way that balances ambition, risk and pace. Any process of change should acknowledge today's circumstances and consider carefully how to migrate to new structures.

Making progress may be helped by having a framework that supports needed discussion. A framework helps ensure that the parties are talking about the same thing, using a shared reference point and language. A framework need not be prescriptive; it can allow for additions, deletions, changes, reconfiguration etc.

A key principle that underpins such a framework and that should shape governance and institutional arrangements is '**function before form**'. A broad set of capabilities will be required to be provided and various roles will need to be performed, but there are options for how these might be deployed. This suggests the need to understand the required functions and their interactions well and then place them into an institutional architecture.

Nine key functions have been identified. Some are new and some are existing, but which may be enhanced.

- **Policy and Direction:** Provide political context and clear purpose and direction.
- **Leadership:** Translate policy and direction into a clear expression of objectives and provide active leadership to achieve energy system transformation outcomes.
- **Engagement:** Facilitate dialogue with consumers and citizens and the communities in which they live and work.

- **Analysis:** Undertake analysis, modelling and other tasks and deliver consistent outputs that respond to key questions, illuminate problems and reveal insights that can be applied to identify and evaluate potential solution options.
- **Strategic Planning:** Translate transformation objectives into a strategic plan and an approach to change, including how interdependencies and trade-offs can be revealed and managed, with the plan given authority by being endorsed by Government and the regulator.
- **Delivery Planning and Assurance:** Develop and manage a strategic programme plan for acting on the strategic plan and delivering outcomes, with the plan given authority by being endorsed by Government and the regulator.
- **Execution:** Implement and operate energy system solutions at national and regional levels.
- **Regulation:** Assure efficiency in delivery and consumer value for money and support achievement of Net Zero.
- **Change Management:** Manage the process of change in the energy sector, including in its governance and institutions, to enable transformation.

The **principal institutions** responsible for performing these functions and delivering energy system transformation include, but are not limited to:

- **Government (UK and Devolved):** Coordinated across departments and led by the Department of Energy Security and Net Zero.
- **Energy System Delivery Board:** A new group tasked with providing leadership for delivering energy transformation outcomes; chaired by Government and comprising representation from across the energy system.
- **Government (Regional and Local):** Representing the interests and contributions of place in energy system transformation.
- **Ofgem:** Protecting the interests of consumers through regulation and supporting achievement of Net Zero, and where beneficial, working with other regulators to do so.
- **Future System Operator (FSO):** Formed from transformation of the Electricity System Operator (ESO) after its separation from National Grid to provide strategic and delivery planning and coordination of stakeholders across the energy system in addition to its duties for electricity operations³¹.
- **Industry:** The collection of existing and new parties that build the energy system and deliver energy services including the networks, supply chain, and many other stakeholders.

³¹ Current position. Operations functions could potentially be extended to other vectors at some point in the future. It is also assumed that the view presented in the Ofgem consultation on the future of local energy institutions and governance will be implemented (in some form); that is, there will be Regional System Planners and a Market Facilitation role, and these roles will be assumed by the FSO.

- **People and Communities:** Consumers and citizens including domestic, commercial and industrial individuals and groups.

The relationships between the functions and the parties that will be responsible for performing them can then be proposed. The placement of functions with an organisation may change over time as circumstances evolve and as experience in operation is gained.

The “mapping” of the functions and their interactions to organisations allows an architecture for governance and institutions to be prepared and discussed. Its operation can then be explored. This will see agreement of “artefacts” or “products” (such as strategies, plans, reports, insights, usually in document form) that will be created, exchanged, endorsed and approved through various processes and interactions. Some of these are already established; others need to be updated or created. Key artefacts would include:

- **Energy System Objectives:** Clear statement of objectives and milestones that reflect policy and must be achieved to support Net Zero and satisfy statutory obligations.
- **Energy System Strategic Plan:** Whole energy system plan (across the value chain and across vectors and sectors), addressing spatial, temporal, functional and operational structure of the energy system, enablement requirements (planning and consents, digitalisation, markets, regulation, for example) and other considerations such as relationships with other interdependent sectors (water, agriculture, land use for example). This would include the Strategic Spatial Energy Plan (SSEP) and Centralised Strategic Network Plans (CSNPs) within its scope.
- **Energy System Delivery and Assurance Plan:** Strategic programme plan for delivering the strategic plan, addressing (amongst other things) cross-cutting delivery issues and dependencies such as supply chain development that span the strategic interventions needed.
- **Electricity Transmission Design Principles:** A public document detailing the principles and methods used to design the system and decide the configuration of assets.
- **Shared Resources:** A portfolio of resources that will grow and evolve over time including tools, models, data, algorithms, standards.

The Commissioner’s recommendations identify artefacts that will be needed for the transmission case and provide the opportunity to extend these to the whole energy system. These artefacts complement other key items such as the National Policy Statements. The Commissioner’s recommendations also describe some needed interactions between parties. The coordination of these interactions is central to success; of note is the endorsement of strategic plans by Government and Ofgem, a key aspect of achieving the seven-year delivery time.

Drawing these ideas together allows a very high-level operational view to be prepared as shown in Figure 7.1.

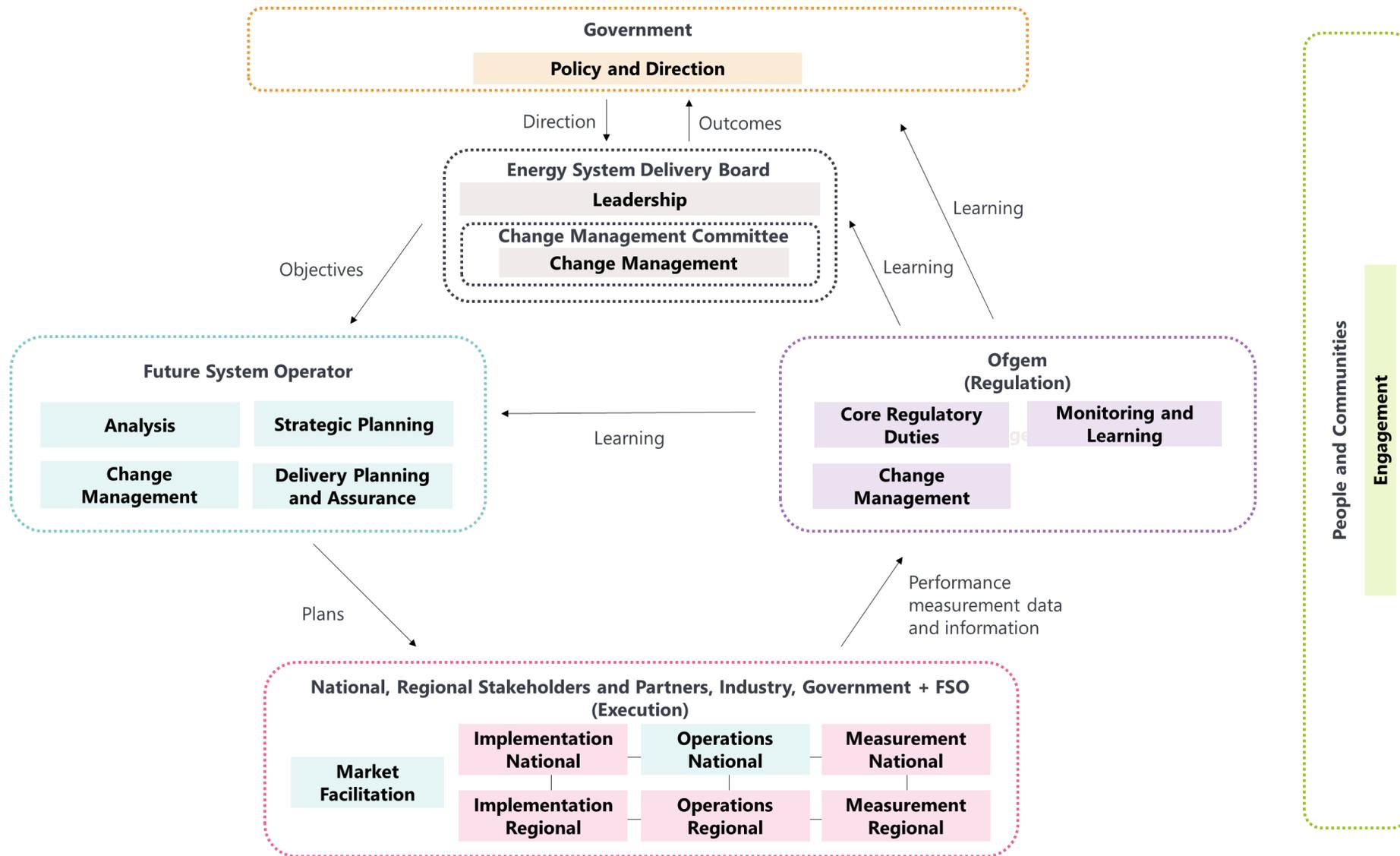


Figure 7.1 High level operational structure

The operating structure acknowledges that there will be a period of change as the energy system moves from its current mode of operation to its future mode of operation.

This change process should not seek to design the perfect answer before acting. Instead, it should build in mechanisms to enable progress to be made quickly, but address the uncertainty implied by explicitly measuring progress and performance. These measurements can then be used as the basis of learning that can be applied to direction, objectives, and plans.

This iterative feedback loop creates the agility needed to address complexity, uncertainty, and pace. It is emphasised that other mechanisms such as the refresh cycle of key government objectives and plans needs to be clear on when and how learning is applied to offer sufficient certainty for long term decision making, or where that isn't possible, to enable risks to be identified and properly assessed.

This framework and other thinking developed using it are offered as an outline of possible arrangements. It builds on the ideas introduced above and is intended to provide a description that could be helpful in facilitating discussion and ensuring that the parties have a shared reference for that discussion. It is expected that this discussion will be led by the ESDB and its CMC.

The key role of governance and institutional arrangements in achieving needed outcomes underscores the importance of the immediate next steps described above.

What other aspects should be addressed in future work?

Delivering transmission infrastructure more quickly is only one aspect of transmission-related change that is important in energy system transformation in pursuit of Net Zero.

- It is important to look beyond process improvement to include other interventions that could deliver benefits, for example, use of grid-forming technologies or dynamic rating to increase capacity of existing infrastructure, deployment of storage to delay or avoid the need to build networks, application of digitalisation including Artificial Intelligence to enhance operations and the contribution of well-functioning flexibility markets amongst others.
- The extent to which process automation would improve consistency in information capture and enable better, quicker information flows should be explored in the context of energy system digitalisation and rapidly developing digital techniques, including Artificial Intelligence and Machine Learning.
- The relationship with distribution networks and local energy planning is a critical consideration; if distribution networks do not keep pace, the value of transmission development will be diminished.
- The scale and pace of local energy initiatives need to be understood so their materiality in the context of transmission (and distribution) networks can be considered.

- The impact of multi-vector developments and solutions (potential trade-offs between “electrons” and “molecules” for example) could be substantial and should be investigated in pursuit of benefits.
- The uncertainties of demand and the potential impact of demand reduction could be material to future developments and should be addressed.
- The impact of both supply and demand flexibility should be better understood. This includes progressing the creation and establishment of well-functioning flexibility markets, ensuring that interactions between national and regional operations are clearly understood and implemented and that integration of enabling technologies such as storage and digital platforms is aligned.
- The role that targeted innovation programmes could play in delivering outcomes should be explored with forward programmes being shaped accordingly.
- The critical role of supply chains is appreciated, but exploration of the nature and pace of decarbonisation in the supply chain itself is needed. This could be an important consideration with steel and cement for example. A valuable perspective here is the potential for development of UK based supply chains.
- Efforts to build transmission more quickly should not ignore adaptation and the need to address impacts of increasingly severe and frequent extreme weather events.
- Further exploration of experience from other sectors might give insight. Transport, water and telecommunications are examples, but there may be others that are relevant.
- Further exploration of international experience, particularly in countries such as Denmark with large commitments to offshore wind could reveal valuable insights.

As work progresses to address the role that transmission systems play in a transformed energy system, these other aspects should be addressed. Well established governance and institutional arrangements will facilitate this happening in a coherent, productive and timely manner.

8. Glossary

NAME	DEFINITION
ASTI	Accelerating Strategic Transmission Investment
BEAMA	British Electrotechnical and Allied Manufacturers' Association
CBA	Cost Benefit Analysis
CES	Crown Estate Scotland
CMC	Change Management Committee
CO2	Carbon Dioxide
CSNP	Centralised Strategic Network Plan
DCO	Development Consent Order
DESNZ	Department for Energy Security and Net Zero
DfE	Department for Education
DLR	Dynamic Line Rating
DLUHC	Department for Levelling Up, Housing and Communities
DNO	Distribution Network Operator
ENC	Electricity Networks Commissioner
ERTS	Emergency Return to Service
ESC	Energy Systems Catapult
ESDB	Energy System Delivery Board
ESO	Electricity System Operator. This term is used when referring to the current institution and roles
ETDP	Electricity Transmission Design Principles
ETYS	Electricity Ten Year Statement
FSO	Future System Operator. This term is used when referring to the future institution and roles
GB	Great Britain
Government	Unless specified in text refers to UK Government
Governments	Unless specified in text refers to UK Government and devolved Governments
HND	Holistic Network Design
HND-FUE	Holistic Network Design – Follow Up Exercise
MEA	Marine Environmental Assessment
MVP	Minimum Viable Product
NGESO	National Grid Electricity System Operator
NGET	National Grid Electricity Transmission
NOA	Network Options Assessment
NPF	National Planning Framework
NPS	National Policy Statements
NSIP	Nationally Strategic Infrastructure Project
Ofgem	Office of Gas and Electricity Markets
OFTO	Offshore Transmission Owner
OHL	Overhead line
PINS	Planning Inspectorate

SEA	Strategic Environmental Assessment
SHET	Scottish Hydro Electricity Transmission
SPT	Scottish Power Transmission
SQSS	Security and Quality of Supply Standards
STC	System Operator Transmission Owner Code
TCE	The Crown Estate
TO	Transmission Owner

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