Department for Energy Security & Net Zero

National Policy Statements for Energy

Appraisal of Sustainability - Main Report

March 2023

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Non-Technical Summary

Overview of NPS and Appraisal of Sustainability

An Appraisal of Sustainability (AoS) has been prepared for the revised draft energy National Policy Statements (NPS) published for consultation by the Secretary of State for Energy Security and Net Zero as follows:

- EN-1: Overarching National Policy Statement for Energy
- EN-2: National Policy Statement for Natural Gas Generating Infrastructure
- EN-3: National Policy Statement for Renewable Electricity Generation
- EN-4: National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines
- EN-5: National Policy Statement for Electricity Networks Infrastructure

The suite of Energy National Policy Statements was first designated in 2011. In the 2020 Energy White Paper a review of the NPSs was announced under section 6 of the Planning Act and has resulted in the reviewed and updated NPSs that are the subject of the AoS.

Planning consents for a new generation of large-scale energy infrastructure will be decided on the basis of provisions in the energy NPSs. The AoS sets out the likely significant sustainability effects of developing new energy infrastructure of the types envisaged by the reviewed and updated energy NPSs as a whole (EN-1) and for each technology (EN-2 to EN-5), as well as indicating how the NPSs are consistent with the principles of sustainable development more generally.

The AoS fulfils the requirements of the Environmental Assessment of Plans and Programmes Regulations 2004 (as amended), known as the Strategic Environmental Assessment (SEA) Regulations and the Planning Act requirement that NPSs must be the subject of an AoS before they are designated. The scope of such an appraisal is similar to that of an environmental report under the SEA Regulations, but with more emphasis on social and economic impacts, and informed overall with the principles of sustainable development (often summarised as ensuring that development meets the needs of the present without compromising the ability of future generations to meet their own needs).

A first round of public consultation was carried out on the five NPSs and the AoS Report in September – November 2021. This revised AoS report is designed to inform further public consultation on the revised and updated drafts of the five NPSs with which it is being published.

Habitats Regulations Assessment (HRA) has been undertaken in parallel to the AoS and its results incorporated into the AoS as appropriate, though it has been reported separately to the AoS, in order to meet the requirements of the Habitats Regulations.

The AoS and HRA apply to the same geographical area of the NPSs – namely England and Wales, though in certain circumstances elements will apply to Scotland. The Energy NPSs do not apply to Northern Ireland. The temporal scope of the AoS and the HRA has been aligned with that for the NPSs, which remain in force unless withdrawn or suspended in whole or in part by the Secretary of State. It should be noted though, that the AoS and the HRA consider the full lifetime of any individual energy related development which might arise from the reviewed NPSs and that includes the construction, operation and decommissioning stages.

The Process Followed for the AoS

There are five stages in the AoS process. The first three stages and part of Stage 4, as described below, have been completed thus far:

Stage 1: Identifying other plans, programmes and sustainability objectives that inform and influence the development of the NPSs; establishing an understanding of the social, environmental and economic current and future baseline conditions of the UK, with particular emphasis on England and Wales; identifying key sustainability issues in England and Wales; outlining AoS Objectives against which to later evaluate the NPS proposals; and gathering consultation feedback on the proposed breadth of coverage and level of detail for the AoS.

Stage 2 – Initial assessment of NPSs proposals against the AoS Objectives and provision of recommendations to enhance their sustainability ; assessing alternatives to key policy stances in the NPSs; completing an assessment of the preferred NPSs; identifying the cumulative, synergistic and indirect effects likely to arise as a result of the implementation of the preferred NPSs proposals; identifying appropriate mitigation to avoid predicted negative effects; and identifying a suitable monitoring programme for significant effects.

Stage 3 – Preparing AoS Report to accompany the NPSs for public consultation (2021).

Stage 4- Preparing revised SA Report taking on board public consultation comments and changes to the NPS to accompany the revised NPS for consultation (2023). This is the current stage.

Government will consider comments received during the further public consultation, and the NPSs will be subject to approval by Parliament before final designation. Upon designation of the NPSs, an AoS Post Adoption Statement will be published, and this will outline how the findings of the AoS and the responses to consultation have been taken into account. It will also provide further information on how monitoring of the significant effects of implementing the revised NPSs will be carried out.

The process followed for the HRA

In England and Wales, under the Conservation of Habitats and Species Regulations 2017 (as amended), as well as the Conservation of Offshore Marine Habitats and Species Regulations 2017 (together known as the ‘Habitats Regulations’) an ‘Appropriate Assessment’ is required to be undertaken on proposed plans or projects which are not necessary for the management of the International Site but which are likely to have a significant effect on one or more International Sites either individually, or in combination with other plans or projects.

International Sites include Special Areas of Conservation (SACs), originally designated under European Council Directive 92/43/EEC (referred to as the Habitats Directive), and Special Protection Areas (SPAs), originally designated under the Conservation of Wild Birds Directive (Council Directive 2009/147/EC (which codifies Directive 79/409/EEC)) for rare, vulnerable and regularly occurring migratory bird species and internationally important wetlands. As a matter of Government policy listed or proposed Ramsar sites, potential SPAs (pSPA), candidate SACs (cSAC) and sites identified, or required, as compensatory measures for adverse effects on habitats sites, pSPAs, cSACs and listed or proposed Ramsar sites, are treated in the same way as International Sites. Hereafter, all the above sites are referred to as International Sites.

A HRA report was prepared for the revised and updated NPSs (EN-1 to EN-5) and considers the potential effects of designating the draft NPSs on International Sites. As for the AoS Report, the HRA report was published for public consultation alongside the NPSs in 2021 and has been revised taking on board public consultation comments and changes to the NPS to accompany the revised NPS for consultation (2023).

NPSs Public Consultation Version 2023

The National Policy Statements set out Government policy for the delivery of major energy infrastructure in England and Wales, though it only applies to those elements of energy infrastructure that are considered to be National Significant Infrastructure Projects (NSIPs). Legislation sets out those elements of energy infrastructure considered to be NSIPs:

- **electricity generating stations, (meeting the thresholds set out in the Planning Act 2008).** This includes onshore generating stations (but not onshore wind or electricity storage, except hydroelectric storage) generating more than 50 megawatts (MW) in England and 350MW in Wales. It also includes offshore generating stations generating more than 100MW offshore in territorial waters adjacent to England and within the English part of the Renewable Energy Zone and those generating more than 350MW in territorial waters adjacent to Wales and the Welsh part of the Renewable Energy Zone (the Welsh Zone as defined by section 158 of the Government of Wales Act 2006). For these types of infrastructure, this Overarching NPS (EN-1) in conjunction with any of the relevant technology-specific NPSs will be the primary policy for Secretary of State decision making
- **large gas reception and liquefied natural gas (LNG) facilities and underground gas storage facilities (meeting the thresholds set out in the Planning Act 2008).** For this infrastructure EN-1 in conjunction with EN-4 (for natural gas only) will be the primary policy for Secretary of State decision making
- **cross-country gas and oil pipe-lines and Gas Transporter pipe-lines (meeting the thresholds and conditions set out in the Planning Act 2008).** For this infrastructure EN-1 in conjunction with EN-4 (for natural gas only) will be the primary policy for Secretary of State decision making
- **above ground electric lines at or above 132kV (meeting the thresholds set out in the Planning Act 2008).** For this infrastructure, EN-1 in conjunction with the Electricity Networks NPS (EN-5) will be the primary basis for Secretary of State decision making.

The NPS will remain in force unless withdrawn or suspended in whole or in part by the Secretary of State.

AoS Framework

The establishment of appropriate objectives and guide questions (AoS Framework) is central to the appraisal process and provides a method to enable the consistent and systematic assessment of the effects of the NPSs. Broadly, the objectives present the preferred social, economic or environmental outcome which typically involves minimising detrimental effects and enhancing positive effects where relevant. Guide questions were also developed for each of the objectives to illustrate its relevance to energy infrastructure development and give more detail and focus to the appraisal process. The questions asked explore direct, indirect as well as cumulative and synergistic effects where appropriate for the different technologies. Table below sets out the final AoS Framework taking into account relevant comments received from various organisations during public consultation.

AoS Objectives and Guide Questions

No	AoS Objective	Guide Questions
1	Consistent with the national target of reducing carbon emissions to Net Zero by 2050	Will the NPS… • Reduce carbon emissions of the national portfolio of major energy infrastructure consistent with the contribution share of the energy sector to the carbon budgets and Net Zero targets? • Reduce direct and indirect emissions of all greenhouse gases, including carbon dioxide, during construction, operation and decommissioning? • Maximise supply of energy from low carbon/renewable energy sources / use of low carbon/renewable energy? • Maximise opportunities for making use of waste heat? • Use carbon removals to offset residual emissions from energy such as Bioenergy with Carbon Capture & Storage (BECCS) and Nature Based Solutions? • Create new carbon sinks/removals through natural sequestration including that by natural habitats, green-blue Infrastructure and soils?
2	Maximise adaptation and resilience to climate change* *Adaptation is about taking the necessary steps to address the risks of climate change now and in the future. Resilience is the ability of a system to adsorb and bounce back after an adverse event now and in the future. *Note that the risks of climate change to other built and natural infrastructure and assets are*	Will the NPS… • Require energy infrastructure that is resilient and adapted over its lifetime to the risks of climate change including: - increased river, surface and groundwater flooding due to extreme winter rainfall events and increase in winter mean rainfall? - increased coastal flooding and erosion damage due to sea level rise and storms? • Manage the risks associated with flooding over the energy infrastructure's lifetime, without increasing the flood risk elsewhere and identifying opportunities to reduce the risk overall, including through working with nature based solutions? • Avoid development in areas likely to be affected by coastal erosion or where this is not possible ensure that coastal change can be managed throughout the lifetime of the energy infrastructure? • Manage the risks associated to periods of limited water availability over the lifetime of the energy infrastructure? • Manage the risks associated with storms, heatwaves and wildfires over the lifetime of the energy infrastructure? • Contribute to the adaptation of nature to a changing climate? • Take advantage of the role and opportunity of nature based solutions to mitigate and adapt to climate change?

No	AoS Objective	Guide Questions
	dealt with under AoS Objectives 3, 7 and 9.	
3	Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	Will the NPS… • Protect and enhance nationally designated sites such as SSSIs, National Nature Reserves, Heritage Coasts and Marine Conservation Zones, including those of potential or candidate designation? • Protect and enhance valued habitat and populations of protected/scarce species on locally designated sites, including Key Wildlife Sites, Local Wildlife Sites and Local Nature Reserves? • Prevent development on irreplaceable habitats, such as ancient woodland and ancient and veteran trees except in exceptional circumstances and with appropriate compensation measures? • Protect and enhance the Nature Recovery Network? • Protect and enhance priority habitats, and the habitat of priority species? • Promote new habitat creation or restoration and linkages with existing habitats? • Reduce or avoid impacts to habitats with important roles in carbon sequestration? • Increase the resilience of biodiversity to the potential effects of climate change? • Encourage sensitive or nature inclusive design in terrestrial and marine environments? • Ensure energy activities protect fish stocks and marine mammals? • Ensure energy activities do not exacerbate disturbance to bird populations? • Promote Biodiversity Net Gain for any new major infrastructure development in England using latest Defra metric? • Promote Net Benefit for Biodiversity for any new major infrastructure development in Wales? • Contribute to meeting relevant statutory targets in the Environment Act? • Prevent spread of invasive species (native and non-native), including new invasive species because of climate change?
4	Protect and enhance sites designated for their international importance for nature	Will the NPS… • Avoid the loss of sites of international importance (SPAs, SACs and Ramsar sites), including those of potential designation (candidate SPAs, proposed SACs, Sites of Community Importance (SCI) and proposed Ramsar sites) both onshore and offshore? • Support continued improvements to the condition status of the UK's national site network?

No	AoS Objective	Guide Questions
	conservation purposes (linked to separate HRA process for Energy NPS)	
5	Protect and enhance cultural heritage assets and their settings, and the wider historic environment	Will the NPS… • Conserve and enhance designated heritage assets and their settings (World Heritage Sites, Scheduled Monuments, Listed Buildings and structures, Registered Parks and Gardens, Registered Historic Landscapes, Heritage Coasts, Registered Battlefields and Conservation Areas), as well as maritime assets such as Protected Wrecks? • Conserve and enhance non-designated and / or locally listed heritage assets (including newly discovered heritage assets and archaeology) and their settings? • Avoid significant harm to heritage assets, for example from the generation of noise, pollutants and visual intrusion? • Ensure appropriate archaeological assessment prior to development? • Maintain or improve the interpretation, understanding and appreciation of the historic environment?
6	Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	Will the NPS… • Support the integrity and uphold the statutory purposes of any areas designated for landscape value ie, National Parks and AONBs, including in conjunction with the provisions of any relevant Management Plan? • Maintain the character of those stretches of coastline identified and locally ‘designated’ as Heritage Coasts? • Conserve and enhance the intrinsic character or setting of designated landscapes, townscapes and seascapes? • Conserve, protect and enhance natural environmental assets (e.g. parks and green spaces, common land, woodland / forests etc) as they contribute to landscape and townscape quality? • Support measures to enhance the resilience of ecosystems at a landscape scale and also to maximise benefits including public access and enjoyment of landscapes? • Support functional landscapes e.g. those which reduce flood risk, sequester carbon or offer recreational opportunities in peri urban areas? • Minimise noise and light pollution from construction and operational activities on residential amenity and on sensitive locations, receptors and views?
7	Protect and enhance the water environment	Will the NPS… • Protect ground, surface, estuarine and coastal water quality, including during periods of increased summer temperatures due to climate change?

No	AoS Objective	Guide Questions
		• Safeguard the availability of water resources (surface and groundwater), including during periods of increased summer temperatures due to climate change? • Minimise the use of water resources / water consumption? • Protect the integrity of coastal and estuarine processes? • Reduce operational and accidental discharges to the water environment? • Protect the quality of the seabed and its sediments, and avoids significant effects on seabed morphology and sediment transport processes? • Support measures to attain good environmental status of both marine and coastal/estuarine waters as determined by the WFD and MSFD? • Contribute to meeting relevant statutory targets in the Environment Act 2021?
8	Protect and enhance air quality	Will the NPS… • Minimise emissions of dust and other air pollutants that affect human health or biodiversity? • Improve air quality within AQMAs and avoid the need for new AQMAs? • Promote enhancements to green infrastructure networks to help improve air quality?
9	Protect soil resources and avoid land contamination	Will the NPS… • Assist in facilitating the re-use of previously developed land? • Avoid the loss of Best and Most Versatile agricultural land? • Protect soil resources and ensure their sustainable use and management? • Seek to remediate contaminated land? • Increase the resilience of soils to the potential effects of climate change through minimising erosion and pollution and promoting good water management to keep soil moisture in balance?
10	Protect, enhance and promote geodiversity	Will the NPS… • Protect and enhance geodiversity resource? • Protect or enhance SSSIs designated for their geological interest? • Avoid the degradation and removal, wherever possible, of RIGS? • Support access to, interpretation and understanding of geodiversity?
11	Improve health and well-being and safety for all citizens and reduce	Will the NPS… • Protect the health of communities through prevention of accidental pollutant discharges, exposure to electric and magnetic fields, shadow flicker or radiation?

No	AoS Objective	Guide Questions
	inequalities in health	• Minimise nuisance on communities and their facilities including air, noise and light pollution? • Provide for facilities that can promote more social interaction and a more active lifestyle and enjoyment of the countryside and coasts? • Promote initiatives that enhance safety and personal security for all? • Promote Access to Greenspace and Green Infrastructure Standards? • Support enhanced security, reliability and affordability of the national energy supply?
12	Promote sustainable transport and minimise detrimental impacts on strategic transport network and disruption to basic services and infrastructure	Will the NPS… • Prevent adverse changes to strategic transport infrastructure road/rail/airport? • Prevent loss or disruption to basic services and infrastructure (e.g. electricity, gas)? • Promote transportation of goods and people by low/zero carbon transport modes? • Reduce travel distances to work and reduce the need for out commuting? • Facilitate working from home, remote working and home-based businesses?
13	Promote a strong economy with opportunities for local communities	Will the NPS … • Support enhanced security, reliability and affordability of the national energy supply? • Support creation of both temporary and permanent jobs and increase skills, particularly in areas of need? • Have wider socio-economic effects such as changes to the demographics, community services or house prices?
14	Promote sustainable use of resources and natural assets	Will the NPS… • Reduce consumption of materials, energy and resources during construction, operation and decommissioning of energy infrastructure? • Promote sustainable waste management practices in line with the waste hierarchy? • Encourage the use of recycled and / or secondary materials? • Promote the use of low carbon materials and technologies? • Produce waste by-products that require appropriate management? • Provide for safe and secure interim storage of waste, where necessary? • Promote the use of local suppliers that use sustainably-sourced and locally produced materials? • Support enhanced security, reliability and affordability of the national energy supply?

Approach to appraisal

The appraisal of the NPSs policies was undertaken in a topic by topic manner, with the overarching NPS for energy (EN-1) tested against each of the 14 AoS objectives. The appraisal of the policies in the draft technology NPSs was undertaken against relevant AoS objectives only to reflect non-generic effects associated with the technologies.

The appraisal is done in accordance with the criteria set out in Annex II of the ODPM guidelines. In predicting effects, changes to the baseline which would occur as a result of implementing the NPS are identified. These changes are then described (where possible) in terms of their geographic scale, the timescale over which they could occur, whether the effects would be temporary or permanent, positive or negative, likely or unlikely, frequent or rare and whether or not they are secondary, cumulative or synergistic.

Quantitative information is not available to help inform the development of predictions in most cases. In such cases, the effects have been predicted based on professional judgement and by reference to relevant legislation and regulations and baseline data. Significance of likely effects was predicted according to the five categories set out in the following table:

Key to Appraising Significance of Predicted Effects

Likely Significance of Effects		
Significant positive effect likely	++	Policy is expected to address an existing sustainability problem or deliver sustainability enhancements, such as substantial environmental net gain above existing/emerging policy.
Minor positive effect likely	+	Policy is expected to lead to environmental net gain in line with existing or emerging Government policy OR result in protection and conservation of a sustainability asset (for example, a designated biodiversity site or designated heritage asset).
No effect likely or not applicable	0	No perceptible effects expected, or the objective is not relevant to the part of the NPS being assessed.
Minor negative effect likely	-	Policy is expected to result in adverse effects of a lower magnitude or smaller scale, which can be mitigated through standard measures and best practice.
Significant negative effect likely	--	Policy is expected to result in adverse effects of a greater magnitude or larger scale, which cannot be mitigated OR will require extensive and bespoke mitigation solutions (further studies may be required to identify appropriate solutions).

AoS of reasonable strategic alternatives for implementing the aims of the NPSs was also undertaken. To maintain the AoS at a level proportionate to the level of detail within the NPS, the strategic alternatives were assessed at a higher level than the AoS Framework by using six sustainable development themes, identified through aggregating the AoS objectives into topics that better reflected the strategic characteristics of the options.

Sustainable Development Themes and AoS Objectives

Headline SD Themes	**AoS/SEA Objectives (numbers refer to AoS objectives)**
Climate Change	Net Zero (1)
Security of Energy Supply	Health (11), Economy (13)
Health & Well- Being	Air Quality (8), Health (11)
The Economy	Health (11), Economy (13), Resources (14)
The Built Environment	Transport (12), Heritage (5), Adaptation and Resilience (2), Landscapes and Townscapes (6)
The Natural Environment	Adaptation and Resilience (2), Biodiversity (3 & 4), Heritage (5), Landscapes and Townscapes (6), Water (7), Soils (9), Geodiversity (10)

Note that in consideration of Alternatives, the assessment is undertaken in comparison to the revised NPSs. The findings of the AoS in respect of the revised EN-1 broadly apply to all of the alternatives – the key differentiator being the inclusion or absence of specific technologies and the relative outcomes of such inclusion or absence. The same broad methodology was applied in relation to alternatives for revised EN-2 to EN-5 with the key differentiator being the inclusion or absence of particular aspects related to the particular technologies and the relative outcomes of such inclusion or absence.

In order to draw comparison between the Alternatives on a broad level, the following scale has been used:

Scale	**Description**
Large Positive	A materially different positive outcome is anticipated compared to EN-1*
Positive	A more positive outcome is anticipated compared to EN-1*
Neutral	This alternative is anticipated to have the same outcome as EN-1*
Negative	A more adverse outcome is anticipated compared to EN-1*
Large Negative	A materially different adverse outcome is anticipated compared to EN-1*

* EN-2 to EN-5 for technology AoS

Summary of key AoS findings for EN-1 to EN-5

As noted previously, the AoS set out recommendations for clarifying and strengthening of the NPS and these were discussed with NPSs development teams in an iterative fashion alongside the consideration of alternatives. Key findings for overarching EN-1 and technology (relating to EN-2 to EN-5) specific sustainability effects are provided below. The AoS for EN-2 to EN-5 noted additional specific non-generic adverse effects related to individual technologies, over and above those noted within EN-1.

Note that for all assessments there is uncertainty as to the precise level of effect as this will be dependent upon the precise nature of the energy infrastructure and the area within which it is to be located.

AoS Findings for EN-1: Overarching National Policy Statement for Energy

The following sets out key findings from the AoS for EN-1.

- The energy NPSs will be transformational in enabling England and Wales to transition to a low carbon economy and thus help to realise UK Net Zero commitments sooner than continuation under the current planning system. However, there is also some uncertainty about the exact level of transformation as it is difficult to predict the mix of technology that will be delivered by the market against the framework set by the Government and its cumulative contribution.
- It is important to recognise that energy NPSs will still result in the generation of residual carbon emissions (due to some of the proposed technologies being emitters) and these carbon emissions will need to be addressed if the Government target of Net Zero by 2050 is to be met. Also, some climate change is inevitable and as such, there is a need for energy infrastructure to be resilient to climate change – the NPS sets out a clear and robust approach for ensuring this is done.
- The energy NPSs are likely to contribute positively and cumulatively towards improving the vitality and competitiveness of the UK energy market by providing greater clarity for developers. This should improve the UK's security of supply and, less directly through increased economic opportunities for local communities, have positive effects for health and well-being in the medium to longer term through helping to secure affordable supplies of energy and minimising fuel poverty. However, it is to be recognised that in health terms there is the potential for effects to be distributed disproportionally at a local level, with vulnerable groups being potentially susceptible to effects, though these issues can be addressed when details of schemes and their location are known.
- The development of new energy infrastructure supported by the energy NPSs, at the scale and speed required to meet the current and future need, is likely to have some minor negative effects, potentially cumulative on cultural heritage, the water environment, air quality, soils and potentially geodiversity. This is an inevitable reflection of the nature of this largescale infrastructure, the 'footprint', material and resource requirements as well as the construction activities involved to develop these assets.
- Short-term construction negative effects (from new energy infrastructure supported by the energy NPSs) are likely through an increased use of raw materials and resources and also changes to existing land and sea uses which may affect the local economy. In general, it should be possible to mitigate satisfactorily the most significant potential negative effects of new energy infrastructure consented in accordance with the energy NPSs, and they explain ways in which this can be done.
- Due to the nature and size of potential infrastructure schemes (as well as likely potential locations in areas such as coastal areas), opportunities for landscape mitigation will be limited and while energy NPSs, and in particular EN-1, set out a robust approach to addressing impacts on landscape, townscape and seascape across the short, medium and long timeframes, significant adverse and potentially cumulative effects are likely to remain.
- There is potential for significant negative cumulative effects on biodiversity to arise from construction and operation activities as a result of energy NPSs infrastructure

schemes. However, due to the possibility of enhancement of the natural environment and biodiversity net gains as part of such schemes, there is also potential for significant positive cumulative effects on biodiversity in the medium to long term.

Apart from carbon emissions that result in global cumulative negative effects once in the atmosphere, cumulative negative effects will likely be felt mostly at the regional or sub-regional scale on biodiversity, landscape, water and air quality, water resources, flood risk, coastal change and health levels depending upon location and the extent of clustering of new energy and other infrastructure. Proposed energy developments will still be subject to project level assessments, including Environmental Impact Assessment, and this will address locationally specific effects. The energy NPSs set out mitigation for cumulative negative effects by requiring the Secretary of State to consider accumulation of effects as a whole in their decision-making on individual applications for development consent.

Summary of key AoS findings for EN-1

AoS Objective	**Timescales**		
	S	**M**	**L**
1. Consistent with the national target of reducing carbon emissions to Net Zero by 2050	+	++	++
2. Maximise adaptation and resilience to climate change	+	++	++
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	--	-- +	-- +
4. Protect and enhance sites designated for their international importance for nature conservation purposes	--	-- +	-- +
5. Protect and enhance cultural heritage assets and their settings, and the wider historic environment	-	-	-
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	--	--	--
7. Protect and enhance the water environment	-	-	-
8. Protect and enhance air quality	-	-	-
9. Protect soil resources and avoid land contamination	-	-	-
10. Protect, enhance and promote geodiversity	-	- +	- +
11. Improve health and well-being and safety for all citizens and reduce inequalities in health	+	+	+

12. Promote sustainable transport and minimise detrimental impacts on strategic transport network and disruption to basic services and infrastructure	-	+	+
13. Promote a strong economy with opportunities for local communities	- ++	++	++
14. Promote sustainable use of resources and natural assets	-	0	0 +

As required by the SEA Regulations, an assessment of reasonable alternatives has also been carried out in respect of EN-1. The alternatives assessed against EN-1 were:

Plan/Alternative	Overview of technologies
EN-1	EN-1 combines infrastructure set out in Chapter 3 of this NPS. In summary: Renewables (including Biomass and Energy from Waste with or without CCS*)*, Natural Gas-fired electricity generation with or without CCS, Hydrogen-fired electricity generation, Pumped Hydro Storage, Nuclear, associated electricity network infrastructure, and natural gas, oil, hydrogen and CCS infrastructure.
Alternative 1 (A1)	As EN-1 without Nuclear and Unabated Natural Gas.
Alternative 2 (A2)	As EN-1 without Unabated Natural Gas.
Alternative 3 (A3)	As EN-1 without Nuclear.

Summary of AoS findings for Alternatives to EN-1

Headline SD themes	**EN-1**	**Alternative A1**	**Alternative A2**	**Alternative A3**
Climate Change (Net Zero)		**Large Positive**	**Large Positive**	**Negative**
Security of Energy Supply		**Large Negative**	**Negative**	**Negative**
Health & Well-Being		**Neutral**	**Neutral**	**Neutral**
The Economy		**Neutral**	**Neutral**	**Neutral**
The Built Environment		**Positive / Negative**	**Negative**	**Negative**
The Natural Environment		**Negative**	**Negative**	**Negative**

The key differences between the different alternatives and the plan (EN-1) are:

Alternative A1 As EN-1 without Nuclear and Unabated Natural Gas would:

- be materially beneficial for the achievement of Net Zero due to no emissions from unabated gas, although reliant on smaller group of low carbon technologies for delivery;
- be materially adverse on security of supply as reliant on technologies still under development such as Hydrogen and Energy Storage at scale to ensure peak supply and maintain the stability and security of the electricity system;
- have no differential effects on the economy or human health (compared to EN-1) because of providing for a range of low energy sources to meet future energy needs, as well as economic stimulus and improved employment opportunities, though note some negative effects may arise due to disruption to existing industries / communities; and
- have a mix of beneficial and negative effects on the built and natural environment due to positive environment effects through for example mitigation of climate change, though negative due to large areas of land and sea required for renewables.

Alternative A2 As EN-1 without Unabated Natural Gas would:

- be materially beneficial for the achievement Net Zero due to no emissions from unabated gas;
- have adverse effects on Security of Supply, as although it would be less reliant (than alternative A1) on yet to be fully proven technologies, such as Hydrogen and Energy Storage at scale, there would still be a need for them to ensure peak supply and maintain the stability and security of the electricity system;
- be neutral (compared to EN-1) in relation to benefits to the Health and Well-being and Economy SD themes by providing for a range of low energy sources to meet future energy needs, as well as economic stimulus and improved employment opportunities though there may also be economic and community costs at the local scale; and
- have a negative effect for the Built and Natural Environment as greater use of Natural Gas with CCS (compared to EN-1) may require more land take due to the associated need for CCS infrastructure.

Alternative A3 As EN-1 without Nuclear would:

- have adverse effects on the achievement of Net Zero due to greater ongoing emissions from unabated gas;
- have adverse effects on Security of Supply as reliant on a smaller range of electricity generating technologies;
- be neutral in terms of Health and Well-being and the Economy by providing for a range of low energy sources to meet future energy needs, as well as economic stimulus and improved employment opportunities though there may also be economic and community costs at the local scale;
- have adverse effects for the Built Environment due to additional land take by wind and solar Renewables and location near to coasts, estuaries or rivers by Natural Gas with or without CCS, affecting flood risk; and
- have adverse effects for the Natural Environment as emphasis on Renewables and Natural Gas with CCS would require larger areas to meet the same energy output as EN-1.

None of these alternatives are as good as, or better than, the proposals set out in EN-1 and therefore the government's preferred option is to take forward the Energy NPS EN-1 (and the technology-specific NPSs EN-2 to EN-5, see following sections).

AoS findings for EN-2: Natural Gas Electricity Generating Infrastructure

Key points from the AoS for EN-2 (AoS-2) are:

- Natural gas generating infrastructure development has similar effects to other types of energy infrastructure, resulting from impacts associated with large facilities at single sites; as well as those associated with linear features linked with potential development of CCS infrastructure. Therefore, for the majority AoS objectives, the strategic effects of EN-2 are considered to match those identified in AoS-1.
- Non-generic effects have been identified associated with EN-2 technologies for four AoS objectives (Carbon Emissions, Biodiversity, Water Environment and Air Quality). The non-generic effects have been found to be negative across short, medium and long terms for all four AoS Objectives and they linked to construction and operation activities of natural gas generating infrastructure.
- Consistency with the national target of reducing carbon emissions to net zero by 2050 is also considered negative in the long term, reflecting the residual emissions from unabated natural gas plants, unless balanced by negative emissions.
- In the long term, following decommissioning, as discharges and emissions to the air and water would cease, the effects would be neutral for Water Environment and Air Quality.

EN-2 (informed by AoS-2) contains a range of technology specific mitigation measures, along with those proposed in EN-1, which seek to address the range of negative effects identified. Additionally, EN-1 (informed by AoS-1) includes extensive mitigations to ensure these effects are considered by applicants and the Planning Inspectorate when preparing and determining applications.

Summary of Key AoS Findings Specific to Natural Gas Electricity Generating Infrastructure

	Assessment of non-generic effects (by timescale)		
AoS Objective	S	M	L
1. Consistent with the national target of reducing carbon emissions to Net Zero by 2050	-	-	-
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	-	0
7. Protect and enhance the water environment	-	-	0
8. Protect and enhance air quality	-	-	0

As required by the SEA Regulations, an assessment of reasonable alternatives has also been carried out in respect of EN-2. The two alternatives assessed against EN-2 were:

Plan	Overview

EN-2	EN-2 covers natural gas-fired electricity generating infrastructure over 50 MW electricity generating capacity in England and over 350 MW electricity generating capacity in Wales. EN-1 provides that consent will only be given to new and refurbishing combustion generating stations with a generating capacity at or over 300 MW that are CCR.
Alternative (a)	Only consent low carbon gas plant (i.e. natural gas with CCS or hydrogen-fired)
Alternative (b)	Only consent combustion generation plants which can demonstrate that they are capable of converting to low carbon alternatives in future

Summary of AoS Findings for Alternatives to EN-2

Headline SD themes	EN-2	Alternative (a)	Alternative (b)
Climate Change (Net Zero)		Large Positive	Positive
Security of Energy Supply		Large Negative	Negative
Health & Well-Being		Positive / Negative	Positive / Negative
The Economy		Positive / Negative	Positive / Negative
The Built Environment		Positive / Negative	Positive / Negative
The Natural Environment		Positive / Negative	Positive / Negative

The key differences between alternative (a) and EN-2 are:

- Alternative a) materially beneficial for the achievement of Net Zero due to no emissions from unabated gas.
- Alternative a) materially adverse on Security of Supply as reliant on technologies still under development such as Hydrogen and Energy Storage at scale to ensure peak supply and maintain the stability and security of the electricity system.

The key differences between alternative (b) and EN-2 are:

- Alternative b) beneficial for the achievement of Net Zero by ensuring that no new unabated gas plant is 'locked-in' without the capability to convert to low carbon alternatives when ready.
- Alternative b) adverse on Security of Supply, as although it would be less likely to be reliant (than alternative (a)) on yet to be fully proven technologies such as Hydrogen and Energy Storage at scale, there may still be a need for them to ensure peak supply and maintain the stability and security of the electricity system.

It is recognised that alternative (b) could present a more sustainable alternative than the policies set out in EN-1 and EN-2, if implemented in a way which minimises the potential impact on security of supply. As set out in the Energy White Paper, published in December 2020, the government is committed to consult on proposals to update the Carbon Capture

Readiness requirements to reflect technological advances, such as conversion to low carbon hydrogen and apply them more broadly, by removing the 300MW threshold and including all combustion technologies within scope. As noted in EN-1, if that consultation leads to changes in the relevant legal or policy framework then those new requirements will apply and this NPS will be updated to reflect any revised requirements ahead of designation.

AoS Findings for EN-3 Renewable Energy Infrastructure

Key points from the AoS for EN-3 (AoS-3) are:

- Renewable energy infrastructure development has similar effects to other types of energy infrastructure matching many of the strategic effects identified for EN-1. Solar, biomass or energy from waste facilities will occupy land and as such potentially result in a whole range of terrestrial impacts. Offshore wind will, conversely, have impacts on marine and coastal environments.
- Non-generic effects associated with additional detail provided about the Technologies in EN-3 were considered for eight AoS objectives (Carbon Emissions, Biodiversity, Water Environment, Landscape / Seascape, Air Quality, Health, Economy and Resources). The non-generic effects have been found to be generally negative across short, medium and long terms, though there are some elements of positivity in respect of the need to promote sustainable use of resources and natural assets.
- Consistency with the national target of reducing carbon emissions to Net Zero by 2050 is considered significantly negative over the short, medium and long terms reflecting residual emissions from unabated waste combustion plants, in particular if negative emissions technologies are not used. Apart from waste combustion plants, all other technologies in EN-3 are renewable energy technologies and will contribute positively to the Net Zero target.
- Negative effects on biodiversity are likely to occur with all renewable energy generation projects covered in EN-3, some of which could be significant. This includes impacts on fish; seabed habitats and species including intertidal and subtidal; marine mammals; and birds from wind farms in marine environments and in terrestrial environments habitat loss or alteration resulting from land clearance and soil compaction; and/ or construction of infrastructure; and compromised water quality impacting aquatic flora and fauna from a variety of renewable energy technology..
- Positive specific effects associated with the technologies may occur on the fishing industry from offshore wind farms acting as fish nurseries; on biodiversity from solar farms, where land is no longer managed intensively; on biodiversity from pumped hydro storage schemes, as a result of habitat creation and fish re-stocking; and on resources where residues from biomass plants can be recovered and re-used rather than being sent to landfill.

EN-1 (informed by AoS-1) includes extensive mitigations to ensure these effects are considered by applicants and the Planning Inspectorate when preparing and determining applications. EN-3 (informed by AoS-3) contains a range of specific mitigation measures, along with those proposed in EN-1, which seek to address the range of non-generic negative effects identified. In some cases, such as for noise impacts, which are included under the Health AoS objective, it is recognised that the effect may not be able to be mitigated completely. Overall, it is considered that residual negative but uncertain effects will remain for the AoS objectives considered.

Summary of Key AoS Findings Specific to Biomass and Waste Combustion

AoS Objective	Assessment of non-generic effects (by timescale)					
	S		M		L	
1. Consistent with the national target of reducing carbon emissions to Net Zero by 2050	--		--		--	
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-		-		-	
8. Protect and enhance air quality	-		-		-	
11. Improve health and well-being and safety for all citizens and reduce inequalities in health	-		-		-	
14. Promote sustainable use of resources and natural assets	-	+	-	+	-	+

Summary of Key AoS Findings Specific to Offshore Wind

AoS Objective	Assessment of non-generic effects (by timescale					
	S		M		L	
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	--		--		--	
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-		-		-	
13. Promote a strong economy with opportunities for local communities	-	+	-	+	-	+

Table 10-7 - Summary of Key AoS Findings Specific to Pumped Hydro

AoS Objective	Assessment of non-generic effects (by timescale					
	S		M		L	
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-		-	+	-	+
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-		-		-	

11. Improve health and well-being and safety for all citizens and reduce inequalities in health	--	--	-
13. Promote a strong economy with opportunities for local communities	-	-	-

Summary of Key AoS Findings Specific to Solar Photovoltaic

<table>
<tr><th rowspan="2">AoS Objective</th><th colspan="5">Assessment of non-generic effects (by timescale</th></tr>
<tr><th>S</th><th colspan="2">M</th><th colspan="2">L</th></tr>
<tr><td>3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network</td><td>-</td><td>-</td><td>+</td><td>-</td><td>+</td></tr>
<tr><td>6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity</td><td>-</td><td colspan="2">-</td><td colspan="2">-</td></tr>
<tr><td>11. Improve health and well-being and safety for all citizens and reduce inequalities in health</td><td>-</td><td colspan="2">-</td><td colspan="2">-</td></tr>
</table>

Summary of Key AoS Findings Specific to Tidal Stream Energy

AoS Objective	Assessment of non-generic effects (by timescale		
	S	M	L
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	-	-
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-	-	-

As required by the SEA Regulations, an assessment of reasonable alternatives has also been carried out in respect of EN-3. The alternative assessed against EN-3 was: only consent biomass/ waste combustion plant with Combined Capture and Storage (CCS), noting that EN-3 will consent such plant without CCS.

Summary of AoS Findings for Alternatives to EN-3

Headline SD themes	EN-3	Alternative (a)
Climate Change		Positive / Negative

Security of Energy Supply		Negative
Health & Well-Being		Positive / Negative
The Economy		Positive / Negative
The Built Environment		Positive / Negative
The Natural Environment		Positive / Negative

The key difference between this alternative and EN-3 would its benefit for the achievement of net zero due to reduction of emissions from energy from waste and negative emissions through BECCS. This assessment is highly uncertain and would depend on what happens to the waste if not used within the power sector (as energy recovery from residual waste has a lower greenhouse gas impact than landfill) and the extent to which biomass may be more cost effective in decarbonising other sectors (such as heat and transport) over the long-term.

However, the use of carbon capture and storage with biomass and energy from waste could present a more sustainable alternative than the policies set out in EN-1 and EN-3, if implemented in a way which minimises unintended consequences. As set out in the Energy White Paper, published in December 2020, the government is committed to consult on proposals to update the Carbon Capture Readiness requirements to reflect technological advances, such as conversion to low carbon hydrogen and apply them more broadly, by removing the 300MW threshold and including all combustion technologies within scope. If that consultation leads to changes in the relevant legal or policy framework then those new requirements will apply and this NPS will be updated to reflect any revised requirements ahead of designation.

AoS Findings for EN-4: Gas Supply Infrastructure and Gas and Oil Pipelines Infrastructure

Key points from the AoS for EN-4 (AoS-4) are:

- Generally, the development of oil and gas supply infrastructure and gas and oil pipelines has similar effects to other types of energy infrastructure, although due to the linear nature of cross-country, long distance pipelines, effects are often more dispersed and spread across a wider area. For the majority of the AoS objectives, the strategic effects of EN-4 are considered to match those identified in AoS-1 as above.
- Non-generic effects associated with additional detail provided about the technologies in EN-4 were further considered for six AoS objectives (Carbon Emissions, Biodiversity, Water Environment, Landscape and Townscape, Soil and Air Quality). The non-generic effects have been found to be generally negative across short, medium and long terms.
- Minor negative effects are predicted in the short, medium and long term for Carbon Emissions (reflecting the residual emissions from underground natural gas storage and natural gas facilities), for Biodiversity (due to disposal of brine from Underground Gas Storage, dredging from LNG Import Facilities and construction of Gas and Oil Pipelines, for Landscape/Townscape (from large scale structures for LNG Import Facilities), Water Environment (from dredging and disposal of spoils for LNG Import Facilities in coastal and estuarine locations affecting negatively water quality in such locations and Oil and Gas Pipeline construction may negatively affect watercourses, aquifers etc). Air quality may be negatively affected by venting of gas from Gas

Reception Facilities and sterilisation of mineral resources and soil pollution may occur as a result of Gas Pipelines construction and operation.

EN-1 (informed by AoS-1) includes extensive mitigations to ensure these effects are considered by applicants and the Planning Inspectorate when preparing and determining applications. EN-4 (informed by AoS-4) contains a range of technology specific mitigation measures, along with those proposed in EN-1, which seek to address the range of negative effects identified. Nevertheless, it is considered that residual negative, but uncertain, effects will remain in most cases for the six AoS objectives considered.

Summary of Key AoS Findings Specific to Underground Natural Gas Storage

AoS Objective	**Assessment of non-generic effects (by timescale)**		
	S	**M**	**L**
1. Consistent with the national target of reducing carbon emissions to Net Zero by 2050	-	-	-
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	-	0
7. Protect and enhance the water environment	-	0	0

Summary of Key AoS Findings Specific to LNG Import Facilities

AoS Objective	**Assessment of non-generic effects (by timescale**		
	S	**M**	**L**
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	0	0
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-	-	0
7. Protect and enhance the water environment	-	-	0

Summary of Key AoS Findings Specific to Gas Reception Facilities

AoS Objective	**Assessment of non-generic effects (by timescale**		
	S	**M**	**L**
8. Protect and enhance air quality	0	-	0

Summary of Key AoS Findings Specific to Gas and Oil Pipelines

AoS Objective	**Assessment of non-generic effects (by timescale**		
	S	**M**	**L**
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	-	0
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-	-	0
7. Protect and enhance the water environment	-	0	0
9. Protect soil resources and avoid land contamination	0	0	0

As required by the SEA Regulations, an assessment of reasonable alternatives has also been carried out in respect of EN-4. The alternatives assessed against EN-4 was: only consent new gas infrastructure (gas pipelines and underground gas storage) which can demonstrate that it can convert to a low carbon alternative in future.

Summary of AoS Findings for Alternatives to EN-4

Headline SD themes	**EN-4**	**Alternative (a)**
Climate Change (Net Zero)		Positive
Security of Energy Supply		Large Negative
Health & Well-Being		Positive / Negative
The Economy		Negative
The Built Environment		Positive
The Natural Environment		Positive

The key material difference between this alternative and EN-4 is that the alternative may materially compromise security of supply and affordability through providing less confidence for developers to come forward with planning applications. This may result in energy shortages which will in turn may compromise the economy. EN-4 thus represents a more sustainable alternative.

AoS findings for EN-5: Electricity Networks Infrastructure

Key points from the AoS for EN-5 are:

- Electricity networks infrastructure development has similar effects to other types of energy infrastructure, although due to the linear nature of cross-country, long electricity lines, effects are often more dispersed and spread across a wider area. Therefore, for the majority of AoS objectives, the strategic effects of EN-5 are considered to match those identified in AoS-1.

- Non-generic effects associated with additional detail provided about the Technologies in EN-5 were considered for four AoS objectives (Carbon Emissions, Biodiversity, Landscape and Townscape, as well as Health and Wellbeing). The non-generic effects have been found to be generally negative across short, medium and long terms for these AoS Objectives, other than health and wellbeing which is considered neutral.
- In relation to the national target of reducing carbon emissions to Net Zero by 2050, effects are considered to be negative across the short medium and long term, due to the potentially unavoidable use of SF6 in switchgear.
- Minor negative effects of technology on biodiversity in the short, medium and long term, due to the possibility of overhead lines continuing to affect birds in certain circumstances, despite mitigations proposed.
- Significant and ongoing negative effects on landscape and townscape / visual amenity, across the short, medium and long term, due to overhead lines permanently affecting character and setting of landscapes and townscapes.
- Minor negative effects on health and well-being expected to arise across short, medium of long term, due to potential EMF exposure by people living near power lines.

EN-1 (informed by AoS-1) includes extensive mitigations to ensure these effects are considered by applicants and the Planning Inspectorate when preparing and determining applications. EN-5 (informed by AoS-5) contains a range of technology specific mitigation measures, along with those proposed in EN-1, which seek to address the range of negative effects identified. Nevertheless, it is considered that residual negative, but uncertain, effects will remain in most cases for the four AoS objectives considered.

Summary of Key AoS Findings Specific to Electricity Networks

AoS Objective	**Assessment of non-generic effects (by timescale)**		
	S	**M**	**L**
1. Consistent with the national target of reducing carbon emissions to Net Zero by 2050	-	-	-
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	-	-
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	--	--	--
11. Improve health and well-being and safety for all citizens and reduce inequalities in health	-	-	-

As required by the SEA Regulations, an assessment of reasonable alternatives has also been carried out in respect of EN-5. One alternative was identified and assessed: adopt a blanket presumption that all electricity lines should be put underground.

Summary of AoS Findings for Alternatives to EN-2

Headline SD themes	EN-5	Alternative (a)
Climate Change		Negative
Security of Energy Supply		Negative
Health & Well-Being		Positive / Negative
The Economy		Negative
The Built Environment		Negative
The Natural Environment		Positive / Negative

The key differences between this alternative and EN-5 are:

- adverse for the achievement of Net Zero due to the additional emissions associated with energy intensive tunnelling technologies.
- adverse for the Security of Energy Supply and the Economy due to higher costs and increased disruption for maintenance and repair.
- Adverse for the Built Environment as excavations for undergrounding may affect unknown archaeology.

Given that underground lines are not without a range of adverse impacts of their own, and that they are significantly more expensive, it is considered better to adopt the policies set out in EN-1 and EN-5. This is because the range of factors to be taken into account means that any decision to underground is best taken within a more flexible policy framework that follows a case by case evaluation of all of the impacts of a particular project and supports the use of both undergrounding and overhead lines as appropriate, in line with the appraisal findings.

Cumulative Effects with other Plans and Programmes

Cumulative effects on economies, communities and the environment that may arise where the effects of several proposed pieces of new energy infrastructure interact are intrinsic to the assessments of EN-1 to EN-5.

But cumulative effects can also arise due to effects from the energy NPSs combining with effects from other plans and policies. However, due to the strategic and high level nature of the energy NPSs and the lack of any locational and specific detail on any infrastructure developments that are likely to be brought forward, as well as that inevitably there is going to be a delay between the adoption of the energy NPSs and any subsequent energy infrastructure development, it is not possible to know when (or indeed if) any subsequent project proposal will come forward and it is not therefore possible to predict what other plans and projects will be relevant to future project assessments.

The type of PPPs that could have cumulative or in-combination effects with infrastructure developed under the NPSs are:

- Applications lodged but not yet determined;
- Projects subject to periodic review;

- Projects authorised but not yet started;
- Projects started but not yet completed;
- Known projects that do not require external authorisation;
- Proposals in adopted plans; and
- Proposals in draft plans formally published or submitted for final consultation, examination or adoption.

Typical types of effects that could lead to cumulative or in-combination effects include (but are not limited to):

- Resilience to climate change
- Noise, vibration and light disturbance;
- Air, land and water pollution;
- Changes to water quantity / flow and coastal change,
- Landscape;
- Species injury and mortality;
- Changes in habitat extent, composition and structure;
- Health and Wellbeing;
- Sustainable transport; and
- Economy

Such in-combination effects are more likely to arise when multiple projects have similar impacts; due to effects exceeding the limit of what the relevant sustainability parameters can tolerate and becoming significant effects. Note that projects that include non-energy infrastructure development and smaller scale development that is not an NSIP can also lead to cumulative or in-combination effects and should be considered at the appropriate point. In-combination effects can be by virtue of proximity, connectivity and/or timing. The most common combined effects include additive air quality, water quality/quantity and habitat/species disturbance impacts.

Transboundary effects

Transboundary effects extend to multiple countries rather than just the UK. Potential transboundary effects from the NPSs have been approached in a similar way to other cumulative effects, only that the assessment looks at effects that originate within the UK but have the ability to extend across national borders. Transboundary effects are addressed through Regulation 14 of the SEA Regulations, which requires notification to Member States of the European Union of any Plan or Programme which is considered likely to have significant effect on the environment of that Member State.

Two types of technology have been considered in this assessment of transboundary effects: nuclear and offshore wind.

Transboundary effects from nuclear power stations are addressed in the AoS of EN-6[1]. Unintended release of radiation from nuclear power stations may result in transboundary effects. In the UK, the nuclear regulatory bodies will need to be satisfied that the radiological

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47778/1925-appl-of-sust-of-revised-draft-en6.pdf

and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit. As part of the site licensing process, a potential operator will be required to demonstrate that the nuclear facility is designed and can be operated such that several levels of protection and defence are provided against significant faults or failures, that accident management and emergency preparedness strategies are in place and that all reasonably practicable steps have been taken to minimise the radiological consequences of an accident. The robustness of the regulatory regime surrounding these installations in the UK thus result in a low probability of an unintended release and therefore any significant transboundary effects.

Radioactive releases from nuclear power stations are strictly controlled in accordance with limits laid down in permits issued by the Nuclear Installations Inspectorate and the Environment Agency under the Environmental Permitting (England and Wales) Regulations 2016. This regulatory system ensures that permitted radioactive discharges are within authorised limits. These releases are likely to remain sufficiently localised so as not to impact significantly on neighbouring countries.

Transboundary effects of offshore wind farms have been identified in relation to fish, marine mammals and birds as their movements are independent of national geographical boundaries. The biodiversity assessment for this technology concluded that there are likely significant transboundary effects on these receptors. The HRA concludes that there is potential for adverse effects on International Sites in other nations (transboundary), particularly as a result of offshore wind and coastal development.

Transboundary effects of offshore wind farms have also been identified on human activities such as on navigation, wind energy, grid connection and other.

Therefore, it is considered that Ireland, France, Belgium, Germany, Denmark, Sweden and the Netherlands should be consulted on the potential for significant environmental effect from implementation of the NPS. For the same reasons, there would also be potential effects on Norway and the Crown Dependencies of the Isle of Man and the Channel Islands as well as in each of the four nations within the United Kingdom.

Monitoring the Effects of the NPSs Implementation

Monitoring involves measuring indicators which will enable the establishment of a causal link between the implementation of the plan and the likely significant effect (positive or negative) being monitored. It thus helps to ensure that any adverse effects which arise during implementation, whether or not they were foreseen, can be identified and that action can be taken to deal with them.

While significant effects have not been identified in relation to all Objectives and it is considered that in many instances the NPS text provides robust policy to address issues, the non-specific spatial nature of the NPS does mean that there is in some instances a degree of uncertainty in findings and as such a potential for unforeseen individual or cumulative effects to arise. Therefore it was considered important to take a precautionary approach to monitoring.

A monitoring programme has been prepared on this basis and is presented in this report.

Overall effects and Monitoring Requirements for EN-1 to EN-5

AoS Objective	Overall effects of EN-1 to EN-5 and need for monitoring
Objective 1 Consistent with the	Generally, the NPS is predicted to perform significantly positive in respect of this Objective through the promotion of a variety of zero

national target of reducing carbon emissions to net zero by 2050	and low carbon technologies and will likely be transformational in enabling England and Wales to transition to a low carbon economy and thus help to realise UK Net Zero commitments sooner than continuation under the current planning system. However, there is some uncertainty about the exact level of transformation as it is difficult to predict the mix of technology that will be delivered by the market against the framework set by the Government and its cumulative contribution in terms of GHG emissions. The promotion of three particular technologies (unabated gas, unabated waste incineration and electricity distribution networks) by the NPS have been identified as resulting in negative effects across the short, medium and long term, due to the potential use of unabated carbon technologies and of SF6 in switchgear, respectively. It is thus important that these particular effects are monitored.
Objective 2 Maximise adaptation and resilience to climate change	The NPS generally performs well in respect of adaptation and resilience to climate change through the requirements that are placed on developers to address this extremely important topic in the face of unavoidable climate change. There is a degree of uncertainty over the severity of such climatic events, how technologies may adapt to such circumstances and in combination effects with other non-energy infrastructure projects may affect such adaptation. As such there is a high chance of unforeseen effects arising against this objective which will need to be carefully monitored.
Objective 3 Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	The technologies promoted by the NPS could result in significant adverse effects on biodiversity, both onshore and offshore, particularly in the short term but also in the medium to long term. The effects could be direct, indirect, cumulative or synergistic. Longer term, there are opportunities for counteracting positive effects through achievement of Biodiversity Net Gain as part of the implementation of the energy projects. There is, however, a degree of uncertainty associated with the effects identified due to the non-spatial nature of the NPS and a potential for unforeseen effects, due to issues such as clustering of technology and in combination effects with other non-energy projects which will need to be carefully monitored.
Objective 4 Protect and enhance sites designated for their international importance for nature conservation purposes	There is potential for significant negative effects on sites designated for their international importance and nature conservation purposes (as a result of the implementation of energy projects promoted by the NPS or in combination with other non-energy projects) in the short, medium and long term. This could include effects on sites which are in the jurisdiction of other countries (transboundary). The effects identified are uncertain as they will depend on the specific locations and scale of development, which is largely unknown at this given that the NPSs do not outline specific proposals. Such effects will require monitoring.
Objective 5	For the most part, it is anticipated that there is the potential for minor negative effects (including cumulative effects) on heritage assets and

Protect and enhance cultural heritage assets and their settings, and the wider historic environment	their settings (designated and non-designated) on land and at sea in the short, medium and long term. It is considered that there are sufficient requirements planned by the NPS on developers to address the anticipated adverse effects associated with this Objective. However, it is considered that there is also a potential for unforeseen potentially significant effects to occur due to issues such as clustering of technologies which cannot be determined at this stage due to the non-specific / spatial elements of the NPS as well as in-combination effects with non-energy infrastructure projects. Such effects will require monitoring.
Objective 6 Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	Significant negative effects for landscape, seascape and townscape and visual receptors are likely as a result of the NPS implementation in the short, medium and long term and it is to be noted that due to the considerable size of energy infrastructure projects supported by the NPS, opportunities for mitigation of such effects will be limited. It is also considered that there is also a potential for unforeseen significant effects to occur due to issues such as clustering of technologies due to the non-specific / spatial elements of the NPS as well as in combination effects with non-energy infrastructure projects. It is thus important that such effects are monitored.
Objective 7 Protect and enhance the water environment	Minor negative effects for water quality are likely as a result of the NPS implementation in the short term through to the long term as it will not be possible to avoid all negative effects on the water environment, given the likely scale and nature of the technologies being supported by the NPS. The effects may occur, for example, through construction activities releasing pollutants into the water environment and cooling water abstraction and discharge for technologies such as nuclear and gas fired power stations. While it is considered that the NPS provides a robust approach to dealing with these issues, there remains the potential for significant effects to occur due to unforeseen issues associated with the non-specific / spatial elements of the NPS and the potential for clustering of certain types of energy infrastructure and in combination effects with other non-energy infrastructure projects. Such effects will require monitoring.
Objective 8 Protect and enhance air quality	While the NPS notes a robust approach to managing effects on air quality, it is anticipated that such effects will likely be slightly adverse, due to the potential for emissions of air pollutants during construction of projects and residual operational emissions for some types of technologies. While it is considered that the NPS provides a robust approach to dealing with these issues, there remains the potential for significant effects to occur due to unforeseen issues associated with the non-specific / spatial elements of the NPS and the potential for clustering of certain types of energy infrastructure and in combination

	effects with other non-energy infrastructure projects. Such effects will require monitoring.
Objective 9 Protect soil resources and avoid land contamination	Minor negative effects on soil resources are likely as a result of the NPS implementation in the short, medium and long term due to the potential for loss of agricultural land and contamination of soil, potentially from spills of oil or chemicals used in the construction, operations and decommissioning of certain types of energy infrastructure. The effects identified are uncertain (and as such potentially unforeseen) as they will depend on the specific nature, location and scale of development. It is thus important that such effects are monitored.
Objective 10 Protect, enhance and promote geodiversity	There is potential for negative effects on geodiversity due to NPS implementation in the short, medium and long term, through loss of land / seabed, changes to coastal processes etc., particularly during construction impacting geodiverse sites. However, due to the potential for enhancement of access to geological features, there is also potential for minor positive effects in the medium to long term. The effects identified are uncertain (and as such potentially unforeseen) as they will depend on the specific location, nature, design and scale of development.
Objective 11 Improve health and well-being and safety for all citizens and reduce inequalities in health	Reliable energy supplies nationally promoted by the NPS will contribute to positive effects generally on the economy and skills with indirect positive effects for health and well-being in the medium to longer term through helping to secure affordable supplies of energy and minimising fuel poverty. Opportunities for employment (across the short, medium and long term) are also likely, with consequent beneficial effects on wellbeing. The NPS makes clear the need to identify potential adverse health impacts, including on vulnerable groups within society and notes that opportunities should be taken to mitigate direct impacts by promoting local improvements to encourage health and wellbeing. The potential for in combination effects with other non-energy infrastructure projects will also need to be considered. The success of such approach would be informed through effective monitoring.
Objective 12 Promote sustainable transport and minimise detrimental impacts on strategic transport network and disruption to basic services and infrastructure	The NPS provides for a robust approach to promoting sustainable transport, as well as minimising detrimental impacts on the strategic transport network and disruption to services and infrastructure. It also describes the need to promote sustainable transport modes (including water borne transport, as well as improving access by active, public and shared transportpublic transport, walking and cycling), as well as to reduce the need for parking. As such, it is anticipated that uncertain (and as such unforeseen) effects may be experienced in the short (construction) term but with benefits experienced across the later timescale of the development. There remains, however, the potential for significant effects to occur due to unforeseen issues associated with the non-specific / spatial elements of the NPS and the potential for clustering of certain types of energy infrastructure and in combination effects with other non-energy infrastructure projects. Such effects will require monitoring.

Objective 13 Promote a strong economy with opportunities for local communities	Development of new energy infrastructure as promoted by the NPS will support the security, reliability and affordability of the national energy supply and lead to the provision of jobs in local areas to the development and further afield. Some of these jobs are likely to be specialist in nature, but others will be lower skilled, or suitable for apprenticeships or will provide opportunities to further develop skills. It is anticipated that most jobs would be during the construction phase, with significantly less fewer jobs during operation and then an increase during any decommissioning phase. As noted though, a significant increase in workers can lead to stress on local housing and labour markets (particularly in more rural areas / smaller towns) and it is considered monitoring would help to inform approaches to these issues. As such, some slight adverse effects are anticipated in the short term, but overall, there should be significant benefits in local areas during construction, with ongoing benefits through the medium to long term. There remains, however, the potential for significant effects to occur due to unforeseen issues associated with the non-specific / spatial elements of the NPS and the potential for clustering of certain types of energy infrastructure and in combination effects with other non-energy infrastructure projects. Such effects will require monitoring.
Objective 14 Promote sustainable use of resources and natural assets	The NPS provides a robust approach to promoting sustainable use of resources and natural assets and notes how good design can reduce the requirement for consumption of materials and applying this to a project at as early a stage as possible will act to reduce consumption. Clear note is also made of a number of key aspects such as the waste hierarchy, and the requirement to set out the arrangements that are proposed for managing any waste produced for waste management plans, as well as the sourcing of materials from recycled or reused sources and the use of low carbon materials. While there will be a high level of consumption of sources in the short term (construction phases), including virgin material, this will reduce during the operational phase and techniques such as the use of Building Information management tools (or similar) will provide opportunities in the long term for realising the recovery and reuse of materials used at the construction stage. Use of resources and waste arisings will need to be monitored as part of scheme development.

1: Introduction

This document is the revised Appraisal of Sustainability (AoS) report for the revised draft energy National Policy Statements (NPS) published for consultation by the Secretary of State for Energy Security and Net Zero as follows:

- **EN-1: Overarching National Policy Statement for Energy** – this sets out the Government's policy for delivery of major energy infrastructure.
- **EN-2: National Policy Statement for Natural Gas Generating Infrastructure**. Natural gas-fired generating stations can be configured to produce Combined Heat and Power (CHP) and be Carbon Capture Ready (CCR) and/or have Carbon Capture and Storage (CCS) technology applied. Hydrogen gas-fired electricity generating infrastructure over 50MW electricity generating capacity in England and over 350MW electricity generating capacity in Wales will require consent from the Secretary of State. The guidance that is contained in EN-2 has been drafted in respect of natural gas-fired electricity generating infrastructure but may also be important and relevant to hydrogen gas-fired electricity generating infrastructure.
- **EN-3: National Policy Statement for Renewable Electricity Generation**. This EN covers the following types of nationally significant renewable electricity generating stations:
    - energy from biomass and/or waste including mixed waste containing non-renewable fractions (>50 MW in England and >350MW in Wales);
    - pumped hydro storage (>50 MW in England and >350MW in Wales);
    - solar photovoltaic (PV) (>50 MW in England and >350MW in Wales);
    - offshore wind (>100MW in England and >350MW in Wales); and
    - tidal stream (>100MW in England and >350MW in Wales).
- **EN-4: National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines.** This EN covers:
    - underground gas storage and LNG facilities (meeting tests relating to storage or working capacity and maximum flow rate.
    - Gas reception facilities with a projected maximum flow rate of at least 4.5 million standard cubic metres of gas per day
    - Gas transporter pipelines (onshore) which are (a) expected to be more than 800mm in diameter and more than 40 kilometres in length or (b) the construction of which is likely to have a significant effect on the environment. The design operating pressure must be more than 7 bar gauge and must be expected to convey gas for supply (directly or indirectly) to at least 50,000 customers, or potential customers, of one or more gas supplier.
    - Pipelines over 16.093km (10 miles) long which would otherwise require authorisation under s.1 of the Pipe-lines Act 1962 together with diversions to such pipelines regardless of length.
- **EN-5: National Policy Statement for Electricity Networks Infrastructure**. This EN covers above ground electricity lines:
    - whose nominal voltage is expected to be 132kV or above (other than a 132kV line associated with the construction or extension of a devolved Welsh generating station);
    - whose length is greater than 2km;

- that are not a replacement line falling within Section 16(3)(ab) of the 2008 Act; and
- that are not otherwise exempted for reasons set out in Sections 16(3)(b) and (c), (3A) and (3B) of the 2008 Act.

Other kinds of electricity infrastructure (including lower voltage overhead lines, underground or sub-sea cables at any voltage, and associated infrastructure) will only be subject to this NPS under certain circumstances.

For a comprehensive description of what is contained within each NPS (and what energy infrastructure is excluded), please see the relevant section of each EN.

The National Policy Statement for Nuclear Power Generation (EN-6) is not being updated. EN-6 currently sets out the planning and consents regime for nuclear projects deployable before 2025 and a new NPS for nuclear electrical generation deployable after 2025 will be developed.

The suite of Energy National Policy Statements was first designated in 2011. In the 2020 Energy White Paper a review of the NPSs was announced under section 6 of the Planning Act and has resulted in the reviewed and updated NPSs that are appraised in this report.

The main function of this report is to set out the likely significant effects on the environment of developing new energy infrastructure of the types envisaged by the reviewed and updated energy NPSs as a whole and for each technology, as well as indicating how the NPSs are consistent with the principles of sustainable development more generally.

The revised AoS report is designed to inform further public consultation on the revised and updated drafts of the five NPSs with which it is being published. A first round of public consultation was carried out on the five NPSs and the AoS Report in September – November 2021.

This AoS report has been developed by Atkins Limited, with the support of Land Use Consultants (LUC), between March and June 2021 and updated between June 2022 and January 2023 and provides an AoS of the Overarching NPS for Energy (henceforth AoS-1) as well as an AoS of the four technology NPSs (henceforth AoS-2, AoS-3, AoS-4 and AoS-5) and their contribution towards achieving a range of environmental, social and economic objectives. The approach adopted in the AoS is consistent with the requirements of SEA and has been expanded to include a wider range of issues, such as socio-economic issues, normally found within an AoS.

Sections 2-4 of this report include a description of the methodology, baseline and issues which are common across all of the AoSs. The technology-specific AoSs (AoS-2 to AoS-5) focus on alternatives and issues which are additional to those already covered in the assessment of EN-1 set out in AoS-1. It is important to note that EN-1 to EN-5 are not site-specific and provide a framework for assessing applications for developments of the relevant type in any location.

This AoS report should be read in conjunction with the relevant National Policy Statements, in particular the Overarching NPS for Energy (EN-1) which sets out the background on the planning regime and government policy on energy and energy infrastructure. AoS-1 in Section 5 must also be read in conjunction with the AoSs for the relevant technology-specific NPSs (AoS-2 to AoS-5) which are set out in Sections 6 to 9 of this report, and vice versa.

A Habitats Regulations Assessment (HRA) has been undertaken in parallel to the AoS and its results incorporated into the AoS as appropriate, though it has been reported separately to this AoS report, in order to meet the requirements of the Habitats Regulations.

1.1: Purpose of this AoS report

This AoS report has two primary functions:

- The Environmental Assessment of Plans and Programmes Regulations 2004 (as amended), known as the Strategic Environmental Assessment (SEA) Regulations (and which are derived from the Strategic Environmental Assessment Directive - 2001/42/EC), require that before a plan or programme which establishes the framework for development consent is adopted, it should be subject to consultation alongside an environmental report which identifies, describes and evaluates the significant effects which its implementation is likely to have on the environment. Amongst other things, the NPSs are a plan or programme for the purposes of the Regulations, and so this AoS report fulfils the function of an environmental report under the Regulations.
- The Planning Act requires that NPSs must be the subject of an AoS before they are designated. The scope of such an appraisal is similar to that of an environmental report under the SEA Regulations, but with more emphasis on social and economic impacts, and informed overall with the principles of sustainable development (often summarised as ensuring that development meets the needs of the present without compromising the ability of future generations to meet their own needs).

By requiring the AoS to be produced alongside the NPSs while they are still in draft form, the SEA Regulations and Planning Act aim to ensure that consultees are able to review and comment on the NPSs with a sense of what it would mean in environmental and wider sustainability terms for a new generation of large-scale energy infrastructure to be built in accordance with decisions made on Planning Act applications for development consent which will be decided on the basis of the energy NPSs.

1.1.1 Report Structure

The remainder of this report is structured as follows:

Section 2: Overview of AoS process: This section covers the approach taken to the appraisal process, including description of the methodology that has been applied.

Section 3: Scope of the AoS: covers geographical and temporal scope of the AoS and how this document fulfils the requirements of the SEA Regulations.

Section 4: Policy context, baseline, issues and framework: presents the scoping information that supports the AoS.

Section 5: Assessment for Overarching NPS for Energy (EN-1): presents the findings of the AoS of EN-1, including possibilities for mitigation and cumulative effects. This section also includes an assessment of NPS Alternatives for EN-1 and identifies and assesses strategic alternatives to Overarching NPS for Energy (EN-1); it also provides a comparison of the significant sustainability effects of the strategic alternatives and why the draft NPS is the preferred option.

Section 6: Assessment for Natural Gas Generation Infrastructure (EN-2): presents the findings of the AoS of EN-2 including possibilities for mitigation and cumulative effects. This section also includes an assessment of alternatives for EN-2.

Section 7: Assessment for Renewable Energy Infrastructure (EN-3): presents the findings of the AoS of EN-3 including possibilities for mitigation and cumulative effects. This section also includes an assessment of alternatives for EN-3.

Section 8: Assessment for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4): presents the findings of the AoS of EN-4 including possibilities for mitigation and cumulative effects. This section also includes an assessment of alternatives for EN-4.

Section 9: Assessment for Electricity Networks Infrastructure (EN-5): presents the findings of the AoS of EN-5 including possibilities for mitigation and cumulative effects. This section also includes an assessment of alternatives for EN-5.

Section 10: Appraisal of Sustainability – Summary results for EN-1 to EN-5

Section 11: Cumulative Effects: presents an overview of anticipated cumulative, synergistic and indirect effects, as well as consideration of cumulative effects in-combination with other plans and policies

Section 12: Monitoring: This section sets out monitoring proposals for the implementation of the NPSs.

The Appendices to this report are published separately and are as follows:

- Appendix A - Glossary & List of Abbreviations
- Appendix B - Response to Consultation
- Appendix C - Review of Policies, Plans and Programmes
- Appendix D - Baseline Data and contextual information
- Appendix E - Recommendations made through the AoS process
- Appendix F - Baseline Maps (provided in a separate Volume)

2: Overview of AoS process

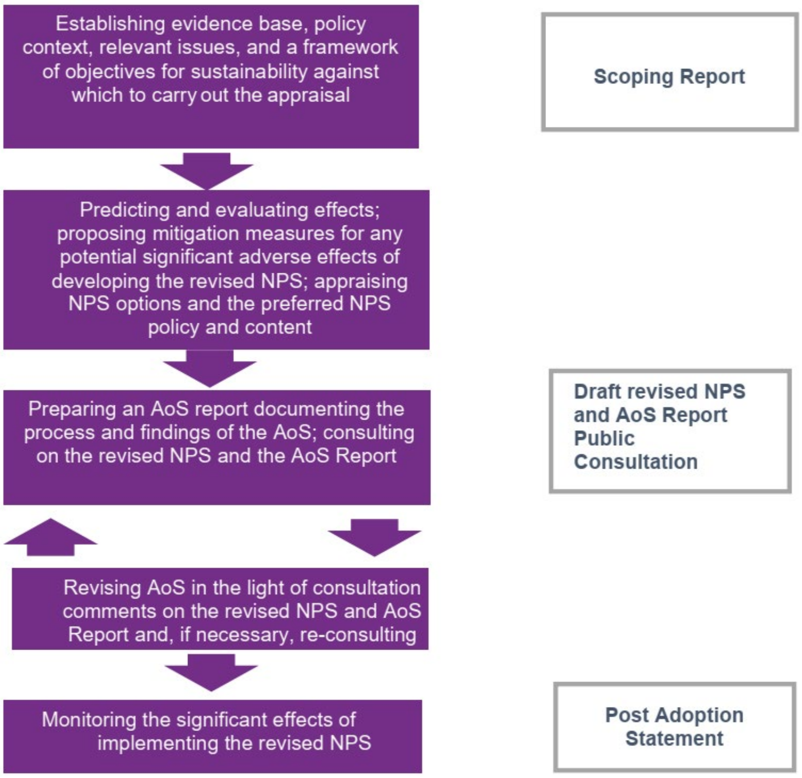
2.1: Assessment Methodology

The AoS process and methods that have been applied are broadly based on a number of published guidance documents (note that there is no specific guidance on preparing an AoS):

- Sustainability Appraisal (SA) of Regional Spatial Strategies and Local Development Documents - Guidance for Regional Planning Bodies and Local Planning Authorities, by the ODPM, the Scottish Executive, the Welsh Assembly Government and the Northern Ireland Department of the Environment November 2005;
- A Practical Guide to the Strategic Environmental Assessment Directive, by the ODPM, the Scottish Executive, the Welsh Assembly Government and the Northern Ireland Department of the Environment, September 2005; and
- Revised National Planning Policy Framework, 2021 and associated Planning Practice Guidance, 2021.

It is to be noted that the processes of SEA and Habitats Regulation Assessment (HRA) are based on European Union (EU) Directives. While the United Kingdom has left the EU, the relevant SEA and HRA Regulations implementing these processes still apply at the time of writing this report however, future changes cannot be ruled out.

Figure 2-1 - Government's guidance for preparing SEAs and Sustainability Appraisals



Source: Based on ODPM (2005) A practical guide to the Strategic Environmental Assessment Directive and ODPM (2005) Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents

The AoS of the revised NPS has been carried out in a staged approach, with this AoS report representing the 3rd stage in the above Figure 2-1 which demonstrates the various preparation stages of the AoS. As already noted, the revised NPS and the AoS report were the subject of public consultation in 2021. Following further material revisions to NPS policy, the AoS Report has been updated to reflect such revisions. Both NPS and AoS Report are being published for another round of public consultation in 2023.

The methodology that has been adopted is described below.

2.2: Setting the Context and Establishing the Baseline

The NPSs will both influence and be influenced by other plans, policies and programmes (PPPs) produced by local and combined authorities (which will set out the local context in which any infrastructure will be located), by statutory agencies and other bodies with plan making responsibilities. Legislation is a further driver that sets the framework for the NPSs, both directly and indirectly. Relevant legislation, plans and programmes have been identified and considered to inform the preparation of this AoS report.

To predict how NPSs policies will likely affect the future baseline, it is first important to understand its current state and then examine the likely evolution without the implementation of the revised NPSs. The future baseline reflects the conditions which will be influenced by many governmental and sectoral factors, including the existing NPS. This is set out in Section 4.2. Baseline information provides the basis for understanding existing local environmental, economic and social issues, in particular in respect of health, and alternative ways of dealing with them; formulating objectives to address these issues and predicting and monitoring sustainability effects.

Key sustainability issues have been identified through analysis of the baseline data and review of other plans and programmes. The identification of these issues helped focus the AoS processes on the aspects that really matter. Implications to NPSs development and opportunities for how the NPSs could assist in addressing these issues were also identified.

A set of AoS Objectives has been developed, against which the policies in the NPSs could be assessed. For each objective, guide questions were set out to form the AoS framework. The assessment aid questions provided a clarification of the intended interpretation of each objective to support direction of change sought through the implementation of the NPSs.

The scoping information contained in this report was first refined through prior consultation on the AoS Scoping Report with the statutory consultees identified under the SEA Regulations (including those of England, Northern Ireland, Scotland and Wales)[2]. This consultation took place from 1 April 2021 to 6 May 2021. The scoping consultation comments were taken on board in preparing this AoS Report (see Appendix B) and updates made are reflected in this report.

Additional amendments were made to the scoping information following public consultation on the five NPSs and the AoS Report in 2021. The public consultation comments were taken on board in preparing this revised AoS Report (see Appendix B) and updates made are reflected in this report as appropriate.

Government has decided that an appraisal of sustainability against a separate equality objective is unnecessarily duplicative and difficult to apply at the strategic level of the energy National Policy Statements. Not all Appraisals of Sustainability have included a specific equality objective. Issues relating to equality are also addressed through other objectives in the framework, e.g. the objective to improve health and well-being for all citizens and reduce

[2] The Environment Agency, English Heritage (now known as Historic England), Natural England, Department of Agriculture, Environment and Rural Affairs (Northern Ireland), Historic Scotland, Scottish Natural Heritage, Scottish Environment Protection Agency, Cadw (Welsh Historic Monuments), Countryside Council for Wales, and the Environment Agency Wales.

inequalities in health. In reviewing the National Policy Statement, the Secretary of State will be subject to the Public Sector Equality Duty. When considering individual development consent applications, interested parties may make representations on the effect of the proposed development on individuals (including those with protected characteristics), and relevant material considerations should be integrated into the wider assessment of the merits and demerits of the application.

2.3: Appraisal of NPSs Policies

The appraisal of the NPSs policies has been undertaken in a topic by topic manner, with the draft overarching NPS for energy (EN-1) tested against each of the 14 AoS objectives (see Section 4). The findings of AoS-1 are presented in Section 5 by AoS Objective. Where relevant, the interactions between topics have been considered and the commentary is reported against each of the AoS Objectives.

The appraisal of the policies in the draft technology NPSs was undertaken against relevant AoS objectives to reflect non-generic effects associated with the technologies (see Sections 6 to 9).

The appraisal seeks to predict the significant sustainability effects of the plan[3]. This is done in accordance with the criteria set out in Annex II of the ODPM guidelines. In predicting effects, changes to the baseline which would occur as a result of implementing the NPS are identified. These changes are then described (where possible) in terms of their geographic scale, the timescale over which they could occur, whether the effects would be temporary or permanent, positive or negative, likely or unlikely, frequent or rare and whether or not they are secondary, cumulative or synergistic.

Quantitative information is not available to help inform the development of predictions in most cases. In such cases, the effects have been predicted based on professional judgement and by reference to relevant legislation and regulations and baseline data. Significance of likely effects was predicted according to the five categories set out in the following table:

Table 2-1 - Key to Appraising Significance of Predicted Effects

Likely Significance of Effects		
Significant positive effect likely	++	Policy is expected to address an existing sustainability problem or deliver sustainability enhancements, such as substantial environmental net gain above existing/emerging policy.
Minor positive effect likely	+	Policy is expected to lead to environmental net gain in line with existing or emerging Government policy OR result in protection and conservation of a sustainability asset (for example, a designated biodiversity site or designated heritage asset).
No effect likely or not applicable	0	No perceptible effects expected, or the objective is not relevant to the part of the NPS being assessed.

[3] ODPM (2005) A Practical Guide to the Strategic Environmental Assessment Directive. See Figure 5. Available online at: http://www.communities.gov.uk/publications/planningandbuilding/practicalguidesea

Minor negative effect likely	-	Policy is expected to result in adverse effects of a lower magnitude or smaller scale, which can be mitigated through standard measures and best practice.
Significant negative effect likely	--	Policy is expected to result in adverse effects of a greater magnitude or larger scale, which cannot be mitigated OR will require extensive and bespoke mitigation solutions (further studies may be required to identify appropriate solutions).

As noted above, it is important to note that EN-1 to EN-5 are not site-specific and provide a framework for assessing applications for developments of the relevant type in any location. This does mean though that all findings carry a degree of uncertainty as precise effects will ultimately be determined by the nature of the infrastructure and the specific location within which it is developed.

Where beneficial and adverse effects have both been noted, this is shown in relation to the relevant AoS Objective as applicable.

It is noted that an initial assessment was undertaken on a draft EN-1 document dated April 2021 and that this resulted in suggestions of additional mitigation (in the form of recommendations, see Appendix E) to be considered in the drafting of EN-1 for public consultation. Equally, initial assessments were also undertaken on draft technology EN-2 to EN-5 documents dated May 2021 and suggestions of additional mitigation made (see also Appendix E).

Further assessments were undertaken in June 2022 -January 2023 of revised updated drafts of EN-1 to EN-5 and additional suggestions made as a result (see Appendix E) which were considered in the drafting of the revised updated EN-1 to EN-5.

2.4: Relationships Between the Overarching AoS and the Technology Specific AoSs for Cumulative Effects Assessment

The Overarching AoS considers the likely significant effects of implementing the draft EN-1 NPS as a whole, together with the mix of technologies it includes (set out in EN-2 to EN-5), as well as the likely significant generic effects associated with all major energy infrastructure. Specific effects associated with specific energy technology are detailed in AoS-2 for Natural Gas Electricity Generating Infrastructure, AoS-3 for Renewable Energy Infrastructure, AoS-4 for Gas Supply Infrastructure and Gas and Oil Pipelines and AoS-5 for Electricity Networks Infrastructure. (see Sections 6 to 9).

The SEA Regulations require consideration of cumulative effects (Schedule 2, Paragraph 6). Cumulative effects on communities and the environment can arise where the effects of several proposed pieces of new energy infrastructure interact. Such effects may be additive, neutralising or synergistic – where the effect of one or more effects acting together is more than the simple sum of the effects when acting alone. For example, a wildlife habitat can become progressively fragmented with limited effects on a particular species until the last fragmentation makes the habitat too small to support the species anymore. Conversely, progressive small additions of habitats may have limited effects individually until a threshold is reached at which the areas and linkages of habitat contribute positively to green infrastructure aims. Clustering of new energy developments can have positive synergistic effects on the local economy, upskilling and community vitality but conversely may have negative cumulative effects on landscape, air quality and local amenity. It may be considered that climate change is the ultimate cumulative effect.

The nature (positive or negative) and significance of any cumulative effects is likely to be associated with the number and types of technology specific infrastructure projects and the sensitivities of the receiving communities and environment. It is to be noted that the technology specific NPSs do not have any locational specificity and therefore it is difficult to predict any significant cumulative effects. Nonetheless, each energy technology is associated with certain characteristics and an understanding of the potential for cumulative effects was used to identify any key effects and mitigation possibilities.

The significance of cumulative effects may vary with the mix of energy technology projects that are proposed. It is considered that the cumulative effects on certain topics, such as climate change and the economy, may be significant overall at the national level of the NPS, whilst effects on other topics, such as water quality and resources, and biodiversity, are more likely at the regional or sub-regional and local levels. Consideration of interactions and cumulative effects was integral to the appraisal process and addressed in this AoS using professional judgement and evidence from the draft NPSs, the baseline and the plans/programmes review.

The cumulative effects assessment was undertaken both individually for each energy NPS and also considering the cumulative effects between all five NPSs in combination (see section 2.6 below).

2.5: Appraisal of Alternatives

The SEA Regulations also require the environmental assessment of reasonable alternatives to the NPS policies and these alternatives are analysed in Section 5 of this AoS Report for EN-1 and Sections 6 to 9 for the AoSs of EN-2, EN-3, EN-4 and EN-5.

It is important to maintain the Appraisal of Sustainability at a level proportionate to the level of detail within the NPS. For this reason, the strategic alternatives for implementing the aims of the NPS were assessed at a higher level by using six sustainable development themes, identified through aggregating the AoS objectives into topics that better reflected the strategic characteristics of the options (see Table 2-2). The six sustainable development themes included in the AoS for assessing alternatives were informed by the themes previously used in the AoS of the current NPSs to ensure an element of consistency in the approach to assessment of alternatives.

Table 2-2 - Sustainable Development Themes and AoS Objectives

Headline SD Themes	**AoS/SEA Objectives** **(numbers refer to AoS objectives)**
Climate Change	Net Zero (1)
Security of Energy Supply	Health (11), Economy (13)
Health & Well- Being	Air Quality (8), Health (11)
The Economy	Health (11), Economy (13), Resources (14)
The Built Environment	Transport (12), Heritage (5), Adaptation and Resilience (2), Landscapes and Townscapes (6)

The Natural Environment	Adaptation and Resilience (2), Biodiversity (3 & 4), Heritage (5), Landscapes and Townscapes (6), Water (7), Soils (9), Geodiversity (10)

Note that in consideration of Alternatives, the assessment is undertaken in comparison to the revised EN-1 and as such, the findings of the AoS in respect of the revised EN-1 in Section 5 broadly apply to all of the alternatives – the key differentiator being the inclusion or absence of specific technologies and the relative outcomes of such inclusion or absence. The same broad methodology was applied in relation to alternatives for revised EN-2 to EN-5 with the key differentiator being the inclusion or absence of particular aspects related to the particular technologies and the relative outcomes of such inclusion or absence.

In order to draw comparison between the Alternatives on a broad level, the following scale has been used:

Table 2-3: Differentiator scale for Alternatives

Scale	Description
Large Positive	A materially different positive outcome is anticipated compared to EN-1*
Positive	A more positive outcome is anticipated compared to EN-1*
Neutral	This alternative is anticipated to have the same outcome as EN-1*
Negative	A more adverse outcome is anticipated compared to EN-1*
Large Negative	A materially different adverse outcome is anticipated compared to EN-1*

* EN-2 to EN-5 for technology AoS

2.6: Cumulative and Transboundary Effects

Cumulative effects arise where several proposals or elements of the energy NPSs, individually may or may not have significant effect but in-combination have a significant effect due to spatial crowding or temporal overlap. Synergistic effects occur when two or more effects act together to create an effect greater than the simple sum of the effects when acting alone. Cumulative effects can also arise due to effects from the NPSs combining with effects from other plans and policies.

Transboundary effects extend to multiple countries rather than just the UK.

Both types of effects have been considered in relation to the energy NPSs.

2.7: Monitoring the Effects of the NPSs Implementation

Monitoring involves measuring indicators which will enable the establishment of a causal link between the implementation of the plan and the likely significant effect (positive or negative) being monitored. It thus helps to ensure that any adverse effects which arise during implementation, whether or not they were foreseen, can be identified and that action can be taken to deal with them. A monitoring programme has been prepared and is presented in this report.

2.7: Consultation on this revised AoS Report

The AoS Report was originally published for public consultation between September and November 2021. Due to consultation comments received, as well as changes to the global geo-political landscape and issues of energy security, it was decided to update the NPSs and associated AoS to reflect the latest situation.

The revised AoS Report is therefore published for further public consultation together with the revised draft NPSs. Please refer to the consultation document for details.

2.8: Next Steps

The revised draft NPSs will be subject to Parliamentary scrutiny. Government will consider comments received during the further public consultation, and the NPSs will be subject to approval by Parliament before final designation. Upon designation of the NPSs, an AoS Post Adoption Statement will be published, and this will outline how the findings of the AoS and the responses to consultation have been taken into account. It will also provide further information on how monitoring of the significant effects of implementing the revised NPSs will be carried out.

2.9: Habitats Regulations Assessment

A Habitats Regulations Assessment (HRA) report has been prepared for the suite of draft NPSs in a parallel process to the AoS. The HRA report has been the subject of public consultation alongside the draft NPSs and the AoS report in 2021. A revised HRA Report now accompanies the revised updated NPSs during a second public consultation in 2023.

In England and Wales, under the Conservation of Habitats and Species Regulations 2017 (as amended), as well as the Conservation of Offshore Marine Habitats and Species Regulations 2017 (together known as the 'Habitats Regulations') an 'Appropriate Assessment' is required to be undertaken on proposed plans or projects which are not necessary for the management of the International Site but which are likely to have a significant effect on one or more International Sites either individually, or in combination with other plans or projects.

International Sites include Special Areas of Conservation (SACs), originally designated under European Council Directive 92/43/EEC (referred to as the Habitats Directive), and Special Protection Areas (SPAs), originally designated under the Conservation of Wild Birds Directive (Council Directive 2009/147/EC (which codifies Directive 79/409/EEC)) for rare, vulnerable and regularly occurring migratory bird species and internationally important wetlands. As a matter of Government policy listed or proposed Ramsar sites, potential SPAs (pSPA), candidate SACs (cSAC) and sites identified, or required, as compensatory measures for adverse effects on habitats sites, pSPAs, cSACs and listed or proposed Ramsar sites, are treated in the same way as International Sites. Hereafter, all the above sites are referred to as International Sites.

Therefore, a HRA report was prepared for the revised and updated NPSs (EN-1 to EN-5) and considers the potential effects of designating the draft NPSs on International Sites.

It is important to note that the Habitats Regulations require assessment of the NPSs as a plan and as such the HRA has been undertaken on that basis – this does not remove the requirement for detailed project level HRA to be undertaken at development consent stage. At this point, there are no specific sites, allocations or any spatial component to the NPSs. Therefore, the HRA has purely focused on the policy content within each NPS and has been applied to drafts of EN-1 to EN-5 in a manner which is consistent with their non-spatial, strategic nature as these NPS do not identify locations to construct new nationally significant infrastructure.

The HRA of the draft National Policy Statements (EN-1 to EN-5) noted that while the lack of spatial information within the NPSs made it impossible to reach certainty on the effect of the plan on the integrity of any International Site, the potential for proposed energy infrastructure projects of the kind contemplated by EN-1 to EN-5 to have adverse effects on the integrity of such sites cannot be ruled out, based on following the precautionary principle. The HRA explains why the Government considers that EN-1 to EN-5 are, nevertheless, justified by imperative reasons of overriding public interest, while noting that its conclusions are only applicable at the NPS level and are without prejudice to any project-level HRA, which may result in the refusal of consent for a particular application.

3: Scope of the AoS

3.1: Thematic Scope

The SEA Regulations require the analysis of likely significant effects on the environment in an environmental report to include the effects on a range of issues or topics (known as 'SEA Topics'), which are: "biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors". There is also a requirement for the environmental report to include "measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment" of implementing the plan or programme. This is what Sections 5 to 9 of this AoS report do for each of the five NPSs.

The scoping consultation confirmed that all of the SEA Topics were relevant to the development of energy infrastructure. Table 3-1 identifies the headings under which analysis of these issues is set out in this AoS report (particularly in Section 4).

Table 3-1 – How SEA Topics are covered by the AoS Objectives

SEA Topics	Headings used in this AoS
Biodiversity, Fauna and Flora	3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network; and 4. Protect and enhance sites designated for their international importance for nature conservation purposes. 7. Protect and enhance the water environment 8. Protect and enhance air quality.
Population	6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity; 11. Improve health and well-being and safety for all citizens and reduce inequalities in health; 13. Promote a strong economy with opportunities for local communities; and 12. Promote sustainable transport and minimise detrimental impacts on strategic transport network and disruption to basic services and infrastructure.
Human Health	8. Protect and enhance air quality; 11. Improve health and well-being and safety for all citizens and reduce inequalities in health.
Soil	9. Protect soil resources and avoid land contamination; and 10. Protect, enhance and promote geodiversity.
Water	2. Maximise adaptation and resilience to climate change; and 7. Protect and enhance the water environment
Air	8. Protect and enhance air quality

SEA Topics	Headings used in this AoS
Climatic Factors	2. Maximise adaptation and resilience to climate change; and 7. Protect and enhance the water environment
Material Assets	9. Protect soil resources and avoid land contamination; 10 Protect, enhance and promote geodiversity; and 14. Promote sustainable use of resources and natural assets.
Cultural Heritage	5. Protect and enhance cultural heritage assets and their settings, and the wider historic environment; and 6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity.
Landscape	6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity

3.2: Geographic Scope

The AoS applies to the same geographical area of the NPSs – namely England and Wales, though in certain circumstances elements will apply to Scotland. The Energy NPSs do not apply to Northern Ireland.

Potential effects have been considered across a range of geographic scales (including international, UK, regional and local). However, as the NPSs do not prescribe the location for new infrastructure projects, there are limitations in terms of appraising those effects that are site specific in nature. This is not to exclude the possibility that they could be significant but rather to indicate that such effects may only be effectively judged as significant at the project level (for example, increases in noise or vibration levels from a new access road affecting a local housing settlement). This explains why effects that may be quite intensely felt at local level do not always register as strategically significant in the scoring sections of the assessment.

The assessment of project level effects will be given full consideration at the application for development consent, as detailed in the NPSs, particularly through Environmental Impact Assessment (EIA), and, where relevant, Habitats Regulations Assessment (HRA).

3.3: Temporal Scope

The temporal scope of the AoS has been aligned with that for the NPSs, which remain in force unless withdrawn or suspended in whole or in part by the Secretary of State. It should be noted though, that the AoS considers the full lifetime of any individual energy related development which might arise from the reviewed NPSs and that includes the construction, operation and decommissioning stages.

The effects of a policy, plan or programme sometimes change over time for a number of reasons. This has been reflected in the appraisal. In this context, for the purposes of the appraisal, the “short term” has been defined as the effects arising generally during the infrastructure construction period typically 2-7 years (different technologies have different construction times); the “medium term” as typically between 5 and 30 years (operational lifetimes vary with the characteristics of different technologies); and the “long term” as beyond 30 years (and including decommissioning where relevant).

4: Policy context, baseline, issues and framework

4.1: Review of Policies, Plans and Programmes

The SEA Regulations requires a report containing:

'*an outline of the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes'.* (Schedule 2, Paragraph 1)

'*The environmental protection objectives, established at international, (European) Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation*'. (Schedule 2, Paragraph 5)

The review of international and national plans, policies and programmes (PPP) is a valuable element of the AoS process as it assists with the following:

- The identification of environmental, social and economic objectives of other relevant plans or programmes that should guide the identification of sustainability issues;
- The development of the AoS framework which should comprise sustainability objectives; and
- Determining whether there are any clear potential conflicts or challenges between the PPP and the emerging policy which is the subject of the AoS process. Note that there are a number of policy levers other than the planning regime which Government can and does use to try to achieve its overall objectives in relation to the Energy sector. In the energy NPSs and their AoSs, we are concerned only with those policies which relate to land use and help set the framework for development consent.

The international and national PPP that have been reviewed are listed in Table 4-1 and details of the review presented in Appendix C.

Table 4-1 - International and national PPP reviewed[4]

International
Aarhus Convention (Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters) (2001)
Bern Convention on the Conservation of European Wildlife and Natural Habitats (1979)
Closing the Gap: Social Determinants of Health (World Health Organisation, 2008)
Convention on the Protection of the Archaeological Heritage (1992) – the 'Valetta Convention'
Convention on the Protection of Underwater Cultural Heritage (2001)
Espoo Convention on Environmental Impact Assessment in a Transboundary Context (1991)

[4] The review of Plans, Policy and Legislation is not to be considered an exhaustive list and elements may have been superseded. However, it is the purpose to illustrate the evolution of sustainability requirements and demonstrate the context of the NPS and associated AoS and to show how these are broadly influenced in setting Objectives for both.

European Landscape Convention (2000) – the 'Florence Convention'
Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat (1971)
Kyoto Protocol to the UN Framework Convention on Climate Change (agreed in 1997, ratified in 2005)
The OSPAR Convention
The Paris Agreement (2015)
UK-EU TAC Agreement, Articles: ENER.21 Renewable Energy and Energy Efficiency, ENER.22 Support for Renewable Energy, ENER.23 Cooperation in the Development of Offshore Renewable Energy, and ENER.26 Research, Development and Innovation.
UN Convention on Biological Diversity (2010)
UN Framework Convention on Climate Change (1994)
UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (1972)
WHO Guidelines for Community Noise 1999
WHO Night Noise Guidelines for Europe 2009
National (United Kingdom)
A Children's Environment and Health Strategy for the United Kingdom (2009)
A connected society – A strategy for tackling loneliness, 2018
A Green Future: Our 25 Year Plan to Improve the Environment (HM Government 2018)
Air Pollution: Action in a Changing Climate (Defra, 2010)
Air Quality Standards Regulation 2010 as amended by The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019
Air Quality Plan for Nitrogen Dioxide in the UK, 2017
Ancient Monuments and Archaeological Areas Act 1979
Ancient Woodland Inventory
BIS Climate Change Adaptation Plan 2011
British Energy Security Strategy 2022
Building a Low-Carbon Economy – The UK's Contribution to Tackling Climate Change (Committee on Climate Change, 2008) and the Fourth Carbon Budget: Reducing Emissions Through the 2020s (CCC, 2010)
Carbon Plan (DECC, 2011)
Children's Environment and Health Action Plan – Summary of current activities which address children's environment and health issues in the UK (2007)
Clean Air Strategy, 2019
Climate Change Act 2008 and its 2050 Target Amendment Order, 2019
Climate Change Risk Assessment 2017
Conservation of Habitats and Species Regulations 2010 as amended by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019

Countryside and Rights of Way Act 2000
Cutting Carbon, Creating Growth: Making Sustainable Local Transport Happen White Paper 2011
Decarbonising Transport: Setting the Challenge 2020
DfT Single Departmental Plan 2019
Eels (England and Wales) Regulations 2009
Enabling the Transition to a Green Economy: Government and business working together (HM Government, 2011)
Enterprise and Regulatory Reform Act 2013
Environment Act 1995 (as amended)
Environment Bill Policy Statement 2020
Environmental Permitting (England and Wales) Regulations 2016
Environmental Protection Act (1990)
Fisheries Act 2020
Flood and Water Management Act 2010
Flood Risk Management Plans
Government Heritage Statement 2017
Guidance for Local Authorities on Implementing the Biodiversity Duty (2007)
Health Impact Assessment in Strategic Environmental Assessment (2001)
Heritage Protection for the 21st Century 2007
Historic Buildings and Ancient Monuments Act 1953
Inclusive Transport Strategy 2018
Industrial Decarbonisation Strategy (2021)
Infrastructure Planning (Environmental Impact Assessment) Regulations 2018
Local Transport Act 2008
Localism Act 2011
Low Carbon Transition Plan 2009
Marine and Coastal Access Act 2009
National Forest Inventory
National Heritage Act 1983 (as amended 2002)
National Infrastructure Plan (HM Treasury, 2014)
National Infrastructure Strategy
National Infrastructure Assessment 2018
National Parks and Access to Countryside Act 2006
National Pollinator Strategy 2014-2024
Natural Environment and Rural Communities Act 2006
Natural Environment White Paper (Defra, 2011)

Network Rail Delivery Plan 2019-2024
Planning Practice Guidance – Climate Change 2015
Protection of Military Remains Act 1986
Resource Security Action Plan 2012
River Basin Management Plans (RBMP)
Salmon and Freshwater Fisheries Act 1975
Shoreline Management Plans
Stern Review of the Economics of Climate Change (Stern, 2007)
The Agriculture Act 2020
The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Defra, 2007)
The Energy White Paper (2020)
The Flood Risk Regulations 2009
The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019
The Growth Plan 2022
The Planning Act 2008
The Planning (Listed Buildings and Conservation Areas) Act 1990
The Protection of Wrecks Act 1973
The Road to Zero, 2018
The Ten Point Plan for a Green Industrial Revolution (2020)
The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
The Water Act 2014
The Wildlife and Countryside Act (1981)
Towards Social Investment for Growth and Cohesion 2014 - 2020
Transport Act 2000
UK Biodiversity Plan (1994)
UK Clean Growth Strategy 2017
UK Climate Change Risk Assessment 2017 Synthesis report: priorities for the next five years
UK Climate Projections 18
UK Government Sustainable Development Strategy: Securing the Future (HM Government, 2005)
UK Marine Policy Statement 2011
UK Marine Strategy 2019
UK Post-2010 Biodiversity Framework (July 2012)
UK Renewable Energy Road Map 2013
UK Shared Framework for Sustainable Development; One Future – Different Paths 2005

Water Resources Act 1991 (which applies in England and Wales)
England
Biodiversity 2020: a Strategy for England's Wildlife and Ecosystem Services (Defra, 2011)
Climate Change: Second national adaptation programme (2018-2023)
English National Parks and Broads UK Government Vision and Circular 2010 (DEFRA 2010)
Environmental Damage (Prevention and Remediation) (England) Regulations 2015 as amended by The Environmental Damage (Prevention and Remediation) (England) (Amendment) Regulations 2019
Environmental Noise (England) Regulations 2006 SI 2238 as amended by Environmental Noise (England) (Amendment) Regulations 2009 and 2010
Future Water, the Government's Water Strategy for England (Defra, 2008)
Government Policy Statement on Flood and Coastal Erosion Risk Management Strategy
Government Review of Waste Policy in England 2011
Government Forestry and Woodlands Policy Statement (2013)
Healthy Lives, Healthy People: Our strategy for public health in England (2010)
Highways England Growth and Housing Fund
Landscape Character Framework
Marine Plans for England
National Flood and Coastal Erosion Risk Management Strategy for England 2020
National Planning Policy for Waste (2014)
Noise Policy Statement for England (DEFRA, 2010)
Planning for the Future: A guide to working with Highways England on planning matters
Project Speed
Roads Investment Strategy 2020 - 2025
Safeguarding our Soils: a strategy for England 2009
The Contaminated Land (England) Regulations 2006 (HMSO, 2006) as amended by the Contaminated Land (England) (Amendment) Regulations 2012
The Environment Act 2021
The Planning White Paper
The National Adaptation Programme – Making the country resilient to a changing climate (2013)
The National Flood and Coastal Erosion Risk Management Strategy for England (FCERM) (Environment Agency, 2011)
The National Planning Policy Framework (2012; revised 2021)
The Smoke Control Areas (Authorised Fuels) England (No. 2) Regulations 2014
The Town and Country Planning (Trees Preservation) (England) Regulations 2012

Waste (England and Wales) Regulations 2011 as amended by The Waste (England and Wales) (Amendment) Regulations 2014
Waste Management Plan for England (2013)
Waste Prevention Programme for England 2013
Wales
Adapting to Climate Change: Guidance for Flood and Coastal Erosions Risk Management Authorities in Wales 2021
Environment (Wales) Act 2016
Environmental Damage (Prevention and Remediation) (Wales) Regulations 2009
Future Wales Collection of Evidence
Future Wales Habitats Regulation Assessment
Future Wales Integrated Sustainability Appraisal
Future Wales – The National Plan 2040
Guidance for flood consequence assessments: climate change allowances 2021
Historic Environment Act (Wales) 2016
National Strategy for Flood and Coastal Erosion Risk Management in Wales (2020)
Natural Resource Policy (Welsh Government) (2017)
Natural Wales Resources Technical Guidance (Series - Natural Resource Wales)
Llwybr Newydd The Wales Transport Strategy (2021)
One Wales: One Planet – the Sustainable Development Scheme for Wales (2009)
Planning Policy Wales (Edition 11, 2021)
Planning (Wales) Act 2015, including consideration of Development of National Significance (DNS)
Policy Statement on Local Ownership of Energy Developments
Prosperity for All: A Climate Conscious Wales
Rural Development Plan 2007-2013
Shoreline Management Plans applicable in Wales
State of Natural Resources Report (Natural Resources Wales 2020)
Technical Advice Notes (TANs) TAN 5: Nature Conservation and Planning (2009) TAN 6: Planning for Sustainable Rural Communities (2010) TAN 8: Renewable Energy (2005) TAN 11: Noise (1997) TAN 13: Tourism (1997) TAN 14: Coastal Planning (1998) (to be combined with TAN 15 in September 2021) TAN 15: Development and Flood Risk (2004) TAN 16: Sport, Recreation and Open Space (2009) TAN 18: Transport (2007)

TAN 21: Waste (2014)
The Climate Change Strategy for Wales (2010)
The Contaminated Land (Wales) Regulations 2006 as amended by the Contaminated Land (Wales) (Amendment) Regulations 2012
The Town and Country Planning (Development Management Procedure) (Wales) Order 2012 as amended by The Town and Country Planning (Development Management Procedure) (Wales) (Amendment) Order 2017
The Town and Country Planning (Trees) (Amendment) (Wales) Regulations 2017
The Smoke Control Areas (Authorised Fuels) (Wales) Regulations 2019
The Waste (Miscellaneous Provisions) (Wales) Regulations 2012
The Welsh Historic Environment Strategic Statement: Action Plan (2010)
Towards Zero Waste - One Wales: One Planet - The Overarching Waste Strategy Document for Wales (2010)
Water Strategy for Wales (2015)
Wellbeing and Future Generations (Wales) Act 2015
Welsh Government Rural Communities - Rural Development Programme (2014-2020)
Welsh National Marine Plan (Welsh Government (2019)
Woodlands for Wales (2011)
Valued and Resilient: The Welsh Government's Priorities for Areas of Outstanding Natural Beauty and National Parks (2018)
Scotland
2020 Challenge for Scotland's Biodiversity - A Strategy for the conservation and enhancement of biodiversity in Scotland
Cleaner Air for Scotland – the Road to a healthier future (the Scottish Government 2015)
Climate Change (Emissions Reduction Targets) (Scotland) Act 2019
Climate Change (Scotland) Act 2009
Climate Ready Scotland Scottish Climate Change Adaptation Programme (2014)
Climate Ready Scotland Scottish Climate Change Adaptation Programme (2019-2024)
Contaminated Land (Scotland) Regulations (2000 and 2005)
Control of Woodland Removal 2012
Environmental Noise (Scotland) Regulations (2006) as amended by The Environmental Noise (Scotland) Amendment Regulations 2018
Flood Risk Management Act (Scotland) (2009)
Forestry and Land Management (Scotland) Act 2018
Forestry (Felling) (Scotland) Regulations 2019
Planning Advice Note (PAN) 3/2010 Community Engagement
PAN 33 Development of Contaminated Land (Revised Oct 2000)
PAN 51 Planning, Environmental Protection and Regulation (Revised 2006)
PAN 2/2011 Planning and Archaeology

PAN 71 Conservation Area Management
PAN 60 Planning for Natural Heritage
PAN 1/2011 Planning and Noise
PAN 61 Waste Management Planning
Scotland’s Biodiversity Strategy (consists of two documents - 2020 Challenge for Scotland's Biodiversity - A Strategy for the conservation and enhancement of biodiversity in Scotland and Scotland’s Biodiversity: It’s in Your Hands (2003))
Scotland’s Forestry Strategy 2019-2029
Scotland's Third National Planning Framework (2014)
Scotland’s Zero Waste Plan (2010)
Scottish Energy Strategy: The Future of Energy in Scotland (2017)
Scottish Planning Policy (2014)
Securing a green recovery on a path to net zero: climate change plan 2018–2032 - update
The Air Quality (Scotland) Amendments Regulations 2016
The Air Quality Standards (Scotland) Regulations (2010)
The Nature Conservation (Scotland) Act 2004 (Authorised Operations) Order 2011
The Scottish Forestry Strategy (2006)
The Smoke Control Areas (Authorised Fuels) Scotland Regulations 2014
The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013
The Town and Country Planning (Tree Preservation Order and Trees in Conservation Areas) (Scotland) Regulations 2010
The Waste (Scotland) Regulations 2012
The Water Environment (Controlled Activities) (Scotland) Regulations 2011
Tourism Development Framework for Scotland (2013)
Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 and amendments
Wildlife and Natural Environment (Scotland) Act 2011 (as amended)

A series of tables contained in Appendix C present the review of PPP and document the following:

- The primary objectives of the documents including their environmental protection objectives where appropriate;
- Key indicators and targets of relevance in the documents; and
- How the objectives within the plans and programmes have been taken into consideration in the AoS and NPS processes.

The review of PPPs revealed a large number of common themes in terms of their objectives relating to sustainability within the context of strategic development planning, including:

Biodiversity and the Natural Environment

- Protection of sites designated for nature conservation purposes
- Protect and enhance endangered or important species and habitats, including those considered irreplaceable such as Ancient Woodland and Veteran trees
- Contribute to the delivery of biodiversity strategies and plans
- Support ecosystem resilience
- Plan nature networks by improving core sites, increasing size of core sites, increase number of sites and create large areas, improve 'permeability' of surrounding landscape and create corridors of connecting habitat
- Establish the Nature Recovery Network to achieve objectives that by 2042: 75% of protected sites on land (including freshwaters) are restored to favourable condition; 500,000 hectares of additional wildlife-rich habitat outside of protected sites are created or restored; recover threatened and iconic animal and plant species by providing more, diverse and better connected habitats; support work to increase woodland cover; achieve a range of environmental, economic and social benefits, such as carbon capture, flood management, clean water, pollination and recreation
- Contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network
- Contribute to delivering multi-functional Green Infrastructure – note this will also have implications in addition to biodiversity across a range of themes such as climate change, air quality, water quality and so on
- Enhance the resilience of the natural environment and its biodiversity to climate change
- Prevent spread of invasive species (native and non-native), including new invasive species because of climate change
- Contribute to the achievement of Environment Net Gain

Geodiversity

- Protection of sites designated for geodiversity importance

Greenhouse gas (GHG) Emissions

- Reduce GHG emissions, particularly CO_2
- Maximise the use of low carbon (or renewable and low carbon) energy
- Increase energy efficiency and make use of new technology and use of waste heat
- Minimise use of fossil fuels
- Promote use of carbon capture and storage technology
- Protect existing woodlands and plant new woodlands to increase biodiversity recovery, carbon sequestration and resilience in the face of climate change
- Restore both upland and lowland peatlands (largest stores of carbon) to a natural condition so that they can sequester carbon indefinitely
- Protect marine and coastal habitats as they have the potential to sequester and store large amounts of carbon
- Contribute to the achievement of Net Zero Carbon target

Adaptation to a Changing Climate and Flooding

- Prepare for extreme weather events including drought and sea level rise and coastal erosion
- Minimise the risk and impact of flooding from all sources for life of development
- Take account of the potential impact of climate change over the lifetime of development
- Avoid development in flood risk areas when possible
- Manage flood risk from river at river catchment level and flood risk and coastal erosion at sections of the coastline level
- Utilise Natural Flood Management, river restoration and SuDS
- Utilise 'nature-based solutions' for adaptation and mitigating climate change impacts, such as peatland restoration, appropriate tree planting, green infrastructure including in urban environments.
- Utilise the concept of sustainable adaptation to look at the prerequisites for a long-term, integrated approach to adaptation, including the synergies and trade-offs associated with cross-sectoral adaptation. Four key principles:
    - Adaptation should aim to maintain or enhance the environmental, social and economic benefits provided by a system, while accepting and accommodating inevitable changes to it.
    - Adaptation should not solve one problem while creating or worsening others. Action that has multiple benefits and avoids creating negative effects for other people, places and sectors should be prioritised.
    - Adaptation should seek to increase resilience to a wide range of future risks and address all aspects of vulnerability, rather than focusing solely on specific projected climate impacts.
    - Approaches to adaptation should be flexible and not limit future action

Air Quality

- Do not cause additional AQMA to be designated
- Reduce emissions of NO_2
- Reduce emissions from transport (roads in particular)
- Increase use of low emission / zero emission at point of use vehicles
- Increase convenience and use of sustainable transport modes
- Reduce emissions of PM_{10} and $PM_{2.5}$
- Reduce air pollution’s wider impacts on the environment and biodiversity

Water Resources

- Protect and improve the quality of ground and surface water (including sea)
- Prevent deterioration and enhance status of aquatic ecosystems, including groundwater
- Reduce pollution
- Need to consider as appropriate water resource management and drought management
- Make use of Sustainable Drainage Systems (SuDS)

Land Use, Soil and Agriculture

- Prioritise development on brownfield sites
- Seek to reclaim derelict and contaminated land
- Protect farmland and soils – particularly Best and Most Versatile (BMV) agricultural land
- Ensure soils are sustainably managed (applies to all land uses including land being developed and in urban uses)
- Improve soil health
- Restore and protect peatlands
- Zero avoidable waste by 2050 (including treating soil as a resource not a waste)
- Create new forestry to address climate change, drainage, soils protection, biodiversity and recreational benefits

Cultural Heritage

- Conserve and protect historic assets (designated and undesignated) and those of cultural note
- Improve access to historic assets, including buildings and landscapes of value where appropriate
- Sympathetic design and use of vernacular architecture when appropriate to enhance the local character and 'sense of place'

Landscapes and Townscapes

- Afford the highest level of protection to nationally designated landscapes.
- Seek to protect and enhance designated landscapes
- Protect and enhance landscape and townscape character and local distinctiveness, with a particular emphasis on conserving and enhancing the natural beauty of national parks and AONBs, and those stretches of coastline given the status of Heritage Coast
- Protect tranquillity from noise and light pollution
- Foster good design quality for all new development
- Promote regeneration of previously developed land when appropriate
- Adaptive management of landscapes to climate change

Natural Resources and Waste

- Apply the waste hierarchy and promote the circular economy:
    - Ensure efficient resource use and minimise resource footprint
    - Employ waste reduction methods to minimise construction and maintenance waste
    - Consider opportunities to maximise on-site re-use of materials including soils
    - Use secondary and recycled materials (including soils) and sustainable construction techniques
    - Recover energy and materials from waste (anaerobic digestion, incineration with energy recovery and pyrolysis)
    - Reduce the amount of waste disposed of at landfill and incinerated without energy recovery

Economic Themes

- Improve physical accessibility to jobs through the location of employment sites and transport links close to areas of high unemployment
- Improve accessibility to superfast / ultrafast broadband
- Widen the number and range of accessible employment opportunities and support growth in employment and labour productivity
- Improve attractiveness for inward investment
- Improve rail and road journey reliability for business users
- Support local businesses
- Support enhancement of local economy anhd overall prosperity
- Support development of the skills base

Social Themes

- Distinctive development that recognises, reflects and enhances the ‘sense of place’ and ‘sense of community’
- Self-sufficient, resilient and adaptable communities
- Communities that will develop roots and connections between people
- Access to a mix of affordable housing to meet the needs of all sections of society, at different phases of life
- Access to social facilities – community, cultural, health and leisure / recreational
- Access to transport with an emphasis on active, low carbon and sustainable modes
- Access to and provision of modern and robust infrastructure, including digital, to allow connected communities
- Access to Open Space and Green Infrastructure
- Access to educational, training and employment opportunities

Health & Community Themes

- Tackle poor health by improving the health of everyone, and of the worst off in particular
- Tackle, where possible, specific issues that can affect health e.g. poor air quality
- Reduce health inequalities among different groups in the community (e.g. young children, pregnant women, black and minority ethnic people; older people, people with disabilities; low income households)
- Support the public to make healthier and more informed choices with regard to their health and adopt physically active lifestyles
- Address pockets of deprivation
- Provide physical access for people with disabilities
- Provide or improve access to local health and social care services
- Provide opportunities for increased exercise, thus reducing obesity, particularly in children, and illnesses such as coronary heart disease
- Provide for an ageing population
- Create outdoor recreational opportunities to promote a healthy lifestyle

- Promote healthy lifestyles through exercise, physically active travel and access to good quality and affordable food, which can assist in reducing both physical and mental illnesses

Cross cutting

- Support the UK Government's 25 Year Plan to Improve the Environment 2018 goals and key actions as follows:

- Using and managing land sustainably, including embedding an "environmental net gain" principle into development.
- Recovering nature and enhancing the beauty of landscapes.
- Connecting people to the environment to improve health and wellbeing.
- Increase resource efficiency and reducing pollution.
- Securing clean, healthy and productive and biologically diverse seas and oceans.
- Protecting and improving the global environment.

Meet the following relevant targets set out in the 25 Year Plan:

Clean air:

- meeting legally binding targets to reduce emissions of five damaging air pollutants; this should halve the effects of air pollution on health by 2030
- maintaining the continuous improvement in industrial emissions by building on existing good practice and the successful regulatory framework

Clean and plentiful water:

- clean and plentiful water by improving at least three quarters of our waters to be close to their natural state as soon as is practicable by:
    - reducing the damaging abstraction of water from rivers and groundwater, ensuring that by 2021 the proportion of water bodies with enough water to support environmental standards increases from 82% to 90% for surface water bodies and from 72% to 77% for groundwater bodies
    - reaching or exceeding objectives for rivers, lakes, coastal and ground waters that are specially protected, whether for biodiversity or drinking water as per our River Basin Management Plans

Thriving plants and wildlife:

- At sea: reversing the loss of marine biodiversity and, where practicable, restoring it; increasing the proportion of protected and well-managed seas, and better managing existing protected sites; making sure populations of key species are sustainable with appropriate age structures; ensuring seafloor habitats are productive and sufficiently extensive to support healthy, sustainable ecosystems
- On land and in freshwaters: restoring 75% of our one million hectares of terrestrial and freshwater protected sites to favourable condition, securing their wildlife value for the long term; creating or restoring 500,000 hectares of wildlife-rich habitat outside the protected site network, focusing on priority habitats as part of a wider set of land management changes providing extensive benefits; taking action to recover threatened, iconic or economically important species of animals, plants and fungi, and where possible to prevent human induced extinction or loss of

known threatened species in England and the Overseas Territories; increasing woodland in England in line with our aspiration of 12% cover by 2060: this would involve planting 180,000 hectares by end of 2042

Reducing the risks of harm from environmental hazards:

- Reduce the risk of harm to people, the environment and the economy from natural hazards including flooding, drought and coastal erosion by:
    - making sure everyone is able to access the information they need to assess any risks to their lives and livelihoods, health and prosperity posed by flooding and coastal erosion
    - bringing the public, private and third sectors together to work with communities and individuals to reduce the risk of harm
    - making sure that decisions on land use, including development, reflect the level of current and future flood risk
    - ensuring interruptions to water supplies are minimised during prolonged dry weather and drought
    - boosting the long-term resilience of our homes, businesses and infrastructure

Using resources from nature more sustainably and efficiently:

- ensure that resources from nature, such as food, fish and timber, are used more sustainably and efficiently. This policy approach aims to do this by:
    - maximising the value and benefits we get from our resources, doubling resource productivity by 2050
    - improving our approach to soil management: by 2030 we want all of England's soils to be managed sustainably, and we will use natural capital thinking to develop appropriate soil metrics and management approaches
    - increasing timber supplies
    - ensuring that all fish stocks are recovered to and maintained at levels that can produce their maximum sustainable yield
    - ensuring that food is produced sustainably and profitably

Enhancing beauty, heritage and engagement with the natural environment:

- Conserve and enhance the beauty of our natural environment, and make sure it can be enjoyed, used by and cared for by everyone. We will do this by:
    - safeguarding and enhancing the beauty of our natural scenery and improving its environmental value while being sensitive to considerations of its heritage.
    - making sure that there are high quality, accessible, natural spaces close to where people live and work, particularly in urban areas, and encouraging more people to spend time in them to benefit their health and wellbeing
    - focusing on increasing action to improve the environment from all sectors of society

Mitigating and adapting to climate change:

- Take all possible action to mitigate climate change, while adapting to reduce its impact. This policy approach aims to do this by:
    - continuing to cut greenhouse gas emissions including from land use, land use change, the agriculture and waste sectors and the use of fluorinated gases
    - making sure that all policies, programmes and investment decisions take into account the possible extent of climate change this century

- implementing a sustainable and effective second National Adaptation Programme

Minimising waste:

- Minimise waste, reuse materials as much as we can and manage materials at the end of their life to minimise the impact on the environment. This policy approach aims to do this by:
  - working towards our ambition of zero avoidable waste by 2050
  - working to a target of eliminating avoidable plastic waste by end of 2042
  - meeting all existing waste targets – including those on landfill, reuse and recycling – and developing ambitious new future targets and milestones
  - significantly reducing and where possible preventing all kinds of marine plastic pollution – in particular material that came originally from land

- **Support Environment Act 2021 stipulations:**

- targets for four priority areas: (a) air quality; (b) water; (c) biodiversity; (d) resource efficiency and waste reduction to be set.
- two priority areas: air quality (PM2.5 air quality target) and biodiversity (species abundance target) and important new target to reverse the decline in species abundance by the end of 2030.
- environmental improvement plan for significantly improving the natural environment for a period no shorter than 15 years.
- 10% biodiversity net gain required for new development.
- prevent waste/reduce the amount of a product that becomes waste and increase re-use, redistribution, recovery and recycling.

- **Support revised National Planning Policy Framework stipulations**:

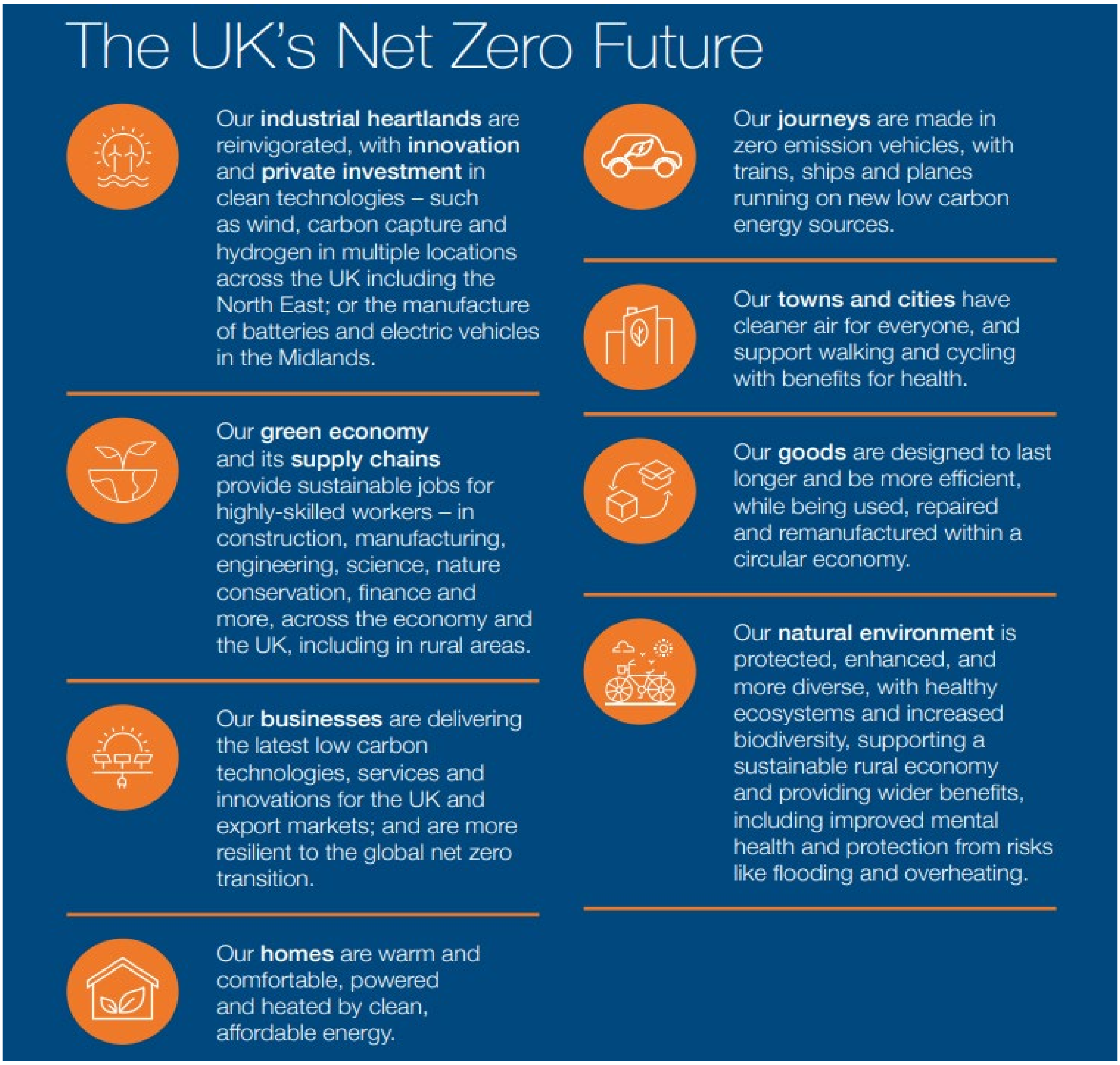
Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

- environmental objective of Sustainable Development is now clearly set: to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy, alongside
- an economic objective: to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure; and
- a social objective: to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering well-designed, beautiful and safe places, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being.

- **Align with UK Net Zero Strategy:**

- In the recently published Net Zero Strategy, the government provides a vision of the UK's Net Zero Future (Figure 4-1). This is highly relevant for the Energy NPSs as they are nested within this wider government vision.

Figure 4-1 The UK's Net Zero Future



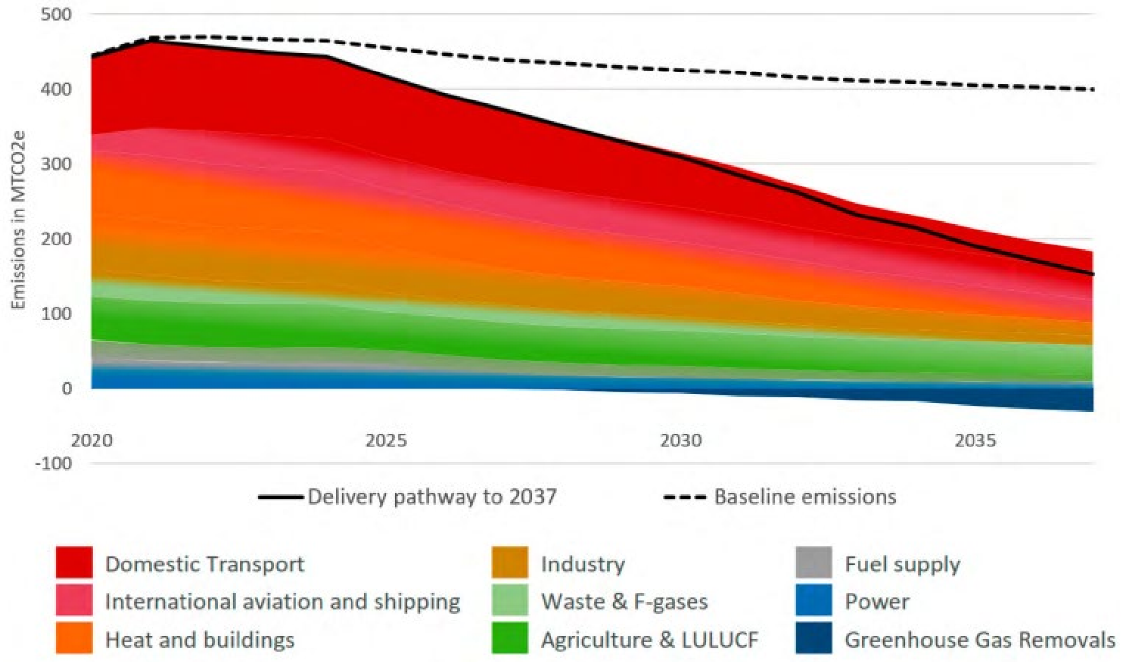
- Government also sets out that the exact technology and energy mix in 2050 cannot be known now, and the path to net zero will respond to the innovation and adoption of new technologies over time. However, it is expected to rely on the following key green technologies and energy carriers, which interact to meet demand across sectors and to remain low carbon:
  - Electricity from low carbon generation and storage technologies meets higher demand for low carbon power in buildings, industry, transport, and agriculture;
  - Hydrogen can complement the electricity system, especially in harder to electrify areas like parts of industry and heating, and in heavier transport such as aviation and shipping. A range of low carbon production methods could be used;

- Carbon capture usage and storage (CCUS) can capture CO_2 from power generation, hydrogen production, and industrial processes – storing it underground or using it. This technology also supports negative emissions from engineered greenhouse gas removals – bioenergy with carbon capture and storage (BECCS) and Direct Air Carbon Capture and Storage (DACCS); and
- Biomass combined with CCUS can remove carbon from the atmosphere and support low carbon electricity and hydrogen generation. Biomass and other wastes can also support low carbon fuels for industry, buildings, and transport.

- The Net Zero Strategy explores three 2050 scenarios which are summarised below:
  - High electrification: explores the impact of using widespread electrification to support transport, heating, and industry decarbonisation coupled with deep decarbonisation of electricity supply.
  - High resource: explores the impact of using low-carbon hydrogen more extensively, particularly for decarbonising buildings and heavy vehicles. It assumes higher levels of tree-planting are achievable, increasing the 'negative emissions' available from land-use sinks.
  - High innovation: explores a world in which successful innovations, such as synthetic fuels and zero emission aircraft, enable lower residual emissions to be reached sooner in aviation. Higher capture rates – above baseline assumptions – increase the impact of carbon capture technologies, particularly higher deployment of direct air capture.

- Drawing on the insights from the illustrative 2050 scenarios, Government have developed a delivery pathway: an indicative trajectory of emissions reductions which meets targets up to the sixth carbon budget ending in 2037 (Figure 4-2). The pathway is based on understanding now of the potential for each sector to reduce emissions up to 2037, considering the balance between sectors that is optimal for the entire economy in terms of delivery and cost. Emission reductions beyond our existing policies combine evidence on theoretical potential for abatement with judgements about barriers to delivery, the rate at which low carbon options could be adopted in practice and timescales for key decisions. An economy-wide view has been taken, including to balance end use sector demands with supply side considerations, such as infrastructure and the operation of the electricity and other fuel supply sectors. As a general principle, the indicative pathway to 2037 prioritises emissions reductions where known technologies and solutions exist and thereby minimises reliance on the use of greenhouse gas removals to meet targets. It is designed to drive progress in the short-term, while creating options in a way that seeks to keep the range of options presented in the illustrative 2050 scenarios open.

Figure 4-2 UK indicative delivery pathway to 2037 by sector



4.2: Baseline Information and Key Issues

The SEA Regulations require identification and characterisation of:

'*the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme*'. (Schedule 2, Paragraph 2)

'*the environmental characteristics of areas likely to be significantly affected*'. (Schedule 2, paragraph 3)

'*any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of particular environmental importance, such as areas designated pursuant to Directive 79/409/EEC and 92/43/EEC*'. (Schedule 2, Paragraph 4)

This chapter sets out baseline information for the UK and baseline information required for the assessment of each NPS. The baseline information in this Chapter and Appendix C is an update of information used to inform the current NPSs. -

4.2.1: Summary of national baseline data

The AoS is being undertaken to support reviewed NPSs which will have national implications and the approach to the baseline data collation process that has been adopted involved the collation of higher-level national data.

Appendix D sets out national baseline information that has been collated. The indicators that have been considered are listed below.

Table 4-2 - Summary of national baseline information

Topic	**Baseline Information (national)**
Climate change	Distribution of greenhouse gas emissions Contribution of sectors to greenhouse gas emissions Predicted changes to temperature and weather patterns (climate projections)
Biodiversity and the Natural Environment	Special Protection Areas Special Areas of Conservation Ramsar sites National Nature Reserves Local Nature Reserves Sites of Special Scientific Interest (England, Scotland, Wales) and Areas of Special Scientific Interest (Northern Ireland) Marine Conservation Zones (England, Wales, Northern Ireland) Nature Conservation Marine Protected Areas (Scotland) Ancient Woodland]

	Biosphere Reserves Nature Recovery Network Climate change adaptation risks and opportunities to protected sites, species, habitats and natural areas
Communities – Population, Employment and Viability	Population Location of major settlements and areas of population Working age population Unemployment Economic Activity Rates
Communities – Supporting Infrastructure	Location of strategic rail links Location of strategic road network Location of airports Location of ports
Communities - Health and Well-Being	Radioactivity levels in the environment The Index of Multiple Deprivation (England) The Scottish Index of Multiple Deprivation The Welsh Index of Multiple Deprivation Northern Ireland Multiple Deprivation Measure The Measuring National Well-Being Programme England Coast Path, National Trails (England and Wales), Scotland's Great Trails
Cultural Heritage	World Heritage Sites Scheduled Monuments Registered Battlefields Registered Parks and Gardens Protected Wrecks Listed Buildings Conservation Areas Registered Historic Landscapes (Wales)
Landscape, Townscape, and Seascape	National Parks Areas of Outstanding Natural Beauty (England, Wales, Northern Ireland) and National Scenic Areas (Scotland) Heritage Coasts (England and Wales) National Character Areas and Landscape Character Assessments (England) National Landscape Character Areas (Wales) Seascapes (Wales) Tranquillity Maps (Wales) Dark Sky reserves (Wales)

Air Quality	Air Quality Management Areas Air Pollution Information System for assessment of ecological receptors
Land Use, Soils and agriculture	Sites of Special Scientific Interest (England, Scotland, Wales) and Areas of Special Scientific Interest (Northern Ireland) UNESCO Global Geoparks Agricultural Land Classification National Soil Map (Soil Associations, including peat and peaty soil associations)
Water Quality and Resources	Water Framework Directive (WFD) River Basin Management Plans Bathing Water Quality Marine Strategy Framework Directive
Flood Risk and Coastal Change	Flood Zones (England, Scotland, Wales) and Flood Risk Areas (Northern Ireland) Shoreline Management Plans Flood Risk Management Plans
Natural Resources and Waste	Sector waste statistics

Appendix D is supported by Figures 1 - 6 in Appendix F which show the geographical distribution of some of the key designations and land uses across the UK. Table 4-3 provides a summary of the data presented on these figures. An indication is provided in brackets of whether an information layer only applies to a specific part of the UK.

Table 4-3- Key designations and land use across the UK

Figure	**Key designations / land use considered**
Figure 1: Biodiversity and Ecosystems	Special Protection Areas Special Area of Conservation Ramsar sites Sites of Special Scientific Interest (England, Scotland, Wales) and Areas of Special Scientific Interest (Northern Ireland) National Nature Reserves Ancient Woodland Inventory (England and Scotland) Marine Conservation Zones (England, Wales, Northern Ireland) Nature Conservation Marine Protected Areas (Scotland) Biosphere Reserves
Figure 2: Infrastructure	Urban Areas Location of strategic rail links Location of strategic road network

	Location of airports Location of ports
Figure 3: Historic Environment	Protected Wrecks (England) World Heritage Sites Scheduled Monuments (England and Scotland) Registered Battlefields (England and Scotland) Registered Parks and Gardens (England and Scotland) Registered Historic Landscapes (Wales)
Figure 4: Landscape / Health and Well-being	Areas of Outstanding Natural Beauty National Parks Heritage Coasts (England and Wales) National Trials (England) England Coast Path
Figure 5: Air Quality	Air Quality Management Areas
Figure 6: Flood Risk	Flood Risks Zones (England) Flood Risk Areas (Northern Ireland) Flood Risk Zones (Wales)

Note that while the above Figures depict a range of key designation and land use across the United Kingdom, the scale at which this mapping is presented does not allow for the full granularity of data of relevance. Underpinning many of the above noted aspects are a series of more 'local' designations and land uses which are also sustainability considerations and which have been considered where appropriate in this study. These include, for example, sites designated as Local Nature Reserves, Sites of Nature Conservation Importance, Noise Important Areas, non-designated heritage assets, listed buildings, Conservation Areas, Special Landscape Areas, Areas of Great Landscape Value, areas of contaminated land and so on.

4.2.2: Key Issues

The SEA Regulations require identification and characterisation of:

'*any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of particular environmental importance, such as areas designated pursuant to Directive 79/409/EEC on the conservation of wild birds and the Habitats Directive.* (Schedule 2, paragraph 4)

The identification of key sustainability issues (or 'problems') has been based upon the collation of baseline data (Appendix D) and the review of relevant PPP (Appendix C). The summary of issues is presented below in Table 4-4. Note that due to the geographical scope of the NPS, this summary of key sustainability issues is focused on England and Wales, along with the United Kingdom as a whole as appropriate. Further detail on Scotland and Northern Ireland is provided in the baseline and contextual information contained within Appendix D.

It should be noted that some issues are cross-cutting and affect several topics. For example, climate change can affect biodiversity, water resources, flooding and landscapes. There is also requirement to consider cumulative and in-combination effects across AoS Objectives. Table 4-4 shows the linkages to the AoS Objectives identified.

In addition, Table 4-4 below identifies the likely evolution of each key sustainability issue, if the revised NPSs were not to be designated (with the current NPS remaining in force). This addresses the SEA Regulations requirement to describe ‘the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme’. (Schedule 2, Paragraph 2).

Table 4-4 - Baseline evolution, key issues and implications and opportunities for the NPS

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
Biodiversity – new development and climate change put pressure on sites designated for nature conservation and other wildlife rich sites but the Nature Recovery Network and wider Green Infrastructure can benefit from opportunities to deliver Biodiversity Net Gain (or net benefit for biodiversity in Wales) through new development Across England and Wales, there are sites internationally (SACs, SPAs, Ramsar sites) and nationally (SSSIs) designated for nature conservation. SACs, SPAs, Ramsar sites and SSSIs are afforded the highest level of protection through statutory designations. Within England there are a total of 82 SPAs, while Wales has a total of 17. There are also 242 SACs in England and 85 in Wales. A number of SPAs and SACs protect habitat and/or species associated with the marine environment. Currently, there are 46 SPAs with marine components designated partly or wholly within English waters and 10 within Welsh waters. A total of 3 SPAs with marine components are located within both English and Welsh waters. There are also currently 37 SACs with marine components designated partly or wholly within English waters and 12 designated partly or wholly within Welsh waters. A further 3 SACs with marine	**Declining** Although designated sites are afforded protection; this is unlikely to prevent some decline in habitat quality due to ongoing water and air pollution and the effects of climate change. The same is true for the Nature Recovery Network and Green Infrastructure Network. However, there are Government initiatives under way to counteract the declines such as the establishment of the Nature Recovery Network and the Green Infrastructure Framework.	The NPSs should aim to protect and enhance all sites of biodiversity importance and place a particular emphasis on protecting sites designated for nature conservation. This could be achieved by ensuring that planning / design of new Energy developments and their associated infrastructure avoid sensitive areas and through the adoption of best practice wildlife friendly designs that deliver multi-functional green infrastructure. Where this is not possible, the NPPF mitigation hierarchy should be followed: significant adverse impacts should be avoided and, wherever possible, alternative options which reduce or eliminate such impacts should be pursued. Where significant adverse impacts are unavoidable, suitable mitigation measures should be proposed (or, where this is not possible, compensatory measures should be considered). In Wales and for development proposals that may affect Wales, a stepwise approach must be followed to maintain and enhance biodiversity and build resilient ecological networks by ensuring that any adverse sustainability effects are firstly avoided, then minimized, mitigated, and as a last resort compensated for; enhancement must be	Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network. Protect and enhance sites designated for their international importance for nature conservation purposes (linked to separate HRA process for Energy NPS)

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
components are located within both English and Welsh waters. As of May 2018, there were 68 Ramsar sites in England, totalling an area of 320,648 ha, while Wales has 7 Ramsar sites, totalling 11,366ha. In addition to these internationally designated sites, there are over 4000 SSSIs within England and over 1000 in Wales. There are also 89 MCZs designated in England. **The planning system also recognises irreplaceable habitats, such as Ancient Woodlands and Ancient and Veteran trees, on which development should be refused due to the difficulty in restoring, recreating or replacing the habitat once destroyed.** There are substantial numbers of NNR and LNR recorded across England and Wales, together with Sites of Nature Conservation Interest (SNCIs) and locally designated wildlife corridor sites. Although these areas are not afforded the highest statutory protection, they contribute significantly towards nature conservation. All sites, from those designated with the very highest level of protection, to those areas at the local level, are threatened by a range of issues such as habitat loss, human encroachment, poor management practices and invasive species. Changes in air and water quality along with a changing climate can also change distribution of species and habitats within these sites. Increased accessibility or proximity of		secured wherever possible. Finally, where the adverse effect on the environment clearly outweighs other material considerations, the development should be refused. In parallel with the AoS of the NPS, HRA is being undertaken which will identify the internationally designated nature conservation areas, where possible establish the likelihood of impacts on the integrity of these sites and identify appropriate avoidance and mitigation measures early in the development of the NPS. It is noted that in the case of offshore wind some sites are already at environmental limits of development. The NPSs should not allow development on irreplaceable habitats, such as ancient woodland and ancient and veteran trees except in exceptional circumstances and with appropriate compensation measures. The NPSs should afford protection to priority species and their habitats. The NPSs should champion the National Infrastructure Commission design principles, namely: Good design supports local ecology, which is essential to protect and enhance biodiversity. Projects should make active interventions to enrich our ecosystems. They should seek to deliver a net biodiversity gain, contributing to the restoration of wildlife on a	

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
development to designated sites also has the potential to adversely affect them indirectly. The wider green infrastructure network across England and Wales incorporates not only sites designated for nature conservation purposes, but also many other multi-functional green spaces and the connections between such locations. This network is highly susceptible to impacts from development including: • direct land take (which may contribute to fragmentation) • construction and operational disturbance (noise, vibration, light pollution, etc.) • emissions / contamination (air, water and soil). The establishment of the Nature Recovery Network (NNR) will aim to address many of the issues discussed above through enhancing sites designated for nature conservation and other wildlife-rich places, corridors and stepping stones wildlife populations to grow and move; improving the landscape's resilience to climate change, providing natural solutions to reduce carbon and manage flood risk, and sustaining vital ecosystems such as improved soil, clean water and clean air. By 2042, the aim is to restore 75% of protected sites on land (including freshwaters) to favourable condition and restore 500,000 hectares of additional wildlife-rich habitat outside of protected sites. Regional NNR are being established across the UK.		large scale while protecting irreplaceable natural assets and habitats. The NPSs should recognise the biodiversity is an asset and ensure that demands on Nature do not exceed its supply, and that Nature's supply relative to its current level is increased as per the Dasgupta Review. The NPSs should explore opportunities for new habitat creation and enhancement associated with energy developments, eg. through contributing to the Local Nature Recovery Strategy and helping establish the Nature Recovery Network. The potential for biodiversity creation in brownfield sites should be also taken into account, noting that some brownfield sites will be protect in their own right or have high biodiversity value already so won't be adequate for habitat creation in these circumstances. The NPSs should halt and reverse the loss of biodiversity through the achievement of Biodiversity Net Gain in areas not formally designated, aiming for a target of at least 10%, and reversing the decline in species abundance by the end of 2030 aligning with the Environment Act targets.	

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
In recognition of the continued threats and alarming levels of biodiversity decline, there are a range of commitments made through Strategies, Policy and Action Plans at the International, National and Local levels to protect species (including European Protected Species) and sites, halt biodiversity loss and reverse those losses made to date. Recognising that new development can provide opportunities for increased biodiversity, or to aid certain species, the Environment Act 2021 resulted in the need for new development to deliver a minimum of 10% Biodiversity Net Gain (or net benefit for biodiversity in Wales) and prepare protected species strategies and protected site strategies. Providing BNG is also set out within the NPPF (paras 174, 180). Biodiversity Net Gain delivered through new development also has a role to play in delivering the NRN with developers/delivery bodies being part of the NRN Partnership.		The NPSs should maintain and enhance nature based on seeking multiple ecosystem benefits and solutions. The NPSs should support cohesive ecosystems and ecological networks that help habitats and species adapt to the consequences of climate change. The NPSs should promote the application of nature-based solutions (peatlands, native woodlands, saltmarsh and sea grass meadows, traditionally managed habitats such as hedgerows, hay meadows, heathlands and old orchards) which will have a significant role to play in helping the UK hit net zero by 2050 alongside improving biodiversity (see also Adaptation to a Changing Climate key issue). The NPSs should recognise that increased accessibility to appropriately designed multi-functional green infrastructure can play a significant role in diverting pressure away from more sensitive sites or areas.	
Geodiversity - new development puts pressure on designated geodiversity sites In addition to the three Geoparks designated within England and two in Wales, there are a number of areas designated as SSSI due to having geodiversity, or geodiversity combined with	**Declining** While some of the geodiversity resource is in favourable condition, some is not and all aspects are experiencing	A co-ordinated strategic approach to development and infrastructure is required to limit the potential for inappropriate greenfield development to occur. This will help to manage pressures on SSSIs designated for their geological importance and on RIGS.	Protect, enhance and promote geodiversity

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
biodiversity importance. These areas are in a mix of conditions, with both favourable and unfavourable occurring. There are also some of the areas in decline, while others are recovering. There are also a range of Regionally Important Geology Sites (RIGS) across England and Wales. Geology across England and Wales is likely to face threats from development; human activities such as pollution, roads, disturbance, farming practices; loss of habitat; and a changing climate.	threats from development, as well as the need to adapt to climate change. In the absence of the NPS, there is heightened potential for inappropriate greenfield development.	The NPSs present an opportunity to develop strategic principles designed to control pollution, promote the re-use of previously developed land and tackle some of the causes of climate change, all of which should help to afford protection to the geodiversity resource.	
Greenhouse gas emissions – there is an urgent need to further reduce emissions and reduce energy demand The release into the atmosphere of greenhouse gases (e.g. CO_2, CH_4, N_2O, O_3) resulting from fossil fuel usage, agriculture, land use change and other human activities has been linked with atmospheric warming and global climate change. The United Kingdom has achieved significant cuts to emissions in recent years. Total emissions of direct greenhouse gases have decreased by 44% between 1990 and 2019 and 3% between 2018 and 2019. This decline between 1990 and 2019 is driven predominantly by a decrease in emissions from the energy supply sector – particularly from power stations. CO_2 is the largest contributor to global warming in the UK. As of 2019, CO_2 emissions were 454.8 Mt	**Declining** Interventions at the local and regional level have started to reduce the rate of greenhouse gas emissions; and actions outside the NPS are contributing to decarbonisation of energy networks. However, the underlying trend points towards a slowing of emissions rather than reversal of trends.	The NPSs should ensure that reducing CO_2 emissions and achieving Net Zero carbon through promoting low carbon and renewable generation as a core component of development ambitions alongside development of carbon capture usage and storage and negative emissions removals, both technological and nature-based. The NPSs should also ensure that opportunities are taken for maximising tree cover and peatland restoration. Amongst other benefits, careful site location and species selection in new woodland can contribute to carbon sequestration by absorbing increased amounts of CO_2 from the atmosphere. Restoration of peatland in unfavourable condition will allow the	Contribute to the national target of reducing carbon emissions to Net Zero by 2050

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
CO_2 equivalent, 43.8% below the 1990 level. CH4 is the second most significant greenhouse gas in the UK after CO_2 and since 1990, emissions of CH_4 have decreased by 59.7%. As of 2015, methane emissions were 54 Mt CO_2 equivalent. As of 2019, emissions of N_2O were 22 Mt CO_2 equivalent. Emissions of N_2O have declined 55.1% since 1990. Emissions of the F-gases (HFCs, PFCs, SF6 and NF3) totalled 13 Mt CO_2 equivalent in 2019. Since 1990 the overall decrease in their emissions has been 22.6%. The UK statutory target for reducing GHG emissions was strengthened in May 2019 to Net Zero by 2050 meaning that the level of emissions in 2050 must 100% lower than the 1990 baseline (Net Zero target). The strengthened target reflects the necessity of limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. Under the UK Climate Change Act 2008, the UK has so far set six 'carbon budgets'. These set interim five-year caps on emissions from 2008 to 2037. The UK is currently in the third budget period (2018 to 2022). The UK has succeeded in meeting the first and second budget periods and is on track to meet the third. However, it is not on track to meet the fourth and fifth budget. This has resulted in the December 2020 revised target (under the UK's Nationally Determined Contribution communication		preservation a large carbon stock and avoid its release to the atmosphere.	

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
to the UNFCCC[5]) to reduce economy-wide greenhouse gas emissions by at least 68% by 2030 (as opposed to 57%). The sixth carbon Budget[6] has new interim target of 78% reduction by 2035. The UK Net Zero Strategy sets out that the exact technology and energy mix in 2050 cannot be known now, and the path to net zero will respond to the innovation and adoption of new technologies over time. However, it is expected to rely on the following key green technologies and energy carriers, which interact to meet demand across sectors and to remain low carbon: • Electricity from low carbon generation and storage technologies meets higher demand for low carbon power in buildings, industry, transport, and agriculture; • Hydrogen can complement the electricity system, especially in harder to electrify areas like parts of industry and heating, and in heavier transport such as aviation and shipping. A range of low carbon production methods could be used; • Carbon capture usage and storage (CCUS) can capture CO_2 from power generation, hydrogen production, and industrial processes – storing it underground or using it. This technology also supports negative emissions from engineered			

[5] UNFCCC is the United Nations Framework Convention on Climate Change
[6] Sixth Carbon Budget - Climate Change Committee (theccc.org.uk)

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
greenhouse gas removals – bioenergy with carbon capture and storage (BECCS) and Direct Air Carbon Capture and Storage (DACCS); and • Biomass combined with CCUS can remove carbon from the atmosphere and support low carbon electricity and hydrogen generation. Biomass and other wastes can also support low carbon fuels for industry, buildings, and transport. Nature Based Solutions (NBS) are a means to achieve negative emissions by biological sequestration. Compared to technology-based solutions to climate challenges, NBS are often more cost-effective, longer lasting, and have multiple synergistic benefits including: reducing net emissions, expanding carbon sinks; providing habitats for biodiversity, benefiting human health and well-being, helping our society and economy adapt to climate change, and making more resilient and nicer places to live and work.			
Adaptation to a changing climate – England and Wales are already seeing the impact of climate change through increased severe weather events, leading to flooding, heat waves and hotter summers. There is a need for development to be climate change resilient The UK's Climate Projections show that the UK as a whole is likely to continue to experience hotter, drier summers, warmer, wetter winters and rising sea levels. This is likely to have a significant effect on a	**Declining** Climate change is recognised as a global concern with England and Wales, as with the rest of the UK, anticipated to experience hotter, drier summers; warmer, wetter winters; and rising sea levels.	The NPSs needs to recognise that changes in temperature and rainfall patterns, along with more frequent extreme weather events (for example leading to drought or flood), create the situation where a greater degree of resilience will have to be incorporated into energy infrastructure. The NPS should recognise the challenges that a changing climate will bring and aim to reduce the impacts. More frequent and	Maximise adaptation and resilience to climate change Enhance biodiversity, promote ecosystem resilience and

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
range of environmental conditions, including the water environment through lower and higher flows and heating of water bodies and there is an urgent need to develop climate resilience. Along with an increase in extreme weather events, it is anticipated that a changing climate will lead to an increase in risk to people and place. These increased risks include risks to health and well-being from increase in extremes of temperatures; risk to people, communities and buildings from flooding; risk to viability of coastal communities from sea level rise; risk to health and social care delivery from extreme weather and risk to health from changes in air quality. A changing climate is likely to result in increased frequency and intensity of severe weather events. At present, significant proportions of the UK population are at risk from flooding, although the degree of risk varies, with a range of factors affecting potential risk. Increased flooding and increased flood risk from surface water, rivers and the sea as well as coastal erosion are recognised as being some of the main potential threats from a changing climate due to potential direct risk to properties and infrastructure, as well as potential direct risk to human life and indirect risk to mental wellbeing. In addition, extreme weather events could include increased risk of higher summer temperatures, or severe cold spells. Across England and Wales, areas of potential flood risk from both rivers and coastal sources have been	These trends are anticipated to continue irrespective of interventions from outside the NPS.	extreme weather events leading to flooding as well as issues such as sea level rise and coastal change and erosion should be considered in any design – this would also include potential risks posed by increased heat, or more intense cold. The NPSs should seek to ensure that new development minimises any negative effects arising from flooding and avoids where possible areas of highest flood risk. Flood risk and coastal change can have significant impacts on species and sites and should be considered in any design. The implementation of multi-functional green-blue infrastructure including SuDS and other similar appropriate measures or new approaches should be considered and encouraged where feasible. This should include Natural Flood Management and other means of increasing flood storage capacity. There are multiple benefits associated with nature-based solutions such as tree planting or peat restoration, including climate change adaptations. Strategic policies present the opportunity to promote this as a means of delivering urban cooling, wildlife benefits, contributing to flood reduction and supporting carbon sequestration The NPSs should address the risks to the viability and diversity of terrestrial and	functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
identified and are noted in a series of flood hazard maps and flood management plans. Flood Zones 2 and 3 are located across England and Wales. Very significant numbers of properties are currently at flood risk – for example, in England alone this is in excess of 5.2 million properties.		freshwater habitats and species from multiple climate hazards. The NPSs should address the risks to natural carbon stores and sequestration from multiple hazards leading to increased emissions. The NPSs should address the risks to people and the economy from climate-related failure of the power system. The NPSs should address risks to soil health from increased flooding and drought. Recognition also needs to be made of health implications from a changing climate and the NPSs can drive a strategic response to health stressors associated with climate change.	
Air Quality – the United Kingdom experiences pockets of poor air quality, principally derived from concentrations of urban and industrial activity, major road infrastructure and congestion Air pollution affects public health, the natural environment and the economy. Air quality has improved in the UK over the last sixty years as a result of the switch from coal to gas and electricity for heating of domestic and industrial premises, stricter controls on industrial emissions, higher standards for the composition of fuel and	**Improving** At the national level air quality is generally improving as industrial practices, energy sources and tighter environmental legislation have contributed to reductions in pollutants. However, parts of England and Wales experience localised pockets of poor air	The NPSs should aim to protect and enhance air quality and should seek to ensure that reducing NO_2, $PM_{2.5}$ and PM_{10} emissions is a fundamental principle. The NPSs should aim to ensure that no AQMA is worsened, or proposed development does not lead to changes, particularly increases, in traffic / transport that could lead to the declaration of further AQMA. The NPSs should aim to exceed Government targets for air quality and be reflective of appropriate legislation, in particular any	Protect and enhance air quality Improve health and well-being and safety for all citizens and reduce inequalities in health

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
tighter regulations on emissions from motor vehicles. However, poor air quality – particularly from motor vehicles – remains a significant issue for community health and for biodiversity, especially in/downwind of urban areas and major transport networks. It is also to be noted that the use of solid fuels (including for 'lifestyle' fuel such as wood burners in homes) are recognised as being a major contributor to poor air quality in towns, particularly during winter months. Nevertheless, poor air quality is generally associated with urban/industrial areas and major road infrastructure and this is reflected in the typical location for Air Quality Management Areas (AQMA), many of which have been designated due to high NO2 and PM10 levels. Across England, there are a total of 532 AQMA, while within Wales there were 44, all principally in those areas of greatest population, or areas of particular road congestion and these have impacts both on human health and biodiversity in general and designated sites in particular. Approximately 85% of Sites of Special Scientific Interest (SSSI's) in England have nitrogen deposition rates above levels at which harm is expected (environmental thresholds), these exceedances will influence the ability of protected sites to reach favourable conservation status / favourable condition. An estimated 95% of nitrogen sensitive habitat is thought to be exceeding its critical load. Nitrogen emissions have been identified as a	quality – interventions outside the NPS will seek to address some of these issues, but opportunities exist for the NPS to influence this issue.	targets arising from the Environment Act 2021 and seek to deliver health benefits from improved air quality, as well as considering ecological receptors. Recognition should also be made of how new technologies can have air quality implications.	Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network

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significant pressure or threat to 62% of England's International (European) protected sites. The Environment Act 2021 stipulates air quality (PM2.5) as priority quality long term target.			
Water environment –pollutants from a range of sectors including energy pose considerable risks to the quality of water across England and Wales. Additional water demand from energy development would likely put further pressure on water resources. There are considerable pressures on water resources with resulting major impacts on many of the waterbodies across the UK. For the purposes of taking a holistic approach to management of water resources and to address the pressures on the water environment, under the Water Framework Directive (WFD), the UK has been divided into a series of River Basin Districts (RBD). As with most water bodies in England, there are a range of significant water management issues manifested across RBD, with pollution from infrastructure being of note. The mechanisms protecting the quality or quantity of water under the WFD also protect surface and groundwater bodies from which raw water for drinking water supplies is abstracted. There are a series of Drinking Water Safeguard Zone (DWSZ) across England and Wales.	**Stable / Improving** Surface water quality is predicted to remain stable; however, ongoing pressures remain and climate change may compromise improvements.	The NPSs should seek to prevent pollution of water bodies (including groundwater and bathing water) both during the construction and operation of any proposed energy development. This could be achieved via the appropriate use of SuDS, green infrastructure or other appropriate measures and new approaches in infrastructure drainage design to enhance water quality and reduce pollution and flood risk. Risk to all types of water bodies (not just main rivers) is to be considered during any development design. Recognition of the objectives of the WFD should be made and all opportunities to help meet the objectives of the WFD should be taken when possible. Green-blue Infrastructure should be considered in the NPS in the context of the aims of the WFD and how this can realise these, as well as other wider benefits and objectives. Without a coordinated approach to energy development and infrastructure there is increased potential for reduced water	Protect and enhance the water environment Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network

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The number of waterbodies assessed each year varies and has decreased from 10,761 in 2009 to 9,300 in 2018. There was a small decrease in the overall number of water bodies awarded high or good surface water status between 2009 and 2018. In 2018, 35% of surface water bodies assessed under the WFD in the UK were in high or good status. This reflects very little change from 36% of surface water bodies assessed in 2009 and 37% in 2013. It is anticipated that overall water quality will improve as the UK aims to ensure that the objectives of the WFD (all aquatic ecosystems and terrestrial ecosystems and wetlands to reach good chemical and ecological status by 2027). **The UK** also **has over 600 designated Bathing Waters designated under the Bathing Water Regulations 2013.** Under the WFD, there is a requirement for measures to promote use of water efficiently and in a way that can sustain future supplies. Climate change and a growing population will increase pressure on water resources and strategic approaches to managing such issues will need to be developed.		availability and water quality/pollution problems to result at water bodies, including contamination of drinking water, and effects on habitats.	
Soil and Agricultural Land – soil is a non-renewable resource and is vulnerable to erosion, degradation, development and contamination. There is a need to address this in order to enable	**Declining** Soils - Declining (non-sustainable soil management)	The NPS should seek to make best use of areas that are already urbanised (or subject to energy / industrial uses) and provide an	Protect soil resources, direct development away from

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beneficial re-use of previously developed land and help protect soil resources, in particular Best and Most Versatile Agricultural Land, from pressure for greenfield development Soil sealing (the covering of the soil surface with impervious material or the changing of its nature so that it becomes impermeable) and compactation are associated with development and is a primary cause of soil loss. This can also increased water runoff and flood risk. The surrounding soils need to be suitably managed to be able to allow excess water to drain through the soil profile, rather than overland flow. Many areas of land in the UK have also been contaminated by past industrial and other human activities, including former factories, storage depots and landfills. Energy related infrastructure is also a frequent source of land contamination. Land at the full range of potentially contaminated sites could be contaminated by a wide range of harmful substances such as oils and tars, heavy metals, asbestos and chemicals. While many special sites of contamination have been identified, by its nature, it is often very difficult to know where land has been contaminated previously or is currently suffering ongoing contamination. As such the number of known sites of contamination is likely to be only a very small fraction of the overall number of potentially contaminated sites. Given the present and historic levels of industrial, commercial and transportation	Agricultural Land - Declining (increasing pressures on greenfield land)	opportunity for regeneration / improvements to land quality. Measures should be taken to avoid land take /loss of BMV land land and to protect soil generally through avoidance of impacts such as contamination, loss, mixing, compactation or sealing of soils. The NPSs must recognise that soils and agricultural land are effectively finite in amount and declining in extent so land take is an important consideration. Whilst mitigation against the permanent loss of BMV land is extremely difficult, minimising the loss, securing the beneficial re-use of the displaced soils, and suitable management of remaining soils (through the Defra Construction code of Practice for the Sustainable Use of Soils on Construction Sites), can help mitigate the loss or damage of the finite soil resource. The NPSs must protect soils as they are essential natural capital and perform a range of important ecosystem services and functions. Changing precipitation patterns due to climate change will require soils to provide additional resilience to flooding and this will require appropriate management and land use. Dealing with the past pollution / contamination legacy is a major issue and should be	greenfield to brownfield, avoid development on BMV land and avoid land contamination

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activity across England and Wales, in addition to the high levels of urbanisation, it is suggested that the number of areas of contaminated land could be considerable. Agricultural land across England and Wales is graded, with those considered Best and Most Versatile (BMV) being noted as Grade 1, 2 and 3a. BMV soils are under pressure in many areas from development in order to support market led growth aspirations. The development of greenfield sites can lead to loss to valuable agricultural land which generally cannot be mitigated. Climate change could directly affect many soils properties including drainage, soil moisture content, nutrient cycle rates, carbon sequestration and emission rates and changes in soil leaching, erosion, and runoff. It could also affect soil biodiversity, and stability through clay shrinking.		addressed at all opportunities due to its ongoing environmental impact. Note that the sub-surface is an increasingly used source of energy and there are further opportunities though there may be implications for issues such as the water environment.	
Cultural Heritage – there is a substantial cultural heritage resource across England and Wales; however, there is considerable variation in the condition and integrity of assets. There is a need for a strategic perspective that promotes contextual understanding and supports regeneration where this contributes to conservation and enhancement	**Stable/Declining** Designated heritage assets benefit from protection that will continue without the NPS. However, in the absence of a national level strategic plan there is a greater risk of	New energy related development may result in pressure on areas of importance for their cultural heritage and aesthetic quality. There is a requirement for development proposals to be carefully considered such that assets are preserved and enhanced – the NPS will need to respond to context such that preservation is pursued where appropriate, but pro-active management and redevelopment can be	Protect and enhance cultural heritage assets and their settings, and the wider historic environment

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Those cultural heritage assets of the greatest recognition in England and Wales are the 22 World Heritage Sites. These sites are recognised as having Outstanding Universal Value and the management plans note that this is to be understood, protected and sustained. In addition, there is also a very large number of Scheduled Monuments across England and Wales (in excess of 24,000), including a large number which are at particular risk of being lost through neglect, decay or deterioration. Similarly, there is a very significant number of listed buildings across England and Wales (in excess of 10,000) and many of these are at particular risk of being lost through neglect, decay or deterioration. Likewise, Conservation Areas are under increasing pressure from development, neglect, decay or deterioration. **There are over 1,600 Registered Historic Parks and Gardens within England and** over **400 sites on the Register of Parks and Gardens of Special Historic Interest in Wales** which require protection from development. In addition, Areas of Ancient Woodland, i.e. those areas that have been continuously wooded since at least 1600AD are scattered across England and Wales. These areas have a significant contribution to the cultural heritage of an area and are also of importance to biodiversity and landscape. Of course, by its nature, there are also a number of undesignated assets or unknown archaeological	uncoordinated and piecemeal energy development resulting in contributing to the successive erosion of the quantum and integrity of the nation's cultural heritage resource.	supported where this secures viable futures for cultural heritage resources that are currently threatened. Additional energy related development may be inappropriately located or designated to pose a risk to the cultural heritage assets as well as their setting. Without a co-ordinated strategic approach to development and infrastructure there is an increased potential for this risk to result. As well as those sites of the very highest value such as World Heritage Sites, similar potential impacts can be identified in respect of the range of Scheduled Monuments, Listed Buildings, Conservation Areas, Registered Parks and Gardens and locally listed cultural heritage assets. It is important to note that the nature of cultural heritage features means that not all are known at present; in particular, buried archaeological remains. As such, any energy related development should be as sensitively designed as possible to recognise and be sympathetic to the existing cultural character and quality and opportunities for improving assets and settings should be examined.	

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remains which could have national regional or local value. The importance of the protection of the historic environment is increasingly being recognised at a national and regional level, with the loss of heritage resources being difficult to mitigate. Development affects the historic environment through loss, damage or changes to setting for instance from visual intrusion, increased traffic, noise, or air pollution.			
Landscapes, Seascapes & Townscapes – there are marked contrasts in the quality, character and distinctiveness of landscapes and townscapes across England and Wales. There is a need to fully protect the highest quality areas, whilst driving best practice principles through all energy development to address poor landscape and townscape environments. There are a total of 13 National Parks within England and Wales. There are also 34 AONB's in England and 4 within Wales. In addition, there are a total of 46 Heritage Coasts around both England and Wales and 58 Registered Historic Landscapes in Wales. These are statutorily designated as our finest landscapes and there is a statutory duty on public bodies to 'have regard' to their statutory purposes. England and Wales have been divided into a series of National Character Areas, each with their own characteristics and then further sub-divided into a range of Landscape Character Areas.	**Improving** The most exceptional landscape and townscapes benefit from the highest level of protection through designations and statutory duty (the CROW Act and the Environment Act) that are unaffected by the NPS.. In general terms, modern design principles are promoting a renewed focus on the quality of design and this trend is likely to continue; however, without the NPS energy infrastructure	The NPSs should seek to conserve and enhance the natural beauty of national parks and AONBs, which is their shared statutory purpose. For land use planning the NPPF expresses this in terms of conserving and enhancing their 'landscape and scenic beauty'. Particular attention should be paid to these areas designated for their landscape value. This includes their landscape and seascape settings where intrusive development can affect the designated area and delivery of its statutory purpose. The character of the wider landscape and townscape should also be protected by ensuring that its integrity and valuable natural open space is not lost. Opportunities for landscape enhancement should be explored, e.g. through sympathetic design and enhancements to existing landscape improvement areas, as well as new planting opportunities associated with new	Conserve and enhance the natural beauty of protected of the landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity

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There are also significant areas designated as Green Belt, with "a fundamental aim to prevent urban sprawl by keeping land permanently open. This designation serves five main purposes of checking unrestricted sprawl in large built up areas; prevents neighbouring towns from merging; assists safeguarding the countryside from encroachment; preserves the setting and special character of historic towns and assists in regeneration, by encouraging the recycling of derelict and other urban land[7]. While there are areas of great beauty and tranquillity across England and Wales, it is also important to recognise that there are significant parts that are characterised by urban development, major infrastructure and other noise and visual intrusion (including light pollution). This is largely associated with the main urban areas. Nevertheless, there exists across England and Wales, significant elements of green infrastructure that includes for example, parks, open spaces, playing fields, woodlands and private gardens, as well as agricultural and upland areas. This, alongside 'blue infrastructure' of rivers, canals, streams and other water bodies can act in a multi-functional way across a range of issues by supporting, for example, biodiversity, carbon storage, natural drainage and flood storage and	development may lack strategic focus and direction, resulting in variable quality and some pressure on greenfield land.	energy development and be in keeping with the aims of the Nature Recovery Network. Increased energy development poses a serious risk to the special qualities of designated and other valued landscapes. Especially vulnerable are special qualities such as relative tranquillity and a sense of wildness or remoteness. As such, there is a need to protect those special qualities across many parts of England and Wales. Without a co-ordinated strategic approach to development and infrastructure degradation of the special qualities of our finest landscapes designated as AONBs and National Parks may be degraded or lost. The NPSs should also aim to ensure that energy developments and associated infrastructure avoid sensitive areas, in particular national Parks and AONBs, The NPSs set out criteria to help assess whether exceptional circumstances can be demonstrated to justify major energy related development within a national park or AONB. The NPSs should also respect particular landscape or townscape settings. Careful consideration should be given to design quality in both an urban and rural setting, promoting placemaking principles and	

[7] National Planning Policy Framework (2021)

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health and wellbeing. However, increased urbanisation and general development has acted to erode the connectivity of this green and blue infrastructure, resulting in a decrease in its integrity. The townscapes across England and Wales includes substantial cultural heritage assets. There are many areas benefitting from associated designations, which include World Heritage Sites, Conservation Areas and local listings (refer to the cultural heritage key issue description). In many areas, 20th and 21st century redevelopment and regeneration have introduced a juxtaposition of modern architecture with historic fabric, delivering distinctiveness within the townscape. However, there are also areas where the quality and integrity of townscape has been eroded by successive and often piecemeal regeneration activities and there is a need to promote enhanced design through all energy development proposals.		seeking to inject character and distinctiveness where possible and where this enhances the sense of place. Design, where possible, should respond positively to the local characteristics, including vernacular architecture when appropriate. Without a co-ordinated strategic approach to development and infrastructure, there is increased potential for planning decisions to lead to inappropriate development, which could produce a cumulatively damaging impact on a designated landscape or fragment existing networks of open space thereby reducing connectivity.	
Resources and Waste – growth continues to be associated with increased resource use and waste generation. There is an urgent need to reverse trends in order to move towards a circular economy where resource efficiency is maximised, and waste generation curbed. New energy development will impact on and interact with a wide range of resources such as energy (fuel) use, use of construction materials (aggregate, concrete, etc.), waste generation and disposal etc.	**Declining** Continued growth will contribute towards a trend of increased waste and resource use. Interventions outside the planning system are helping to shift towards greater efficiencies in resource use and	The NPSs should seek to reduce consumption of resources by energy generation and transmission infrastructure by applying the waste hierarchy and promoting the circular economy. Reducing the need for virgin construction materials, e.g. through encouraging the use of recycled or secondary materials will not only reduce consumption but will also reduce the need to transport construction materials to	Promote sustainable use of resources and prevent waste

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Construction will contribute to increases in the levels of waste generated if building materials are not efficiently used / reused. With more waste being produced, trip kilometres to transport such waste for disposal will result in greater transport trip generation and increased emissions of air pollutants or greenhouse gases. The UK generated 221.0 million tonnes of total waste in 2016, and it is estimated that 41.1 million tonnes of this was commercial and industrial (C&I) waste. In 2018, 26,411,000 tonnes of Waste from Households (WfH) were generated in the UK with an overall recycling rate of 45%. In England, the recycling rate was 44.7%, in Wales it was 54.1%. Around 14,644,000 tonnes of the UK's municipal waste went to landfill in 2018. Total UK commercial and industrial waste, comprising inert, non-hazardous arising which result from trade or businesses, was 43.9 million tonnes in 2018. Around 85% of this total was generated in England. Waste is produced during operation of certain energy generation (**e.g. soot, bio-catch from water cooling, dredging for HEP, end of life management for renewables and other infrastructure**).	adherence to the waste hierarchy, but underlying waste generation volumes are anticipated to increase cumulatively with population growth.	site and to transport construction waste off site. The NPSs should ensure that soil resources are treated as a finite resource rather than a waste product of development sites. The NPSs should address waste resulting from the operation and decommissioning of energy generation and distribution infrastructure. The NPSs can also help reduce the consumption of fossil fuels by the economy by helping to promote a shift to more sustainable forms of energy generation (including potentially using waste as a source of energy where it cannot be recycled or reused) and transport such as active modes like cycling and walking, as well as Low and Zero Emission Vehicles by helping to provide / enable the appropriate infrastructure in new development areas. The NPSs should look at the widest perspective of energy and developments should be assessed in the context of the whole energy supply chain, from cradle to grave, and in the long term. Where energy infrastructure involves the long term storage of waste (nuclear, carbon capture), the carbon and environmental costs of this should be	

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		assessed as integral to the energy infrastructure.	
Economic activity, opportunity and deprivation – there are marked spatial contrasts in economic activity and GVA by job across England and Wales and the challenge is to achieve more equitable access to opportunity as a means of tackling deprivation. The economy across the UK has been subject to challenging conditions in the immediate years leading up to 2023 due to impacts from COVID-19, 'Brexit', high rates of inflation and associated interest rate rises, as well as other major global uncertainties such as the duration and outcome of the war in Ukraine. As of January 2023, it remains uncertain as to how these will continue to impact in coming years. Main points from the ONS note that UK gross domestic product (GDP) is estimated to have increased by a record 16.0% in Quarter 3 (July to Sept) 2020, revised from the first estimate of 15.5% growth. Though this reflects some recovery of activity following the record contraction in Quarter 2 (Apr to June) 2020, the level of GDP in the UK is still 8.6% below where it was at the end of 2019, revised from an initial estimate of 9.7%. Compared with the same quarter a year ago, the UK economy fell by a revised 8.6%.	**Uncertain** The headline statistics generally show an upward trend in employment and GVA by job; and a falling trend in unemployment. However, there are clear spatial disparities between the value of jobs, which can be a proxy for the quality of job opportunities available. The impact of Covid-19 and other global factors on these trends is not yet readily apparent in data.	Without the strategic approach to energy development the required development and associated infrastructure is less likely to be provided to encourage investment in areas where highest numbers of residents can benefit from new employment opportunities. The NPS also offers the opportunity to help shape the spatial distribution of employment generation helping to overcome some traditional barriers to opportunities, such as accessibility. The pattern of deprivation across England and Wales is geographically complex, incorporating stark contrasts between wealthy and severely deprived communities. Without the strategic approach to energy development, opportunities to deliver development and infrastructure which can improve equitable and inclusive access to employment and increases in income of local people are less likely to be achieved.	Promote a strong economy with opportunities for local communities

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While output in the services, production and construction sectors increased by record amounts in Quarter 3 2020, the level of output remains below Quarter 4 (Oct to Dec) 2019 levels, before the impact of the coronavirus (COVID-19) pandemic was seen. There has been a recovery in private consumption, government consumption and, to a lesser extent, business investment in Quarter 3 2020 in line with the easing of public health restrictions, however, the levels remain below their pre-lockdown level. As of October 2022, the unemployment rate in England was 3.7%, while it was 3.4% in Wales. Economic activity in the same period was 78.8% in England and 74.8% in Wales. These issues will undoubtedly play a major role in deprivation and economic outcomes for all parts of England and Wales, with those areas of current deprivation most likely to have the worst economic recovery and future outcome. The Indices of Multiple Deprivation show that the majority of the most deprived areas in the UK are located within urban centres of population. The south east, south west and east of England are the least deprived areas in the UK. Deprivation increases in urban areas, with towns and cities generally being more deprived that rural areas. The north west and north east are the most deprived areas of England. Middlesbrough, Knowsley, Kingston upon Hull, Liverpool and Manchester are			

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the five local authority districts with the largest proportions of highly deprived neighbourhoods in England. The south east and north east coast are the most deprived areas in Wales. Deprivation is most concentrated in the south east, around the urban areas of Cardiff, Newport, Swansea and Bridgend. The smaller towns within the valleys of the south east, such as Caerphilly and Merthyr Tydfil are similarly deprived. Comparatively the rural areas of Wales are considerably less deprived. These areas have relatively lower income, less access to services, higher unemployment and increased crime rates. There has been little variance in the locations of the most deprived areas of the UK over the last 20 years, with certain areas being in a state of persistent deprivation. It is important to note that there are also pockets of deprivation surrounded by less deprived places in every region of England. These areas have relatively poorer health and well-being in comparison as those classed as less deprived.			
Population growth and demographics – England and Wales have a growing population, with a general underlying trend towards an ageing population, though there are areas with younger population profiles. These demographic characteristics contribute to a complex pattern of highly-contrasting communities, with differing	**Increasing** Population growth is projected to continue to increase across the UK and the overall trend is towards an ageing population.	Both England and Wales (along with the UK as a whole) are expected to see population growth in the coming years, with the proportion of residents of an older age. This growth will be uneven across the country, with a focus on larger urban areas most likely in relation to population growth (though the	Promote a strong economy with opportunities for local communities

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requirements for economic and social infrastructure. The population of England in mid-2021 was 56,536,419 which accounts for 84% of the UK's population. The population of Wales in mid-2021 was 3,105,410 which accounts for 5% of the UK's population. Over the year to mid-2019, decreasing numbers of births and net international migration have resulted in the slowest rate of growth that the UK has seen in 15 years, returning it to the level seen in mid-2004 at 0.5% (361,000). Despite population growth slowing, this was the 37th consecutive year (since 1982) that the total UK population has increased It is also anticipated that the population profile will age, though all age groups will increase in numbers. Local authorities with the highest proportions of older people in the UK are most commonly found in coastal areas of southern and eastern England. The population of the UK is spread unevenly, with the population density ranging from 5,700 people per square kilometre across London to fewer than 50 people per square kilometre in the most rural local authorities of the UK. The south east of England, in particular London and the surrounding areas are highly populated. Large urban areas are located along the south coast, including Brighton, Southampton, Portsmouth and Bournemouth. The midlands and north west are also		move to home working induced by COVID-19 may have implications for smaller towns, villages and rural areas). Smaller villages and rural areas may experience an increasingly older demographic (as would less deprived areas), though again, the implications of COVID-19 are unclear in this regard.	

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locations of large urban areas, including Birmingham, Leicester, Nottingham, Greater Manchester and Liverpool. The east, north east and south west of England contain fewer major settlements, however large urban areas are located in these regions, including Newcastle, Sunderland, Leeds and Bristol. The most populated area of Wales is the south coast, where the large urban areas of Cardiff, Newport, Bridgend and Swansea are located. The north coast has fewer major urban settlements, however areas of population are present in Rhyl, Colwyn Bay and Bangor. Central and western Wales have smaller towns and villages distributed throughout the regions.			
Communities: Supporting Physical Infrastructure – infrastructure investment is delivered by a range of providers across the United Kingdom and can often be reactive. Significant new infrastructure, or upgrades to existing infrastructure is planned across a range of sectors. The strategic rail network in England is well developed. All major cities are connected as are the majority of significant towns. Extensive rail networks are located around large conurbations such as London and Greater Manchester, with the major cities in the midlands being well connected. Remote,	**Improving** There are various infrastructure investment plans and programmes being developed and implemented and these should continue to enhance the supporting transport, utilities and digital infrastructure to support growth levels.	There is a role for the NPS in promoting infrastructure provision in a co-ordinated and pro-active manner, delivering the means to catalyse, rather than react to demands for growth. The NPS should seek to ensure that energy development provides opportunities for utilisation of electric vehicles, as well as access to more sustainable transport modes.	Promote sustainable transport and minimise detrimental impacts on strategic transport network and disruption to basic services and infrastructure

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rural and coastal areas are less well served by rail. Both the north and south coast of Wales are well connected by rail, linking the major coastal cities such as Cardiff and Swansea in the south, and Llandudno, Bangor and Holyhead in the north. Few major branch lines extend from these links, and the central and western regions of Wales are comparatively poorly severed by rail. England is covered by a comprehensive network of motorways and A roads. All major cities are served by motorways, whilst towns and larger villages are connected by A routes. Areas not serviced by these connections are generally rural and in areas of low population. The south and north coast of Wales are the only areas with motorway connections. The remaining regions are serviced by the A road network which links the major towns and villages. Comparatively the central and upland regions are less provisioned with strategic network links. There is a well-established electricity generation and distribution network across both England and Wales, which is being increasingly utilised for an expanding EV charging network. As would be expected, greatest provision of electricity network capacity is to the more urbanised areas. This network is increasingly supplied by renewable sources. As would be expected, there is significant wastewater infrastructure across the area, though, as with other areas there are legacy and capacity			Promote a strong economy with opportunities for local communities

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issues with some elements. For example, many areas still have both a combined and separate sewer systems for collecting all wastewater and sewage and under heavy storm conditions, the sewer capacity can be exceeded. Consequently, these areas have above average risk for sewer incapacity and also has several frequent spilling storm overflows. Provision of gas networks is variable across the country. Across the United Kingdom, the areas with ultrafast broadband connectivity are mainly located in urban residential areas, though it should be noted that there are pockets within many urban areas where only standard broadband is available.			
Communities: Physical Health and mental wellbeing – in general terms there are significant differences in measures of good physical and mental health as well as life expectancy across England and Wales, many indicators reflecting the spatial distributions of economic activity and income, age, deprivation, race and similar - there is a need to tackle spatial inequalities in health regards. There is also a growing appreciation of the importance of supporting good mental health and generating a sense of well-being as a means of promoting healthy communities. There is a role for the environment in enabling people to	**Stable / Uncertain** While population levels are likely to continue to rise, there is uncertainty over migration levels due to a lack of clarity on issues such as 'Brexit', COVID-19 and general global economic uncertainty. These factors will all have major implications for health outcomes for the wider	Indirectly, health and wellbeing levels could be improved through secondary effects of policies that help to create healthy environments. This involves the protection of existing and creation of new open spaces, contributing to a strengthened multi-functional green infrastructure network; and policy approaches designed to reduce air pollution, decreasing noise pollution and reducing traffic congestion. Good design principles can combine with broader green infrastructure as key factors in fostering active travel, recreation and healthy lifestyles.	Improve health and well-being and safety for all citizens and reduce inequalities in health

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
feel connected to place; and growing evidence that physical activity and access to nature and opportunities for community interaction is an important contributor to mental health and well-being. **Mental well-being in adults aged 16 and over on average ranked 24.3 out of 35 in 2018/2019. This represents a deterioration over the short and long term. This varies across the UK as follows:** • **England – 24.3 out of 35** • **Wales – 23.9 out of 35** • **Scotland – 24.4 out of 35** • **Northern Ireland – 25.1 out of 35** **In April to June 2022, 33.1% of adults aged 16 and over rated how worthwhile they feel the things they do in life are as very high. This represents no change from the previous year but a deterioration since the same period in 2017. This varies across the UK as follows:** • **England – 33.0%** • **Wales – 29.3%** • **Scotland – 32.8%** • **Northern Ireland – 42.2%** **In April to June 2022, 32.3% of adults aged 16 and over rated their happiness yesterday as very high. This represents no change from the previous year but a deterioration since the same**	population but particularly for those in more deprived or vulnerable groups. Population profiles are also likely to continue to get older – this will likely result in changes to overall health outcomes with an increased number of long-term conditions and place an increasing burden on health provision and facilities.	The NPS should seek to ensure continued open access to land and provision of quality greenspace along with improvement of the physical environment in general. Ensuring continued or enhanced access to employment, educational, recreational / leisure and health services and facilities, along with adequate provision, should also be a priority. Improved walking and cycling facilities, along with open spaces and outdoor recreational facilities are vital to ensuring people have opportunities to undertake informal and formal physical activity outdoors in a safe manner. This will help to increase physical activity levels and improve general health and wellbeing. The NPS needs to ensure that energy developments are safe, both in terms of crime as well as accidents and engender a perception of safety.	

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
period in 2017. This varies across the UK as follows: • **England – 32.2%** • **Wales – 32.8%** • **Scotland – 31.7%** • **Northern Ireland – 34.9%** **In April to June 2022, 26.0% of adults in the UK rated their life satisfaction as very high. This represents no change from the previous year but a deterioration since the same period in 2017.** **In April 2020 to March 2021, it was reported that 6.47% people in England felt lonely often or always. Data was not available for the other regions within the UK.[8]** The labour market shocks associated with the coronavirus pandemic have been felt more by young people and the lowest paid; people aged under 30 years and those with household incomes under £10,000 were around 35% and 60%, respectively, more likely to be furloughed than the general population. Measurements of health and well-being as a result of the coronavirus pandemic are still to be confirmed and indications of mental health issues such as anxiety are being preliminarily explored. The reliability of such data is unknown at this stage.			

[8] Office for National Statistics (2022) *Measures of National Well-being Dashboard: Quality of Life in the UK.* Available: https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/measuresofnationalwellbeingdashboardqualityoflifeintheuk/2022-08-12

Key Issues and summary of baseline situation/information	Summary of likely evolution of the baseline without the Energy NPS (direction of condition trend)	Implications and Opportunities identified for the Energy National Policy Statement	AoS Objective
Crime across England shows regional variations, with the South West (particularly those rural parts) having the lowest rate of crime in 2018/19 (67.8 per 1000 people, as opposed to 110.3 per 1000 people in the north east). The level of crime has been broadly stable in recent years however, the latest figures from the Crime Survey for England and Wales for the year ending June 2022 estimate a significant 8% reduction compared with the year ending March 2020. Underlying this were significant falls in theft (19%), burglary (28%), computer misuse (27%), robbery (23%) and vehicle offences (19%) and almost all other crime types saw non-significant falls. However, while the most recent crime rate appears to be falling, it is unclear to what extent Covid-19 is impacting crime rates.			

4.3: Appraisal Objectives and Guide Questions (AoS Framework)

The establishment of appropriate objectives and guide questions is central to the appraisal process and provides a method to enable the consistent and systematic assessment of the effects of the NPSs. The appraisal objectives described in this section have been informed by: the examination of the baseline evidence, incorporating the identification of key issues; the review of plans and programmes; and comments received during the consultation on the Scoping Report (see Appendix B). Their development also reflects national guidance on SEA and SA practice. Broadly, the objectives present the preferred social, economic or environmental outcome which typically involves minimising detrimental effects and enhancing positive effects where relevant. Guide questions were also developed for each of the objectives to illustrate its relevance to energy infrastructure development and give more detail and focus to the appraisal process. The questions asked explore direct, indirect as well as cumulative and synergistic effects where appropriate for the different technologies.

Table 4-5 sets out the final AoS Framework taking into account relevant comments received from various organisations during public consultation.

Table 4-5 - AoS Objectives and Guide Questions

No	AoS Objective	Guide Questions
1	Consistent with the national target of reducing carbon emissions to Net Zero by 2050	Will the NPS… • Reduce carbon emissions of the national portfolio of major energy infrastructure consistent with the contribution share of the energy sector to the carbon budgets and Net Zero targets? • Reduce direct and indirect emissions of all greenhouse gases, including carbon dioxide, during construction, operation and decommissioning? • Maximise supply of energy from low carbon/renewable energy sources / use of low carbon/renewable energy? • Maximise opportunities for making use of waste heat? • Use carbon removals to offset residual emissions from energy such as Bioenergy with Carbon Capture & Storage (BECCS) and Nature Based Solutions? • Create new carbon sinks/removals through natural sequestration including that by natural habitats, green-blue Infrastructure and soils?
2	Maximise adaptation and resilience to climate change* *Adaptation is about taking the necessary	Will the NPS… • Require energy infrastructure that is resilient and adapted over its lifetime to the risks of climate change including: - increased river, surface and groundwater flooding due to extreme winter rainfall events and increase in winter mean rainfall? - increased coastal flooding and erosion damage due to sea level rise and storms? • Manage the risks associated with flooding over the energy infrastructure's lifetime, without increasing the flood risk elsewhere and

	steps to address the risks of climate change now and in the future. Resilience is the ability of a system to adsorb and bounce back after an adverse event now and in the future. *Note that the risks of climate change to other built and natural infrastructure and assets are dealt with under AoS Objectives 3, 7 and 9.*	identifying opportunities to reduce the risk overall, including through working with nature based solutions? • Avoid development in areas likely to be affected by coastal erosion or where this is not possible ensure that coastal change can be managed throughout the lifetime of the energy infrastructure? • Manage the risks associated to periods of limited water availability over the lifetime of the energy infrastructure? • Manage the risks associated with storms, heatwaves and wildfires over the lifetime of the energy infrastructure? • Contribute to the adaptation of nature to a changing climate? • Take advantage of the role and opportunity of nature based solutions to mitigate and adapt to climate change?
3	Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	Will the NPS… • Protect and enhance nationally designated sites such as SSSIs, National Nature Reserves, Heritage Coasts and Marine Conservation Zones, including those of potential or candidate designation? • Protect and enhance valued habitat and populations of protected/scarce species on locally designated sites, including Key Wildlife Sites, Local Wildlife Sites and Local Nature Reserves? • Prevent development on irreplaceable habitats, such as ancient woodland and ancient and veteran trees except in exceptional circumstances and with appropriate compensation measures? • Protect and enhance the Nature Recovery Network? • Protect and enhance priority habitats, and the habitat of priority species? • Promote new habitat creation or restoration and linkages with existing habitats? • Reduce or avoid impacts to habitats with important roles in carbon sequestration? • Increase the resilience of biodiversity to the potential effects of climate change? • Encourage sensitive or nature inclusive design in terrestrial and marine environments? • Ensure energy activities protect fish stocks and marine mammals?

		• Ensure energy activities do not exacerbate disturbance to bird populations? • Promote Biodiversity Net Gain for any new major infrastructure development in England using latest Defra metric? • Promote Net Benefit for Biodiversity for any new major infrastructure development in Wales? • Contribute to meeting relevant statutory targets in the Environment Act? • Prevent spread of invasive species (native and non-native), including new invasive species because of climate change?
4	Protect and enhance sites designated for their international importance for nature conservation purposes (linked to separate HRA process for Energy NPS)	Will the NPS… • Avoid the loss of sites of international importance (SPAs, SACs and Ramsar sites), including those of potential designation (candidate SPAs, proposed SACs, Sites of Community Importance (SCI) and proposed Ramsar sites) both onshore and offshore? • Support continued improvements to the condition status of the UK's national site network?
5	Protect and enhance cultural heritage assets and their settings, and the wider historic environment	Will the NPS… • Conserve and enhance designated heritage assets and their settings (World Heritage Sites, Scheduled Monuments, Listed Buildings and structures, Registered Parks and Gardens, Registered Historic Landscapes, Heritage Coasts, Registered Battlefields and Conservation Areas), as well as maritime assets such as Protected Wrecks? • Conserve and enhance non-designated and / or locally listed heritage assets (including newly discovered heritage assets and archaeology) and their settings? • Avoid significant harm to heritage assets, for example from the generation of noise, pollutants and visual intrusion? • Ensure appropriate archaeological assessment prior to development? • Maintain or improve the interpretation, understanding and appreciation of the historic environment?
6	Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	Will the NPS… • Support the integrity and uphold the statutory purposes of any areas designated for landscape value ie, National Parks and AONBs, including in conjunction with the provisions of any relevant Management Plan? • Maintain the character of those stretches of coastline identified and locally 'designated' as Heritage Coasts? • Conserve and enhance the intrinsic character or setting of designated landscapes, townscapes and seascapes? • Conserve, protect and enhance natural environmental assets (e.g. parks and green spaces, common land, woodland / forests etc) as they contribute to landscape and townscape quality?

		• Support measures to enhance the resilience of ecosystems at a landscape scale and also to maximise benefits including public access and enjoyment of landscapes? • Support functional landscapes e.g. those which reduce flood risk, sequester carbon or offer recreational opportunities in peri urban areas? • Minimise noise and light pollution from construction and operational activities on residential amenity and on sensitive locations, receptors and views?
7	Protect and enhance the water environment	Will the NPS… • Protect ground, surface, estuarine and coastal water quality, including during periods of increased summer temperatures due to climate change? • Safeguard the availability of water resources (surface and groundwater), including during periods of increased summer temperatures due to climate change? • Minimise the use of water resources / water consumption? • Protect the integrity of coastal and estuarine processes? • Reduce operational and accidental discharges to the water environment? • Protect the quality of the seabed and its sediments, and avoids significant effects on seabed morphology and sediment transport processes? • Support measures to attain good environmental status of both marine and coastal/estuarine waters as determined by the WFD and MSFD? • Contribute to meeting relevant statutory targets in the Environment Act 2021?
8	Protect and enhance air quality	Will the NPS… • Minimise emissions of dust and other air pollutants that affect human health or biodiversity? • Improve air quality within AQMAs and avoid the need for new AQMAs? • Promote enhancements to green infrastructure networks to help improve air quality? • Contribute to meeting relevant statutory targets in the Environment Act 2021?
9	Protect soil resources and avoid land contamination	Will the NPS… • Assist in facilitating the re-use of previously developed land? • Avoid the loss of Best and Most Versatile agricultural land? • Protect soil resources and ensure their sustainable use and management? • Seek to remediate contaminated land? • Increase the resilience of soils to the potential effects of climate change through minimising erosion and pollution and promoting good water management to keep soil moisture in balance?

10	Protect, enhance and promote geodiversity	Will the NPS… • Protect and enhance geodiversity resource? • Protect or enhance SSSIs designated for their geological interest? • Avoid the degradation and removal, wherever possible, of RIGS? • Support access to, interpretation and understanding of geodiversity?
11	Improve health and well-being and safety for all citizens and reduce inequalities in health	Will the NPS… • Protect the health of communities through prevention of accidental pollutant discharges, exposure to electric and magnetic fields, shadow flicker or radiation? • Minimise nuisance on communities and their facilities including air, noise and light pollution? • Provide for facilities that can promote more social interaction and a more active lifestyle and enjoyment of the countryside and coasts? • Promote initiatives that enhance safety and personal security for all? • Promote Access to Greenspace and Green Infrastructure Standards? • Support enhanced security, reliability and affordability of the national energy supply?
12	Promote sustainable transport and minimise detrimental impacts on strategic transport network and disruption to basic services and infrastructure	Will the NPS… • Prevent adverse changes to strategic transport infrastructure road/rail/airport? • Prevent loss or disruption to basic services and infrastructure (e.g. electricity, gas)? • Promote transportation of goods and people by low/zero carbon transport modes? • Reduce travel distances to work and reduce the need for out commuting? • Facilitate working from home, remote working and home-based businesses?
13	Promote a strong economy with opportunities for local communities	Will the NPS … • Support enhanced security, reliability and affordability of the national energy supply? • Support creation of both temporary and permanent jobs and increase skills, particularly in areas of need? • Have wider socio-economic effects such as changes to the demographics, community services or house prices?
14	Promote sustainable use of resources and natural assets	Will the NPS… • Reduce consumption of materials, energy and resources during construction, operation and decommissioning of energy infrastructure? • Promote sustainable waste management practices in line with the waste hierarchy? • Encourage the use of recycled and / or secondary materials? • Promote the use of low carbon materials and technologies?

		• Produce waste by-products that require appropriate management? • Provide for safe and secure interim storage of waste, where necessary? • Promote the use of local suppliers that use sustainably-sourced and locally produced materials? • Support enhanced security, reliability and affordability of the national energy supply?

5: Assessment for Overarching NPS for Energy EN-1 (AoS-1)

5.1: Introduction

The findings of the AoS of the draft Overarching Energy NPS (EN-1) are set out in this section of the report and address each of the AoS Objectives in turn. Many issues and effects for sustainability are cross-cutting and effects are reported where they are most relevant to avoid duplication of appraisal. Inter- relationships between topics and likely significant secondary, synergistic and cumulative effects are also reported where appropriate in each topic. Where significant adverse effects were predicted, possibilities for mitigation were suggested.

Recommendations for clarifying and strengthening of the NPS were discussed with DESNZ in an iterative fashion and the following sets out the assessment of the NPS as published for public consultation.

Technology specific sustainability effects are reported in detail in AoSs 2-5 (Sections 6 to 9 in this report); appraisal findings reported here relate to likely generic effects and the overall effects for the Overarching NPS (EN-1).

The AoS has been undertaken with consideration of the mitigation hierarchy to avoid harm in the first instance. Where this is not possible, then mitigation and enhancement are applied, followed by compensation where required. Note that for all assessments there is uncertainty as to the precise level of effect as this will be dependent upon the precise nature of the energy infrastructure and the area (or alternative areas) within which it could be located.

It should be borne in mind that EN-1 makes clear that in exceptional circumstances the Secretary of State may still grant development consent where the public benefits of such development can be demonstrated to clearly outweigh any significant impacts and this is likely to result in significant residual adverse effects across the sustainability themes, in particular those related to the protection of the environment. Such exceptional residual significant adverse effects are not reflected in this AoS.

The process of assessment has been undertaken in three steps, by first identifying the anticipated effects of the technologies set out in EN-1; then how the NPS addresses the effects, with reference to the relevant text from EN-1 how it is considered that the NPS addresses the issues identified under each AoS Objective and then conclusions of the assessment are made. As the assessments took place in an iterative fashion, recommendations made in earlier stages of the AoS have been addressed or embedded in the NPS text.

5.2: AoS Objective 1: Consistent with the national target of reducing carbon emissions to Net Zero by 2050

5.2.1: Anticipated Effects

National policy for the development of new energy infrastructure has the potential to generate substantial GHG emissions. In preparing such policy, there will be a need to ensure that GHG emissions are reduced significantly and that Net Zero is achieved through the promotion of low carbon and renewable generation as a core component of development ambitions alongside development of carbon capture usage and storage for combustion plants and negative emissions removals, both technological and nature-based.

National policy for the development of infrastructure should ensure that opportunities are taken for maximising tree cover and peatland restoration, where practical. Amongst other benefits, careful site location and species selection in new woodland can contribute to carbon sequestration by absorbing increased amounts of CO_2 from the atmosphere. Restoration of peatland in unfavourable condition will allow the preservation a large carbon stock and avoid its release to the atmosphere.

5.2.2: Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 1.

Reduce carbon emissions of the national portfolio of major energy infrastructure consistent with the contribution share of the energy sector to the carbon budgets and Net Zero targets

EN-1 Part 2 recognises that there is an urgent need for different energy technologies to meet the decarbonisation target of net zero (100% reduction) by 2050 and the interim Government targets of reducing GHG emissions by 68% by 2030 and 78% by 2035 compared to 1990 levels.

To help meet these targets, EN-1 Part 3 excludes highly carbon intensive new coal and large scale oil-fired electricity generation from the need case as they are not consistent with the transition to net zero.

EN-1 Part 3 then establishes the urgent need for the following type of energy infrastructure: Offshore Wind (including floating wind), Solar PV, Wave, Tidal Range, Tidal Stream, Pumped Hydro, Energy from Waste (including Advance Conversion Technologies) with or without Carbon Capture and Storage (CCS), Biomass with or without CCS, Natural Gas with or without CCS, Low carbon Hydrogen, Large-scale nuclear, Small Modular Reactors, Advanced Modular Reactors, and Fusion Power Plants.

EN-1 Part 3 acknowledges that unabated natural gas for heat and electricity, and crude oil to provide fuels for transport will still be needed during the transition to a Net Zero economy and that some residual unabated fossil fuels may even be needed beyond 2050. It notes that this can be consistent with the Net Zero target if the emissions from their use are balanced by negative emissions from Greenhouse Gas Removal technologies.

The AoS concludes that that mix of energy technologies set out in EN-1 will likely deliver a significant reduction in GHG emissions and contribute its fair share of reductions to the carbon budgets and Net Zero targets.

Maximise supply of energy from low carbon/renewable energy sources / use of low carbon/renewable energy

Most of the energy infrastructure promoted in EN-1 Part 3 will produce low carbon/renewable energy: energy from waste with CSS, biomass with CCS, blue hydrogen (from natural gas with CCS), zero carbon energy (nuclear) and renewable energy (offshore wind, solar PV, wave, tidal Range, tidal Stream, pumped hydro, green hydrogen from renewables).

The exceptions are natural gas without CCS, energy from waste without CCS and biomass without CCS which would result in higher carbon intensity energy due to continuing unabated carbon emissions to the atmosphere. CCS is not required from the outset for any of these three technologies thus allowing for the development of unabated energy generation plant if they are capable of being retrofitted with CCS at a later stage.

EN-1 Part 3 allows for new combustion plant (natural gas and biomass) which are of generating capacity at or over 300MW and of a type covered by The Carbon Capture Readiness (Electricity Generating Stations) Regulations 2013, to be consented without CCS provided it can be demonstrated that the plant is "Carbon Capture Ready" (CCR) and sets out the planning application conditions such type of infrastructure will need to fulfil as follows:

Applicants will need to demonstrate that their proposal complies with guidance issued by the Secretary of State in November 2009 or any successor to it regarding CCR. The guidance requires:

1. that sufficient space is available on or near the site to accommodate carbon capture equipment in the future;
2. the technical feasibility of retrofitting their chosen carbon capture technology;
3. that a suitable area of deep geological storage offshore exists for the storage of captured CO_2 from the proposed power station;
4. the technical feasibility of transporting the captured CO_2 to the proposed storage area; and
5. the likelihood that it will be economically feasible within the power station's lifetime, to link it to a full CCS chain, covering retrofitting of capture equipment, transport and storage.

Applicants should conduct a single economic assessment which encompasses retrofitting of capture equipment, CO2 transport and the storage of CO2. Applicants should provide evidence of reasonable scenarios, taking into account the cost of the capture technology and transport option chosen for the technical CCR assessments and the estimated costs of CO2 storage, which make operational CCS economically feasible for the proposed development.

The Secretary of State should consult the EA or NRW on the technical and economic feasibility assessments. The Secretary of State should also have regard to advice from the EA or NRW as to the suitability of the space set aside on or near the site for CCS equipment. If the Secretary of State, having considered these assessments and other available information including comments by EA or NRW, concludes that it will not be technically and economically feasible to retrofit CCS to a proposed plant during its expected lifetime, then the proposed development cannot be judged to be CCR and therefore cannot receive consent.

If granted consent, operators of the power station will be required to:

- retain control over sufficient additional space on or near the site on which to install the carbon capture equipment and the ability to use it for that purpose
- submit update reports on the technical aspects of its CCR status to the Secretary of State for DESNZ. These reports will be required within 3 months of the commercial operation date of the power station (so avoiding any burden on the operator with an unimplemented consent) and every two years thereafter. Should CCS equipment be retrofitted to the full capacity of the plant, the obligation to provide such reports will lapse

CCR requirements do not apply to Energy from Waste plant, however. It is noted that carbon emissions from Energy from Waste (EfW) plants in the UK already exceed the cement and chemical industries and are almost on a par with emissions from refining iron and steel[9]. That figure is set to nearly double based on new EfW plants in construction or development.

[9] Can Energy from Waste drive CCS Energy? - Energy Systems Catapult

Fitting these plants with CCS, or as minimum making sure that any new such plant is CCR, would support economy-wide decarbonisation.

Further discussion of the potential impacts on GHG emissions regarding unabated Natural Gas and Biomass and Waste to Energy is provided in AoS-2 for the Natural Gas Infrastructure NPS (see Section 6) and AoS-3 for the Renewable Infrastructure NPS (see Section 7).

The AoS concludes that allowing new combustion plant to be built without CCS in EN-1 is likely to lead to negative effects in terms of increased GHG emissions in the short to medium term, until such plant is retrofitted with CCS.

Maximise opportunities for making use of waste heat?

Combined Heat and Power (CHP) is the generation of usable heat and electricity in a single process. A CHP station may either supply steam direct to customers or capture waste heat for low-pressure steam, hot water, or space heating purposes after it has been used to drive electricity generating turbines. The heat can also be used to drive absorption chillers, thereby providing cooling.

The Government's strategy for CHP is described in EN-1 Part 3. It notes in developing proposals for new thermal generating stations, developers should consider both the current and future opportunities for CHP from the very earliest point and it should be adopted as a criterion when considering locations for a project.

Applicants are required either to include CHP or present evidence in the application that the possibilities for CHP have been fully explored. It is noted that if an application does not demonstrate that CHP has been considered the Secretary of State should seek further information from the applicant. The Secretary of State should not give development consent unless satisfied that the applicant has provided appropriate evidence that CHP is included or that the opportunities for CHP have been fully explored

For non-CHP generations stations, where there is reason to believe that opportunities to supply heat through CHP may arise in the future, the Secretary of State may also require that developers ensure that their stations are 'CHP ready' and are designed in order to allow heat supply at a later date.

EN-1 notes that CHP may require additional space than for a non-CHP generating station. It is possible that this might conflict with space required for a generating station to be CCR. The material provided by applicants should therefore explain how the development can both be ready to provide CHP in the future and also be CCR or set out any constraints (for example space restrictions) which would prevent this.

The AoS concludes that the requirements for installation of CHP as set in EN-1 are strong and likely to lead to maximisation of opportunities in the short, medium and long term.

Reduce direct and indirect emissions of all greenhouse gases, including carbon dioxide, during construction, operation and decommissioning?

EN-1 sets out in Part 5 that the construction, operation and decommissioning of energy infrastructure will in itself lead to GHG emissions and that, while all steps should be taken to reduce and mitigate climate change impacts, it is accepted that there will be residual emissions from energy infrastructure, particularly during the economy wide transition to net zero, and potentially beyond.

EN-1 Part 5 requires that all proposals for energy infrastructure projects should include a GHG assessment as part of their Environmental Statement. This should include:

- A whole life GHG assessment showing construction, operational and decommissioning carbon impacts;
- An explanation of the steps that have been taken to drive down the climate change impacts at each of those stages;
- Measurement of embodied GHG impact from the construction stage;
- How reduction in energy demand and consumption during operation has been prioritised in comparison with other measures;
- How operational emissions have been reduced as much as possible through the application of best available technology for that type of technology;
- Calculation of operational energy consumption and associated GHG emissions;
- Whether and how any residual GHG emissions will be (voluntarily) offset or removed using a recognised framework; and
- Where there are residual emissions, the level of emissions and the impact of those on national and international efforts to limit climate change, both alone and where relevant in combination with other developments at a regional or national level, or sector level, if sectoral targets are developed.

EN-1 Part 5 also notes that the Secretary of State must be satisfied that the applicant has, as far as possible, assessed the GHG emissions of all stages of the development. Planning applications for new energy infrastructure should look for opportunities within the proposed development to embed nature-based or technological solutions to mitigate or offset the emissions of construction and decommissioning, but not of operational emissions. Steps taken to minimise and offset construction and decommissioning emissions should be set out in a GHG Reduction Strategy, secured under the development consent order.

In making a decision, EN-1 Part 5 notes that the Secretary of State should be content that the applicant has taken all reasonable steps to reduce the GHG emissions of the construction and decommissioning stage of the development. The Secretary of State should give appropriate weight to projects that embed nature-based or technological processes to mitigate or offset the emissions of construction and decommissioning within the proposed development. However, in light of the vital role energy infrastructure plays in the process of economy wide decarbonisation, the Secretary of State accepts that there are likely to be some residual emissions from construction and decommissioning of energy infrastructure.

With regards to decision making by the Secretary of State concerning operational GHG emissions, EN-1 Part 5 acknowledges that operational GHG emissions are a significant adverse impact from some types of energy infrastructure which cannot be totally avoided (even with full deployment of CCS technology). Given the characteristics of these and other technologies and the range of non-planning policies that can be used aimed at decarbonising electricity generation such as UK ETS, Government has determined that operational GHG emissions are not reasons to prohibit the consenting of energy projects including those which use these technologies or to impose more restrictions on them in the planning policy framework than are set out in the energy NPSs (e.g. the CCR requirements).

EN-1 sets out that operational emissions from energy infrastructure will be addressed in a managed, economy-wide manner, to ensure consistency with carbon budgets, net zero and our international climate commitments. The Secretary of State does not, therefore, need to assess individual applications for planning consent against operational carbon emissions and their contribution to carbon budgets, net zero and our international climate commitments.

EN-1 Part 2 sets out the various levers outside of the planning system that will encourage the reduction of operational emissions from the energy sector. These are:

- Contracts for Difference (CfD) - The CfD scheme opened in 2014, with CfDs being awarded to developers of eligible projects through a competitive bidding process administered by National Grid's Electricity Systems Operator (ESO). The scheme has been hugely successful in driving substantial deployment of renewable electricity capacity at scale whilst rapidly reducing costs. The competitive nature of the scheme has been a crucial factor in minimising the costs of decarbonisation for consumers, contributing to the price per unit of offshore wind falling by around 65 per cent between the first allocation round in 2015 and the fourth in 2021, making offshore wind one of the lowest cost ways of generating electricity.
- Deployment of CCUS facilities - Government is developing business models to incentivise the deployment of Carbon Capture, Utilisation and Storage (CCUS) facilities and low carbon hydrogen production in the UK. The British Energy Security Strategy also committed to designing, by 2025, new business models for hydrogen transport and storage infrastructure.
- Power CCUS and Industrial Carbon Capture – Government will put in place a commercial framework which will enable developers to finance the construction and operation of power CCUS and Industrial Carbon Capture (ICC) facilities and CO2 transport and storage networks, stimulating a pipeline of projects and building a UK supply chain. For Power CCUS, Government will introduce the Dispatchable Power Agreement Business Model, to incentivise power CCUS to play a role in the electricity system which complements renewables. For ICC, Government will incentivise the deployment of carbon capture technology through the Industrial Carbon Capture Business Model for industrial users who often have no viable alternatives available to achieve deep decarbonisation, this will include Energy from Waste facilities.
- TRI Model - Government are also developing the Transportation and Storage regulatory investment ('TRI Model') which is based on an economic regulation funding model consisting of three elements: revenue model, economic regulatory regime and a government support package (GSP).
- UK Emissions Trading Scheme (UKETS
- Carbon Price Support (CPS)
- Emissions Performance Standard (EPS)

The AoS concludes that EN-1 requirements for a GHG assessment as part of the planning application are strong as far as quantification of GHG emissions associated with construction and decommissioning. But the mechanisms for reducing operational emissions as calculated by the applicant are deemed vague and do not provide firm assurances that operational emissions will indeed be capped at levels consistent with the carbon budgets and the Net Zero Strategy, as the various levers are still under development.

Use carbon removals to offset residual emissions from energy such as Bioenergy with Carbon Capture & Storage (BECCS) and Nature Based Solutions

EN-1 Part 5 sets out that planning applications for new energy infrastructure should look for opportunities within the proposed development to embed nature-based or technological solutions to mitigate or offset the emissions of construction and decommissioning. Steps taken to minimise and offset construction and decommissioning emissions should be set out in a GHG Reduction Strategy, secured under the development consent order. The GHG

Reduction Strategy should consider the creation and preservation of carbon stores and sinks including through woodland creation, peatland restoration and through other natural habitats.

The AoS concludes that EN-1 Part 5 places strong requirements on the applicant via preparation of a GHG offset strategy for residual construction and decommissioning emissions but, as for GHG emissions reductions, that is not the case for residual operational emissions.

As an energy NPS, the AoS notes that EN-1 is not expected to cover Greenhouse Gas Removal (GGR) Strategy in terms of which technologies or nature-based solutions to apply for operational emissions.

Create new carbon sinks/removals through natural sequestration including that by natural habitats, green-blue Infrastructure and soils?

EN-1 Part 5 sets out that planning applications for new energy infrastructure should look for opportunities within the proposed development to embed nature-based or technological solutions to mitigate or offset the emissions of construction and decommissioning, but not the emissions from operation. Steps taken to minimise and offset construction and decommissioning emissions should be set out in a Greenhouse Gas Reduction Strategy, secured under the development consent order. The GHG Reduction Strategy should consider the creation and preservation of carbon stores and sinks including through woodland creation, peatland restoration and through other natural habitats.

5.2.3: Assessment Conclusions and Summary

Considering policy in EN-1 as discussed above, Table 5-1 provides the summary assessment of EN-1 for the AoS Objective Reducing Carbon Emissions to Net Zero.

Minor positive effects are predicted in the short term as unabated combustion technologies are potentially permitted alongside renewables and nuclear technologies and opportunities for the recovery of heat are maximised. In the medium to long term, the effects become significant positive as earlier unabated combustion technologies get retrofitted with CCS, any new combustion technology is with CCS, nuclear continues to contribute zero carbon energy, renewables make a very significant proportion of the energy mix, recovery of heat continues to be maximised; and operational residual emissions are balanced by Greenhouse Gas Removal technologies, including those emissions from unabated natural gas plants used for peaking. It is noted that this assessment does not consider the effects of Low Carbon Hydrogen production as EN-1 does not set provisions in this respect.

Table 5-1 - Reducing Carbon emissions to Net Zero Objective Summary

AoS Objective	**Assessment of generic effects (by timescale)**		
	S	M	L
Consistent with the national target of reducing carbon emissions to Net Zero by 2050 Guide questions: • Reduce carbon emissions of the national portfolio of major energy infrastructure consistent with the		++	++

contribution share of the energy sector to the carbon budgets and Net Zero targets? • Reduce direct and indirect emissions of all greenhouse gases, including carbon dioxide, during construction, operation and decommissioning? • Maximise supply of energy from low carbon/renewable energy sources / use of low carbon/renewable energy? • Maximise opportunities for making use of waste heat? • Use carbon removals to offset residual emissions from energy such as Bioenergy with Carbon Capture & Storage (BECCS) and Nature Based Solutions? • Create new carbon sinks/removals through natural sequestration including that by natural habitats, green-blue Infrastructure and soils?			

5.3: AoS Objective 2: Maximise adaptation and resilience to climate change

5.3.1: Anticipated Effects

A greater degree of resilience to the unavoidable impacts of climate change will have to be incorporated into energy infrastructure design to address changes in temperature and rainfall patterns, along with more frequent extreme weather events (for example drought or flood) as well as sea level rise and coastal change and erosion.

Flood and drought risk and coastal change and erosion can also have significant impacts on species and nature sites and this should be considered in any energy infrastructure design through the implementation of multi-functional green-blue infrastructure and other similar appropriate measures or new approaches.

Nature-based solutions such as tree planting or peat restoration for carbon sequestration (as discussed in section 5.2) also provide for climate change adaptation through delivering urban cooling, wildlife benefit and contributing to flood reduction and will need to be considered in this regard.

5.3.2: Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 2.

Require energy infrastructure that is resilient and adapted over its lifetime to the risks of climate change including: increased river, surface and groundwater flooding due to extreme winter rainfall events and increase in winter mean rainfall and increased coastal flooding and erosion damage due to sea level rise and storms

EN-1 Part 4 Climate Change Adaptation recognises that climate change is already altering the UK's weather patterns and this will continue to accelerate depending on global carbon emissions. This means it is likely there will be more extreme weather events, such as heavy rainfall and very hot days will be more intense and more frequent, as well as climatic and seasonal changes such as hotter, drier summers and warmer and wetter winters. There is also a likelihood of increased flooding, drought, heatwaves, and intense rainfall events, as well as rising sea levels, increased storms and coastal change.

EN-1 Part 4 sets out that applicants must consider the impacts of climate change when planning the location, design, build, operation and, where appropriate, decommissioning of new energy infrastructure.

Key generic considerations that applicants should take into account to help ensure that energy infrastructure is resilient to climate change are:

- The ES should set out how the proposal will take account of the projected impacts of climate change, using government guidance and industry standard benchmarks such as the Climate Change Allowances for Flood Risk Assessments, Climate Impacts Tool, and British Standards for climate change adaptation, in accordance with the EIA Regulations.
- Applicants should assess the impacts on and from their proposed energy project across a range of climate change scenarios, in line with appropriate expert advice and guidance available at the time.
- Applicants should demonstrate that proposals have a high level of climate resilience built-in from the outset and should also demonstrate how proposals can be adapted over their predicted lifetimes to remain resilient to a credible maximum climate change scenario. These results should be considered alongside relevant research which is based on the climate change projections.
- Where energy infrastructure has safety critical elements (for example parts of new gas-fired power stations or some electricity sub-stations), the applicant should apply a credible maximum climate change scenario. Although the likelihood of this scenario is thought to be low, it is appropriate to take a risk-averse approach with elements of infrastructure which are critical to the safety of its operation.

Key generic considerations that the Secretary of State should take into account to help ensure that energy infrastructure is resilient to climate change are:

- The Secretary of State should be satisfied that applicants for new energy infrastructure have taken into account the potential impacts of climate change using the latest UK Climate Projections and associated research and expert guidance (such as the Environment Agency's Climate Change Allowances for Flood Risk Assessments or the Welsh Government's Climate change allowances and flood consequence assessments) available at the time the ES was prepared to ensure they have identified appropriate mitigation or adaptation measures. This should cover the estimated lifetime of the new infrastructure, including any decommissioning period. Should a new set of UK Climate Projections or associated research become available after the preparation of the ES, the Secretary of State (or the Examining Authority during the examination stage) should consider whether they need to request further information from the applicant.
- The Secretary of State should be satisfied that there are no features of the design of new energy infrastructure critical to its operation which may be seriously affected by more radical changes to the climate beyond that projected in the latest set of UK climate projections, taking account of the latest credible scientific evidence on, for example, sea level rise (for example by referring to additional maximum credible

scenarios – i.e. from the Intergovernmental Panel on Climate Change or EA) and that necessary action can be taken to ensure the operation of the infrastructure over its estimated lifetime.
- If any adaptation measures give rise to consequential impacts (for example on flooding, water resources or coastal change) the Secretary of State should consider the impact of the latter in relation to the application as a whole and the impacts guidance set out in Part 5 of this NPS.
- Any adaptation measures should be based on the latest set of UK Climate Projections, the government's latest UK Climate Change Risk Assessment, when available and in consultation with the EA's Climate Change Allowances for Flood Risk Assessments or the Welsh Government's Climate change allowances and flood consequence assessments.

Given the strong policy as set out above, the AoS concludes that EN-1 will likely lead to energy infrastructure that is resilient and adapted over its lifetime to the risks of climate change.

Avoid development in areas likely to be affected by coastal erosion or where this is not possible ensure that coastal change can be managed throughout the lifetime of the energy infrastructure

EN-1 Part 5 Coastal Change deals specifically with onshore energy infrastructure projects situated on the coast, which should:

- ensure that policies and decisions in coastal areas are based on an understanding of coastal change over time;
- prevent new development from being put at risk from coastal change by:
  i. avoiding inappropriate development in areas that are vulnerable to coastal change or any development that adds to the impacts of physical changes to the coast, and
  ii. directing development away from areas vulnerable to coastal change.
- ensure that the risk to development which is, exceptionally, necessary in coastal change areas because it requires a coastal location and provides substantial economic and social benefits to communities, is managed over its planned lifetime; and
- ensure that plans are in place to secure the long-term sustainability of coastal areas.

Where relevant, applicants should undertake coastal geomorphological and sediment transfer modelling to predict and understand impacts and help identify relevant mitigating or compensatory measures.

The ES should include an assessment of the effects on the coast, tidal rivers and estuaries. In particular, applicants should assess:

- the impact of the proposed project on coastal processes and geomorphology, including by taking account of potential impacts from climate change. If the development will have an impact on coastal processes the applicant must demonstrate how the impacts will be managed to minimise adverse impacts on other parts of the coast
- the implications of the proposed project on strategies for managing the coast as set out in Shoreline Management Plans (SMPs) (which provide a large-scale assessment of the physical risks associated with coastal processes and present a long term policy

framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner), any relevant Marine Plans, River Basin Management Plans, and capital programmes for maintaining flood and coastal defences and Coastal Change Management Areas

- how coastal change could affect flood risk management infrastructure, drainage and flood risk
- the effects of the proposed project on maintaining coastal recreation sites and features
- the vulnerability of the proposed development to coastal change, taking account of climate change, during the project's operational life and any decommissioning period

Applicants must demonstrate that full account has been taken of the potential effects of climate change on these risks.

Applicants should propose appropriate mitigation measures to address adverse physical changes to the coast, in consultation with the MMO, the EA/NRW, LPAs, other statutory consultees, Coastal Partnerships and other coastal groups, as it considers appropriate. Where this is not the case the Secretary of State should consider what appropriate mitigation requirements might be attached to any grant of development consent.

The Secretary of State should be satisfied that the proposed development will be resilient to coastal erosion and deposition, taking account of climate change, during the project's operational life and any decommissioning period. Proposals that aim to facilitate the relocation of existing energy infrastructure from unsustainable locations which are at risk from coastal change, should be supported where it would result in climate-resilient infrastructure.

The Secretary of State should not normally consent new development in areas of dynamic shorelines where the proposal could inhibit sediment flow or have an adverse impact on coastal processes at other locations. Impacts on coastal processes must be managed to minimise adverse impacts on other parts of the coast. Where such proposals are brought forward consent should only be granted where the Secretary of State is satisfied that the benefits (including need) of the development outweigh the adverse impacts.

The Secretary of State should ensure that applicants have restoration plans for areas of foreshore disturbed by direct works and will undertake pre- and postconstruction coastal monitoring arrangements with defined triggers for intervention and restoration.

The Secretary of State should examine the broader context of coastal protection around the proposed site, and the influence in both directions, i.e. coast on site, and site on coast.

The Secretary of State should consult the MMO on projects which could impact on coastal change in England, or NRW for projects in Wales, since the MMO or NRW may also be involved in considering other projects which may have related coastal impacts.

In addition to this NPS the Secretary of State must have regard to the appropriate marine policy documents, as provided for in the Marine and Coastal Access Act 2009. The Secretary of State may also have regard to any relevant SMPs

Furthermore, EN-1 Part 4 sets out that adaptation measures should be required to be implemented at the time of construction where necessary and appropriate to do so. However, where they are necessary to deal with the impact of climate change, and that measure would have an adverse effect on other aspects of the project and/or surrounding environment (for example coastal processes), the Secretary of State may consider requiring the applicant to ensure that the adaptation measure could be implemented should the need arise, rather than at the outset of the development (for example increasing height of existing, or requiring new, sea walls).

Given the strong policy as set out above, the AoS concludes that EN-1 will likely to development away from areas likely to be affected by coastal erosion or where this is not possible ensure that coastal change can be managed throughout the lifetime of the energy infrastructure.

Manage the risks associated with flooding over the energy infrastructure's lifetime, without increasing the flood risk elsewhere and identifying opportunities to reduce the risk overall

EN-1 Part 4 Climate Change Adaptation sets out that new energy infrastructure will typically be a long-term investment and will need to remain operational over many decades, in the face of a changing climate. Consequently, applicants must consider the direct (e.g. flooding of buildings and indirect (e.g. flooded access roads to the site) impacts of climate change when planning the location, design, build, operation and, where appropriate, decommissioning of new energy infrastructure.

EN-1 Part 4 acknowledges that in certain circumstances, measures implemented to ensure a scheme can adapt to climate change may give rise to additional impacts, for example as a result of protecting against flood risk, there may be consequential impacts on coastal change.

EN-1 Part 4 sets out that adaptation measures should be required to be implemented at the time of construction where necessary and appropriate to do so. However, where they are necessary to deal with the impact of climate change, and that measure would have an adverse effect on other aspects of the project and/or surrounding environment (for example coastal processes), the Secretary of State may consider requiring the applicant to ensure that the adaptation measure could be implemented should the need arise, rather than at the outset of the development (for example increasing height of existing, or requiring new, sea walls).

EN-1 Part 5 addresses Flood Risk specifically. It recognises that having resilient energy infrastructure not only reduces the risk of flood damages to the infrastructure, it also reduces the disruptive impacts of flooding on those homes and businesses that rely on that infrastructure. Although flooding cannot be wholly prevented, its adverse impacts can be avoided or reduced through good planning and management.

All buildings in flood risk areas can improve their preparedness to reduce costs and disruption to key public services when a flood happens. Where infrastructure is not better protected as part of a wider community scale flood defence scheme, those who own and run infrastructure sites – whether in public or private hands – are expected to take action to keep water out, minimise the damage if water gets in through flood-resilient materials, and reduce the disruption caused. This includes effective contingency planning to mitigate the impacts of flooding on the delivery of important services.

The aims of planning policy on development and flood risk are to ensure that flood risk from all sources of flooding is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to steer new development to areas with the lowest risk of flooding. Where new energy infrastructure is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and, where possible, by reducing flood risk overall. It should also be designed and constructed to remain operational in times of flood. Proposals that aim to facilitate the relocation of existing energy infrastructure from unsustainable locations which are or will be at unacceptable risk of flooding, should be supported where it would result in climate-resilient infrastructure.

For all energy projects in Flood Zones 2 and 3 in England or Zones B and C in Wales, a site-specific flood risk assessment (FRA) should be provided by the applicant. In Flood Zone 1 in England or Zone A in Wales, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the EA or NRW as having critical drainage problems; land identified (for example in a local authority strategic flood risk assessment) as being at increased flood risk in future; land that may be subject to other sources of flooding (for example surface water); and where the EA or NRW, Lead Local Flood Authority, Internal Drainage Board or other body have indicated that there may be drainage problems.

Applicants for projects which may be affected by, or may add to, flood risk should arrange pre-application discussions with the EA, and, where relevant, other bodies such as Lead Local Flood Authorities, Internal Drainage Boards, sewerage undertakers, navigation authorities, highways authorities and reservoir owners and operators. Such discussions should identify the likelihood and possible extent and nature of the flood risk, help scope the FRA, and identify the information that will be required by the Secretary of State to reach a decision on the application when it is submitted. The Secretary of State should advise applicants to undertake these steps where they appear necessary but have not yet been addressed.

If the EA, NRW or another flood risk management authority has reasonable concerns about the proposal on flood risk grounds, the applicant should discuss these concerns with the EA or NRW and take all reasonable steps to agree ways in which the proposal might be amended, or additional information provided, which would satisfy the authority’s concerns.

The Sequential Test ensures that a sequential, risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account. Where it is not possible to locate development in low-risk areas, the Sequential Test should go on to compare reasonably available sites with medium risk areas and then, only where there are no reasonably available sites in low and medium risk areas, within high-risk areas.

The technology specific NPSs set out some exceptions to the application of the Sequential Test. However, when seeking development consent on a site allocated in a development plan through the application of the Sequential Test, informed by a strategic flood risk assessment, applicants need not apply the Sequential Test, provided the proposed development is consistent with the use for which the site was allocated and there is no new flood risk information that would have affected the outcome of the test.

Consideration of alternative sites should take account of the policy. All projects should apply the sequential approach to locating development within the site.

In determining an application for development consent, the Secretary of State should be satisfied that where relevant:

- the application is supported by an appropriate FRA;
- the Sequential Test has been applied and satisfied as part of site selection;
- a sequential approach has been applied at the site level to minimise risk by directing the most vulnerable uses to areas of lowest flood risk;
- the proposal is in line with any relevant national and local flood risk management strategy;
- sustainable drainage systems (SuDs) (as required in the next paragraph on National Standards) have been used unless there is clear evidence that their use would be inappropriate;

- in flood risk areas the project is designed and constructed to remain safe and operational during its lifetime, without increasing flood risk elsewhere
- the project includes safe access and escape routes where required, as part of an agreed emergency plan, and that any residual risk can be safely managed over the lifetime of the development.
- land that's likely to be needed for present or future flood risk management infrastructure has been appropriately safeguarded from development to the extent that development would not prevent or hinder its construction, operation or maintenance.

For energy projects which have drainage implications, approval for the project's drainage system, including during the construction period, will form part of the development consent issued by the Secretary of State. The Secretary of State will therefore need to be satisfied that the proposed drainage system complies with any National Standards published by Ministers under Paragraph 5(1) of Schedule 3 to the Flood and Water Management Act 2010.

In addition, the development consent order, or any associated planning obligations, will need to make provision for appropriate operation and maintenance of any SuDS throughout the project's lifetime. Where this is secured through the adoption of any SuDS features, any necessary access rights to property will need to be granted.

Where relevant, the Secretary of State should be satisfied that the most appropriate body is being given the responsibility for maintaining any SuDS, taking into account the nature and security of the infrastructure on the proposed site. Responsible bodies could include, for example the landowner, the relevant lead local flood authority or water and sewerage company (through the Ofwat-approved Sewerage Sector Guidance), or another body, such as an Internal Drainage Board.

Energy projects should not normally be consented within Flood Zone 3b the Functional Floodplain (where water has to flow or be stored in times of flood), or Zone C2 in Wales, or on land expected to fall within these zones within its predicted lifetime. This may also apply where land is subject to other sources of flooding (for example surface water). However, where essential energy infrastructure has to be located in such areas, for operational reasons, they should only be consented if the development will not result in a net loss of floodplain storage and will not impede water flows.

Exceptionally, where an increase in flood risk elsewhere cannot be avoided or wholly mitigated, the Secretary of State may grant consent if they are satisfied that the increase in present and future flood risk can be mitigated to an acceptable level and taking account of the benefits of, including the need for, nationally significant energy infrastructure as set out in Part 3 above. In any such case the Secretary of State should make clear how, in reaching their decision, they have weighed up the increased flood risk against the benefits of the project, taking account of the nature and degree of the risk, the future impacts on climate change, and advice provided by the EA or NRW and other relevant bodies.

Given the strong policy in EN-1 as set out above, the AoS concludes that EN-1 will likely lead to energy infrastructure development capable of managing the risks associated with flooding over the energy infrastructure's lifetime, without increasing the flood risk elsewhere and identifying opportunities to reduce the risk overall.

Manage the risks associated to periods of limited water availability over the lifetime of the energy infrastructure

EN-1 Part 4 Climate Change Adaptation specifically sets out that applicants must consider limited water availability for operations when planning the location, design, build, operation and, where appropriate, decommissioning of new energy infrastructure. The ES should set out how the proposal will take account of the projected impacts of climate change, using government guidance and industry standard benchmarks such as the Climate Change Allowances for Flood Risk Assessments, and Climate Impacts Tool, and British Standards for climate change adaptation, in accordance with the EIA Regulations.

On this basis, the AoS concludes that EN-1 will likely lead to energy infrastructure development capable of managing the risks associated with limited water availability over the energy infrastructure's lifetime.

Manage the risks associated with storms, heatwaves and wildfires over the lifetime of the energy infrastructure

EN-1 Part 4 specifically sets out applicants must consider storms, heatwave and wildfire threats to buildings infrastructure and operations and ancillary infrastructure (e.g. roads impacted by storms, heatwaves or wildfires) when planning the location, design, build, operation and, where appropriate, decommissioning of new energy infrastructure.

On this basis, the AoS concludes that EN-1 will likely lead to energy infrastructure development capable of managing the risks associated with storms, heatwaves and wildfires over the energy infrastructure's lifetime.

Take advantage of the role and opportunity of nature based solutions to mitigate and adapt to climate change and contribute to the adaptation of nature to a changing climate

EN-1 Part 4 sets out that in preparing measures to support climate change adaptation, applicants should consider whether take reasonable steps to maximise use of nature-based solutions alongside other conventional techniques. Integrated approaches, such as looking across the water cycle considering coordinated management of water storage, supply, demand, wastewater and flood risk can provide further benefits to address multiple infrastructure needs, as well as carbon sequestration benefits could provide a basis for such adaptation. In addition to avoiding further GHG emissions when compared with some more traditional adaptation approaches, nature based solutions can also result in biodiversity benefits and net gain as well as increasing absorption of carbon dioxide from the atmosphere.

On this basis, the AoS concludes that EN-1 will likely lead to the application of nature based solutions associated with new energy infrastructure and deliver multiple benefits.

5.3.3: Assessment Conclusions and Summary

The policies set out in EN-1 sections on Climate Change Adaptation, Coastal Change and Flood Risk (as discussed above) address comprehensively address AoS Objective 2 Maximise adaptation and resilience to climate change. The summary assessment is set out in Table 5-2.

EN-1 ensures that at the time the ES is prepared by the applicants:

- The latest UK Climate Projections and associated research and expert guidance are taken into account; and

- impacts on and from their proposed energy project across a range of climate change scenarios are considered; and in particular demonstration of how proposals can be adapted over their predicted lifetimes to remain resilient to a credible maximum climate change scenario.

EN-1 details climate adaptation requirements and considerations in relation to onshore energy infrastructure projects situated on the coast. It covers coastal erosion and deposition specifically, acknowledging that the impact of climate change on such processes and the need to address this. It also addresses pluvial, riverine and coastal flooding, again acknowledging the impact of climate change on flooding and sets out specific planning conditions for energy infrastructure. It also sets requirements for the management of other climate change risks associated with periods of limited water availability, storms, heatwaves and wildfires over the lifetime of the energy infrastructure.

EN-1 sets out that applicants should consider whether take reasonable steps to maximise use of nature-based solutions to address the impacts of flooding and coastal erosion, including the use of SUDS alongside other conventional techniques.

It is considered that EN-1 provides a robust approach to ensuring that issues relating to a changing climate and the need to adapt to this in the construction, operation and decommissioning of energy related infrastructure will be considered as part of any development. This will ensure that resilience to climate change is a key component of these developments with beneficial effects from the short, through to the long term and with effects becoming potentially significant as more climate resilient energy infrastructure is built over time.

Table 5-2 - Maximise adaptation and resilience to climate change Objective Summary

AoS Objective	**Assessment of generic effects (by timescale)**		
	S	M	L
Maximise adaptation and resilience to climate change Guide questions: • Require energy infrastructure that is resilient and adapted over its lifetime to the risks of climate change including: - increased river, surface and groundwater flooding due to extreme winter rainfall events and increase in winter mean rainfall? - increased coastal flooding and erosion damage due to sea level rise and storms? • Manage the risks associated with flooding over the energy infrastructure's lifetime, without increasing the flood risk elsewhere and identifying opportunities to reduce the risk overall, including through working with nature based solutions? • Avoid development in areas likely to be affected by coastal erosion or where this is not possible ensure that coastal change can be managed throughout the lifetime of the energy infrastructure?	+	++	++

- Manage the risks associated to periods of limited water availability over the lifetime of the energy infrastructure? - Manage the risks associated with storms, heatwaves and wildfires over the lifetime of the energy infrastructure? - Take advantage of the role and opportunity of nature based solutions to mitigate and adapt to climate change and contribute to the adaptation of nature to a changing climate?			

5.4: AoS Objective 3: Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network

5.4.1: Anticipated Effects

The scope and scale of the development enabled by the NPS has the potential for a range of impacts on the natural environment and biodiversity including loss of habitat and species, disturbance, pollution, habitat fragmentation/severance/isolation, obstructions, changes to terrestrial microclimates and changes to coastal and marine processes due to construction, operation and decommissioning activities associated with energy infrastructure.

Therefore, the NPS should aim to protect and enhance all sites of biodiversity importance and place a particular emphasis on protecting sites designated for nature conservation. It should not allow energy development on irreplaceable habitats, such as ancient woodland and ancient and veteran trees except in exceptional circumstances and with appropriate compensation measures.

The NPS should explore opportunities for new habitat creation and enhancement associated with energy developments, e.g. through contributing to the Local Nature Recovery Strategy and helping establish the Nature Recovery Network. The potential for biodiversity creation in brownfield sites should be also taken into account, noting that some brownfield sites will be protect in their own right or have high biodiversity value already so won't be adequate for habitat creation in these circumstances.

Loss of biodiversity to be halted and reversed by the NPS through the achievement of Biodiversity Net Gain in areas not formally designated, with a target of at least 10%, and reversing the decline in species abundance by the end of 2030 aligning with the Environment Act 2021 targets.

Whilst maintaining and enhancing nature based on seeking multiple ecosystem benefits and solutions such as the application of nature-based solutions (peatlands, native woodlands, saltmarsh and sea grass meadows, traditionally managed habitats such as hedgerows, hay meadows, heathlands and old orchards) will have a significant role to play in helping the UK hit net zero by 2050 alongside improving biodiversity.

Finally, the NPS should support cohesive ecosystems and ecological networks that help habitats and species adapt to the consequences of climate change.

5.4.2: Approach to Development and Mitigation as set out in EN-1

Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 3.

Protect and enhance nationally designated sites such as SSSIs, National Nature Reserves and Marine Conservation Zones, including those of potential or candidate designation

EN-1 Part 5 Biodiversity and Geological Conservation acknowledges that many SSSIs are also designated as sites of international importance and will be protected accordingly (see assessment for AoS Objective 4 concerning sites of international sites). Those that are not, or those features of SSSIs not covered by an international designation, should be given a high degree of protection. Most National Nature Reserves are notified as SSSIs.

Development on land within or outside a SSSI, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits (including need) of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of SSSIs. The Secretary of State should use requirements and/or planning obligations to mitigate the harmful aspects of the development and, where possible, to ensure the conservation and enhancement of the site's biodiversity or geological interest.

EN-1 Part 5 sets out that the protected feature or features and the conservation objectives for the Marine Conservation Zones (MCZ) are stated in the designation order for the MCZ and that the Secretary of State is bound by the duties in relation to MCZs imposed by sections 125 and 126 of the Marine and Coastal Access Act 2009.

EN-1 Part 5 references Marine Protected Area (MPA) is a term used to describe the network of HRA sites, SSSIs and MCZs in the English and Welsh marine environment and that the Secretary of State should assess the impact, either alone or in combination, on all designated MPA sites when making any decision on development consent. EN-1 Part 5 Coastal Change further sets out that the applicant should be particularly careful to identify any effects of physical changes on the integrity and special features of Marine Protected Areas (MPAs). These could include MCZs, 'HRA Sites' including Special Areas of Conservation and Special Protection Areas with marine features, Ramsar Sites, Sites of Community Importance, and SSSIs with marine features.

Where the development is subject to EIA, the applicant should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England), on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats.

Where EIA is not required, the applicant should provide environmental information proportionate to the infrastructure to help the Secretary of State consider thoroughly the potential effects of a proposed project.

The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.

As a general principle, development should, in line with the mitigation hierarchy, aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives. Where significant harm cannot be avoided, then appropriate compensation measures should be sought.

If significant harm to biodiversity resulting from a development cannot be avoided (for example through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then the Secretary of State will give significant weight to any residual harm and consent may be refused.

The AoS concludes that EN-1 will likely result in new energy infrastructure which will protect and enhance nationally designated sites except in the circumstances of overriding public benefits considerations outweighing any loss or deterioration but even the Secretary of State is bound to use requirements and/or planning obligations to mitigate the harmful aspects of the development and, where possible, to ensure the conservation and enhancement of the site's biodiversity or geological interest.

Protect and enhance valued habitat and populations of protected/scarce species on locally designated sites, including Key Wildlife Sites, Local Wildlife Sites and Local Nature Reserves

EN-1 Part 5 Biodiversity and Geological Conservation sets out that sites of regional and local biodiversity and geological interest, which include Regionally Important Geological Sites, Local Nature Reserves and Local Wildlife Sites, are areas of substantive nature conservation value and make an important contribution to ecological networks and nature's recovery. They can also provide wider benefits including public access (where agreed), climate mitigation and helping to tackle air pollution. National planning policy expects plans to identify and map Local Wildlife sites, and to include policies that not only secure their protection from harm or loss but also help to enhance them and their connection to wider ecological networks.

Where the development is subject to EIA, the applicant should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England), on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats.

Where EIA is not required, the applicant should provide environmental information proportionate to the infrastructure to help the Secretary of State consider thoroughly the potential effects of a proposed project.

The Secretary of State should give due consideration to such regional or local designations. However, given the need for new nationally significant infrastructure, these designations should not be used in themselves to refuse development consent. Development will still be expected to comply with the biodiversity and geological conservation requirements set out in this NPS.

The AoS concludes that EN-1 will likely provide adequate levels of protection to locally designated sites except in the circumstances of overriding public benefits considerations where the Secretary of State may not refuse development consent.

Prevent development on irreplaceable habitats, such as ancient woodland and ancient and veteran trees except in exceptional circumstances and with appropriate compensation measures

EN-1 Part 5 Biodiversity and Geological Conservation states that the Secretary of State should not grant development consent for any development that would result in the loss or deterioration of irreplaceable habitats, including ancient woodland, and ancient or veteran trees, unless the public benefits (including need) of the nationally significant energy infrastructure would clearly outweigh any loss or deterioration to the habitat and a suitable compensation strategy exists.

Applicants should include measures to mitigate the direct and indirect effects of development on ancient woodland, veteran trees or other irreplaceable habitats during both construction and operational phase.

The AoS concludes that EN-1 will likely provide adequate levels of protection to irreplaceable habitats except in the circumstances of overriding public benefits considerations outweighing any loss or deterioration.

Protect and enhance the Nature Recovery Network

EN-1 Part 4 sets out that the Environment Act (2021) mandated the preparation of Local Nature Recovery Strategies (LNRSs) across England. They are a new system of spatial strategies for nature recovery and will play a major role in providing detail on the best locations to create, enhance and restore nature and deliver wider environmental benefits. LNRSs will also agree priorities for nature recovery and map the most valuable existing areas for nature. They will be critical in delivering new government targets for species abundance and habitat creation commitments, as well as other pressing environmental outcomes for water and flood risk, carbon and trees. LNRSs will also drive the creation of a Nature Recovery Network (NRN), a major commitment in the government’s 25 Year Environment Plan.

Note is also made in EN-1 that applications for development consent should be accompanied by a statement demonstrating how opportunities for delivering wider environmental net gains have been considered, and where appropriate, incorporated into proposals as part of good design (including any relevant operational aspects) of the project. A number of tools and guidance documents are also detailed which could help during consideration of projects.

The AoS concludes that EN-1 sets out mechanisms which will help to protect and enhance elements such as the Nature Recovery Network, through consideration of natural capital assets and ecosystem services.

Protect and enhance priority habitats, and the habitat of priority species

EN-1 Part 5 sets out that many individual wildlife species receive statutory protection under a range of legislative provisions. Other species and habitats have been identified as being of principal importance for the conservation of biodiversity in England and Wales, as well as for their continued benefit for climate mitigation and adaptation and thereby requiring conservation action.

The Secretary of State should ensure that these species and habitats are protected from the adverse effects of development by using requirements, planning obligations, or licence conditions. The Secretary of State should refuse consent where harm to the habitats or species and their habitats would result, unless the benefits (including need) of the development outweigh that harm. In this context the Secretary of State should give substantial weight to any such harm to the detriment of biodiversity features of national or regional importance which it considers may result from a proposed development.

The AoS concludes that EN-1 will likely provide sufficient levels of protection to priority habitats and the habitat of priority species except in the circumstances of overriding public benefits considerations outweighing any harm.

Reduce or avoid impacts to habitats with important roles in carbon sequestration

EN-1 Part 5 sets out that applicants' proposals should consider any reasonable opportunities to maximise the restoration, creation, and enhancement of wider biodiversity, and the protection and restoration of the ability of habitats to store or sequester carbon.

The AoS concludes that EN-1 will likely reduce or avoid impacts to habitats with important roles in carbon sequestration.

Promote new habitat creation or restoration and linkages with existing habitats

EN-1 Part 5 sets out that the Secretary of State should consider what appropriate requirements should be attached to any consent and/or in any planning obligations entered into, in order to ensure that any mitigation or biodiversity net gain measures, if offered, are delivered and maintained. Any habitat creation or enhancement delivered, including linkages with existing habitats, for compensation or biodiversity net gain should generally be maintained for a minimum period of 30 years, or for the lifetime of the project, if longer.

The AoS concludes that EN-1 will likely promote new habitat creation or restoration and linkages with existing habitats.

Increase the resilience of biodiversity to the potential effects of climate change

EN-1 Part 5 sets out that the Secretary of State should have regard to the aims and goals of the government's 25 Year Environment Plan and any relevant measures and targets, including statutory targets in the Environment Act or elsewhere. In addition, in exercising functions in relation to Wales, the Secretary of State should act in accordance with duties placed upon public authorities, including Ministers of the Crown, by Section 6 of the Environment (Wales) Act 2016 to seek to maintain and enhance biodiversity, and in so doing promote the resilience of ecosystems, so far as consistent with the proper exercise of these functions. In doing so, the Secretary of State should also take account of the context of the challenge of climate change and the role of new energy infrastructure in addressing this: failure to address this challenge will result in significant adverse impacts to biodiversity.

The AoS concludes that EN-1 will likely deliver enhanced biodiversity with increased resilience to climate change.

Encourage sensitive or nature inclusive design in terrestrial and marine environments

EN-1 Part 5 sets out that as a general principle, development should, in line with the mitigation hierarchy, at the very least aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives where significant harm cannot be avoided, then appropriate compensation measures should be sought. If significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then the Secretary of State will give significant weight to any residual harm. In Wales, applicants should refer to the step wise approach as set out in Planning Policy Wales (PPW).

EN-1 Part 5 also sets out that the applicant should include appropriate avoidance, mitigation, compensation and enhancement measures as an integral part of the proposed development. In particular, the applicant should demonstrate that:

- during construction, they will seek to ensure that activities will be confined to the minimum areas required for the works
- the timing of construction has been planned to avoid or limit disturbance
- during construction and operation best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements
- habitats will, where practicable, be restored after construction works have finished
- opportunities will be taken to enhance existing habitats rather than replace them, and where practicable, create new habitats of value within the site landscaping proposals. Where habitat creation is required as mitigation, compensation, or enhancement the location and quality will be of key importance. In this regard habitat creation should be focused on areas where the most ecological and ecoystems services benefits can be realised.

Applicants should consider producing and implementing a Biodiversity Management Strategy as part of their development proposals. This could include provision for biodiversity awareness training to employees and contractors so as to avoid unnecessary adverse impacts on biodiversity during the construction and operation stages.

The design of any direct cooling system the locations of the intake and outfall should be sited to avoid or minimise adverse impacts on the receiving waters, including their ecology. There should also be specific measures to minimise impact to fish and aquatic biota by entrainment and impingement or by excessive heat or biocidal chemicals from discharges to receiving waters.

EN-1 Part 4 adds that the construction of an onshore energy project on the coast may involve, for example, dredging, dredge spoil deposition, cooling water, culvert construction, marine landing facility construction and flood and coastal protection measures which could result in direct effects on the coastline, seabed and marine ecology and biodiversity.

Additionally, indirect changes to the coastline and seabed might arise as a result of a hydrodynamic response to some of these direct changes. This could lead to localised or more widespread coastal erosion or accretion and changes to offshore features such as submerged banks and ridges, marine biodiversity and heritage assets.

The AoS concludes that the principles and requirements placed upon energy infrastructure development will likely encourage sensitive or nature inclusive design in terrestrial and marine environments.

Ensure energy activities protect fish stocks and marine mammals & Ensure energy activities do not exacerbate disturbance to bird populations

EN-1 Part 5 states that the design of Energy NSIP proposals will need to consider the movement of mobile / migratory species such as birds, fish and marine and terrestrial mammals and their potential to interact with infrastructure. As energy infrastructure could occur anywhere within England and Wales, both inland and onshore and offshore, the potential to affect mobile and migratory species across the UK and more widely across Europe (transboundary effects) requires consideration, depending on the location of development.

On this basis, EN-1 is likely to ensure that energy activities protect birds, fish and mammals.

Promote Biodiversity Net Gain for any new major infrastructure development in England using latest Defra metric/ Promote Net Benefit for Biodiversity for any new major infrastructure development in Wales/ Contribute to meeting relevant statutory targets in the Environment Act

EN-1 Part 4 Environment and Biodiversity Net Gain sets out that Energy NSIP proposals, whether onshore or offshore, should seek opportunities to contribute to and enhance the natural environment by providing net gains for biodiversity where possible. However, EN-1 points out that currently environmental net gain only applies to terrestrial and intertidal components of projects in England. Principles for Marine Net Gain are currently in development by Defra who will provide guidance in due course. There are provisions in the Environment Act 2021 to allow marine net gain to become mandatory in the future.

In England, applicants for onshore elements of any development are encouraged to use the most current version of the Defra biodiversity metric to calculate their biodiversity baseline and present planned biodiversity net gain outcomes. This calculation data should be presented in full as part of their application. Where possible, this data should be shared with the Local Authority and Natural England for discussion before at the pre- application stage as it can help to highlight biodiversity and wider environmental issues which may later cause delays if not addressed. Biodiversity net gain should be applied in after compliance with the mitigation hierarchy and does not change or replace existing environmental obligations.

In Wales, applicants should consider the guidance set out in section 6.4 of Planning Policy Wales and the relevant policies in the Wales National Marine Plan.

Biodiversity net gain can be delivered onsite or wholly or partially off-site. Any off-site delivery of biodiversity net gain should also be set out within the application for development consent. When delivering biodiversity net gain off-site, developments should do this in a manner that best contributes to the achievement of relevant wider strategic outcomes, for example by increasing habitat connectivity or enhancing other ecosystem service outcomes. Reference should be made to relevant national or local plans and strategies, such as green infrastructure strategies, Local Nature Recovery Strategies, to inform off-site biodiversity net gain delivery.

In addition to delivering biodiversity net gain, developments may also deliver wider environmental gains and benefits to communities relevant to the local area, and to national policy priorities, such as: reductions in GHG emissions; reduced flood risk; improvements to air or water quality; landscape enhancement or increased access to natural greenspace, including by promoting nature-based solutions. The scope of potential gains will be dependent on the type, scale, and location of specific projects. Although achieving biodiversity net gain is not currently an obligation on applicants, Schedule 15 of the Environment Act contains provisions which, when commenced, mean the Secretary of State may not grant an application for Development Consent Order unless satisfied that a biodiversity gain objective is met in relation to the onshore development in England to which the application relates.

The biodiversity gain objective will be set out in a biodiversity gain statement (as defined under the Act). Normally these statements will be included within NPS but the Act allows for the statement to be published separately where a review of an NPS has begun before the provisions are commenced, as is the case with these energy NPS.

Under the provision of the Act, any such separate biodiversity statement will be regarded as contained within these national policy statements. The Act also contains the power to extend this requirement to offshore development.

EN-1 Part 4 goes further by requiring applications for development consent be accompanied by a statement demonstrating how opportunities for delivering wider environmental net gains have been considered, and where appropriate, incorporated into proposals as part of good design (including any relevant operational aspects) of the project. Applicants should make use of available guidance and tools for measuring natural capital assets and ecosystem services, such as the Natural Capital Committee's 'How to Do it: natural capital workbook', Defra's guidance on Enabling a Natural Capital Approach (ENCA) , and other tools that aim to enable wider benefits for people and nature. Where environmental net gain considerations have featured as part of the strategic options appraisal process to select a project, the applicants should reference that information to supplement the site-specific details.

The AoS concludes that any new major terrestrial and onshore energy infrastructure in England and Wales will likely deliver Biodiversity Net Gain and wider environmental net gains. The situation is less clear with regards to marine biodiversity net gain given that such requirements have yet to become mandatory.

Prevent spread of invasive species (native and non-native), including new invasive species because of climate change

EN-1 states that the design of Energy NSIP proposals will need to prevent the spread of invasive species, including new species because of climate change.

5.4.3: Assessment Conclusions and Summary

The policies set out in EN-1 sections on Biodiversity Net Gain and Biodiversity and Geological Conservation (as discussed above) thoroughly address AoS Objective 2 Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network.

EN-1 recognises that careful siting and use of appropriate technologies can help to mitigate adverse impacts on the environment and sets out an overarching principle in relation to protecting biodiversity, which is that development should at the very least aim to avoid significant harm to biodiversity interests, including through mitigation and consideration of reasonable alternatives. It is suggested that in cases where significant harm is unavoidable, then appropriate compensation measures should be sought. Where this is not possible, it is suggested that the Secretary of State gives significant weight to any residual harm.

Development proposals should seek opportunities to contribute to and enhance the natural environment by providing net gains for biodiversity where possible, and as part of good design. To aid this, EN-1 requires that the Secretary of State should maximise opportunities for biodiversity within developments, using planning obligations.

EN-1 further states that proposals should consider and seek to provide improvements to natural capital and ecosystem services (wider environmental net gain) when considering how to achieve biodiversity net gain. Considerations of biodiversity in EN-1 also recognise that the potential impacts of climate change on biodiversity mean that the two policy considerations are intrinsically linked and that the benefits of nationally significant low carbon energy infrastructure development may also yield benefits for biodiversity interests.

In terms of designations, EN-1 notes that the Secretary of State should ensure that appropriate weight is given to designated sites of international, national and local importance, protected species, habitats and other species of importance for the conservation of biodiversity. EN-1 suggests that development on land within or outside a SSSI which is likely to have adverse effects (either individually or in combination with other developments) should not be permitted but notes that an exception to this is possible where the benefits of the development in the location proposed clearly outweigh its impacts on the features of the site qualify it as a SSSI and impacts on the national network of SSSIs. EN-1 encourages the Secretary of State to use requirements and/or planning obligations to mitigate significant harm arising from the development on SSSIs and suggests that, where possible, development should enhance a site's biodiversity.

EN-1 notes that the valuable biodiversity resources within Ancient Woodland cannot be recreated and therefore the Secretary of State should not grant consent for any developments that would result in its deterioration or loss, unless it can be demonstrated that the benefit and need of the development outweighs the loss. The same level of protection through EN-1 is afforded to species and habitats that have been identified as being of principal importance for the conservation of biodiversity; it would need to be demonstrated that the benefits of and need for development outweighs the harm. However, it is also noted in this context that the Secretary of State should give substantial weight to any harm to the detriment of biodiversity features of national or regional importance. EN-1 also suggests that proposals should maximise opportunities to restore, create and enhance wider biodiversity, which could include consideration of Local Nature Recovery Strategies and national goals.

At the local scale, EN-1 suggests that Local Nature Reserves and Local Wildlife Sites require due consideration, but given the need for new energy generating infrastructure, these designations should not be used as the sole reason to refuse development consent.

Given the strategic nature of the NPSs, they will likely allow for a wide range of energy infrastructure development to take place in any part of England and Wales and extending offshore. As such, it is possible to conclude that there will likely be significant negative effects in the short to long term on local and marine biodiversity as a result of development coming forward under the NPSs.

Nevertheless, across all other designations significant positive effects are anticipated in the medium and long term, through the clear approach noted in EN-1 of using the mitigation hierarchy and delivering biodiversity enhancement through an obligation to deliver Biodiversity Net Gain and also Environmental Net Gain.

Table 5-3 - Enhance biodiversity, promoting net gain, and supporting ecosystem resilience and functionality Objective Summary

AoS Objective	**Assessment of generic effects (by timescale)**				
	S	**M**		**L**	
Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network Guide questions: • **Protect and enhance nationally designated sites such as SSSIs, National Nature Reserves and Marine Conservation Zones, including those of potential or candidate designation?** • **Protect and enhance valued habitat and populations of protected/scarce species on locally**	**--**	**--**	**++**	**--**	**++**

designated sites, including Key Wildlife Sites, Local Wildlife Sites and Local Nature Reserves? **• Prevent development on irreplaceable habitats, such as ancient woodland and ancient and veteran trees except in exceptional circumstances and with appropriate compensation measures?** **• Protect and enhance the Nature Recovery Network?** **• Protect and enhance priority habitats, and the habitat of priority species?** **• Promote new habitat creation or restoration and linkages with existing habitats?** **• Reduce or avoid impacts to habitats with important roles in carbon sequestration?** **• Increase the resilience of biodiversity to the potential effects of climate change?** **• Encourage sensitive or nature inclusive design in terrestrial and marine environments?** **• Ensure energy activities protect fish stocks and marine mammals?** **• Ensure energy activities do not exacerbate disturbance to bird populations?** **• Promote Biodiversity Net Gain for any new major infrastructure development in England using latest Defra metric?** **• Promote Net Benefit for Biodiversity for any new major infrastructure development in Wales?** **• Contribute to meeting relevant statutory targets in the Environment Act?** **• Prevent spread of invasive species (native and non-native), including new invasive species because of climate change?**					

5.5: AoS Objective 4: Protect and enhance sites designated for their international importance for nature conservation purposes

5.5.1: Anticipated Effects

The scope and scale of the development enabled by the NPS has the potential for a range of impacts on sites designated for their international importance for nature conservation purposes. Effects will vary depending on the type of development and its location in relation to designated assets. Significant effects could arise as a result of development coming forward under the NPS, which could impact the qualifying features for which 'International Sites' are designated (including Special Areas of Conservation (SAC), Special Protection Areas (SPA), and in the UK, Ramsar sites despite being designated at the international rather than European level). These potential effects and the qualifying features they could impact include:

- Air pollution - arising from emissions to air from transport to and from the site, and emissions directly from certain energy infrastructure.
  - Nutrient-sensitive habitats (including soils and water) and plants, plus species they support
- Noise pollution and vibration - arising from construction, operation and decommissioning activities.
  - Bird species
  - Mammal species
  - Fish species
- Light pollution - arising from construction, operation and decommissioning activities.
  - Bat species
  - Nocturnal bird and insect species
- Change in water quality/temperature - arising from emissions to water during construction and decommissioning, and emissions directly from certain energy infrastructure.
  - Freshwater habitats (such as rivers and lakes)
  - Marine habitats
  - Wetland habitats (including groundwater dependent terrestrial ecosystems)
  - Coastal habitats (saltmarsh, sand dunes)
  - Aquatic species (freshwater, brackish and marine)
- Changes in water quantity/flow/drainage - direct loss from the abstraction of water resources, and indirect or temporary losses, for example during construction phases.
  - Freshwater habitats
  - Marine habitats
  - Wetland habitats
  - Aquatic species (freshwater, brackish and marine)
- Land contamination – arising during construction and during operation from emissions to water (including thermal impacts) and ground.
  - Terrestrial habitats and species
  - Wetland habitats and species
- Habitat loss/fragmentation - direct loss from land take or the abstraction of water resources, and indirect or temporary losses, for example during construction phases.
  - All habitats and species
- Impingement and entrainment of fish – arising from operation processes such as cooling water intake.
- Coastal change - arising from construction, operation and decommissioning activities.
  - Coastal habitats
  - Fish species
  - Seabird species
  - Marine mammals

- Bird/bat strike - from introduced/tall structures presenting obstacles to migration and flight paths.
- Disturbance to marine species - arising from construction, operation and decommissioning activities.
- Climate change effects on habitats and species - arising from construction, operation and decommissioning activities.
- Changes to electromagnetic fields - arising from construction, operation and decommissioning activities.
- Introduction of invasive non-native species - arising from construction, operation and decommissioning activities.

There is also potential for development to result in positive effects on habitat condition and connectivity from management, restoration and enhancements activities.

The development of a range of major generating infrastructure that is enabled through EN-1 has the potential to result in direct adverse impacts on International Sites in the short term, from the construction of developments enabled through EN-1 and associated supporting infrastructure. Furthermore, it is likely that energy infrastructure development will be located in rural and/or coastal areas where the majority of International Sites tend to be located. There is potential for direct and indirect effects on International Sites to occur in the short and medium term, as a result of operational activities. Long term effects will be dependent on the duration that infrastructure developments are in operation, which is likely to be many decades in the case of major energy generating infrastructure. The decommissioning stage of any of the generating infrastructure also has the potential to have direct negative effects on International Sites, due to soil, water and air contamination, as well as disturbance. However, positive effects may be achieved in the long term, through restoration of a decommissioned site.

In parallel with the AoS of the NPS, HRA has been undertaken which identified the internationally designated nature conservation areas, where possible established the likelihood of impacts on the integrity of these sites and identified appropriate avoidance and mitigation measures early in the development of the NPS.

5.2.3: Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 4.

Avoid the loss of sites of international importance (SPAs, SACs and Ramsar sites), including those of potential designation (candidate SPAs, proposed SACs, Sites of Community Importance (SCI) and proposed Ramsar sites) both onshore and offshore

There is potential for the majority of adverse effects on International Sites as a result of energy generating infrastructure development to be avoided, reduced and mitigated through careful siting, design and planning. However, the significance of any effects remains uncertain, and the effectiveness of the mitigation possibilities proposed will depend on the individual sensitivities of the receiving sites, in the context of specific details of the energy infrastructure development's design, layout and operation.

Habitats Regulations Assessment (HRA) will determine whether individual energy infrastructure proposals have an adverse effect on the integrity of International Sites, as recognised in EN-1, as they are important sites for biodiversity identified through international conventions and the Conservation of Habitats and Species Regulations 2017 (as amended) as well as the Conservation of Offshore Marine Habitats and Species Regulations 2017. In addition, EN-1 itself is subject to HRA, which has been carried out alongside this AoS and has informed this assessment.

EN-1 also highlights the need for proposals to be accompanied by and Environmental Statement (ES) (under the Infrastructure Planning Regulations 2017), which describes the likely significant effects of the proposal on the environment, including specific reference to biodiversity. Through this legal requirement for an ES, it is ensured that the direct, indirect, secondary, transboundary and short to long term effects of the development on biodiversity will be considered, as these are requirements in The Regulations. Where development is subject to EIA, EN-1 suggests that the ES should clearly set out any effects on internationally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats. It is considered that in many instances such irreplaceable habitats may also be designated for nature conservation purposes.

EN-1 outlines mitigation measures which are likely to reduce direct and indirect effects on international sites. These include limiting construction activities to the minimum area required, following best practice in terms of avoiding disturbance or damage to species or habitats, restoration of habitats following construction and enhancement of habitats where practicable. The potential for noise disturbance caused by proposed development should also be considered where proximity to designated sites may mean that noise could have an adverse impact on protected species or other wildlife. Seasonality aspects of wildlife in such designated sites should also be considered.

EN-1 also recognises that loss of or damage to designated sites might occur and it notes that information to allow effective consideration of this must be provided, including an assessment of alternative solutions, a case for Imperative Reasons of Overriding Public Interest (IROPI) and appropriate environmental compensation. It is noted that provision of this information will not be taken as an acceptance of adverse impacts. Consideration of compensation should be made as early as possible and close liaison with SNCB and Defra / Welsh Government should be undertaken. Before submitting an application, applicants should seek the views of the SNCB and Defra/Welsh Government as to the suitability, securability and effectiveness of the compensation plan to ensure the development will not hinder the achievement of the conservation objectives for the protected site.

EN-1 notes that the British Energy Security Strategy committed to establishing strategic compensation for renewables NSIPs, to offset environmental effects but also to reduce delays for individual projects.

The AoS therefore concludes that the NPS recognises the importance of designated sites and provides a framework for their protection and avoidance of loss.

Support continued improvements to the condition status of the UK’s national site network?

SACs and Special Protection Areas (SPAs) in the UK no longer form part of the EU’s Natura 2000 ecological network. The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 have created a national site network on land and at sea, including both the inshore and offshore marine areas in the UK. The national site network includes existing SACs and SPAs and any new SACs and SPAs designated under these Regulations.

Any references to Natura 2000 in the 2017 Regulations and in guidance now refers to the new national site network.

Maintaining a coherent network of protected sites with overarching conservation objectives is still required in order to fulfil the commitment made by government to maintain environmental protections and continue to meet international legal obligations, such as the Bern Convention, the Oslo and Paris Conventions (OSPAR), Bonn and Ramsar Conventions

Statutory Nature Conservation Bodies are responsible for monitoring and managing designated sites. It is also noted that applicants can request and agree 'Evidence Plans' with SNCBs, which is a way to agree and record upfront the information the applicant needs to supply with its application, so that the HRA can be efficiently carried out.

If, during the pre-application stage, the SNCB indicate that the proposed development is likely to adversely impact the integrity of a protected site, the applicant must include with their application such information as may reasonably be required to assess a potential derogation under the Habitats Regulations.

Note is also made in EN-1 of the need to protect Marine Conservation Zones and Marine Protected Areas. Marine Protected Area (MPA) is a term used to describe the network of HRA sites, SSSIs and MCZs in the English and Welsh marine environment. It is important that relevant guidance on managing environmental impacts of infrastructure in marine protected areas is followed, and that equal consideration of the effect of proposals should be given to all MPAs regardless of the legislation they were designated under. This is because all sites contribute to the network of MPAs and therefore to overall network integrity. For this reason, the Secretary of State should assess the impact, either alone or in combination, on all designated MPA sites when making any decision on development consent.

For the reasons outlined above, the AoS concludes that the NPS provides a mechanism to support continued improvements to the condition status of the UK's national site network.

5.2.4: Assessment Conclusions and Summary

EN-1 has been subject to HRA to determine whether the strategic plan poses a risk to International Sites and whether it would result in likely significant effects, either alone, or in combination with other plans. The NPSs do not include any sites, locations or other spatial proposals and, therefore, the HRA is an assessment of the policy content only. As such it is high-level and strategic in nature and it does not constitute or take the place of a project HRA for any energy infrastructure development that may come forward under the NPSs.

Given the strategic nature of the NPSs and the lack of geographically specific proposals, they allow for a wide range of potential energy development to take place in any part of England and Wales, territorial waters and within the Renewable Energy Zone offshore. As such, it was not possible for the HRA to conclude that there will be no effects on International Sites as a result of development coming forward under the NPSs. It was not possible to screen out likely significant effects at the screening stage, nor adverse effects on integrity at the appropriate assessment stage. A number of alternatives to the NPSs were considered, but none of the reasonable alternatives would be able to avoid the potential for adverse effects on integrity on International Sites.

The Government has concluded that, whilst energy development should seek to avoid significant adverse effects on International Sites, there is a case for imperative reasons of overriding public interest (IROPI). This means that the NPSs can be designated, even if they could result in adverse effects on the integrity of International Sites. Where this is the case, sufficient compensatory measures must be provided.

Therefore, there is potential for significant negative effects on sites designated for their international importance and nature conservation purposes as a result of the plan implementation in the short, medium and long term. This could include on sites which are in the jurisdiction of other countries (transboundary). The effects identified are uncertain as they will depend on the specific locations and scale of development, which is uncertain given that the NPSs do not outline specific proposals.

Table 5-4 – Protect and enhance sites designated for their international importance for nature conservation purposes Objective Summary

AoS Objective	Assessment of generic effects (by timescale)		
	S	M	L
Protect and enhance sites designated for their international importance for nature conservation purposes Guide questions: • Avoid the loss of sites of international importance (SPAs, SACs and Ramsar sites), including those of potential designation (candidate SPAs, proposed SACs, Sites of Community Importance (SCI) and proposed Ramsar sites) both onshore and offshore? • **Support continued improvements to the condition status of the UK's national site network**	--	--	--

5.6: AoS Objective 5: Protect and enhance cultural heritage assets and their setting, and the wider historic environment

5.6.1: Anticipated Effects

New energy related development may result in pressure on areas of importance for their cultural heritage and aesthetic quality. There is a requirement for development proposals to be carefully considered such that assets are preserved and enhanced – the NPS will need to respond to context such that preservation is pursued where appropriate, but pro-active management and redevelopment can be supported where this secures viable futures for cultural heritage resources that are currently threatened.

The construction, operation and decommissioning of energy infrastructure has the potential to result in adverse impacts on the historic environment. EN-1 defines the historic environment as including all aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, landscaped and planted or managed flora. It is understood that this would include offshore marine shipwrecks, or other submerged artefacts. Those elements of the historic environment that hold value to this and future generations because of their historic, archaeological, architectural or artistic interest are called "heritage assets". Without a co-ordinated strategic approach to development and infrastructure there is an increased potential for this risk to result.

It is to be noted (as recognised in EN-1) that some heritage assets are of a level of significance that warrants official designation e.g. World Heritage Sites, Scheduled Monuments etc., but the absence of designation does not indicate lower significance – these are subject to the same policy considerations[10]. It is important to note that the nature of cultural heritage features means that not all are known at present; in particular, buried archaeological remains.

Enabling the development of energy infrastructure to meet the energy demands of the UK has the potential for a number of generic effects on archaeology and cultural heritage which are applicable across the different types of energy infrastructure development and which may be both direct and indirect. They include:

- Direct disturbance or loss of heritage assets during construction as a result of ground works or excavation; and
- Indirect impacts on the setting of nearby heritage assets, for example visual intrusion within a landscape or townscape context, or from noise or pollutants.

5.6.2: Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 5.

Conserve and enhance designated heritage assets and their settings (World Heritage Sites, Scheduled Monuments, Listed Buildings and structures, Registered Parks and Gardens, Registered Historic Landscapes, Heritage Coasts, Registered Battlefields and Conservation Areas), as well as maritime assets such as Protected Wrecks

EN-1 Part 5 Historic Environment sets out the following categories of designated heritage assets that are of concern: World Heritage Sites; Scheduled Monuments; Protected Wreck Sites; Protected Military Remains; Listed Buildings; Registered Parks and Gardens; Registered Battlefields; Conservation Areas; and Registered Historic Landscapes (Wales only).

EN-1 also sets out that non-designated heritage assets that have been demonstrably shown to be of equivalent significance to Scheduled Monuments, should be considered subject to the same policy considerations as those that apply to designated heritage assets. Note that the absence of designation for such heritage assets does not indicate lower significance.

In determining applications, the Secretary of State should seek to identify and assess the particular significance of any heritage asset that may be affected by the proposed development, including by development affecting the setting of a heritage asset (including assets whose setting may be affected by the proposed development), taking account of a number of important factors as set out in EN-1 Part 5. The Secretary of State must also comply with the requirements on listed buildings, conservation areas and scheduled monuments, set out in Regulation 3 of the Infrastructure Planning (Decisions) Regulations 2010.

In considering the impact of a proposed development on any heritage assets, the Secretary of State should take into account the particular nature of the significance of the heritage assets and the value that they hold for this and future generations. This understanding should be used to avoid or minimise conflict between their conservation and any aspect of the proposal.

[10] It is to be noted that different parts of Government have different responsibilities in relation to heritage assets. For example, the issuing of licenses to undertake works on Protected Wreck Sites in English waters is the responsibility of the Secretary of State for Culture, Media and Sport and does not form part of development consents issued by the Secretary of State for DESNZ. In Wales it is the responsibility of Welsh Ministers. The issuing of licences for Protected Military Remains is the responsibility of the Secretary of State for Defence.

The Secretary of State should take into account the desirability of sustaining and, where appropriate, enhancing the significance of heritage assets, the contribution of their settings and the positive contribution that their conservation can make to sustainable communities, including to their quality of life, their economic vitality, and to the public's enjoyment of these assets. The Secretary of State should also take into account the desirability of the new development making a positive contribution to the character and local distinctiveness of the historic environment. The consideration of design should include scale, height, massing, alignment, materials, use and landscaping (for example, screen planting).

When considering the impact of a proposed development on the significance of a designated heritage asset, the Secretary of State should give great weight to the asset's conservation. The more important the asset, the greater the weight should be. This is irrespective of whether any potential harm amounts to substantial harm, total loss, or less than substantial harm to its significance.

Considerable importance and weight should be given to desirability of preserving all heritage assets. Any harm or loss of significance of a designated heritage asset (from its alteration or destruction, or from development within its setting) should require clear and convincing justification. Substantial harm to or loss of significance of a grade II Listed Building or a grade II Registered Park or Garden should be exceptional. Substantial harm to or loss of significance of assets of the highest significance, including Scheduled Monuments; Protected Wreck Sites; Registered Battlefields; grade I and II* Listed Buildings; grade I and II* Registered Parks and Gardens; and World Heritage Sites, should be wholly exceptional.

Any harmful impact on the significance of a designated heritage asset should be given significant weight when weighed against the public benefit of development.

Where the proposed development will lead to substantial harm to (or total loss of significance of) a designated heritage asset the Secretary of State should refuse consent unless it can be demonstrated that the substantial harm to or loss of significance is necessary to achieve substantial public benefits that outweigh that harm or loss, or all of the following apply:

- the nature of the heritage asset prevents all reasonable uses of the site
- no viable use of the heritage asset itself can be found in the medium term through appropriate marketing that will enable its conservation
- conservation by grant-funding or some form of not for profit, charitable or public ownership is demonstrably not possible
- the harm or loss is outweighed by the benefit of bringing the site back into use

Where the proposed development will lead to less than substantial harm to the significance of the designated heritage asset, this harm should be weighed against the public benefits of the proposal, including, where appropriate securing its optimum viable use.

EN-1 notes that Heritage Coasts have been confirmed by the government as having the highest status of protection in relation to landscape and scenic beauty, the terrestrial and coastal fauna and flora and heritage features. The designation represents a specific statutory purpose in ensuring their continued protection and the Secretary of State should have regard to these in their decision. As such EN-1 notes the applicant should identity any effects on the special character of Heritage Coasts. The Secretary of State may grant development consent in these areas only in exceptional circumstances. Given that recognition has already been made in the NPS in respect of landscape and biodiversity, the AoS recommends that Heritage Coasts are also recognised within the Historic Environment section of the NPS (Section 5.9.4).

The AoS therefore concludes that the NPS recognises the importance of conserving and enhancing designated heritage assets (and equivalent non-designated heritage assets) and their setting and it sets out strong protection policy for these assets. However, when development results in substantial harm to a designated asset, the Secretary can still give consent if it can be demonstrated that the substantial harm to or loss of significance is necessary to achieve substantial public benefits that outweigh that harm or loss. Therefore EN-1 will unlikely provide adequate levels of protection to designated heritage assets when overriding public benefits considerations outweigh any harm of loss.

Conserve and enhance non-designated and / or locally listed heritage assets (including newly discovered heritage assets and archaeology) and their settings?

EN-1 sets out that the Secretary of State should also consider the impacts on other non-designated heritage assets (as identified either through the development plan making process by local authorities, including ‘local listing’, or through the application, examination and decision making process). This is on the basis of clear evidence that such heritage assets have a significance that merits consideration in that process, even though those assets are of lesser significance than designated heritage assets.

In weighing applications that directly or indirectly affect non-designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset.

The AoS therefore finds that EN-1 recognises the importance of non-designated and / or locally listed heritage assets upon which impacts need to be considered. However, when development results in substantial harm to a non-designated asset, the Secretary can still give consent if it can be demonstrated that the substantial harm to or loss of significance is necessary to achieve substantial public benefits that outweigh that harm or loss. Therefore EN-1 will be unlikely to provide adequate levels of protection to non-designated heritage assets when overriding public benefits considerations outweigh any harm of loss.

Avoid significant harm to heritage assets, for example from the generation of noise, pollutants and visual intrusion?

EN-1 sets out that the applicant should ensure that the extent of the impact of the proposed development on the significance of any heritage assets affected can be adequately understood from the application and supporting documents. Studies will be required on those heritage assets affected by noise, vibration, light and indirect impacts, the extent and detail of these studies will be proportionate to the significance of the heritage asset affected.

The applicant is encouraged, where opportunities exist, to prepare proposals which can make a positive contribution to the historic environment, and to consider how their scheme takes account of the significance of heritage assets affected. This can include, where possible:

- enhancing, through a range of measures such a sensitive design, the significance of heritage assets or setting affected
- considering measures that address those heritage assets which are at risk or which may become at risk, as a result of the scheme, including the development of archive capacity which could deliver significant public benefits
- considering how visual or noise impacts can affect heritage assets, and whether there may be opportunities to enhance access to, or interpretation, understanding and appreciation of, the heritage assets affected by the scheme

Careful consideration in preparing the scheme will be required on whether the impacts on the historic environment will be direct or indirect, temporary or permanent.

Applicants should look for opportunities for new development within Conservation Areas and World Heritage Sites, and within the setting of heritage assets, to enhance or better reveal their significance. Proposals that preserve those elements of the setting that make a positive contribution to the asset (or which better reveal its significance) should be treated favourably.

The AoS concludes that EN-1 recognises that heritage assets can be harmed through a range of direct (alteration or destruction) and indirect impacts (through development within its setting) which would give rise to impacts including noise and visual intrusion.

Ensure appropriate archaeological assessment prior to development?
EN-1 sets out a robust approach to assessment of any development applications in terms of cultural heritage. This notes that, through an EIA procedure, applicants should provide a description of the significance of the heritage assets affected by the proposed development and the contribution of their setting to that significance. The level of detail should be proportionate to the importance of the heritage assets and no more than is sufficient to understand the potential impact of the proposal on the significance of the heritage asset. Consultation with relevant statutory bodies is also required, with minimal requirements set out. It is also noted that where a development site includes, or the available evidence suggests it has the potential to include, heritage assets with an archaeological interest, the applicant should carry out appropriate desk-based assessment and, where such desk-based research is insufficient to properly assess the interest, a field evaluation. Where proposed development will affect the setting of a heritage asset, representative visualisations may be necessary to explain the impact. The applicant should ensure that the extent of the impact of the proposed development on the significance of any heritage assets affected can be adequately understood from the application and supporting documents.

The AoS finds that provision for appropriate archaeological assessment prior to development has been set out in EN-1.

Maintain or improve the interpretation, understanding and appreciation of the historic environment?
The AoS finds that EN-1 places a sufficient requirement on the applicant to establish whether there may be opportunities to enhance access to, or interpretation, understanding and appreciation of the heritage assets affected by the scheme.

5.6.3: Assessment Conclusions and Summary

Direct effects are likely to occur in the short term during the construction of development and associated supporting infrastructure. Indirect effects are likely to occur in the short and medium term with long term effects dependent on infrastructure operational duration (which could be many decades) and decommissioning activities.

In areas where there is a concentration or cluster of energy infrastructure development there is also the potential for negative cumulative effects on the setting of heritage assets as well as physical impacts that ultimately may result in a change to the significance of heritage assets. The significance of these effects is highly dependent on the location and scale of development, as well as the importance and nature of heritage assets and their setting relative to energy infrastructure.

In most cases, it is anticipated that there is the potential for minor negative effects (including cumulative effects) on heritage assets (designated and non-designated) in the short, medium and long term as a result of the potential impacts on assets and their settings (with some uncertainty about the extent of direct effects such as disturbance and loss as these will be determined by location and type of any infrastructure in relation to the heritage assets). It is to be noted that some heritage assets such as shipwrecks are located offshore and may be in the legal ownership of or be of considerable historic interest to other countries (for example wrecks identified as war graves) and as such, there is a potential for trans-boundary effects. However, it is considered that all potential effects are addressed through the robust approach outlined in EN-1.

Table 5-5 – Protect and enhance cultural heritage Objective Summary

<table>
<tr><th rowspan="2">AoS Objective</th><th colspan="3">Assessment of generic effects (by timescale)</th></tr>
<tr><th>S</th><th>M</th><th>L</th></tr>
<tr><td>Protect and enhance cultural heritage assets and their settings, and the wider historic environment
Guide questions:
• Conserve and enhance designated heritage assets and their settings (World Heritage Sites, Scheduled Monuments, Listed Buildings and structures, Registered Parks and Gardens, Registered Historic Landscapes, Registered Battlefields and Conservation Areas), as well as maritime assets such as protected wrecks?
• Conserve and enhance non-designated and / or locally listed heritage assets (including newly discovered heritage assets and archaeology) and their settings?
• Avoid significant harm to heritage assets, for example from the generation of noise, pollutants and visual intrusion?
• Ensure appropriate archaeological assessment prior to development?
• Maintain or improve the interpretation, understanding and appreciation of the historic environment?
• Maintain the character of those stretches of coastline identified and locally ‘designated’ as Heritage Coasts</td><td>-</td><td>-</td><td>-</td></tr>
</table>

5.7: AoS Objective 6: Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity

5.7.1: Anticipated Effects

The scope and scale of the development enabled by the plan has the potential for a range of landscape and visual effects which EN-1 recognises will vary according to the type of development, its location and the landscape setting of the proposed development. Note that references in EN-1 to landscape are taken to include seascape and townscape where appropriate.

Virtually all nationally significant energy infrastructure projects will have effects on the landscape and is likely to have visual effects for many receptors around proposed sites. Landscape effects arise not only from the sensitivity of the landscape but also the nature and magnitude of change proposed by the development. Generic effects on landscape from energy infrastructure include:

- the introduction of a range of new, industrial structures, (often of significant size and requiring substantial land take) including long term, permanent structures; and developments that are temporary in the short to medium term;
- introduction of associated outputs to industrial processes such as visible steam plumes, and
- visual effects for receptors (residents, tourists, visitors).

It is to be noted that many areas within England and Wales that could potentially host new energy infrastructure of a large scale (e.g. coastal locations), currently support a high level of local and national landscape designations[11]. The development of a mix of generating technologies will deliver large scale and tall structures, in both existing industrial locations and in new greenfield/offshore/coastal settings. Many of these structures are likely to be in predominantly rural, remote areas, including areas of high landscape value where visual impacts will be significant. The scale and severity of those effects will depend on the energy type, its overall setting context and the specifics of the site itself. EN-1 recognises that coastal areas are particularly vulnerable to visual intrusion because of the potential high visibility of development on the foreshore, on the skyline and affecting views along stretches of undeveloped coast.

Particular effects can be experienced in those areas that are designated for their landscape value such as National Parks, the Broads and AONBs. It is to be noted that each of these areas has specific statutory purposes which help ensure their continued protection that could be adversely affected by development.

The character of the wider landscape and townscape should also be protected by ensuring that its integrity and valuable natural open space is not lost.

Opportunities for landscape enhancement should be explored, e.g. through sympathetic design and enhancements to existing landscape improvement areas, as well as new planting opportunities associated with new energy development and be in keeping with the aims of the Nature Recovery Network.

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[11] EN-1 AoS Baseline, Landscape, Townscape and Visual.

Increased energy development poses a serious risk to the special qualities of designated and other valued landscapes. Especially vulnerable are special qualities such as relative tranquillity and a sense of wildness or remoteness. As such, there is a need to protect those special qualities across many parts of England and Wales. Without a co-ordinated strategic approach to development and infrastructure degradation of the special qualities of our finest landscapes designated as AONBs and National Parks may be degraded or lost.

There is also a need to respect particular landscape or townscape settings. Careful consideration should be given to design quality in both an urban and rural setting, promoting placemaking principles and seeking to inject character and distinctiveness where possible and where this enhances the sense of place. Design, where possible, should respond positively to the local characteristics, including vernacular architecture when appropriate.

Without a co-ordinated strategic approach to development and infrastructure, there is increased potential for planning decisions to lead to inappropriate development, which could produce a cumulatively damaging impact on a designated landscape or fragment existing networks of open space thereby reducing connectivity.

5.7.2: Assessment and Recommendations made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 6.

Support the integrity and uphold the statutory purposes of any areas designated for landscape value ie, National Parks and AONBs, including in conjunction with the provisions of any relevant Management Plan

In respect of those areas with nationally significant landscape designations, such as National Parks, the Broads, AONBs and Heritage Coasts, EN-1 notes that development consent can be granted in exceptional circumstances, having been demonstrated to be in the public interest and with any development carried out to high environmental standards, including through the application of appropriate requirements where necessary.

EN-1 further notes that the duty to have regard to the purposes of nationally designated areas also applies to projects outside the boundaries of the nationally designated area but which may have impacts within them. There is a requirement to avoid harming the purposes of designation to minimise adverse impacts on designated areas with sensitive design given the various siting, operational and other relevant constraints.

The Secretary of State will be required to take into consideration the level of detailed design which the applicant has provided and is secured in the Development Consent Order (DCO), and the extent to which design details are subject to future approvals. EN-1 requires the Secretary of State to be satisfied that local authorities will have sufficient design content secured to ensure future consenting will meet landscape, visual and good design objectives.

In relation to those areas that are not nationally designated, but which may be highly valued locally and protected by local designation, the policies within local development plans that are based on landscape or seascape character assessment should be paid particular attention. However, local landscape designations should not be used in themselves to refuse consent, as this may unduly restrict acceptable development. In addition, consideration of benefits of the project (including need) would be made.

The AoS notes that the NPS should seek to conserve and enhance the natural beauty of national parks and AONBs, which is their shared statutory purpose. For land use planning the NPPF expresses this in terms of conserving and enhancing their 'landscape and scenic beauty'. Particular attention should be paid to these areas designated for their landscape value. This includes their landscape and seascape settings where intrusive development can affect the designated area and delivery of its statutory purpose.

The AoS finds that the EN-1 recognises the importance of supporting the integrity and upholding the statutory purpose of a designated site requiring development to be carried out to high environmental standards, including through the application of appropriate requirements where necessary.

Conserve and enhance the intrinsic character or setting of designated landscapes, townscapes and seascapes?

EN-1 requires the applicant to consider landscape and visual matters in the early stages of siting and design, where site choices and design principles are being established. This will allow the applicant to demonstrate in the ES how both negative effects have been minimised and opportunities for creating positive benefits or enhancement have been recognised. EN-1 however notes that the Landscape and Visual Impact Assessment must make reference to any landscape character assessment and associated studies as a means of assessing landscape impacts relevant to the proposed project.

EN-1 recognises that all projects need to be designed carefully, taking account of the potential impact on the landscape, seascape and townscape and having regard to siting, operational and other relevant constraints the aim should be to minimise harm to the landscape, providing reasonable mitigation where possible and appropriate.

EN-1 notes that reducing the scale of a project can further help to mitigate the visual and landscape effects of a proposed project. However, reducing the scale or otherwise amending the design of a proposed energy infrastructure project may result in a significant operational constraint and reduction in function – for example, the electricity generation output. This though may (in exceptional circumstances) be warranted. Other mitigation can include within a site, elements of design, including colour and materials and landscaping schemes. Offsite mitigation can also take place, for example through filling gaps in existing tree or hedge lines – this may help to enhance landscape in local areas.

The AoS finds that provision for appropriate landscape and visual impact assessment prior to development and the need for careful design and mitigation has been set out in EN-1 which will help conserve and enhance the intrinsic character or setting of designated landscapes, townscapes and seascapes.

Maintain the character of those stretches of coastline identified and locally 'designated' as Heritage Coasts?

EN-1 notes that in addition to the applicant carefully identifying effects of physical changes on the integrity and special features of Marine Protected Areas, identification of effects on the special character of Heritage Coasts should be made. Recognition is also made in EN-1 that Heritage Coasts are defined areas of undeveloped coastline which are managed to conserve their natural beauty and, where appropriate, to improve accessibility for visitors. EN-1 goes on to note that major development within a Heritage Coast (that is not also a National Pakr, the Broads or AONB) is unlikely to be appropriate, unless it is compatible with the special character of the area. The AoS finds that EN-1 will help to ensure the character of Heritage Coasts is maintained.

Conserve, protect and enhance natural environmental assets (e.g. parks and green spaces, common land, woodland / forests etc) as they contribute to landscape and townscape quality

EN-1 notes that consideration should be made of how landscapes can be enhanced through landscape management plans as this will help to enhance environmental assets where they contribute to landscape and townscape quality. However, it is to be recognised that due to the nature and size of potential schemes (as well as likely potential locations such as coastal areas), opportunities for mitigation will be limited and while EN-1 sets out a robust approach to addressing impacts on landscape, townscape and waterscape across the short, medium and long timeframes, the AoS concludes that significant adverse effects are likely to remain.

Support measures to enhance the resilience of ecosystems at a landscape scale and also to maximise benefits including public access and enjoyment of landscapes?

The requirement to incorporate improvements in natural capital and ecosystem services as part of a strategy to deliver Biodiversity Net Gain is clearly set out in EN-1. It notes that in addition to delivering BNG, developments may also deliver wider environmental gains and benefits to communities relevant to the local area and to national policy priorities, such as reductions in GHG emissions, reduced flood risk, improvements to air or water quality, landscape enhancement or increased access to natural greenspace including promoting nature-based solutions.

The AoS concludes that the measures outlined in the NPS will help to enhance the resilience of ecosystems (including those at a landscape scale).

Support functional landscapes e.g. those which reduce flood risk, sequester carbon or offer recreational opportunities in peri urban areas?

EN-1 notes the Secretary of State must be satisfied that energy infrastructure developments are sustainable and, having regard to regulatory and other constraints, are as attractive, durable, and adaptable (including taking account of natural hazards such as flooding) as they can be. In doing so, the Secretary of State should be satisfied that the applicant has taken into account both functionality (including fitness for purpose and sustainability) and aesthetics (including its contribution to the quality of the area in which it would be located, any potential amenity benefits, and visual impacts on the landscape or seascape) as far as possible. Whilst the EN-1 notes the applicant may not have any or very limited choice in the physical appearance of some energy infrastructure, it states there may be opportunities for the applicant to demonstrate good design in terms of siting relative to existing landscape character, land form and vegetation. Furthermore, the design and sensitive use of materials in any associated development such as electricity substations will assist in ensuring that such development contributes to the quality of the area. Applicants are also required to, so far as is possible, seek to embed opportunities for nature inclusive design within the design process.

EN-1 notes that where green infrastructure is affected, the Secretary of State should consider imposing requirements to ensure the functionality and connectivity of the green infrastructure network is maintained in the vicinity of the development and that any necessary works are undertaken, where possible, to mitigate any adverse impact and, where appropriate, to improve that network and other areas of open space including appropriate access to National Trails and other public rights of way and new coastal access routes.

The AoS concludes that EN-1 recognises the importance of supporting functional landscapes.

Minimise noise and light pollution from construction and operational activities on residential amenity and on sensitive locations, receptors and views?

EN-1 notes that a landscape and visual impact assessment (including construction and operation phases) should be made and reported through an Environmental Statement and should include cumulative effects.. Consideration is also to be made of light pollution effects, including on local amenity as well as nature conservation, with specific note made that an assessment of effects should be undertaken that should demonstrate how noise and light pollution from construction and operational activities on residential amenity and on sensitive locations, receptors and views, will be minimised. Further note is made within the NPS of the need to consider and assess the impacts of dust, odour, artificial light, smoke and steam and the Secretary of State should be satisfied that all reasonable steps have been taken and will be taken to minimise any such detrimental impacts.

The AoS therefore concludes that the NPS places sufficient conditions to minimise noise and light pollution form construction and operational activities.

5.7.3: Assessment made in respect of EN-1

Significant negative effects for landscape, townscape and visual receptors are likely as a result of the plan implementation in the short, medium and long term and it is to be noted that due to the size of likely Schemes, opportunities for mitigation will be limited. However, EN-1 sets out a robust approach to addressing impacts on landscape, townscape and seascape across those timeframes.

Table 5-6 – Protect and enhance landscapes Objective Summary

AoS Objective	Assessment of generic effects (by timescale)		
	S	M	L
Protect and enhance the character and quality of the landscapes and townscapes, protect and enhance visual amenity Guide questions: • Support the integrity and uphold the statutory purposes of any areas designated for landscape value ie, National Parks and AONBs, including in conjunction with the provisions of any relevant Management Plan? • Conserve and enhance the intrinsic character or setting of designated landscapes, townscapes and seascapes? • Maintain the character of those stretches of coastline identified and locally 'designated' as Heritage Coasts? • Conserve, protect and enhance natural environmental assets (e.g. parks and green spaces, common land, woodland / forests etc) as they contribute to landscape and townscape quality?	--	--	--

• Support measures to enhance the resilience of ecosystems at a landscape scale and also to maximise benefits including public access and enjoyment of landscapes? • Support functional landscapes e.g. those which reduce flood risk, sequester carbon or offer recreational opportunities in peri urban areas? • Minimise noise and light pollution from construction and operational activities on residential amenity and on sensitive locations, receptors and views?			

5.8: AoS Objective 7: Protect and enhance the water environment

5.8.1: Anticipated Effects

The scope and scale of the development outlined by the NPS has the potential for a number of generic impacts on the water environment (groundwater, inland surface water, transitional waters, coastal and marine waters) which are applicable across the different types of energy infrastructure development. They include:

- increased demand for water leading to volume abstractions and the modification of water levels resulting in reduced surface and groundwater flow;
- increased discharges to water and atmospheric pollution associated with industrial processes, which can lead to reduced water quality;
- construction, operation and decommissioning activities can increase the risk of spills, leaks and pollution events with negative effects on water quality, human health and protected biodiversity; and
- construction activities and the associated land take can result in physical modifications to the water environment.

The development of a range of major generating infrastructure that is enabled through EN-1 has the potential to result in direct adverse impacts in the short term on the water environment. Impacts are likely to occur from the construction of developments enabled through EN-1 and associated supporting infrastructure. Furthermore, it is likely that energy infrastructure development will be located in rural and coastal areas on land which has a strong relationship with ground, surface, estuarine and coastal water bodies. There is potential for indirect effects on the water environment to occur in the short and medium term. Long term indirect effects will be dependent on the duration that infrastructure developments are in operation, which is likely to be many decades in the case of major generating infrastructure. The decommissioning stage of any of the generating infrastructure also has the potential to have direct negative effects on the water environment.

There is potential for negative cumulative effects on the water environment in areas where there is a concentration or cluster of energy infrastructure development. The significance of these effects will be dependent on the locations and scales of development relative to water bodies.

5.8.3: Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 7.

Protect ground, surface, estuarine and coastal water quality, including during periods of increased summer temperatures due to climate change?

In relation to water quality, EN-1 requires applicants to describe existing water quality and the impacts of the proposed project on water quality, including noting any relevant existing discharges, proposed new discharges and any proposed changes to discharges.

In cases where there is potential for a project to have effects on the water environment, it is recommended through EN-1 that an assessment of the existing status of and potential impacts on water quality, water resources and physical characteristics of the water environment and how this might change due to the impact of climate change on rainfall patterns and consequently water availability across the water environment should be undertaken as part of an ES. EN-1 also suggests that ES for energy infrastructure proposals should demonstrate how proposals will minimise the use of water resources and water consumption.

EN-1 also recognises the impacts that energy generating infrastructure's emissions can have on water bodies in terms of causing excessive enrichment of nutrients (eutrophication) as a result of air pollution containing NOx and ammonia. It is noted in EN-1 that changes in algal composition cause algal blooms, which remove oxygen from the water environment that adversely impacts plants and fish. To tackle this, EN-1 advises that where a project may have adverse impacts on air quality, the ES should describe any potential eutrophication impacts.

Despite the risks to water quality identified, there is potential for the majority of adverse effects on the water environment as a result of energy generating infrastructure development to be avoided, reduced and mitigated through careful design and planning to facilitate adherence to good pollution control practice. Furthermore, EN-1 recommends that risks to the water environment can be reduced on sites by designated areas for storage and unloading, appropriate drainage facilities and efficient use of water. Encouragement is also made to consider protective measures to control the risk of pollution to groundwater. It is also to be noted that the NPS makes reference to the use of SuDS. While these would be primarily for addressing issues related to flood risk, they also do have an important function in terms of helping to protect water quality. These systems would help to achieve the noted encouragement within the NPS for applicants to manage surface water during construction by treating surface water runoff from exposed topsoil prior to discharging and to limit the discharge of suspended solids e.g. from car parks or other areas of hard standing, during operation.

However, the long term significance of these effects remains uncertain, and the effectiveness of the mitigation possibilities proposed will depend on the individual sensitivities of the receiving sites, in the context of specific details of the development design, layout and operation.

EN-1 notes that the Secretary of State should consider proposals to mitigate adverse effects on the water environment and any enhancement measures put for forward and whether appropriate requirements should be attached to any development consent and/or planning obligations.

The AoS concludes that the NPS sets out an approach that is sufficient to protect water quality in all waterbody types and includes consideration of the impacts of climate change.

Safeguard the availability of water resources (surface and groundwater), including during periods of increased summer temperatures due to climate change?

To protect water resources, EN-1 advises the applicant should note any relevant abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates, which should include any impact to mains supplies and reference to Abstraction Licensing Strategies and also demonstrate how proposals minimise the use of water resources and water consumption in the first instance. The same approach is recommended by EN-1 for physical characteristics of water bodies including quantity and dynamics of flow. EN-1 also notes that any impacts on water bodies protected under the Water Framework Directive (WFD) or source protection zones (SPZs) around potable groundwater abstractions should also be identified. The NPS notes that consideration should be made of how climate change could impact these elements in the future.

The AoS concludes that the NPS is sufficient to safeguard availability of water resources, with consideration also to be made of a changing climate.

Minimise the use of water resources / water consumption?

EN-1 also notes that the impact on local water resources can be minimised through planning and design for the efficient use of water, including water recycling. If a development needs new water infrastructure, significant supplies or impacts other water supplies, the applicant should consult with the local water company and the EA or NRW.

The AoS concludes that the NPS sets out an approach to minimise the use of water resources.

Protect the integrity of coastal and estuarine processes & protect the quality of the seabed and its sediments, and avoids significant effects on seabed morphology and sediment transport processes?

In terms of the marine environment, EN-1 indicates that applicants for a Development Consent Order will need to take account of relevant marine plans and conduct a marine plan assessment. It is suggested that applicants refer to marine plans at an early stage to avoid less favourable locations. Applicants are encouraged to consult the Marine Management Organisation (MMO) on nationally significant projects as the MMO will advise the Secretary of State on what conditions should apply to deemed marine licence. EN-1 recognises that in coastal environments, the delivery of energy generating infrastructure may involve construction activities that would result in direct impacts on coastal and marine habits, or indirect impacts through changes to the hydrodynamic regime of an area. As such, EN-1 recommends that applicants should undertake coastal geomorphological and sediment transfer modelling where necessary.

Note is also made that the Secretary of State will also consider the interactions of proposed projects with Shoreline / Estuary Management Plans. As such, the NPS sets out that applicants are to detail through an ES, the impact of the proposed project on coastal processes and geomorphology, including by taking account of potential impacts from climate change. If the development will have an impact on coastal processes the applicant must demonstrate how the impacts will be managed to minimise adverse impacts on other parts of the coast. Consideration also needs to be made of the implications of the proposed project on strategies for managing the coast as set out in Shoreline Management Plans (SMPs), any relevant Marine Plans and capital programmes for maintaining flood and coastal defences and Coastal Change Management Areas.

The AoS concludes that the NPS sets out an approach sufficient to protect the integrity of coastal and estuarine processes, as well as protect seabed morphology and sediment transfer processes.

Reduce operational and accidental discharges to the water environment?

EN-1 notes that consideration of discharges are to be described within the ES. This will note any relevant existing discharges, proposed new discharges and proposed changes to discharges and can be expected to address the issue of accidental discharge. It is also to be noted that through EN-1, applicants are encouraged to manage surface water during construction by treating surface water runoff from exposed topsoil prior to discharging and to limit the discharge of suspended solids e.g. from car parks or other areas of hard standing. Additionally, EN-1 encourages applicants to go beyond measures outlined in Water Resource Management Plans, by considering protective measures to control the risk of pollution to groundwater, which could include the use of protective barriers. Note is also made that the risk of impacts on the water environment can be reduced through careful design to facilitate adherence to good pollution control practice. For example, designated areas for storage and unloading, with appropriate drainage facilities, should be clearly marked.

The AoS concludes that the NPS sets out an approach that will help to reduce operational and accidental discharge to the water environment.

Support measures to attain good environmental status of both marine and coastal/estuarine waters as determined by the WFD and MSFD?

EN-1 notes that more weight will be given where a project is likely to have adverse effects on the achievement of objectives under the WFD. Additionally, EN-1 suggests that the Secretary of State will consider whether a proposal has had sufficient regard to River Basin Management Plans, and meets the requirements of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (including regulation 19). The specific objectives for particular river basins are set out in River Basin Management Plans. It is noted the development consent must be refused where a project is likely to cause deterioration of a water body or its failure to achieve good status or good potential, unless the conditions to apply the exemption of Overriding Public Interest, as outlined under Regulation 19, are met. A project may be approved in the absence of a qualifying Overriding Public Interest test only if there is sufficient certainty that it will not cause deterioration or compromise the achievement of good status or good potential.

In addition, consideration should be made of the interaction of the Project and Water Resources Management Plans and Shoreline/Estuary Management Plans.

The AoS concludes that the NPS will help to support measures to attain good environmental status of waterbodies and will take into account (more weight given) in decision making where this is not the case.

Contribute to meeting relevant statutory targets in the Environment Act 2021?

While no direct note is made of the Environment Act 2021 in relation to water quality, EN-1 does note that the principles for marine net gain are currently in development by Defra and there are provisions in the Environment Act 2021 to allow marine net gain to become mandatory in the future. It is anticipated that these provisions will reinforce the need for robust approaches to protecting water quality.

Assessment Conclusions and Summary

The AoS notes that the NPS should seek to prevent pollution of water bodies (including groundwater and bathing water) both during the construction and operation of any proposed energy development. This could be achieved via the appropriate use of SuDS, green infrastructure or other appropriate measures and new approaches in infrastructure drainage design to enhance water quality and reduce pollution and flood risk. Risk to all types of water bodies (not just main rivers) is to be considered during any development design.

Recognition of the objectives of the WFD should be made within the NPS and all opportunities to help meet the objectives of the WFD should be taken when possible.

Green-blue Infrastructure should also be considered in the NPS in the context of the aims of the WFD and how this can realise these, as well as other wider benefits and objectives.

The AoS also notes that without a coordinated approach to energy development and infrastructure there is increased potential for reduced water availability and water quality/pollution problems to result at water bodies, including contamination of drinking water, and effects on habitats.

Minor negative effects for water quality are likely as a result of the plan implementation in the short term through to the long term as it will not be possible to avoid all negative effects on the water environment, given the likely scale and nature of proposed developments, for example through construction activities as well as the need for cooling water abstraction and discharge. Across all timescales, there is potential for the measures outlined above, along with Environment Agency controls to appropriately mitigate these risks, though some minor adverse effects will remain. The effects identified are uncertain as they will depend on the specific locations and scale of development.

Table 5-7 – Protect and enhance water environment Objective Summary

AoS Objective	**Assessment of generic effects (by timescale)**		
	S	**M**	**L**
Protect and enhance the water environment **Guide questions:** • **Protect ground, surface, estuarine and coastal water quality, including during periods of increased summer temperatures due to climate change?** • **Safeguard the availability of water resources (surface and groundwater), including during periods of increased summer temperatures due to climate change?** • **Minimise the use of water resources / water consumption?** • **Protect the integrity of coastal and estuarine processes?** • **Reduce operational and accidental discharges to the water environment?** • **Protect the quality of the seabed and its sediments, and avoids significant effects on seabed morphology and sediment transport processes?**	**-**	**-**	**-**

Support measures to attain good environmental status of both marine and coastal/estuarine waters as determined by the WFD and MSFD? **Contribute to meeting relevant statutory targets in the Environment Act 2021?**			

5.9: AoS Objective 8: Protect and enhance air quality

5.9.1: Anticipated Effects

Enabling the development of energy infrastructure to meet the energy demands of the UK has the potential for a number of generic adverse effects on air quality which are applicable across the different types of energy infrastructure development. They include:

- emissions generated as a result of construction activities (transport emissions from the transport of materials, resources and personnel; dust and fumes from machinery operation, excavation and drilling);
- emissions from project operation (operation of plant, transport of materials, resources and personnel); and
- emissions from plant, machinery and vehicles during the decommissioning of projects (including transport to and from site).

Assessment and Recommendations made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 8.

Minimise emissions of dust and other air pollutants that affect human health or biodiversity

EN-1 notes that adverse effects may occur at all stages of the project, as a result of emissions released during construction, operation, and decommissioning. Air emissions are noted to include particulate matter (for example dust) up to a diameter of ten microns (PM10) as well as gases such as sulphur dioxide, carbon monoxide and nitrogen oxides (NOx). The significance of effects will depend upon local site-specific factors, such as transport routes and proximity to sensitive receptors and it is anticipated these will be dealt with during the project level EIA. EN-1 recognises that proximity to emission sources can have significant impacts on sensitive receptor sites for air quality, such as education or healthcare sites, residential use or sensitive or protected ecosystems. Projects near a sensitive receptor site for air quality should only be proposed in exceptional circumstances if no viable alternative site is available. In these instances, substantial mitigation of any expected emissions will be required.

EN-1 requires the Secretary of State to consider whether mitigation measures are needed both for operational and construction emissions over and above any which may form part of the project application. A construction management plan may help codify mitigation at this stage. EN-1 further notes that mitigations on traffic and transport impacts will help mitigate the effects of air emissions from transport.

In addition, EN-1 notes that during construction, operation and decommissioning of energy infrastructure there is potential for the release of a range of emissions such as odour, dust, steam, smoke, artificial light and infestation of insects. All have the potential to have a detrimental impact on amenity or cause a common law nuisance or statutory nuisance under Part III, Environmental Protection Act 1990. There is a requirement that such emissions are assessed and mitigation measures applied, with all reasonable steps taken to minimise detrimental impacts.

The AoS concludes that EN-1 makes commitments to minimise emissions released during all stages of the project.

Improve air quality within AQMAs and avoid the need for new AQMAs

EN-1 identifies that applicants will be required to undertake an assessment of impacts of the proposed project on air quality as part of the Environmental Statement. EN-1 notes that substantial weight should be given to air quality where a project would lead to a deterioration in an area where national air quality limits or statutory air quality objectives are breached, and air quality considerations will also be important where substantial changes in air quality are expected, even if this does not lead to any breaches of national air quality limits or statutory air quality objectives.

The Secretary of State should give air quality considerations substantial weight where a project is proposed near a sensitive receptor site such as an education or healthcare facility, residential use or a sensitive or protected habitat. Where a project is proposed in close proximity to a sensitive receptor or air quality, if justification cannot be provided for that location and a suitable mitigation plan proposed, consent should be refused.

Where a proposed development is likely to lead to a breach of the air quality thresholds or affect the ability of a non-compliant area to achieve compliance within the timescales set out in the most recent relevant air quality plan at the time of the decision, the applicant should work with the relevant authorities to secure appropriate mitigation measures to ensure that those thresholds are not breached.

The Secretary of State should consider whether mitigation measures are needed both for operational and construction emissions over and above any which may form part of the project application. The measures outlined for transport and traffic impacts in EN-1 will also help to mitigate the effects of air emissions from transport.

The AoS therefore concludes that the NPS recognises the importance of improving air quality within AQMAs and the need to avoid new AQMAs.

Promote enhancements to green infrastructure networks to help improve air quality

EN-1 notes the need for provision and enhancement of green infrastructure and it is recognsied that this can contribute to cleansing of pollutants. Applicants are encouraged to consider how new green infrastructure can be provided, or how existing green infrastructure can be enhanced, as part of their application.

The AoS finds that EN-1 has recognised the importance of enhancing green infrastructure networks to improve air quality.

Contribute to meeting relevant statutory targets in the Environment Act 2021?

EN-1 notes that where a project is likely to have adverse effects on air quality the applicant should undertake an assessment of the impacts of the proposed project as part of the ES describing any significant air emissions. EN-1 specifies that the levels for pollutants in ambient air are set out in the Air Quality Standards Regulations 2010 and reiterated in the Air Quality Strategy. In addition, EN-1 notes that two new air quality targets – one for annual mean concentrations of $PM_{2.5}$ and one further long-term target – are required to be set under the Environment Act 2021. The Secretary of State for Environment, Food and Rural Affairs is required to make available up to date information on air quality to any relevant interested party.

The AoS therefore finds that EN-1 makes commitments to meet relevant statutory targets in the Environment Act 2021.

5.9.3: Assessment made in respect of EN-1

While EN-1 notes a robust approach to managing effects on air quality, it is anticipated that effect on air quality is still expected to slightly adverse, due to the potential for emissions of air pollutants at all stages of the project.

Table 5-8 – Protect and enhance air quality Objective Summary

AoS Objective	**Assessment of generic effects (by timescale)**		
	S	**M**	**L**
Protect and enhance air quality **Guide questions:** • Minimise emissions of dust and other air pollutants that affect human health or biodiversity? • Improve air quality within AQMAs and avoid the need for new AQMAs? • Promote enhancements to green infrastructure networks to help improve air quality? • Contribute to meeting relevant statutory targets in the Environment Act 2021?	-	-	-

5.10: AoS Objective 9: Protect soil resources and avoid land contamination

5.10.1: Anticipated Effects

Soils are an essential natural capital, performing a range of important ecosystem services and functions. Changing precipitation patterns due to climate change will require soils to provide additional resilience to flooding and this will demand appropriate management and land use. Measures should be taken to avoid land take /loss of BMV land and to protect soil generally through avoidance of impacts such as contamination, loss, mixing, compaction or sealing of soils.

Soils and agricultural land are effectively finite in amount and declining in extent so land take is an important consideration. Whilst mitigation against the permanent loss of BMV land is extremely difficult, minimising the loss, securing the beneficial re-use of the displaced soils, and suitable management of remaining soils (through the Defra Construction code of

Practice for the Sustainable Use of Soils on Construction Sites), can help mitigate the loss or damage of the finite soil resource.

Enabling the development of energy infrastructure to meet the energy demands of the UK has the potential for a number of generic effects on soil and geology, which are applicable across the different types of energy infrastructure development. They include:

- Disturbance or loss of soils (including best and most versatile agricultural land) and geologically important sites.
- Increased risk of pollution and potential contamination of soils.

5.10.2: Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 9.

Assist in facilitating the re-use of previously developed land

EN-1 suggests that whilst using previously developed land for new development can reduce impacts on the countryside in terms of land take, it may not be a viable option for many forms of energy infrastructure. EN-1 does however recognise that careful siting and use of appropriate technologies can help to mitigate adverse impacts on the environment. Applicants are required to demonstrate how the design process was conducted and how it evolved. Where several different designs were considered, the applicant should explain why the favoured choice was selected. EN-1 notes that, whilst it is not possible to mitigate the direct effects of an energy project on the existing use of site, applicants should seek to minimise these effects and effects near the site by the application of good design principles and protection of soils during construction.

The AoS notes that EN-1 recognises the beneficial impacts of utilising previously developed land for new development but acknowledges challenges with this approach for many forms of energy infrastructure. Nevertheless, careful site selection and use of appropriate technologies to help mitigate adverse impacts on the environment are noted and the applicant will be expected to justify design decisions with the protection of soils in mind.

Avoid the loss of Best and Most Versatile agricultural land?

EN-1 sets out that the applicant should seek to minimise impacts on the best and most versatile agricultural land (grades 1, 2 and 3a of the Agricultural Land Classification) and should seek to use land in areas of poorer quality (grades 3b, 4 and 5). In terms of Secretary of State decision making in relation to the loss of agricultural land, EN-1 suggests that there should be sufficient justification for the loss of the best and most versatile agricultural land, but little weight should be given to the loss of poorer quality agricultural land. However, EN-1 suggests exceptions to this may include uplands, where particular agricultural practices themselves contribute to local character of the environment or the local economy.

The AoS therefore concludes that the NPS provides protection to Best and Most Versatile agricultural land.

Protect soil resources and ensure their sustainable use and management?

There is potential for the majority of adverse effects on soil resources as a result of energy generating infrastructure development to be avoided, reduced and mitigated through careful design and planning. However, the long term significance of these effects remains uncertain, and the effectiveness of the mitigation possibilities proposed will depend on the individual sensitivities of the receiving sites, in the context of specific details of the development design, layout and operation. In terms of mitigating impacts on soil resources, EN-1 requires applicants to identify any effects on soil quality, seek to minimise them, and take account any mitigation measures proposed. EN-1 also encourages applicants to develop and implement a Soil Management Plan as part of energy infrastructure proposals and this would also likely help to minimise potential land contamination. It is also noted that the sustainable reuse of soils needs to be carefully considered in line with good practice guidance where large quantities of soils are surplus to requirements or are affected by contamination.

The AoS therefore concludes that the NPS recognises the importance of soil resources and encourages applicants to develop and implement a Soil Management Plan and other mitigation measures to reduce effects on soil quality and resource.

Seek to remediate contaminated land?

For developments on previously developed land, EN-1 requires that applicants should ensure that they have considered the risk posed by land contamination and how it is proposed to address this. Consideration should also be made of opportunities for remediation where possible and it is important to do this as early as possible as part of the engagement with relevant bodies before the official pre-application stage.

The AoS therefore concludes that the NPS requires consideration of the risk of contaminated land and recognises the opportunity major new energy infrastructure projects have in remediating contaminated land where development is proposed on previously developed land.

Increase the resilience of soils to the potential effects of climate change through minimising erosion and pollution and promoting good water management to keep soil moisture in balance

EN-1 notes that the Secretary of State should decide whether a development is an acceptable use of the land and should be satisfied that the relevant pollution control authorities agree that potential pollution can be adequately regulated and there will not be cumulative effects arising from the proposed development. EN-1 ensures that the direct, indirect, secondary, transboundary and short to long term effects of the development on soil quality will be considered, as these are requirements in The EIA Regulations.

While specific reference to climate change and its impact on soil resources is not made, the AoS considers the NPS alignment with the EIA Regulations which provide for consideration of long term effects on soils in particular, will take account of climate change. Minimising erosion and pollution will also be driven by Geology and Soils chapters of an EIA. EN-1 also proposes that applicants should identify any effects and seek to minimise impacts on soil health and protect and improve health. This is anticipated to include addressing issues such as soil moisture etc.

5.10.3: Assessment Conclusions and Summary

Direct, short term effects on soil resources, through loss or contamination, are likely to occur from the construction of developments for energy generation and associated infrastructure, especially given that such developments will often be located on greenfield land. There is potential for contamination of soil resources to occur in the short to long term as a result of air and water pollution arising from construction or the operations of energy generating infrastructure or potentially as a result of spills during the operation of such developments. The decommissioning stage of energy generating infrastructure may also cause direct negative effects on soil resources due to spills and contaminated waste left on-site, but also offer potential for the remediation of land. Similarly, delivery of energy generating infrastructure on previously developed land may create opportunities to deliver local regeneration. Cumulative negative effects on soil resources may occur where there is a cluster or concentration of energy infrastructure development, particularly power stations. The significance of any effects will be dependent on the locations and scales of development.

Minor negative effects on soil resources are likely as a result of the plan implementation in the short, medium and long term due to the potential for loss of agricultural land and contamination of soil, potentially from spills of oil or chemicals used in the construction, operations and decommissioning of energy infrastructure. The effects identified are uncertain as they will depend on the specific nature, location and scale of development.

The mitigation outlined above has the potential to ensure that energy generating development enabled development through EN-1 will avoid the best and most versatile agricultural land, where possible. Additionally, the requirement that development should not be given consent unless they have been considered by relevant pollution authorities is likely to minimise the potential for land contamination.

Table 5-9 – Protect soil resources and avoid land contamination Objective Summary

AoS Objective	**Assessment of generic effects (by timescale)**		
	S	**M**	**L**
Protect soil resources and avoid land contamination Guide questions: • Assist in facilitating the re-use of previously developed land? • Avoid the loss of Best and Most Versatile agricultural land? • Protect soil resources and ensure their sustainable use and management? • Seek to remediate contaminated land? • Increase the resilience of soils to the potential effects of climate change through minimising erosion and pollution and promoting good water management to keep soil moisture in balance? •	-	-	-

5.11: AoS Objective 10: Protect, enhance and promote geodiversity

5.11.1: Anticipated Effects

The scope and scale of development enabled by the plan has the potential for a range of effects on geodiversity, which will vary depending on the type of energy generating development and its location in relation to geodiversity assets. These include:

- Disturbance or loss of geologically important sites – direct loss from land take, loss of seabed and indirect or temporary losses during construction phase.
- Changes to coastal and marine processes – through physical changes to coastline and marine environment (including flood management features), dredging, water abstraction and water discharge. This could result in direct loss of exposed features, as well as changes in erosion and sediment transportation.
- Obstructions – from introduced structures presenting obstacles to access and study geodiversity assets

The NPS presents an opportunity to develop strategic principles designed to control pollution, promote the re-use of previously developed land and tackle some of the causes of climate change, all of which should help to afford protection to the geodiversity resource.

5.11.2: Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 10.

Protect and enhance geodiversity resource

EN-1 sets out an overarching principle in relation to geological conservation interests, which is that development should at the very least aim to avoid significant harm to geological conservation interests, including through mitigation and consideration of reasonable alternatives. It is suggested that in cases where significant harm is unavoidable, then appropriate compensation measures should be sought. Where this is not possible, it is noted that the Secretary of State will give significant weight to any residual harm and consent may be refused.

EN-1 ensures that any proposals for energy generating infrastructure are subject to robust consideration by requiring that they are accompanied by an Environmental Statement (ES) (under the Infrastructure Planning Regulations 2017), which describes the significant likely effects of the proposal on the environment. Through this requirement, EN-1 ensures that the direct, indirect, secondary, transboundary and short to long term effects of the development on the environment will be considered, as these are requirements in the EIA Regulations. In locations where energy generating infrastructure will be delivered in close proximity to geodiversity assets, the above requirements are likely to outline any potential impacts to their status and potential mitigation measures. A Geodiversity Management Strategy, as proposed in EN-1 would also help to enhance the geodiversity resource.

EN-1 recognises that, in coastal environments, the delivery of energy generating infrastructure may involve construction activities that would result in direct impacts on coastal environments and indirect impacts through changes to the hydrodynamic regime of an area. As such, EN-1 recommends that applicants should undertake coastal geomorphological and sediment transfer modelling where necessary

There is potential for the majority of adverse effects on geodiversity as a result of energy generating infrastructure development to be avoided, reduced and mitigated through careful siting, design and planning. However, the significance of any effects on geodiversity remains uncertain, and the effectiveness of the mitigation possibilities proposed will depend on the individual sensitivities of the receiving sites, in the context of specific details of the development design, layout and operation.

The AoS concludes that the NPS provides an approach that will help to protect and enhance the geodiversity resource, though this will be on a case by case basis.

Protect or enhance SSSIs designated for their geological interest?

EN-1 notes that the Secretary of State should ensure that appropriate weight is given to designated sites of international, national and local importance for the conservation of geological interest. In particular, EN-1 suggests that Sites of Specific Scientific Interests (SSSIs) should be given a high degree of protection. EN-1 suggests that development on land within or outside a SSSI which is likely to have adverse effects (either individually or in combination with other developments) should not be permitted. EN-1 notes that an exception to this is possible where the benefits of the development in the location proposed clearly outweigh its impacts on the features of the site that qualify it as a SSSI. Furthermore, EN-1 encourages the Secretary of State to use requirements and/or planning obligations to mitigate significant harm arising from the development on SSSIs and suggests that, where possible, development should enhance a site's geological interest.

The AoS concludes that the NPS provides an approach that will help to protect and enhance SSSI's designated for geological interest.

Avoid the degradation and removal, wherever possible, of RIGS?

At the regional and local scale, which includes Regionally Important Geological Sites and Local Geological Sites, EN-1 suggests that due consideration should be given to such sites, but given the need for new energy generating infrastructure, these designations should not be used in themselves to refuse development consent. EN-1 also encourages applicants to produce and implement a Geodiversity Management Strategy with an aim that these strategies will also preserve and enhance access to geological interest features as part of relevant development proposals. EN-1 recognises that careful siting and use of appropriate technologies can help to mitigate adverse impacts on the environment. Applicants are required to demonstrate how the design process was conducted and how it evolved. Where several different designs were considered, the applicant should explain why the favoured choice was selected. This may offer scope for avoidance and mitigation of impacts on geodiversity assets at the design stage.

The AoS concludes that the NPS provides an approach to help avoid degradation and removal of RIGS, though it recognises that this will not always be possible.

Support access to, interpretation and understanding of geodiversity?

Further to any mitigation outlined, EN-1 encourages the Secretary of State to maximise opportunities (using planning obligations) for building in beneficial geological features as part of good design. EN-1 also encourages the applicant to ensure construction of developments should be confined to the minimum area required for the works. The NPS also notes that to further minimise any adverse impacts on geodiversity, where appropriate applicants are encouraged to produce and implement a Geodiversity Management Strategy to preserve and enhance access to geological interest features, as part of relevant development proposals.

The AoS concludes that the NPS provides an approach that can help support access to, interpretation and understanding of geodiversity.

5.11.3: Assessment Conclusions and Summary

The AoS has identified that a co-ordinated strategic approach to development and infrastructure is required to limit the potential for inappropriate greenfield development to occur. This will help to manage pressures on SSSIs designated for their geological importance and on RIGS.

There is potential for negative effects on geodiversity due to NPS implementation in the short, medium and long term, through loss of land / seabed, changes to coastal processes etc., particularly during construction. However, due to the potential for enhancement of geological features outlined above, there is also potential for minor positive effects in the medium to long term. The effects identified are uncertain as they will depend on the specific location, nature, design and scale of development.

Table 5.10– Protect, enhance and promote geodiversity Objective Summary

AoS Objective	Assessment of generic effects (by timescale)				
	S	M		L	
Protect, enhance and promote geodiversity Guide questions: • Protect and enhance geodiversity resource? • Protect or enhance SSSIs designated for their geological interest? • Avoid the degradation and removal, wherever possible, of RIGS? • Support access to, interpretation and understanding of geodiversity?	-	-	+	-	+

5.12: AoS Objective 11: Improve health and well-being and safety for all citizens and reduce inequalities in health

5.12.1: Anticipated Effects

Energy production and distribution has the potential to impact on the health and well-being of the population; potential generic effects of EN-1 implementation include:

- positive effects resulting from security and affordability of supply, and potential enhancements to employment and economic opportunities;
- potential significant negative impacts from energy production and supply, in particular during construction phases (including dust, noise, odour, vibration, artificial light, exposure to pollutants, smoke and steam, waste products and an increase in pest incidence); and
- indirect negative impacts through loss of amenity, access, including access to open spaces/transport networks, changes (increases) to local populations placing pressure on essential services.

5.12.3: Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 11.

Protect the health of communities through prevention of accidental pollutant discharges, exposure to electric and magnetic fields, shadow flicker or radiation

EN-1 notes that where a proposed energy infrastructure project has an effect on human beings, an Environmental Statement should be undertaken that should assess these effects for each element of the project, identifying any potential adverse health impacts, and identifying measures to avoid, reduce or compensate for these impacts as appropriate. This would include all elements such as increased traffic, air or water pollution, dust, odour, hazardous waste and substances, noise, exposure to radiation, and increases in pests as recognised by the NPS and would be anticipated to include EMF and shadow flicker etc. Consideration should also be made of how the impacts of more than one development may affect people simultaneously, so the applicant should consider the cumulative impact on health in the ES where appropriate.

The AoS concludes that protection of community health will be enabled by the approach set out in the NPS.

Minimise nuisance on communities and their facilities including air, noise and light pollution

EN-1 recognises that those areas of energy infrastructure which are most likely to have a significantly detrimental impact on health are subject to separate regulation (for example for air pollution) which will constitute effective mitigation of them, so that it is unlikely that health concerns will either by themselves constitute a reason to refuse consent or require specific mitigation under the Planning Act 2008. However, not all potential sources of health impacts will be mitigated in this way and the Secretary of State will want to take account of health concerns when setting requirements relating to a range of impacts such as noise. Opportunities should be taken to mitigate indirect impacts, by promoting local improvements to encourage health and wellbeing.

EN-1 notes the need to identify any potential adverse health impacts and reflect and address the potential for health effects across the whole of society and the different groups within it and recognises the need to protect the most vulnerable. EN-1 also reflects that not all health impacts will be addressed through separate regulation and notes the need for opportunities to be taken to mitigate indirect impacts, by promoting local improvements to encourage health and wellbeing, this includes potential impacts on vulnerable groups within society i.e. those groups within society which may be differentially impacted by a development compared to wider society as a whole.

EN-1 also recognises the potential for dust, odour, artificial light, smoke, steam and insect infestation to cause detrimental impact on amenity or cause a common law nuisance or statutory nuisance under Part III, Environmental Protection Act 1990. Applicants are required to carry out assessment of such nuisance and that all reasonable steps have been taken, and will be taken, to minimise any such detrimental impacts. Sensitive receptors are to be identified. It is also advised that consultation takes place with local planning authorities and where appropriate, the EA about the scope and methodology of the assessment.

In addition, the NPS recognises that excessive noise can have wide-ranging impacts on the quality of human life, health (for example owing to annoyance or sleep disturbance), the environment and use and enjoyment of areas of value such as quiet places and areas with high landscape quality. The NPS notes the Noise Policy Statement for England and that the Welsh Government’s overarching policy is set out in its Noise and Soundscape Action Plan. Its focus is on creating appropriate soundscapes for communities. This includes not only managing noise but also considering what sounds are appropriate in a given time and place. A range of mitigation measures relating to noise are also provided within the NPS.

The AoS concludes that the NPS provides an approach that will help minimise nuisance on communities from a range of pollution types.

Provide for facilities that can promote more social interaction and a more active lifestyle and enjoyment of the countryside and coasts

EN-1 recognises that there is a risk to open space, countryside and coasts due to the need to locate infrastructure in these locations. In addition, it is recognised within EN-1 that new energy infrastructure may also affect the composition, size and proximity of the local population, and in doing so have indirect health impacts, for example if it in some way affects access to key public services, transport or the use of open space for recreation and physical activity. EN-1 also recognises that there is a potential for impact on community facilities through an influx of workers to an area, along with a potential risk to social cohesion.

However, these issues are addressed throughout EN-1 which notes, for example, that it is government's policy is to ensure there is 'good design' and adequate provision of high quality open space (including green infrastructure) and sports and recreation facilities to meet the needs of local communities. Open spaces, sports and recreational facilities all help to underpin people's quality of life and have a vital role to play in promoting healthy living. Well designed and managed green infrastructure in particular, provides multiple benefits at a range of scales. It can contribute to health, wellbeing, biodiversity recovery, absorb surface water, cleanse pollutants and absorb noise and reduce high temperatures. It will also play an increasingly important role in mitigating or adapting to the impacts of climate change. The provision and enhancement of green infrastructure can improve air quality, particularly in urban areas. Applicants are therefore encouraged to consider how new green infrastructure can be provided, or how existing green infrastructure can be enhanced, as part of their application. Note is also made that applicants will need to consult the local community on proposals to build on existing open space, sports or recreational buildings and land. Taking account of the consultations, applicants should consider providing new or additional open space including green and blue infrastructure, sport or recreation facilities, to substitute for any losses as a result of their proposal. Applicants should use any up-to-date local authority assessment or, if there is none, provide an independent assessment to show whether the existing open space, sports and recreational buildings and land is surplus to requirements.

The AoS concludes that the NPS provides an approach that will help to promote more social interaction and active lifestyles. Recognition is made of the importance of community and recreational facilities and the need for their continued provision.

Promote initiatives that enhance safety and personal security for all?

It is to be noted that EN-1 provides further clarity on pollution control as well as the role of safety legislation and notes how this can help to protect health. Further consideration is made within relevant discrete sections with particular direct relevance to health, such as air quality or noise and vibration, as well as indirect relevance such as green space that can help promote healthy living.

EN-1 also recognises that national security considerations apply across all national infrastructure sectors. DESNZ works closely with Government security agencies including the Centre for the Protection of National Infrastructure (CPNI) and the National Cyber Security Centre (NCSC) to provide advice to the most critical infrastructure assets on terrorism and other national security threats, as well as on risk mitigation. In the UK's civil nuclear industry, security is also independently regulated by the Office for Nuclear Regulation (ONR). It is also Government policy is to ensure that, where possible, proportionate protective security measures are designed into new infrastructure projects at an early stage in the project development.

The AoS concludes that the NPS provides an approach that will help ensure safety and personal security.

Promote Access to Greenspace and Green Infrastructure Standards?

EN-1 recognises that developments may also deliver wider environmental gains and benefits to communities relevant to the local area and to national policy priorities, such as increased access to natural greenspace, including by promoting nature based solutions. Note is also made of adequate provision of high quality open space (including green infrastructure). The scope of potential gains will be dependent on the type, scale, and location of specific projects.

The AoS concludes that the NPS will help to promote access to Greenspace.

Support enhanced security, reliability and affordability of the national energy supply?

Clear recognition is made within EN-1 of the need for a secure, reliable and affordable national energy system and it is explicitly recognised that given the vital role of energy to economic prosperity and social well-being, it is important that supplies of energy – both gas and electricity - remain secure, reliable and affordable.

As such, the AoS concludes reliable energy supplies nationally will contribute to positive effects generally on the economy and skills with indirect positive effects for health and well-being in the medium to longer term through helping to secure affordable supplies of energy and minimising fuel poverty.

5.12.4: Assessment Conclusions and Summary

Reliable energy supplies nationally will contribute to positive effects generally on the economy and skills with indirect positive effects for health and well-being in the medium to longer term through helping to secure affordable supplies of energy and minimising fuel poverty. Opportunities for employment (across the short, medium and long term) are also likely, with consequent beneficial effects on wellbeing.

EN-1 also makes clear recognition of the need to identify potential adverse health impacts, including on vulnerable groups within society and notes that opportunities should be taken to mitigate direct impacts by promoting local improvements to encourage health and wellbeing. Beneficial effects will be from the short through to the long term.

Table 5-11 – Improve health and well-being Objective Summary

AoS Objective	**Assessment of generic effects (by timescale)**		
	S	**M**	**L**
Improve health and well-being and safety for all citizens and reduce inequalities in health	**+**	**+**	**+**

Guide questions: • Protect the health of communities through prevention of accidental pollutant discharges, exposure to electric and magnetic fields, shadow flicker or radiation? • Minimise nuisance on communities and their facilities including air, noise and light pollution? • Provide for facilities that can promote more social interaction and a more active lifestyle and enjoyment of the countryside and coasts? • Promote initiatives that enhance safety and personal security for all? • Promote access to Greenspace and Green Infrastructure Standards? • Support enhanced security, reliability and affordability of the national energy supply?			

5.14: AoS Objective 12: Promote sustainable transport and minimise detrimental impacts on strategic transport network and disruption to basic services and infrastructure

5.14.1: Anticipated Effects

Enabling the development of energy infrastructure to meet the energy demands of the UK has the potential for a number of generic effects on traffic and transport which are applicable across the different types of energy infrastructure development. They include:

- disruption to road and public transport services, cycleways and footpaths, especially during construction;
- increased traffic leading to congestion and increased journey times;
- increased noise and atmospheric emissions from road transport;
- impacts on aviation through interfering with the operation of radars and radio signals; and
- potential positive effects through new road facilities and transport links, upgrading of existing roads, enhanced public transport. This could include new sustainable transport modes.

There is a role for the NPS in promoting infrastructure provision in a co-ordinated and pro-active manner, delivering the means to catalyse, rather than react to demands for growth.

The NPS should seek to ensure that energy development provides opportunities for utilisation of electric vehicles, as well as access to more sustainable transport modes.

5.14.2: Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 12.

Prevent adverse changes to strategic transport infrastructure road/rail/airport

EN-1 notes that if a project is likely to have significant transport implications, the applicant's ES should include a transport appraisal, using the methodology stipulated in DfT's Transport Analysis Guidance (TAG) and Welsh Governments WelTAG. Applicants should consult the National Highways and Highways Authorities as appropriate on the assessment and mitigation.

EN-1 also notes that where mitigation is required, possible demand management measures must be considered and if feasible and operationally reasonable, required, before considering requirements for the provision of new inland transport infrastructure to deal with remaining transport impacts.

The AoS concludes that provision for appropriate transport assessment prior to development has been set out in EN-1 which will prevent adverse changes to strategic transport infrastructure.

Prevent loss or disruption to basic services and infrastructure (e.g. electricity, gas)

EN-1 notes that a transport assessment should also consider any possible disruption to services and infrastructure (such as road, rail and airports). Further clarity is also provided in relation to water borne transport and notes that Developers should consider the DfT policy guidance "Water Preferred Policy Guidelines for the movement of abnormal indivisible loads" when preparing their Application.

Where appropriate, the applicant should prepare a travel plan including demand management measures to mitigate transport impacts. The applicant should also provide details of proposed measures to improve access by active, public and shared transport, to reduce the need for parking associated with the proposal and to mitigate transport impacts.

EN-1 further notes that there may be requirements to a consent where there is likely to be substantial HGV traffic that:

- control numbers of HGV movements to and from the site in a specified period during its construction and possibly on the routing of such movements;
- make sufficient provision for HGV parking, either on the site or at dedicated facilities elsewhere, to avoid 'overspill' parking on public roads, prolonged queuing on approach roads and uncontrolled on-street HGV parking in normal operating conditions; and
- ensure satisfactory arrangements for reasonably foreseeable abnormal disruption, in consultation with network providers and the responsible police force.

The AoS concludes that the NPS recognises the importance of preventing loss or disruption to basic services and infrastructure. Note this is also further explored in the NPS in relation to flood risk.

Promote transportation of goods and people by low/zero carbon transport modes

EN-1 requires consideration to be made to the cost-effectiveness of demand management measures compared to new transport infrastructure, as well as the aim to secure more sustainable patterns of transport development when considering mitigation measures. Note is made within EN-1 that all stages of the project should support and encourage a modal shift of freight from road to more environmentally sustainable alternatives, such as rail, cargo bike, maritime and inland waterways, as well as making appropriate provision for and infrastructure needed to support the use of alternative fuels including charging for electric vehicles.

EN-1 further notes, that where appropriate, the applicant should prepare a travel plan including demand management measures to mitigate transport impacts. The applicant should also provide details of proposed measures to improve access by active, public and shared transport, to reduce the need for parking associated with the proposal and to mitigate transport impacts.

The AoS finds that EN-1 makes commitments to promote transportation of goods and people by low/zero carbon transport modes.

5.14.3: Assessment Conclusions and Summary

EN-1 provides for a robust approach to promoting sustainable transport, as well as minimising detrimental impacts on the strategic transport network and disruption to services and infrastructure. It also describes the need to promote sustainable transport modes (including water borne transport, as well as improving access by active, public and shared transport), as well as to reduce the need for parking. As such, it is anticipated that uncertain effects may be experienced in the short (construction) term but with benefits experienced across the later timescale of the development.

Table 5-13 – Promote sustainable transport Objective Summary

AoS Objective	Assessment of generic effects (by timescale)		
	S	M	L
Promote sustainable transport and minimise detrimental impacts on strategic transport network and disruption to basic services and infrastructure Guide questions: • Prevent adverse changes to strategic transport infrastructure road/rail/airport? • Prevent loss or disruption to basic services and infrastructure (e.g. electricity, gas)? • Promote transportation of goods and people by low/zero carbon transport modes?	-	+	+

5.15: AoS Objective 13: Promote a strong economy with opportunities for local people

5.15.1: Anticipated Effects

Businesses and jobs rely on the use of energy, with economic output and associated jobs dependent on a robust and reliable system. A robust and reliable system also has important implications for consumers, as well as protecting the fuel poor, providing opportunities to save money on bills, giving warmer, more comfortable homes and balancing investment against bill impacts.

In addition, it is anticipated that the construction, operation and decommissioning of energy infrastructure can be expected to have socio-economic effects at local and regional levels e.g. due to an influx of large numbers of workers during construction phase that can lead to stress on local housing and labour markets (particularly in more rural areas / smaller towns).

Without a strategic approach to energy development the required development and associated infrastructure is less likely to be provided to encourage investment in areas where highest numbers of residents can benefit from new employment opportunities.

The pattern of deprivation across England and Wales is geographically complex, incorporating stark contrasts between wealthy and severely deprived communities. Without the strategic approach to energy development, opportunities to deliver development and infrastructure which can improve equitable and inclusive access to employment and increases in income of local people are less likely to be achieved.

Both England and Wales (along with the UK as a whole) are expected to see population growth in the coming years, with the proportion of residents of an older age. This growth will be uneven across the country, with a focus on larger urban areas most likely in relation to population growth (though the move to home working induced by COVID-19 may have implications for smaller towns, villages and rural areas). Smaller villages and rural areas may experience an increasingly older demographic (as would less deprived areas), though again, the implications of COVID-19 are unclear in this regard.

5.15.3: Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 13.

Support enhanced security, reliability and affordability of the national energy supply

Clear recognition is made within EN-1 of the need for a secure, reliable and affordable national energy system and it is explicitly recognised that given the vital role of energy to economic prosperity and social well-being, it is important that supplies of energy remain secure, reliable and affordable. EN-1 also recognises that provision of energy infrastructure may have socio-economic impacts at local or regional levels. To address this, EN-1 notes that applicants and local authorities are strongly encouraged to engage during early stages of project development so that the applicant can gain a better understanding of local or regional issues and opportunities.

The AoS concludes that the NPS recognises the importance of a secure and affordable energy supply in relation to the economy and opportunities for local people.

Support creation of both temporary and permanent jobs and increase skills, particularly in areas of need, as well as wider socio-economic effects such as changes to the demographics, community services or house prices

EN-1 notes that applicants are encouraged, where possible, to demonstrate that local suppliers have been considered in the supply chain. There is also potential need for consideration noted to include requirement for the approval by the local authority of an employment and skills plan detailing arrangements to promote local employment and skills development opportunities. This would include for the provision of apprenticeships, education and engagement with local schools and colleges and training programmes. Further consideration would be made of any relevant positive provisions the developer has made or is proposing to make to mitigate impacts (for example through planning obligations) and any legacy benefits that may arise as well as any options for phasing development in relation to the socio-economic impacts.

In addition, EN-1 now states that the Secretary of State may wish to include a requirement that specifies the approval by the local authority of an employment and skills plan detailing arrangements to promote local employment and skills development opportunities, including apprenticeships, education, engagement with local schools and colleges and training programmes to be enacted. It is also noted that applicants should also consider developing accommodation strategies where appropriate, especially during construction and decommissioning phases, that would include for the need to provide temporary accommodation for construction workers if required. This could help increase the skills base in local areas.

While not explicitly stated, it is anticipated that through EN-1 setting out that applicants for new energy infrastructure should describe the existing socio-economic conditions in the areas surrounding the proposed development and should also refer to how the development's socio-economic impacts correlate with local planning policies. This would include consideration of demographics, community services and house prices. Consideration should also be made of how impacts can be wider and cross cutting in nature, with the example of impacts on landscape potentially affecting the tourism industry.

In addition, EN-1 also notes the consideration should be made through an Environmental Statement of:

- the creation of jobs and training opportunities. Applicants may wish to provide information on the sustainability of the jobs created, including where they will help to develop the skills needed for the UK's transition to Net Zero;
- the contribution to the development of low-carbon industries at the local and regional level as well as nationally;
- the provision of additional local services and improvements to local infrastructure, including the provision of educational and visitor facilities;
- any indirect beneficial impacts for the region hosting the infrastructure, in particular in relation to use of local support services and supply chains;
- effects on tourism;
- the impact of a changing influx of workers during the different construction, operation and decommissioning phases of the energy infrastructure. This could change the local population dynamics and could alter the demand for services and facilities in the settlements nearest to the construction work (including community facilities and physical infrastructure such as energy, water, transport and waste). There could also be effects on social cohesion depending on how populations and service provision change as a result of the development; and
- cumulative effects – if development consent were to be granted to for a number of projects within a region and these were developed in a similar timeframe, there could be some short-term negative effects, for example a potential shortage of construction workers to meet the needs of other industries and major projects within the region.

The AoS concludes that the NPS supports the need for the creation of jobs and increasing skills, as well as consideration of the wider socio-economic effects of development.

5.15.4: Assessment Conclusions and Summary

Development of new energy infrastructure will support the security, reliability and affordability of the national energy supply and lead to the provision of jobs in local areas to the development and further afield. Some of these jobs are likely to be specialist in nature, but others will be lower skilled, or suitable for apprenticeships or will provide opportunities to further develop skills. It is anticipated that most jobs would be during the construction phase, with significantly fewer jobs during operation and then an increase during any decommissioning phase. As noted though, a significant increase in workers can lead to stress on local housing and labour markets (particularly in more rural areas / smaller towns), however, EN-1 sets out a clear approach to addressing such issues. As such, some slight adverse effects are anticipated in the short term, but overall, there should be significant benefits in local areas during construction, with ongoing benefits through the medium to long term.

It is also important to note that the NPS will help to provide a robust and secure national supply of energy. This will have significant benefits across the wider economy, through for example allowing people and businesses to make long term investment decisions and could be expected to provide significant benefits through to the long term.

Table 5-14 – Promote a strong economy Objective Summary

AoS Objective	**Assessment of generic effects (by timescale)**			
	S		**M**	**L**
Promote a strong economy with opportunities for local communities Guide questions: • Support enhanced security, reliability and affordability of the national energy supply? • Support creation of both temporary and permanent jobs and increase skills, particularly in areas of need? • Have wider socio-economic effects such as changes to the demographics, community services or house prices?	**-**	**++**	**++**	**++**

5.16: AoS Objective 14: Promote sustainable use of resources and natural assets

5.16.1: Anticipated Effects

All large infrastructure projects will require the use of natural resources (potentially of very significant quantities and including from virgin sources) and are likely to generate hazardous and non-hazardous waste (particularly during the construction phase, but also to a lesser degree during operation and decommissioning).

Reducing the need for virgin construction materials, e.g. through encouraging the use of recycled or secondary materials will not only reduce consumption but will also reduce the need to transport construction materials to site and to transport construction waste off site.

It is also to be noted that soil resources are a finite resource and there is a potential that these are considered a waste product of development sites.

5.16:3 Assessment made in respect of EN-1

This assessment of the relevant policies and planning conditions set out in EN-1 has been undertaken considering each of the guide questions associated with AoS Objective 14.

Reduce consumption of materials, energy and resources during construction, operation and decommissioning of energy infrastructure

EN-1 notes criteria for 'Good Design' for energy infrastructure and this sets out that applying 'Good Design' to energy projects should produce sustainable infrastructure efficient in the use of natural resources and energy used in their construction and operation. It is also noted that given the benefits of "good design" in mitigating the adverse impacts of a project, applicants should consider how "good design" principles can be applied to a project during the early stages of the project lifecycle.

Applicants are also encouraged to use construction best practices in relation to storing materials in an adequate and protected place on site to prevent waste, for example, from damage or vandalism. The use of Building Information Management tools (or similar) to record the materials used in construction can help to reduce waste in future decommissioning of facilities, by identifying materials that can be recycled or reused.

The AoS concludes that the approach set out in the NPS will help ensure that consumption of materials, energy and resources is reduced.

Promote sustainable waste management practices in line with the waste hierarchy

EN-1 notes that sustainable waste management is implemented through the "waste hierarchy", which sets out the priorities that must be applied when managing waste. Disposal of waste should only be considered where other waste management options are not available or where it is the best overall environmental outcome.

EN-1 also requires that all applicants should set out the arrangements that are proposed for managing any waste produced and prepare a report that sets out the sustainable management of waste and use of resources throughout any relevant demolition, excavation and construction activities. The arrangements described and a report setting out the sustainable management of waste and use of resources should include information on how re-use and recycling will be maximised in addition to the proposed waste recovery and disposal system for all waste generated by the development.They should also include an assessment of the impact of the waste arising from development on the capacity of waste management facilities to deal with other waste arising in the area for at least five years of operation.

The applicant is encouraged to refer to the Waste Prevention Programme for England, and 'Towards Zero Waste: Our Strategy for Wales' and should seek to minimise the volume of waste produced and the volume of waste sent for disposal unless it can be demonstrated that this is the best overall environmental outcome. If the applicant's assessment includes dredged material, the assessment should also include other uses of such material before disposal to sea, for example through re-use in the construction process. As such, consideration will also be made in the application process by the Secretary of State as to the effectiveness of proposed waste management systems, including ensuring that the waste arisings will not have an adverse effect on waste management facilities to deal with other waste arisings in the area. The Secretary of State should also be satisfied that all waste will be properly managed and that adequate steps have been taken to minimise volume of waste arisings and disposal.It is also noted that the Secretary of State may wish to include a condition on revision of waste management plans at reasonable intervals when giving consent.

The AoS concludes that the NPS promotes sustainable waste management practices in line with the waste hierarchy.

Encourage the use of recycled and / or secondary materials; Promote the use of low carbon materials and technologies & Promote the use of local suppliers that use sustainably-sourced and locally produced materials

EN-1 notes that the UK is committed to moving towards a more circular economy and where possible, applicants are encouraged to source materials from recycled or reused sources and use low carbon materials, sustainable sources and local suppliers. Construction best practices should be used to ensure that material is reused or recycled onsite where possible.

The AoS concludes that the NPS is therefore aligned with encouraging the use of recycled, secondary and sustainably sourced materials from local sources.

Produce waste by-products that require appropriate management & Provide for safe and secure interim storage of waste, where necessary

EN-1 also notes that Government policy on hazardous and non-hazardous waste is intended to protect human health and the environment by producing less waste and by using it as a resource wherever possible. Where this is not possible, waste management regulation ensures that waste is disposed of in a way that is least damaging to the environment and to human health. The EA's Environmental Permitting regime incorporates operational waste management requirements for certain activities. When an applicant applies to the EA for an Environmental Permit, the EA will require the application to demonstrate that processes are in place to meet all relevant Environmental Permit requirements.

Reference is also made to environmental regulatory regimes and in certain circumstances this would apply to waste management.

The AoS concludes that the NPS provides an approach to help ensure the appropriate and safe management of wastes.

Support enhanced security, reliability and affordability of the national energy supply

The AoS concludes that the sustainable use of resources and natural assets, through aspects such as reducing consumption, ensuring greater efficiency, greater use of recycled and secondary materials and sustainable sources, as set out in the NPS will help the support the security, reliability and affordability of the national energy supply by helping to ensure less reliance is needed on external suppliers of materials and resources.

5.16.4: Assessment Conclusions and Summary

EN-1 provides a robust approach to promoting sustainable use of resources and natural assets and notes how good design can reduce the requirement for consumption of materials and applying this to a project at as early a stage as possible will act to reduce consumption. Clear note is also made of a number of key aspects such as the waste hierarchy, and the requirement to set out the arrangements that are proposed for managing any waste produced , as well as the sourcing of materials from recycled or reused sources and the use of low carbon materials. While there will be a high level of consumption of sources in the short term (construction phases), including virgin material, this will reduce during the operational phase and techniques such as the use of Building Information management tools (or similar) will provide opportunities in the long term for realising the recovery and reuse of materials used at the construction stage.

It is also considered that the NPS can also help reduce the consumption of fossil fuels by the economy by helping to promote a shift to more sustainable forms of energy generation (including potentially using waste as a source of energy where it cannot be recycled or reused) and transport such as active modes like cycling and walking, as well as Low and Zero Emission Vehicles by helping to provide / enable the appropriate infrastructure in new development areas.

The NPS should look at the widest perspective of energy and developments should be assessed in the context of the whole energy supply chain, from cradle to grave, and in the long term. Where energy infrastructure involves the long term storage of waste (nuclear, carbon capture), the carbon and environmental costs of this should be assessed as integral to the energy infrastructure.

Table 5-15 – Promote sustainable use of resources and natural assets Objective Summary

AoS Objective	**Assessment of generic effects (by timescale)**		
	S	M	L
Promote sustainable use of resources and natural assets Guide questions: • Reduce consumption of materials, energy and resources during construction, operation and decommissioning of energy infrastructure? • Promote sustainable waste management practices in line with the waste hierarchy? • Encourage the use of recycled and / or secondary materials? • Promote the use of low carbon materials and technologies? • Produce waste by-products that require appropriate management? • Provide for safe and secure interim storage of waste, where necessary? • Promote the use of local suppliers that use sustainably-sourced and locally produced materials? • Support enhanced security, reliability and affordability of the national energy supply? •	-	0	0 +

5.17: Assessment of EN-1 Alternatives

5.17.1: Introduction

The Environmental Assessment of Plans and Programmes Regulations 2004 ("the SEA Regulations") require that when an environmental report on a proposed plan or programme is prepared, it must identify, describe and evaluate the likely significant effects of implementing reasonable alternatives to the plan or programme which it assesses, as well as the likely significant effects of the plan or programme itself. The analysis of reasonable alternatives is to take into account "the objectives and the geographical scope of the plan".

In line with the principles of good policy making and with the requirements of the SEA legislation, reasonable alternatives for implementing the aims of the NPS have been considered.

This section of AoS-1 is concerned with the analysis of reasonable alternatives. The analysis of reasonable alternatives provides a strategic context for the detailed assessment of the likely significant effects of EN-1, as well as a means of evaluating it by comparing it with other ways of achieving the same wider energy policy objectives through the planning regime – both in terms of their comparative merits as ways of achieving those objectives and in terms of their environmental, social and economic impacts.

Four potential reasonable strategic alternatives that appear capable of fulfilling the objectives of EN-1 (as outlined in Section 5.18) have then been tested against the AoS objectives. The assessment of the reasonable strategic alternatives against the AoS objectives is presented in Section 5.19, with a summary of the findings in Section 5.20. As noted in Section 2, the 14 AoS objectives have been grouped into 6 more appropriate headline sustainable development themes for the purpose of the alternatives assessment as set out in Table 5-15.

The preferred policy approach as set out in EN-1 is appraised in detail using the AoS framework of objectives in Section 5 of this report.

In addition to the overarching policies presented in EN-1, more detailed requirements for specific energy technologies are set out in EN-2 to EN-5. The framework for considering consents for new energy infrastructure projects comprises EN-1 and where relevant one or more of the technology-specific NPSs. The formulation of technology-specific alternatives is discussed further and assessed in the relevant technology-specific AoSs, provided in Sections 6 to 9 in this report.

Table 5-15 - Sustainable Development (SD) Themes and AoS Objectives

Headline SD Themes	**AoS/SEA Objectives** **(numbers refer to AoS objectives)**
Climate Change	Net Zero (1)
Security of Energy Supply	Health (11), Economy (13)
Health & Well- Being	Air Quality (8), Health (11)
The Economy	Health (11), Economy (13), Resources (14)
The Built Environment	Transport (12), Heritage (5), Adaptation and Resilience (2)

The Natural Environment	Adaptation and Resilience (2), Biodiversity (3 & 4), Landscapes and Townscapes (6), Water (7), Soils (9), Geodiversity (10)

5.18: Alternatives Considered for AoS of EN-1

The NPSs set a strategic framework within which it is for industry to propose new energy infrastructure projects. The reasonable alternatives that have been formulated to inform the development of EN-1 are based on the fundamental premise that a combination of technologies, not one single technology, will be required to deliver secure and affordable supplies of energy which are compatible with net zero and protect the environment. Table 5-16 summarises EN-1 and the three alternatives that have been considered for EN-1. It is important to note that all of the Alternatives are variations of EN-1 but are differentiated by the removal or restriction of specific technologies.

Table 5-16 - Plan and Alternatives considered for EN-1

Plan/Alternative	Overview of technologies
EN-1	EN-1 combines infrastructure set out in Chapter 3 of this NPS. In summary: Renewables (including Biomass and Energy from Waste with or without CCS*)*, Natural Gas-fired electricity generation with or without CCS, Hydrogen-fired electricity generation, Pumped Hydro Storage, Nuclear, associated electricity network infrastructure, and natural gas, oil, hydrogen and CCS infrastructure.
Alternative 1 (A1)	As EN-1 without Nuclear and Unabated Natural Gas.
Alternative 2 (A2)	As EN-1 without Unabated Natural Gas.
Alternative 3 (A3)	As EN-1 without Nuclear.

Note that in consideration of Alternatives, the assessment is undertaken in comparison to EN-1 and as such, the findings of the AoS in respect of EN-1 in Section 5.2 to 5.16 broadly apply to all of the alternatives – the key differentiator being the inclusion or absence of specific technologies and the relative outcomes of such inclusion or absence. In order to draw comparison between the Alternatives on a broad level, the following scale has been used:

Table 5-17: Differentiator scale for Alternatives

Scale	Description
Large Positive	A materially different positive outcome is anticipated compared to EN-1
Positive	A more positive outcome is anticipated compared to EN-1
Neutral	This alternative is anticipated to have the same outcome as EN-1
Negative	A more adverse outcome is anticipated compared to EN-1
Large Negative	A materially different adverse outcome is anticipated compared to EN-1

5.19: Appraisal of Alternatives

The findings of the appraisal of the strategic alternatives for EN-1 are set out below, arranged by Sustainable Development (SD) theme. As noted, consideration of the Alternatives is in comparison to the proposed EN-1 and not to each other alternative.

5.19.1: Climate Change (Net Zero)

Alternative A1 – As EN-1 without Nuclear and Unabated Natural Gas

By focusing solely on a combination of Renewables, Natural Gas with CCS, Hydrogen and Energy Storage technologies, Alternative A1 has the potential to deliver materially different positive, cumulative effects in the medium to long term than EN-1. These technologies will produce very low carbon intensity energy contributing significantly to emissions reduction and the Net Zero target.

Alternative A2 – As EN-1 without Unabated Natural Gas

Alternative A2 adds Nuclear energy to the technology mix for Alternative A1. Nuclear power stations provide continuous, reliable, power and produce no direct carbon emissions during operation. Nuclear, alongside other technologies could also offer broader system benefits, such as clean hydrogen production or low carbon heat. In comparison to EN-1, this alternative does not include unabated gas, which therefore is materially beneficial for emissions reduction and the achievement of Net Zero.

Alternative A3 – As EN-1 without Nuclear

Alternative A3 adds Unabated Natural Gas Technologies to the technology mix for A1 which could be used as mid merit plant (adjusting its power output as demand for electricity fluctuates throughout the day) or as dispatchable peak capacity.

Allowing unabated generation without balancing emissions out of the atmosphere has adverse effects on emissions reduction and the achievement of Net Zero. Emissions to the atmosphere will continue either until such point CCS is installed in power stations or for as long as mid merit and peak unabated power stations operate.

Direct Air Carbon Capture (DACC) technologies are challenging due to the low concentration of carbon dioxide in the air (as compared to capturing carbon dioxide at point sources, such as at industrial facilities and thermal power stations) and the technology itself requires a lot of energy. Due to these challenges, DAC technologies may not be available until CCS infrastructure is available to allow the storage of the carbon dioxide (and thus negative emissions), or until carbon utilisation markets are available and economic. This may result in unnecessary accumulation of emissions in the atmosphere until such time DAC technologies are fully available.

In comparison to EN-1, this alternative does not include Nuclear, which may lead to greater reliance on unabated gas technology and negative emission technologies, such as Direct Air Carbon Capture and Storage.

Headline SD themes	EN-1	Alternative A1	Alternative A2	Alternative A3
Climate Change (Net Zero)		Large Positive	Large Positive	Negative

5.19.2: Security of Energy Supply

Alternative A1 – As EN-1 without Nuclear and Unabated Natural Gas

The effect of this alternative on the security of energy supply will depend to a large extent on whether a mix of Renewables, Natural Gas with CCS, Hydrogen and Energy Storage technologies can provide safe and secure energy supplies. As the timing of availability of Hydrogen and Energy Storage at scale is currently uncertain, reliance of such technologies could have a materially adverse effect on security of supply in the short to medium term, than that of EN-1.

Alternative A2 – As EN-1 without Unabated Natural Gas

The inclusion of Nuclear in this alternative (in comparison to the technology mix in A1) allows for a continuous and reliable technology which would enhance security of supply as it would lead to less reliance on technologies still under development such as Hydrogen and Energy Storage. In comparison to EN-1, this alternative does not have Unabated Natural Gas, so there could potentially be issues surrounding peak capacity.

Alternative A3 – As EN-1 without Nuclear

In this alternative, Unabated Natural Gas technologies would have the role of enhancing security of supply through providing reliable peak capacity as well as providing a baseline of continuous reliable security of supply of electricity and placing less reliance on technologies still under development, such as Hydrogen and Energy Storage. However, this alternative would still be reliant on a smaller range of generating technologies with adverse impacts on security of supply compared to EN-1.

Headline SD themes	EN-1	Alternative A1	Alternative A2	Alternative A3
Security of Energy Supply		Large Negative	Negative	Negative

5.19.3: Health and Well-being

Alternative A1 – As EN-1 without Nuclear and Unabated Natural Gas

As with EN-1, Alternative A1 has the potential to result in significant indirect positive effects for health and well-being because of improved employment opportunities and the predicted, enhanced economic conditions arising from investment in energy infrastructure. These positive effects have the potential to be cumulative in the long term from improved vibrancy in the energy industry sector.

Alternative A2 – As EN-1 without Unabated Natural Gas

As with EN-1 and Alternative A1, Alternative A2 has the potential to result in significant indirect positive effects for health and well-being because of improved employment opportunities and the predicted, enhanced economic conditions arising from investment in energy infrastructure. These positive effects have the potential to be cumulative in the long term from improved vibrancy in the energy industry sector.

Alternative A3 – As EN-1 without Nuclear

As with EN-1 and the other two Alternatives, Alternative A3 has the potential to result in significant indirect positive effects for health and well-being because of improved employment opportunities and the predicted, enhanced economic conditions arising from investment in energy infrastructure. These positive effects have the potential to be cumulative in the long term from improved vibrancy in the energy industry sector.

Headline SD themes	EN-1	Alternative A1	Alternative A2	Alternative A3
Health & Well-Being		**Neutral**	**Neutral**	**Neutral**

5.19.4: The Economy

Alternative A1 – As EN-1 without Nuclear and Unabated Natural Gas

Alternative A1 provides for a range of low carbon energy sources to meet the UK's future energy needs. Short to medium term positive effects are likely to be significant for the economy and employment across the range of technology types during construction and operation phases given the scale of development required/proposed. These benefits should accrue at local and regional levels and there may be positive cumulative effects nationally for the energy and associated sectors overall, from increased investment in infrastructure.

There is a potential for minor negative effects in the short to medium term where the impacts arising from new energy infrastructure are detrimental to existing industries (e.g. tourism, through a loss of amenity/negative landscape impacts/lower property values, and agriculture/fisheries/shipping through direct impacts on natural resources from direct land loss or windfarm exclusion zones).

Similar to EN-1, the overall long term impacts for Alternative A1 are assessed as positive for the economy as plan implementation will support the creation of jobs and skills development across the energy sector.

Alternative A2 – As EN-1 without Unabated Natural Gas

Alternative A2 provides for a range of low carbon energy sources to meet the UK's future energy needs. Short to medium term positive effects are likely to be significant for the economy and employment across the range of technology types during construction and operation phases given the scale of development required/proposed. These benefits should accrue at local and regional levels and there may be positive cumulative effects nationally for the energy and associated sectors overall, from increased investment in infrastructure.

There is a potential for minor negative effects in the short to medium term where the impacts arising from new energy infrastructure are detrimental to existing industries (e.g. tourism, through a loss of amenity/negative landscape impacts/lower property values, and agriculture/fisheries/shipping through direct impacts on natural resources from direct land loss or windfarm exclusion zones). The overall long term impacts for Alternative A2 are assessed as positive for the economy as plan implementation will support the creation of jobs and skills development across the energy sector.

It is to be noted that this Alternative, as with EN-1 does also include Nuclear technologies and while all the Alternatives will bring benefits to the local economies, due to the longer construction and operation periods for nuclear projects, these impacts (both positive and negative) may be longer lasting. It is anticipated that any negative impacts during construction, for example, a large influx of workers (often to a rural area) that can disrupt local employment and housing markets, can be mitigated to a great extent by industry developers.

Similar to EN-1, the overall long term impacts for Alternative A2 are assessed as positive for the economy as plan implementation will support the creation of jobs and skills development across the energy sector.

Alternative A3 – As EN-1 without Nuclear

Alternative A3 provides for a range of low carbon energy sources to meet the UK's future energy needs. As with EN-1, short to medium term positive effects are likely to be significant for the economy and employment across the range of technology types during construction and operation phases given the scale of development required/proposed. These benefits should accrue at local and regional levels and there may be positive cumulative effects nationally for the energy and associated sectors overall, from increased investment in infrastructure.

There is a potential for minor negative effects in the short to medium term where the impacts arising from new energy infrastructure are detrimental to existing industries (e.g. tourism, through a loss of amenity/negative landscape impacts/lower property values, and agriculture/fisheries/shipping through direct impacts on natural resources from direct land loss or windfarm exclusion zones). The overall long term impacts for Alternative A3 are assessed as positive for the economy as plan implementation will support the creation of jobs and skills development across the energy sector.

Similar to EN-1, the overall long term impacts for Alternative A3 are assessed as positive for the economy as plan implementation will support the creation of jobs and skills development across the energy sector.

Headline SD themes	**EN-1**	**Alternative A1**	**Alternative A2**	**Alternative A3**
The Economy		**Neutral**	**Neutral**	**Neutral**

5.19.5: The Built Environment

Alternative A1 – As EN-1 without Nuclear and Unabated Natural Gas

Renewable technologies tend to involve more extensive land use than thermal power plants of equivalent capacity although Natural Gas with CCS technology also may require extra land for the installation of CCS. This means that with more emphasis on renewable energy in this alternative, in comparison to EN-1, there may be negative effects on attributes such as built heritage due to the additional land area affected.

However, effects to and from flood risk on the built environment would be attenuated due to less need for energy technologies that tend to locate near to coasts, estuaries or rivers (such as nuclear) due to their water resource needs.

Potentially more abated natural gas with CCS in this alternative is likely to result in a greater clustering of generating capacity proposals around preferred locations as the closer a power station is to a viable route to transport and store CO_2, the lower the costs of retrofitting CCS to that power station could be. As such there is the potential for more cumulative local negative effects on the built environment.

Alternative A2 – As EN-1 without Unabated Natural Gas

As per EN-1, results in more emphasis on Nuclear in this alternative, could give rise to infrastructure clustering in areas where there are existing skills in the workforce and ancillary infrastructure such as transport connections.

This alternative does not have Unabated Natural Gas, unlike EN-1 and as such may require more overall land take compared to EN-1, due to the potential requirement of additional land for CCS.

Nuclear also results in a more efficient use of land as more energy can be generated per unit of land area. Compared to Solar Renewables, the need for land area can be significantly lower for the same energy output potentially resulting in less direct potential impact on the built environment. However, effects to and from flood risk to the built environment could be heightened due to preferential location of nuclear and natural gas power stations near to coasts, estuaries or rivers to satisfy water resource needs for cooling.

Inclusion of only Natural Gas with CCS in this alternative is also likely to result in clustering of generating capacity proposals around preferred locations than that of EN-1, as the closer a power station is to a viable route to transport and store CO_2, the lower the costs of retrofitting CCS to that power station could be. As such, there is the potential for more cumulative local negative effects on the built environment.

Alternative A3 – As EN-1 without Nuclear

In comparison to EN-1, more emphasis on Renewable energy will also have potentially more negative impacts on the built environment due to the additional land area affected by wind and solar Renewables. There will also be more need for energy technologies that need to be located near to coasts, estuaries or rivers due to their water resource needs, in particular in the case of Natural Gas with or without CCS, affecting flood risk to built environment.

Headline SD themes	EN-1	Alternative A1	Alternative A2	Alternative A3
The Built Environment		**Positive / Negative**	**Negative**	**Negative**

5.19.6: The Natural Environment

Alternative A1 – As EN-1 without Nuclear and Unabated Natural Gas

Renewable technologies tend to involve more extensive land use than thermal power plants of equivalent capacity although Natural Gas with CCS technology also requires extra land for the installation of CCS. This means that with more emphasis on renewable energy in this alternative, in comparison to EN-1, there may be negative effects on the natural environment due to the additional land area affected.

In the case of offshore renewables power, they involve extensive sea use and there are clearly effects on the natural marine environment such as on biodiversity and visual impact, though these could be mitigated by careful siting.

This means that while more emphasis on renewable energy may have a positive effect on certain natural environment attributes, by contributing to the mitigation of climate change, there will also be potentially negative impacts on other environmental attributes such as visual impact and direct habitat loss due to the additional land / sea area affected.

Alternative A2 – As EN-1 without Unabated Natural Gas

As per EN-1, the inclusion of Nuclear in this alternative would result in a more efficient use of land as more energy can be generated per square meter in comparison to the use of land based renewables, thus potentially resulting in less direct habitat, heritage, soil, water features etc loss.

However, in comparison to EN-1, this alternative does not have unabated gas and as such there may be a requirement for more land take (to allow for CCS) and this may have a greater effect on the natural environment.

Alternative A3 – As EN-1 without Nuclear

The absence of Nuclear from this alternative, in comparison to EN-1, means that there would be less overall efficient use of land / sea, as less energy can be generated per square metre. This would likely result in more direct habitat, heritage, soil, water features etc loss.

Headline SD themes	EN-1	Alternative A1	Alternative A2	Alternative A3
The Natural Environment		Negative	Negative	Negative

5.20: Summary Alternative Findings and Preferred Approach for the NPS

The findings of the assessment of alternatives are summarised on Table 5-18 This shows how Alternatives A1, A2, and A3 were assessed as affecting the headline SD topics compared to EN-1. The detailed assessment of EN-1, appraising the absolute effects of the Plan on the AoS objectives, is presented above in Section 5 of this report.

Table 5-18 - Summary of Alternatives assessment

Headline SD themes	EN-1	Alternative A1	Alternative A2	Alternative A3
Climate Change (Net Zero)		Large Positive	Large Positive	Negative
Security of Energy Supply		Large Negative	Negative	Negative
Health & Well-Being		Neutral	Neutral	Neutral
The Economy		Neutral	Neutral	Neutral
The Built Environment		Positive / Negative	Negative	Negative
The Natural Environment		Negative	Negative	Negative

In comparison with EN-1, the alternatives are assessed as being beneficial in respect of climate change for Alternative 1 and 2, but negative for Alternative 3. All Alternatives are considered negative in terms of Security of Supply due to the reduction in generation options. In terms of Health and Wellbeing and Economy, no differences have been identified between any of the Alternatives and EN-1. In respect of the other sustainability development themes of the Built and Natural Environment there is a more mixed picture of having mainly adverse effects though with some benefits under other Alternatives.The key differences between the different alternatives and the plan (EN-1) are highlighted below.

Alternative A1 As EN-1 without Nuclear and Unabated Natural Gas would:

- be materially beneficial for the achievement of Net Zero due to no emissions from unabated gas, although reliant on smaller group of low carbon technologies (due to the removal of Nuclear) for delivery;
- be materially adverse on security of supply as reliant on technologies still under development such as Hydrogen and Energy Storage at scale to ensure peak supply and maintain the stability and security of the electricity system;
- have no differential effects on the economy or human health (compared to EN-1) because of providing for a range of low energy sources to meet future energy needs, as well as economic stimulus and improved employment opportunities, though note some negative effects may arise due to disruption to existing industries / communities; and
- have a mix of beneficial and negative effects on the built and natural environment due to positive environment effects through for example mitigation of climate change, though negative due to large areas of land and sea required for renewables.

Alternative A2 As EN-1 without Unabated Natural Gas would:

- be materially beneficial for the achievement Net Zero due to no emissions from unabated gas;
- have adverse effects on Security of Supply, as although it would be less reliant (than alternative A1) on yet to be fully proven technologies, such as Hydrogen and Energy Storage at scale, there would still be a need for them to ensure peak supply and maintain the stability and security of the electricity system;
- be neutral (compared to EN-1) in relation to benefits to the Health and Well-being and Economy SD themes by providing for a range of low energy sources to meet future energy needs, as well as economic stimulus and improved employment opportunities though there may also be economic and community costs at the local scale; and
- have a negative effect for the Built and Natural Environment as greater use of Natural Gas with CCS (compared to EN-1) may require more land take due to the associated need for CCS infrastructure.

Alternative A3 As EN-1 without Nuclear would:

- have adverse effects on the achievement of Net Zero due to greater ongoing emissions from unabated gas;
- have adverse effects on Security of Supply as reliant on a smaller range of electricity generating technologies;
- be neutral in terms of Health and Well-being and the Economy by providing for a range of low energy sources to meet future energy needs, as well as economic

stimulus and improved employment opportunities though there may also be economic and community costs at the local scale;

- have adverse effects for the Built Environment due to additional land take by wind and solar Renewables and location near to coasts, estuaries or rivers by Natural Gas with or without CCS, affecting flood risk; and
- have adverse effects for the Natural Environment as emphasis on Renewables and Natural Gas with CCS would require larger areas to meet the same energy output as EN-1.

None of these alternatives are as good as, or better than, the proposals set out in EN-1 and therefore the government's preferred option is to take forward the Energy NPS EN-1 (and the technology-specific NPSs EN-2 to EN-5, see following sections). Note that the British Energy Security Strategy emphasises the importance of addressing underlying vulnerability to international energy prices by reducing dependence on imported oil and gas, and accelerating deployment of renewables, nuclear, hydrogen, CCUS, and related network infrastructure and the NPS is now set out to reflect these wider requirements by introducing greater flexibility in energy infrastructure provision at the national level.

6: Assessment for Natural Gas Electricity Generating Infrastructure EN-2 (AoS-2)

6.1: The NPS for Natural Gas Electricity Generating Infrastructure

The NPS for Natural Electricity Generating Infrastructure (EN-2), in conjunction with the Overarching NPS for Energy (EN-1), sets out the relevant policy and planning factors that should be considered by the Secretary of State when determining whether development consent should be granted for a proposed scheme.

As for EN-1, EN-2 has been developed via an iterative process, taking account of the appraisal of the predicted sustainability effects both for EN-2 preferred polices and reasonable alternatives.

6.2: Appraisal Findings for EN-2

Natural gas electricity generating infrastructure may have various impacts on communities and the environment depending on the nature of the development and its location. As noted in EN-2, all of the generic impacts detailed in EN-1 are likely to be relevant to electricity generating infrastructure, even if only during specific stages of the development (such as construction), or at one specific part of the development (such as a substation).

While reference should be made to AoS-1, this AoS-2 focuses on those potentially significant sustainability effects associated with the technologies set out in EN-2. The effects considered relate to:

- Carbon emissions;
- Air pollution;
- Water Quality and Resources; and
- Biodiversity.

It should be noted that, following an initial review, noise and vibration effects and landscape and visual effects for this technology were considered to be adequately addressed within EN-1 as informed by the findings of AoS-1 (see EN-1 for further information). As such, this AoS does not consider these effects further even though EN-2 specifically refers to them.

The likely significant effects of the technology specific policies, requirements and guidance in EN-2 have been appraised against the corresponding objectives in the AoS framework as set out in Section 4.

Section 2.3 of this report explains how the results of the assessment of likely significant effects are shown. For ease of reference, the table is reproduced here.

Table 6-1 - Key to Appraising Significance of Predicted Effects

Likely Significance of Effects		
Significant positive effect likely	++	Policy is expected to address an existing sustainability problem or deliver sustainability enhancements, such as substantial environmental net gain above existing/emerging policy.
Minor positive effect likely	+	Policy is expected to lead to environmental net gain in line with existing or emerging Government policy OR result in

		protection and conservation of a sustainability asset (for example, a designated biodiversity site or designated heritage asset).
No effect likely or not applicable	0	No perceptible effects expected, or the objective is not relevant to the part of the NPS being assessed.
Minor negative effect likely	-	Policy is expected to result in adverse effects of a lower magnitude or smaller scale, which can be mitigated through standard measures and best practice.
Significant negative effect likely	--	Policy is expected to result in adverse effects of a greater magnitude or larger scale, which cannot be mitigated OR will require extensive and bespoke mitigation solutions (further studies may be required to identify appropriate solutions).

The appraisal focused on the identification of technology specific effects (non-generic) with consideration of mitigation measures as set out in AoS-1, in order to establish whether additional mitigation would be required as part of AoS-2. It is noted that an initial assessment was undertaken on a draft EN-2 document dated April 2021 and that this resulted in suggestions of additional mitigation (in the form of recommendations) to be considered in the drafting of EN-2 for public consultation.

An assessment of residual non-generic effects is provided for the EN-2 document. The likely non-generic effects arising specifically from electricity generating infrastructure are presented together with a summary of the residual non-generic effects for each AoS objective over the short, medium and long term. In this context, for the purposes of the appraisal, the “short term” has been defined as the effects arising generally during the infrastructure construction period typically 2-7 years (different technologies have different construction times); the “medium term” as typically between 5 and 30 years (operational lifetimes vary with the characteristics of different technologies); and the “long term” as beyond 30 years (and including decommissioning where relevant).

In addition, consideration is given to the secondary, cumulative and synergistic effects associated with the adoption of EN-2.

Note that the following assessments should be read in conjunction with the assessment of effects as set out in AoS-1 for each particular Objective, though a focus is placed here on particular issues specific to the technology and the Policy approach necessary to address such issues.

6.2.1: AoS Objective 1: Consistent with the national target of reducing carbon emissions to Net Zero by 2050

6.2.1.1: Anticipated Effects

Natural gas electricity generating infrastructure plays a vital role in providing reliable electricity supplies as the UK makes the transition to a low carbon economy. It is, however, a significant source of carbon emissions if these emissions are unabated. Section 1.1 of EN-2 sets out that that in the Net Zero Strategy, Government committed to take action so that by 2035, all our electricity will come from low carbon sources, subject to security of supply, whilst meeting a 40-60% increase in demand. This means that the majority of new generating capacity needs to be low carbon. However, new unabated natural gas generating capacity will also be needed during the transition to net zero. This will ensure that the system remains reliable and affordable.

6.2.1.2: Approach to Development and Mitigation in EN-1 and EN-2

Generating stations to which EN-2 applies are required to be big enough to conform to government policy on CCR, Decarbonisation Readiness and CCS as set out in EN-1 Section 4.8 and referred to in EN-2 Section 2.4. To ensure that no foreseeable barriers exist to retrofitting CCS equipment on combustion generating stations, all applications for new combustion plant which are of generating capacity at or over 300MW and of a type covered by The Carbon Capture Readiness (Electricity Generating Stations) Regulations 2013 should demonstrate that the plant is “Carbon Capture Ready” (CCR) before consent may be given. The Secretary of State should not give development consent unless it is satisfied that the proposed development meets all the criteria for CCR set out in EN-1.

EN-1 sets out that the Government has made its ambitions for CCS clear – committing to providing funding to support the establishment of CCS in at least four industrial clusters in the mid-2020’s and supporting, using consumer subsidies, at least one privately financed gas CCS power station by 2030. In October 2021, the UK Government published its Net Zero Strategy (NZS) which reaffirmed the importance of deploying CCUS to reaching our 2050 net zero target and also outlines our ambition to capture 20-30Mt of CO2 per year by 2030. The barriers to CCS deployment to date have been commercial rather than technical, and the business models, which may evolve overtime, aim to support the deployment of the technology. Natural gas-fired power CCS stations may still emit residual CO2 and so will be required to comply with any Emission Performance Standards that might be applicable, but this is not part of the consents process. The carbon capture plant required for a new build power CCS plant can be included in the application (whether as part of the principal development or as associated development) for development consent for the relevant thermal generating station and will then be considered as part of that application.

However, as noted within EN-1, power CCUS has not been deployed in the UK to date and although the barriers to deployment are commercial rather than technical, it is reliant on the availability of infrastructure for the transportation and storage of CO2. As such, CCUS is not a requirement for new natural gas electricity generating infrastructure in EN-2.

The Government’s strategy for Combined Heat and Power (CHP) is described in EN-1 Section 4.7 and referenced in EN-2 Section 1.6. It notes in developing proposals for new thermal generating stations, developers should consider both the current and future opportunities for CHP from the start and it should be adopted as a criterion when considering locations for a project. Applicants are required either to include CHP or present evidence in the application that the possibilities for CHP have been fully explored. It is noted that if an application does not demonstrate that CHP has been adequately considered the Examining

Authority should seek further information from the applicant. The Secretary of State should not give development consent unless satisfied that the applicant has provided appropriate evidence that CHP is included or that the opportunities for CHP have been fully explored.

EN-1 further notes that operational greenhouse gas emissions are a significant adverse impact from some types of energy infrastructure which cannot be totally avoided (even with full deployment of CCS technology). Given the characteristics of these and other technologies, as noted in Part 3 of EN-1, and the range of non-planning policies that can be used to decarbonise electricity generation such as UK ETS (see Section 2.4 of EN-1), Government has determined that operational greenhouse gas emissions are not reasons to prohibit the consenting of energy projects or to impose more restrictions on them in the planning policy framework than are set out in the energy NPSs (e.g. the CCR requirements). Any carbon assessment will include an assessment of operational greenhouse gas emissions, but the policies set out in Part 2, including the UK ETS, can be applied to these emissions. Operational emissions will be addressed in a managed, economy-wide manner, to ensure consistency with carbon budgets, net zero and our international climate commitments. The Secretary of State does not, therefore need to assess individual applications for planning consent against operational carbon emissions and their contribution to carbon budgets, net zero and our international climate commitments.

Section 5.3 of EN-1 'Greenhouse Gas Emissions' notes that significant levels of energy infrastructure development are vital to ensure the decarbonisation of the UK economy. The construction, operation and decommissioning of that energy infrastructure will in itself lead to greenhouse gas emissions. While all steps should be taken to reduce and mitigate climate change impacts, it is accepted that there will be residual emissions from energy infrastructure, particularly during the economy wide transition to net zero, and potentially beyond. EN-1 therefore requires that all proposals for energy infrastructure projects should include a carbon assessment as part of their ES. This should include:

- A whole life GHG assessment showing construction, operational and decommissioning GHG impacts;
- An explanation of the steps that have been taken to drive down the climate change impacts at each of those stages;
- Measurement of embodied GHG impact from the construction stage;
- How reduction in energy demand and consumption during operation has been prioritised in comparison with other measures;
- How operational emissions have been reduced as much as possible through the application of best available technology for that type of technology;
- Calculation of operational energy consumption and associated carbon emissions;
- Whether and how any residual GHG emissions will be (voluntarily) offset or removed using a recognised framework; and
- Where there are residual emissions, the level of emissions and the impact of those on national and international efforts to limit climate change, both alone and where relevant in combination with other developments at a regional or national level, or sector level, if sectoral targets are developed.

6.2.1.3: Assessment made in respect of EN-2

Whilst EN-2 technology does not promote the supply of energy from low carbon/renewable energy sources, the requirement for all new combustion plants which are at a generating capacity or over 300MW to be CCR and for CHP opportunities to be considered at the earliest opportunity alongside the Government's commitment to providing funding to support the establishment of CCS in at least four industrial clusters in the mid-2020's are steps forward in aligning with the national target to reduce carbon emissions to Net Zero by 2050.

However, EN-2 will consent natural gas-fired electricity generating infrastructure over 50 MW in England that is not CCR, as the CCR requirement will only applies at or over 300MW. Unabated generation may thus continue (and is recognised by the Government) either until such point CCS is installed in CCR power stations or for as long as unabated power stations operate during the transition to net zero. In this respect, provisions in Section 5.3 of EN-1 will go some way to address these operational emissions by requiring all proposals for energy infrastructure projects to include in a GHG assessment whether and how residual emissions will be (voluntarily) offset or removed and where there are residual emissions remaining these need to be considered in the context of sectoral targets. It is noted that operational emissions will be addressed in a managed, economy-wide manner, to ensure consistency with carbon budgets, net zero and international climate commitments.

Considering the policy in EN-1 and EN-2 as discussed above, Table 6-2 provides the assessment of EN-2 with minor negative effects predicted in the short, medium and long term reflecting the residual emissions from unabated natural gas plants, unless balanced by negative emissions through voluntary or sectoral arrangements. Decommissioning in the long term will likely bring temporary effects similar to those for construction but effects will eventually become neutral through the cessation of operational aspects.

Table 60-21 - Reducing Carbon emissions to Net Zero Objective Summary

AoS Objective	Assessment of non-generic effects (by timescale)		
	S	M	L
Consistent with the national target of reducing carbon emissions to Net Zero by 2050 Guide questions: • Reduce carbon emissions of the national portfolio of major energy infrastructure consistent with the contribution share of the energy sector to the carbon budgets and Net Zero targets? • Reduce direct and indirect emissions of all greenhouse gases, including carbon dioxide, during construction, operation and decommissioning? • Maximise supply of energy from low carbon/renewable energy sources / use of low carbon/renewable energy? • Maximise opportunities for making use of waste heat? • Use negative carbon emissions to offset residual emissions from energy such as Bioenergy with Carbon Capture & Storage (BECCS) and Nature Based Solutions? • Create new carbon sinks/removals through natural sequestration including that by natural habitats, green-blue infrastructure and soils?	-	-	-

6.2.2: AoS Objective 3: Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network

6.2.2.1: Anticipated Effects

The development of natural gas electricity generating infrastructure and specific effects on biodiversity is likely to be associated with impacts from infrastructure footprint and water demands, as well as disturbance from noise and vibration. Pollution emissions to air and water could also have direct and indirect effects.

Given the adoption of EN-2 technology is associated with the potential need for large volumes of process and cooling water, this indicates that coastal, estuarine and riverine locations are likely to be preferred. Such locations are likely to be associated with marginal habitats, specialist species and valuable ecological environments. Development in such locations increases the risk of permanent habitat fragmentation and loss with associated risks of species isolation and reduced biodiversity.

Meeting the requirements of CCR and CCS will increase the footprint at the location of the generating station further impacting terrestrial habitats, as well as giving rise to some development along the routes of CCS delivery systems on land and sea bed, and storage systems at sea impacting both terrestrial and marine habitats (although clustering of CCS or CCR generating plant in particular locations may help to minimise the amount of additional development arising from the transport and storage elements of each new scheme). This is likely to result in potential habitat fragmentation associated with larger site boundaries to meet CCR requirements, habitat disturbance in the short term associated with construction activity, and permanent habitat loss due to additional CCS facilities taking up land.

Meeting of process and cooling water demands normally associated with natural gas electricity generation, compounded by the additional water required by CCS (the addition of a full-scale post-combustion capture system to a power plant can increase the water consumption per megawatt of electrical output (MWh) by as much as 90%[12]) is likely to have adverse effects on aquatic biodiversity.

Specifically, the design of the water cooling systems of natural gas electricity generating stations can result in both direct and indirect effects on aquatic biodiversity, including:

- the discharge of water at higher temperatures than receiving waters, which is likely to have an effect on aquatic flora and fauna,
- effects from the abstraction of water that will reduce flows in water courses, resulting in negative effects on aquatic flora and fauna habitat,
- fish impingement and/or entrainment" – i.e. being taken into the cooling system during abstraction; and
- release of chemical anti-fouling treatment of water for use in cooling systems may have adverse impacts on aquatic biodiversity.

Potentially negative ecological effects will also result from noise above pre-construction ambient levels, beyond that considered within EN-1. Sources of noise and vibration from natural gas generating stations may include the gas and steam, the gas and steam turbines that operate continuously during normal operation and external noise sources such as externally site air cooled condensers that operate continuously during normal operation. It is

[12] https://www.globalccsinstitute.com/news-media/insights/how-does-carbon-capture-affect-water-consumption/

to be noted that noise and vibration effects can also occur underwater or be subterranean. Disturbance of fauna is likely to result from the effects of higher noise levels.

6.2.2.2: Approach to Development and Mitigation in EN-1 and EN-2

EN-1 ensures that any proposals for energy generating infrastructure are subject to robust consideration by requiring that they are accompanied by an Environmental Statement (ES) (under the Infrastructure Planning Regulations 2017, or the Town & Country Planning Environmental Impact Assessment Wales Regulations 2017), which describes the significant likely effects of the proposal on the environment, including specific reference to biodiversity. Through this requirement, EN-1 ensures that the direct, indirect, secondary, transboundary and short to long term effects of the development on biodiversity will be considered, as these are requirements in The EIA Regulations. The applicant is required to consider the potential effects, including benefits of a proposal, which is likely to include biodiversity net gain. In addition, in exercising functions in relation to Wales, the Secretary of State should act in accordance with duties placed upon public authorities, including Ministers of the Crown, by Section 6 of the Environment (Wales) Act 2016 to seek to maintain and enhance biodiversity, and in so doing promote the resilience of ecosystems, so far as consistent with the proper exercise of these functions.

In terms of designations, EN-1 notes that the Secretary of State should ensure that appropriate weight is given to designated sites of international, national and local importance, protected species, habitats and other species of importance for the conservation of biodiversity. At the regional and local scale, EN-1 suggests that Important Geological Sites, Local Nature Reserves and Local Wildlife Sites require due consideration, but given the need for new energy generating infrastructure, these designations should not be used in themselves to refuse development consent.

EN-2 notes that in addition to the mitigation measures set out in EN-1, design of the cooling system should include intake and outfall locations that avoid or minimise adverse impacts. EN-2 further notes there should also be specific measures to minimise fish impingement and/or entrainment and excessive heat from discharges to receiving waters.

It is noted however that EN-2 does not specify what specific mitigation measures could be included to reduce the effects of cooling water on water quality. Such measures could include:

- Design of cooling water system so as to minimise modification of sedimentary and hydrodynamic processes.
- Design the cooling water system to avoid the entrainment and impingement of marine organisms.
- Design the cooling water outfall to increase the momentum of the discharge, to help propel the thermal plume, and promote sufficient mixing and dispersal and decay of associated biocide products (if these are required) and reduce the risk of recirculation.
- Further studies could be carried out, including modelling studies, to establish effects of changes to water quality and water temperature to ascertain significance of impacts on local, national and international sites and species.
- If impacts are found to be significant after such studies, consideration to be given to habitats and species compensation requirements and delivery.

6.2.2.3: Assessment made in respect of EN-2

Adoption of EN-2 technology to facilitate the development of natural gas electricity generating capacity is likely to have negative effects with respect to biodiversity in the short, medium and long term (during the construction and operation of any natural gas powered facility and associated CCS infrastructure). However, the magnitude of these effects will be uncertain, as they will be dependent on the location of the facilities as well as on the character of the terrestrial and aquatic habitats affected and on their environmental sensitivities and designations.

There are ranges of mitigation measures, including those proposed in EN-2, that can minimise these effects, but the extent of the mitigation is uncertain. Therefore, the residual effects are likely to be minor, in the short, medium and long term but with uncertainty across these timescales given uncertainty associated with footprint and location. Decommissioning in the long term will likely bring temporary effects similar to those for construction but effects will eventually become neutral through the cessation of operational aspects such as cooling water discharge as habitats and biodiversity returns to a pre-development condition.

Table 60-3 - Enhancing biodiversity objective Summary

AoS Objective	Assessment of non-generic effects (by timescale)		
	S	M	L
Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network Guide questions: • Protect and enhance nationally designated sites such as SSSIs, National Nature Reserves and Marine Conservation Zones, including those of potential or candidate designation? • Protect and enhance valued habitat and populations of protected/scarce species on locally designated sites, including Key Wildlife Sites, Local Wildlife Sites and Local Nature Reserves? • Prevent development on irreplaceable habitats, such as ancient woodland and ancient and veteran trees except in exceptional circumstances and with appropriate compensation measures? • Protect and enhance the Nature Recovery Network? • Protect and enhance priority habitats, and the habitat of priority species? • Promote new habitat creation or restoration and linkages with existing habitats? • Reduce or avoid impacts to habitats with important roles in carbon sequestration? • Increase the resilience of biodiversity to the potential effects of climate change? • Encourage sensitive or nature inclusive design in terrestrial and marine environments? • Ensure energy activities protect fish stocks and marine mammals?	-	-	0

• Ensure energy activities do not exacerbate disturbance to bird populations? • Promote Biodiversity Net Gain for any new major infrastructure development in England using latest Defra metric? • Promote Net Benefit for Biodiversity for any new major infrastructure development in Wales? • Contribute to the meeting of statutory targets in the Environment Act? • Prevent spread of invasive species (native and non-native), including new invasive species because of climate change?			

6.2.3: AoS Objective 7: Protect and enhance the water environment

6.2.3.1: Anticipated Effects

Natural gas energy generation infrastructure development can have adverse effects on the water environment, including groundwater, inland surface water, transitional waters and coastal waters. During the construction, operation and decommissioning phases, it can lead to increased demand for water, involve discharges to water and cause adverse ecological effects resulting from physical modifications to the water environment. There may also be an increased risk of spills and leaks of pollutants to the water environment. These effects could lead to adverse impacts on health or on protected species and habitats and could, in particular, result in surface waters, groundwaters or protected areas failing to meet environmental objectives established under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 and the Marine Strategy Regulations 2010.Specific effects associated with the adoption of EN-2 technology on water quality are primarily from impacts associated with the design of water cooling systems.

This includes discharging water at higher temperatures than receiving waters, which is likely to have an effect on aquatic flora and fauna (see appraisal of Biodiversity); linked effects from the abstraction of water that will reduce flows in water courses, resulting in negative effects on water quality, sediment transport, and aquatic flora and fauna habitat (see appraisal of Biodiversity); and the release of anti-fouling chemicals from cooling water systems.

In addition, CCS technology has its additional water demands, above that of the generating technology. This implies that favoured locations for new natural gas electricity generating facilities will be coastal, beside estuaries or alongside large rivers. As such, due to the proximity there are increased risk associated with impacts on these water bodies.

Decommissioning could bring adverse effects on water quality through de-construction activities involved. However, mitigation measures such as those utilised during construction e.g construction management plan, can reduce adverse effects, while beneficial effects could be experienced through the cessation of operational aspects such as cooling water discharge.

6.2.3.2: Approach to Development and Mitigation in EN-1 and EN-2

EN-1 requires that where a project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment and how this might change due to the impact of climate change on rainfall patterns and consequently water availability across the water environment as part of the ES or equivalent.

EN-1 notes the Secretary of State should be satisfied that a proposal has regard to the current River Basin Management Plans and meets the requirements of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (including regulation 19). The specific objectives for particular river basins are set out in River Basin Management Plans. In terms of Water Environment (Water Framework Directive) (England and Wales) Regulations 2017compliance, the Secretary of State must refuse development consent where a project is likely to cause deterioration of a water body or its failure to achieve good status or good potential, unless the conditions to apply the exemption of Overriding Public Interest, as outlined under Regulation 19, are met. A project may be approved in the absence of a qualifying Overriding Public Interest test only if there is sufficient certainty that it will not cause deterioration or compromise the achievement of good status or good potential.

EN-1 states the impact on local water resources can be minimised through planning and design for the efficient use of water, including water recycling. If a development needs new water infrastructure, significant supplies or impacts other water supplies, the applicant should consult with the local water company and the EA/NRW.

In addition, EN-2 notes that where the project is likely to have effects on water quality or resources the applicant should undertake an assessment as required in EN-1. The assessment should particularly demonstrate that appropriate measures will be put in place to avoid or minimise adverse impacts of abstraction and discharge of cooling water. Specific note is also made that it is important to consider environmental impacts and mitigation measures holistically across terrestrial and marine environments. This is particularly important when considering new facilities as the siting of this infrastructure will likely be within already constrained and busy estuarine environments.

Examples of such mitigation noted within EN-2 include designing intake and outfall locations to avoid or minimise adverse impacts, and have alternative means of cooling. There should also be specific measures to minimise fish impingement and/or entrainment and excessive heat from discharges to receiving waters.

Chapter 4 of EN-1 sets out that a carbon capture plant required for a new build power CCS plant can be included in the application (whether as part of the principal development or as associated development) for development consent for the relevant thermal generating station and will then be considered as part of that application. A supply of water will be needed for CCS processes (as noted in EN-2) and the volumes required will depend upon a number of factors such as the size and type of technology proposed and the extent of the water resource and its flow rates, as well as factors such as water supply company management plans.

6.2.3.3: Assessment made in respect of EN-2

Overall, the effects described above are likely to be negative and occur through construction, operation (with potentially longer term legacy negative effects) and decommissioning of the natural gas generating infrastructure and associated CCS plant. However, their magnitude will be dependent on location and the character of water bodies affected, their environmental sensitivities and designations.

There are ranges of mitigation measures, including those proposed in EN-2, that can minimise these effects, but the extent of the mitigation is uncertain. Therefore, the residual effects are likely to be minor, in the short, medium and long term but with uncertainty across these timescales. Decommissioning in the long term will likely bring temporary effects similar to those for construction but effects will eventually become neutral through the cessation of operational aspects such as cooling water discharge as water quality returns to a pre-development condition.

Table 60-42 - Protect and enhance water environment objective Summary

AoS Objective	Assessment of non-generic effects (by timescale)		
	S	M	L
Protect and enhance the water environment Guide questions: • Protect ground, surface, estuarine and coastal water quality, including during periods of increased summer temperatures due to climate change? • Safeguard the availability of water resources (surface and groundwater), including during periods of increased summer temperatures due to climate change? • Minimise the use of water resources / water consumption? • Protect the integrity of coastal and estuarine processes? • Reduce operational and accidental discharges to the water environment? • Protect the quality of the seabed and its sediments, and avoids significant effects on seabed morphology and sediment transport processes? • Support measures to attain good environmental status of both marine and coastal/estuarine waters as determined by the WFD and MSFD? • Contribute to the meeting the statutory targets in the Environment Act 2021?	-	-	0

6.2.4: AoS Objective 8: Protect and enhance air quality

6.2.4.1: Anticipated Effects

Energy infrastructure development can have adverse effects on air quality. The construction, operation and decommissioning phases can involve emissions to air which could lead to adverse impacts on human health, on protected species and habitats, or on the wider countryside and species.

EN-2 identifies that natural gas generating stations are likely to emit large amounts of nitrogen oxides (NOx). EN-1 (Section 5.2) notes that a particular effect of NOx from some energy infrastructure may be eutrophication, which is the excessive enrichment of nutrients in the environment. The main emissions from energy infrastructure are from generating stations. Eutrophication can affect plant growth and functioning, altering the competitive balance of species and thereby damaging biodiversity. In aquatic ecosystems it can cause changes to algal composition and lead to algal blooms, which remove oxygen from the water, adversely affecting plants and fish. The effects on ecosystems can be short term or irreversible and can have a large impact on ecosystem services such as pollination, aesthetic services and water supply.

6.2.4.2: Approach to Development and Mitigation in EN-1 and EN-2

EN-1 notes that emissions from combustion plants are generally released through exhaust stacks and the design of exhaust stacks, particularly height, is the primary driver for the delivery of optimal dispersion of emissions and is often determined by statutory requirements. The optimal stack height is dependent upon the local terrain and meteorological conditions, in combination with the emission characteristics of the plant. EN-1 states the EA/NRW will require the exhaust stack height of a combustion generating plant, to be optimised in relation to impact on air quality. The Secretary of State need not, therefore, be concerned with the exhaust stack height optimisation process in relation to air emissions.

EN-2 further notes that to meet the requirements of Defra's legislation on industrial emissions, natural gas generating stations must apply a range of mitigation to minimise NOx and other emissions. These emissions are regulated by the Environment Agency (EA) and Natural Resources Wales (NRW) through the Environmental Permitting Regulations, which require developers to obtain an Environmental Permit (EP) before commencing operation of a new natural gas generating station. Details of the EP regime are set out in EN-1, Section 4.11.

EN-2 notes the developer must carry out an assessment as required in EN-1, consulting the EA, NRW and other statutory authorities at the initial stages of developing their proposals, as set out in EN-1. In considering whether to grant consent, the Secretary of State is required to take account of likely environmental impacts resulting from air emissions and that in the case of NOx or particulates in particular, it follows the advice in EN-1 on interaction with the EA and NRW's regulatory processes. The assessment should propose mitigation where necessary and identify residual effects through the lifecycle of the development, as part of the Environmental Assessment.

EN-2 notes that mitigation will depend on the type and design of a generating station. However, Selective Catalytic Reduction (SCR) – which reduces NOx by the injection of a suitable reagent into flue gas over a catalyst – will have additional adverse impacts for noise and vibration, release of dust and handling of potentially hazardous materials, for example the ammonia used as a reagent.

Finally, EN-2 requires the Secretary of State, in consultation with EA and NRW, to be satisfied that any adverse impacts of mitigation measures for emissions proposed by the applicant have been described in the ES and taken into account in the assessments.

6.2.4.3: Assessment made in respect of EN-2

The development of natural gas electricity generating infrastructure is likely to have a negative effect with respect to air quality, mainly during plant operation. The significance of the effects varies between different technologies, between different releases to atmosphere, and whether there is an AQMA within proximity to the development. For example, the release NOx could be strategic in nature where these releases cross international borders on prevailing winds, or more regional and local in terms of impact on receptors from particulate and dust releases from power stations.

These effects are therefore considered to be potentially significant in nature and strategic in magnitude during the operational phase of the power plant but provisions in EN-1 and EN-2 in respect of NOx and other emissions through the developer obtaining an Environmental Permit before commencing operation will likely mitigate such negative effects. For construction and decommissioning, negative effects are likely to be local in extent through these periods and following decommissioning air quality impacts from the development will be neutral.

Table 60-53 - Protect and enhance air quality objective Summary

AoS Objective	Assessment of non-generic effects (by timescale)		
	S	M	L
Protect and enhance air quality Guide questions: • Minimise emissions of dust and other air pollutants that affect human health or biodiversity? • Improve air quality within AQMAs and avoid the need for new AQMAs? • Promote enhancements to green infrastructure networks to help improve air quality? • Contribute to the meeting the statutory targets in the Environment Act 2021?	-	-	0

6.2.5: Cumulative Effects

Cumulative effects associated with the adoption of EN-2 are likely to arise from the development of CCS infrastructure. Given the likely costs associated with the development of this infrastructure and the off-shore location for the storage of the captured CO2, there is likely to be a clustering of new natural gas and biomass co-fired stations, around strategically located land based transfer stations prior to onward pumping of the CO2 to offshore head works. The locations of any demonstration projects are therefore likely to be initially attractive places to locate natural gas electricity generating capacity, which may reduce as the costs associated with CCS decline in the future.

Cumulative effects are likely to be initially associated with the construction of the CCS associated with natural gas power stations with reasons to be located in similar areas. These effects may actually be more sustained than would be the case with the construction of a single power station with CCS infrastructure as new natural gas electricity generating capacity develops around CCS infrastructure clusters as highlighted earlier.

This clustering around CCS infrastructure and especially land based transfer stations prior to offshore storage reinforces other location drivers. This includes availability of water resources to meet process water demands and cooling water requirements, as well as locations close to ports to receive imported fuel stock and other raw materials and for outward transport of residues to export markets.

These potential cumulative effects will be felt across a number of AoS objectives in an adverse manner including air quality, water quality, resource use, biodiversity and traffic and transport amongst others. These may be difficult to mitigate, where the location of suitable CCS storage reservoirs will be a key driver.

However, there is also the potential for positive cumulative effects at a regional scale associated with spatial clustering in a number of the regions identified above. These are across the AoS objectives economy and skills, health and well-being and equality, and all relate to direct and indirect employment creation within these regions associated with development of CCS infrastructure with natural gas and other generating stations.

Similarly, cumulative effects of construction may arise in conjunction with the development of other energy technologies, particularly those contained in EN-4 where pipeline connections may be required to supply new gas or oil-fired power stations, and EN-3 with the development of off-shore wind generation capacity in potentially similar areas as those selected for CCS storage reservoirs. These will mainly affect the built and natural environment sustainable development themes.

Onshore cumulative effects across NPSs may further arise due to location/proximity. Natural gas electricity generating stations and CCS infrastructure favour coastal locations, as may other energy technologies in EN-3, EN-4 and EN-5 . Cumulative effects on coastal landscapes and coastal change may arise should energy developments be concentrated in areas that provide the specific requirements of that development. Such effects would be permanent and long-term (until decommissioned), and also difficult to mitigate due to the scale of the energy developments, particularly where new natural gas electricity generating and CCS facilities are involved.

6.3: Summary of Key Findings of Appraisal

Natural gas generating infrastructure development has similar effects to other types of energy infrastructure, resulting from impacts associated with large facilities at single sites; as well as those associated with linear features linked with potential development of CCS infrastructure. Therefore, for the majority of AoS objectives, the strategic effects of EN-2 are considered to match those identified in AoS-1.

EN-1 (informed by AoS-1) includes extensive mitigations to ensure these effects are considered by applicants and the Planning Inspectorate when preparing and determining applications. EN-2 (informed by AoS-2) contains a range of technology specific mitigation measures, along with those proposed in EN-1, which seek to address the range of negative effects identified.

However, associated with additional detail provided about the technologies in EN-2, non-generic effects were considered for four AoS objectives (Carbon Emissions, Biodiversity, Water Environment and Air Quality). The non-generic effects have been found to be negative across short and medium term for all four AoS objectives linked to construction and operation activities of natural gas generating infrastructure.

Consistency with the national target of reducing carbon emissions to Net Zero by 2050 is also considered negative in the long term reflecting the residual emissions from unabated natural gas plants, unless balanced by negative emissions. This issue is recognised in EN-2, which notes that in the Net Zero Strategy Government committed to take action so that by 2035, all electricity will come from low carbon sources, subject to security of supply, whilst meeting a 40-60% increase in demand. This means that the majority of new generating capacity needs to be low carbon. However, new unabated natural gas generating capacity will also be needed as electricity generated in this way will continue to be needed during the transition to net zero. This will ensure that the system remains reliable and affordable.

In the long term, following decommissioning, as discharges and emissions to the air and water would cease, the effect would be neutral for Water Environment and Air Quality.

It is important to note there is uncertainty over actual effects as this would be dependent upon location and sensitivity of the receiving environment.

A summary of the likely non-generic effects arising specifically from natural gas electricity generating infrastructure is set out in the following Table 6-6.

Table 60-64 - Summary of Key AoS Findings Specific to natural gas electricity generating Infrastructure

AoS Objective	Assessment of non-generic effects (by timescale)		
	S	M	L
1. Consistent with the national target of reducing carbon emissions to Net Zero by 2050	-	-	-
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	-	0
7. Protect and enhance the water environment	-	-	0
8. Protect and enhance air quality	-	-	0

6.4: Appraisal of Alternatives

6.4.1: Introduction

The scope and methods of appraisal of alternatives are detailed in AoS-1. The two strategic alternatives identified for natural gas electricity generating infrastructure in Section 6.4.2 were assessed using Sustainable Development themes that better keep the appraisal at the higher and strategic level (see table 2.3 of AoS-1). The results are set out below.

Note that in consideration of Alternatives, the assessment is undertaken in comparison to EN-2 and not to each other alternative. As such, the findings of the AoS in respect of EN-2 in Section 2 broadly apply to all of the alternatives – the key differentiator being the inclusion or absence of particular aspects related to the Technology and the relative outcomes of such inclusion or absence. To draw comparison between the alternatives and EN-2 on a broad level, the following scale has been used.

Table 60-7 - Differentiator scale for Alternatives

Scale	Description
Large Positive	A materially different positive outcome is anticipated compared to EN-2
Positive	A more positive outcome is anticipated compared to EN-2
Neutral	This alternative is anticipated to have the same outcome as EN-2
Negative	A more adverse outcome is anticipated compared to EN-2
Large Negative	A materially different adverse outcome is anticipated compared to EN-2

6.4.2: Appraisal Results

The findings of the appraisal of the strategic alternatives for EN-2 are set out below, arranged by Sustainable Development (SD) theme.

The two alternatives under consideration are:

- EN-2 a): only consent low carbon gas plant (i.e. natural gas with CCS or hydrogen-fired), and
- EN2 b): only consent combustion generations plants which can demonstrate that they are capable of converting to low carbon alternatives in future.

6.4.2.1: Climate Change (Net Zero)

Alternative (a), only consent low carbon gas plant (i.e. natural gas with CCS or hydrogen-fired), has the potential to further reduce CO2 emissions from electricity generating infrastructure compared with EN-2 as no unabated natural gas-fired electricity generating stations could be proposed for approval by the Secretary of State.

Alternative (b), only consent combustion generations plants which can demonstrate that they are capable of converting to low carbon alternatives in future, may reduce the number of unabated natural gas-fired electricity generating stations proposed for approval by the Secretary of State. It may also reduce the number of unabated natural gas-fired electricity generating stations proposed for approval by the Secretary of State. This would be beneficial in the medium to longer term from a Net Zero point of view due to less emissions than under

EN-2 and ensure that no new unabated gas plant is 'locked-in' without the capability to convert to low carbon alternatives when ready. It would not be as beneficial as alternative (a) as there could still be emissions until low carbon alternatives become available.

Headline SD themes	**EN-2**	**Alternative (a)**	**Alternative (b)**
Climate Change (Net Zero)		Large Positive	Positive

6.4.2.2: Security of Energy Supply

Alternative (a), only consent low carbon gas plant (i.e. natural gas with CCS or hydrogen-fired), would result in no unabated gas plant coming forward, which together with the uncertainty surrounding the viability of natural gas with CCS and hydrogen fired is likely to result in shortages of energy and likely have a strong negative effect on security of supply.

Alternative (b), only consent natural gas generation plants which can demonstrate that they are capable of converting to low carbon alternatives in future, may reduce the number of proposals submitted to the Planning Inspectorate and Secretary of State, for natural gas generating stations below the current 300MW threshold, but would not rule them out altogether, unlike alternative (a). This could result in approval of a smaller total natural gas electricity generating capacity than would be the case with EN-2 and may therefore increase the risk of insufficient generating capacity being available to provide electricity supply through the transition to a low carbon economy.

Headline SD themes	**EN-2**	**Alternative (a)**	**Alternative (b)**
Security of Energy Supply		Large Negative	Negative

6.4.2.3: Health and Well-Being

Alternative (a), only consent low carbon gas plant (i.e. natural gas with CCS or hydrogen-fired), may result in decreased negative effects on health and well-being as compared with EN-2. Natural gas with CCS will likely result in reduced emissions to air, in particular very low SOx emissions, although NOx emissions may vary depending upon the type of CCS technology. Hydrogen-fired plants produce water emissions only which are harmless. Reduced emissions of NOx and SOx have been associated with positive effects on health.

Alternative (a) is likely to result in a greater clustering of generating capacity proposals around preferred locations than would be the case with EN-2 as a power CCS station is likely to want to locate close to a viable route to transport and store CO2 to reduce costs and sites may be limited. Clustering of CCS projects may therefore increase negative effects on health and well- being from increased air emissions, for NOx in particular, although within statutory limits for each facility, within these regions. Levels of noise at natural gas or hydrogen powered electricity generating facilities will remain, but these are likely to be felt at a smaller number of localities, as there would be fewer power plants consented compared to EN-2 in the short term. However, alternative (a) may also increase negative effects on health and well-being on a wider regional and national scale if security of energy supply cannot be maintained, and this has impacts on employment opportunities and economic growth.

Alternative (b), only consent natural generation plants which can demonstrate that they are capable of converting to low carbon alternatives in future, will result in the same effects described above for alternative (a) but these could be more intense if more natural gas capable of converting to CCS plant is consented or less intense if more hydrogen capable plant is consented.

Headline SD themes	**EN-2**	**Alternative (a)**	**Alternative (b)**

Health & Well-Being		Positive / Negative	Positive / Negative

6.4.2.4: The Economy

Alternative (a), only consent low carbon gas plant (i.e. natural gas with CCS or hydrogen-fired), is likely to result in reduced benefits to the economy compared with EN-2 under current market conditions. It may result in fewer proposals for low carbon gas plant coming forward than proposals for unabated gas along with low carbon gas plant under EN-2, until investors are confident of the viability of CCS and clean hydrogen generation. This is likely to increase negative effects on the economy if security of energy supply cannot be maintained, and this has impacts on employment opportunities and economic growth. This could also increase costs if higher capex plant is required to try to replicate the role of gas in the electricity system, and therefore potentially increase energy bills to consumers. However, if CCS and hydrogen are demonstrated to be economically viable on a larger scale, then the positive effects on the economy are likely to be greater than with the adoption of EN-2. This is related to greater employment opportunities in CCS and hydrogen compared to unabated gas.

Alternative (b), only consent natural gas generations plants which can demonstrate that they are capable of converting to low carbon alternatives in future, may reduce the number of smaller gas-fired electricity generating stations proposed for approval by the Secretary of State than would be the case with EN-2. This is likely to increase negative effects on the economy if security of energy supply cannot be maintained, and this has impacts on employment opportunities and economic growth. Lower potential uptake of low carbon alternatives is also likely to result in reduced employment opportunities compared with EN-2. However, if CCS and hydrogen are demonstrated to be economically viable on a larger scale, then the positive effects on the economy are likely to be greater than with the adoption of EN-2.

Headline SD themes	**EN-2**	**Alternative (a)**	**Alternative (b)**
The Economy		Positive / Negative	Positive / Negative

6.4.2.5: The Built Environment

Alternative (a), only consent low carbon gas plant (i.e. natural gas with CCS or hydrogen-fired), may result in reduced negative effects on the built environment compared with EN-2. This alternative is likely to result in fewer proposals for low carbon gas plant coming forward than proposals for unabated gas along with low carbon gas plant under EN-2, and therefore likely to result in reduced negative effects on flood risk (gas-fired power stations tend to be located in coastal areas or in the floodplains of large rivers where flood risk is elevated, particular in light of climate change). There are also likely to be reduced negative effects on traffic and transport, although those that remain, as with EN-2, are likely to be localised and short term in duration associated with construction and decommissioning. Effects on archaeology and cultural heritage with adoption of alternative (a) are also likely to be less negative compared with EN-2, again associated with likely fewer generating stations actually being built, although those effects that remain are again likely to be local in extent. However, if CCS and hydrogen are demonstrated to be economically viable on a larger scale, then negative impacts on the built environment are likely to be larger compared with adoption of

EN-2, because the footprint of plant with CCS is greater than that of plant without CCS and additional land area will be required to install hydrogen production plant.

Alternative (a) could result in greater clustering of generating capacity proposals around preferred locations than would be the case with EN-2 (as a power CCS station is likely to want to locate close to a viable route to transport and store CO2 to reduce costs and sites may be limited). Clustering of CCS projects may therefore increase negative effects on the built environment within these locations, including cumulative impacts.

Alternative (b), only consent natural gas generation plants which can demonstrate that they are capable of converting to low carbon alternatives in future, will result in the same effects described above for alternative (a) but these could be more intense than for EN-2 if more natural gas capable of converting to CCS plant is consented or less intense if more hydrogen capable plant is consented.

Headline SD themes	EN-2	Alternative (a)	Alternative (b)
The Built Environment		Positive / Negative	Positive / Negative

6.4.2.6. The Natural Environment

Alternative (a), only consent low carbon gas plant (i.e. natural gas with CCS or hydrogen-fired), may result in reduced negative effects on the natural environment compared with EN-2. This alternative is likely to result in fewer proposals for low carbon gas plant than proposals for unabated gas along with low carbon gas plant under EN-2 and therefore likely to result in reduced negative effects on biodiversity as there would be less land take. There are also likely to be reduced negative effects on water quality as less need for cooling water. Effects on landscape, townscape and visual character, and soils and geology, are also likely to be less than would be the case with EN-2, again because there would be less land take for the unabated gas. Those effects that remain are likely to be local in extent. However, if CCS and hydrogen generation is demonstrated to be economically viable on a larger scale, then impacts on the natural environment are likely to be of greater negative magnitude compared with adoption of EN-2 as there will potentially be more land take and more need for cooling water.

Alternative (a) could result in greater clustering of generating capacity proposals around preferred locations than would be the case with EN-2 (as a power CCS station is likely to want to locate close to a viable route to transport and store CO2 to reduce costs and sites may be limited). Clustering of CCS projects may therefore increase negative effects on the natural environment within these locations, including cumulative impacts.

Alternative (b), only consent natural gas generation plants which can demonstrate that they are capable of converting to low carbon alternatives in future, will likely result in the same effects described above for alternative (a) but these could be more intense than for EN-2 if more natural gas capable of converting to CCS plant is consented or less intense if more hydrogen capable plant is consented.

Headline SD themes	EN-2	Alternative (a)	Alternative (b)
The Natural Environment		Positive / Negative	Positive / Negative

6.4.2.7: Summary of Alternatives Findings and Preferred Approach for the NPS

Headline SD themes	EN-2	Alternative (a)	Alternative (b)
Climate Change (Net Zero)		Large Positive	Positive
Security of Energy Supply		Large Negative	Negative
Health & Well-Being		Positive / Negative	Positive / Negative
The Economy		Positive / Negative	Positive / Negative
The Built Environment		Positive / Negative	Positive / Negative
The Natural Environment		Positive / Negative	Positive / Negative

Assessment showed that the Alternative policy (a), only consent low carbon gas plant (i.e. natural gas with CCS or hydrogen-fired), could have greater positive effects than EN-2 on contributing to the achievement of Net Zero as there would be less CO2 emissions. Until these technologies are able to deploy at scale there would be no alternative for mid-merit or peaking plant (given no unabated gas could come forward under this alternative, significantly and negatively impacting Security of Supply and affordability of energy and ultimately resulting in shortages of electricity. Imposing a low carbon requirement for all gas electricity generation would carry significant risks while (as at present) the technology remains unproven at commercial scale and it is unclear how much it will cost to install and operate and may also present economic barriers to developers.

Across the remaining sustainable development themes (Health & Well-Being, Economy, Built Environment and Natural Environment), the adoption of alternative (a) compared with EN-2 could result in different effects depending upon technology economic viability. Where CCS and hydrogen economic viability is not demonstrated on a wider basis, then there are likely to be fewer negative effects compared with EN-2 by virtue of less gas fired plants of any type being built. This is related to reduced land and water resource use as well as reduced pollution effects on health and well-being. However, where CCS and hydrogen generation viability is demonstrated for widespread adoption for electricity generating plant, then there are likely to be greater negative effects on these same topics. In particular, the potential for greater clustering of generating capacity proposals around preferred locations than would be the case with EN-2 (as a power CCS station is likely to want to locate close to a viable route to transport and store CO2 to reduce costs and sites may be limited) will likely intensify cumulative negative effects in these preferential locations. However, if the low carbon alternative is hydrogen only small local clusters are likely and cumulative negative effects will likely be less of an issue.

Alternative policy (b), only consent natural gas generation plants which can demonstrate that they are capable of converting to low carbon alternatives in future, may also lead to fewer applications being presented than would be the case with EN-2 but more than in the case of alternative (a). This may reduce employment opportunities and affect the Economy in the natural gas energy sector, but conversely create new employment opportunities as CCS and hydrogen sectors grow. The impacts of this alternative on the contribution to Net Zero in comparison with EN-2 will be positive, as retrofitting of CCS and/or a change to hydrogen would be a condition for all natural gas plant but could have impacts for security if supply if applications for smaller gas plants reduce due to these additional requirements. Across the remaining sustainable development themes (Health & Well-Being, Built Environment and Natural Environment), the adoption of alternative (b) would result in the same sort of effects as for alternative (a).

Another key difference between alternatives (a) and (b) and EN-2 is that EN-2 is more likely to give confidence to developers to come forward with planning applications which if approved will contribute to security of supply and affordability. This is particularly true in the case of alternative (a) which will likely compromise security of supply and affordability under current market conditions and lead to adverse economic effects through seriously restricting development and investment.

Alternative (b) could present a more sustainable alternative than the policies set out in EN-1 and EN-2, if implemented in a way which minimises the potential impact on security of supply. In this respect, it is reassuring to see that, as set out in the Energy White Paper, published in December 2020, and referred to in EN-1, the government committed to consult on an expansion to Carbon Capture Readiness requirements. As part of this expansion, Carbon Capture Readiness is to be renamed Decarbonisation Readiness. A call for evidence was held in Summer 2021 to gather initial views and evidence. A consultation is due to be held later in 2023. If, that consultation leads to changes in the relevant legal or policy framework then those new requirements will apply and supersede the existing CCR requirements.

7: Assessment for Renewable Energy Infrastructure EN-3 (AoS-3)

7.1: NPS for Renewable Energy Infrastructure

The NPS for Renewable Energy Infrastructure (EN-3), in conjunction with the Overarching NPS for Energy (EN-1), sets out the relevant planning factors that should be considered by the Secretary of State when determining whether development consent should be granted for a proposed scheme.

As for EN-1, EN-3 has been developed via an iterative process, taking account of the appraisal of the predicted sustainability effects both for EN-3 preferred polices and reasonable alternatives.

7.2: Appraisal findings for EN-3

Renewable Energy Infrastructure may have various impacts on communities and the environment depending on the nature of the development and its location. As noted in EN-3, all of the generic impacts detailed in EN-1 are likely to be relevant to this type of infrastructure, however, there are further specific considerations arising from the technologies covered in EN-3 which are covered in this AoS.

The technologies concerned as detailed in EN-3 are: energy from biomass and/or waste including mixed waste containing non- renewable fractions; pumped hydro storage; solar photovoltaic; offshore wind; and tidal stream.

While reference should be made to AoS-1 for consideration of all generic sustainability effects in full, this AoS-3 focuses on those potentially significant sustainability effects associated with the technologies set out in EN-3 (henceforth referred to as non-generic effects). The non-generic effects considered relate to the following AoS Objectives:

- Carbon emissions – AoS Objective 1;
- Biodiversity – AoS Objective 3;
- Landscape and Seascape – AoS Objective 6;
- Air quality – AoS Objective 8;
- Health and Wellbeing – AoS Objective 11;
- Economy – AoS Objective 13; and
- Resources – AoS Objective 14.

It should be noted that for all other AoS Objectives effects were considered to be adequately addressed within EN-1. As such this AoS does not consider such issues further.

The likely significant effects of the technology specific policies, requirements and guidance in EN-3 have been appraised against the corresponding objectives in the AoS framework as set out above.

Section 2.3 of this report explains how the results of the assessment of likely significant effects are shown. For ease of reference, the table is reproduced here.

Table 7-1 - Key to Appraising Significance of Predicted Effects

Likely Significance of Effects		
Significant positive effect likely	++	Policy is expected to address an existing sustainability problem or deliver sustainability enhancements, such as

		substantial environmental net gain above existing/emerging policy.
Minor positive effect likely	+	Policy is expected to lead to environmental net gain in line with existing or emerging Government policy OR result in protection and conservation of a sustainability asset (for example, a designated biodiversity site or designated heritage asset).
No effect likely or not applicable	0	No perceptible effects expected, or the objective is not relevant to the part of the NPS being assessed.
Minor negative effect likely	-	Policy is expected to result in adverse effects of a lower magnitude or smaller scale, which can be mitigated through standard measures and best practice.
Significant negative effect likely	--	Policy is expected to result in adverse effects of a greater magnitude or larger scale, which cannot be mitigated OR will require extensive and bespoke mitigation solutions (further studies may be required to identify appropriate solutions).

The appraisal focused on the identification of technology non-generic effects with consideration of mitigation measures as set out in AoS-1, in order to establish whether additional mitigation would be required as part of AoS-3. It is noted that an initial assessment was undertaken on a draft EN-3 document dated April 2021 and that this resulted in suggestions of additional mitigation (in the form of recommendations, see Appendix E) to be considered in the drafting of EN-3 for public consultation.

Having considered comments received from the public consultation and any changes made to EN-3 as a result, a re-assessment of residual non-generic effects is provided for the EN-3 document (as presented for second round of public consultation) in the following sections.

The likely non-generic effects arising specifically from electricity generating infrastructure are presented together with a summary of the residual non-generic effects on EN-3 for each AoS objective over the short, medium and long term. In this context, for the purposes of the appraisal, the “short term” has been defined as the effects arising generally during the infrastructure construction period typically 2-7 years (different technologies have different construction times); the “medium term” as typically between 5 and 30 years (operational lifetimes vary with the characteristics of different technologies); and the “long term” as beyond 30 years (and including decommissioning where relevant).

In addition, consideration is given to the secondary, cumulative and synergistic effects associated with the adoption of EN-3.

7.2.1: AoS Objective 1: Consistent with the national target of reducing carbon emissions to Net Zero by 2050

7.2.1.1: Anticipated Effects

Electricity generation from renewable sources of energy is an important element in the Government’s development of a low-carbon economy, as set out in the Net Zero Strategy. EN-1 states that the Government needs to transform the energy system, increasing the supply of clean energy from renewables, nuclear and hydrogen manufactured using low carbon processes, and where carbon is still emitted, developing the industry and infrastructure to capture, transport and store it. Electricity generation from renewable sources of energy promoted by EN-3 (ie. pumped hydro storage, solar photovoltaic, offshore wind and tidal stream) is an essential element of the transition to net zero as these sources produce zero or low carbon energy. However, EN-3 also promotes energy from biomass and/or waste including mixed waste containing non- renewable fractions which are acknowledged to produce carbon emissions, due to the presence of carbon in the biomass and of fossil-based carbon which exists alongside the biodegradable materials in the waste. Energy from waste is only partially renewable due to the presence of fossil fuel carbon in the waste.

7.2.1.2: Approach to Development and Mitigation in EN-1 and EN-3

As regards carbon emissions mitigation, policies set out in the draft EN-1 which are of particular relevance to biomass and energy from waste electricity generating stations include the requirement for CCS and CCR for proposals for new and refurbishing combustion plants.

Carbon capture and storage technologies offer the opportunity to decarbonise the electricity system whilst maintaining security of supply, providing reliable low carbon generation capacity. EN-1 sets out the Government ambitions for CCS - committing to providing funding to support the establishment of CCS in at least four industrial clusters by 2030 and supporting, using consumer subsidies, at least one privately financed gas CCS power station by 2030. The barriers to CCS deployment to date have been commercial rather than technical, and the business models, which may evolve overtime, aim to support the deployment of the technology. The carbon capture plant required for a new build power plant can be included as associated development in the application for development consent for the relevant thermal generating station and will then be considered as part of that application.

As CCS is currently not commercially available for installation in new combustion generation plants, current Government policy is for new combustion generating stations with a generating capacity at or over 300MW to be carbon capture ready as set out in EN-1. Applicants need to demonstrate that their proposals comply with relevant CCR guidance and will not receive consent from the Secretary of State unless their proposal is judged to be CCR. The Secretary of State should impose requirements on any development consent for operators to:

- retain control over sufficient additional space (whether on or near the site) for the carbon capture equipment;
- retain their ability to build carbon capture equipment on this space (whether on or near the site) in the future; and
- submit update reports on the technical aspects of its CCR status to the Secretary of State. These reports should be required within three months of the commercial operation date of the power station and every two years thereafter until the plant moves to retrofit CCS.

In the context of the combustion technology promoted by EN-3, it is noted that carbon capture readiness as discussed above is relevant to new biomass plants at or over 300MW of generating capacity but not to new Energy from Waste plants.

The Energy White Paper, published in December 2020, committed to consult on an expansion to Carbon Capture Readiness requirements. A call for evidence was held in Summer 2021 to gather initial views and evidence, with a consultation due in 2023. If that consultation leads to changes in the relevant legal or policy framework then those new requirements will apply and supersede the existing CCR requirements. In the meantime, CCR policy remains as set out in EN-1 and described above.

EN-3 acknowledges that the combustion of biomass for electricity generation plays an important role in meeting the UK’s energy needs and supports the decarbonisation of the sector and that this technology only has a potentially significant role in supporting delivery towards the UK’s net zero target when combined with CCS.

EN-3 further acknowledges that the recovery of energy from the combustion of waste, in accordance with the waste hierarchy, plays an important role in meeting the UK’s energy needs. However, as for biomass this technology can only support delivery towards the UK’s net zero target when combined with CCS.

EN-1 further notes that operational greenhouse gas emissions are a significant adverse impact from some types of energy infrastructure which cannot be totally avoided (even with full deployment of CCS technology). Given the characteristics of these and other technologies, as noted in Part 3 of EN-1, and the range of non-planning policies that can be used to decarbonise electricity generation, such as the UK ETS (see Sections 2.4 and 2.5 of EN-1), Government has determined that operational greenhouse gas emissions are not reasons to prohibit the consenting of energy projects or to impose more restrictions on them in the planning policy framework than are set out in the energy NPSs (e.g. the CCR requirements). Any carbon assessment will include an assessment of operational GHG emissions, but the policies set out in Part 2, including the UK ETS, can be applied to these emissions. Operational emissions will be addressed in a managed, economy-wide manner, to ensure consistency with carbon budgets, net zero and our international climate commitments. The Secretary of State does not, therefore need to assess individual applications for planning consent against operational carbon emissions and their contribution to carbon budgets, net zero and our international climate commitments.

7.2.1.3: Assessment made in respect of EN-3

EN-3 technologies promote the supply of energy from low carbon/renewable energy sources in general, but biomass and waste combustion technologies are sources of CO_2 emissions. It follows that both technologies only have a potentially significant role in supporting delivery towards the UK’s net zero target when combined with CCS. As CCS is currently not commercially available for installation in new combustion generation plants, CCR is the only requirement Government is placing on combustion plants generally and includes biomass combustion. Waste combustion technology is currently exempt from such requirement however.

The Energy White Paper, published in December 2020, committed to consult on an expansion to Carbon Capture Readiness requirements to potentially include waste combustion technologies. A generic requirement for CCR for both type of combustion technology would better align with the national target to reduce carbon emissions to Net Zero by 2050, when CCS becomes commercially available and retrofitted to these generation plants.

Due to the current exemption for CCR on waste combustion technology, it is deemed that this technology will likely have a non-generic significant negative effect on carbon emissions. In this respect, provisions in Section 5.3 of EN-1 will go some way to address operational emissions from these generation plants by requiring all proposals for energy infrastructure projects to include in a carbon assessment and how residual emissions will be (voluntarily) offset or removed and where there are residual emissions remaining these need to be considered in the context of sectoral targets. It is noted that residual operational emissions will be addressed in a managed, economy-wide manner, to ensure consistency with carbon budgets, net zero and international climate commitments but no clear mechanism is set out in this respect in and no guarantee that such emissions will indeed be addressed.

Non-generic effects with regards to the achievement of Net Zero are therefore considered significant negative over the short, medium and long terms reflecting residual emissions from continuation of unabated waste combustion plants under current policy, in particular if negative emissions technologies are not used to remove residual emissions from the atmosphere.

Table 7-2 - Reducing Carbon emissions to Net Zero Objective Summary

AoS Objective	Technology	Assessment of non-generic effects (by timescale)		
		S	M	L
Consistent with the national target of reducing carbon emissions to Net Zero by 2050 Guide questions: • Reduce carbon emissions of the national portfolio of major energy infrastructure consistent with the contribution share of the energy sector to the carbon budgets and Net Zero targets? • Reduce direct and indirect emissions of all greenhouse gases, including carbon dioxide, during construction, operation and decommissioning? • Maximise supply of energy from low carbon/renewable energy sources / use of low carbon/renewable energy? • Maximise opportunities for making use of waste heat? • Use carbon removals to offset residual emissions from energy such as Bioenergy with Carbon Capture & Storage (BECCS) and Nature Based Solutions? • Create new carbon sinks/removals through natural sequestration including that by natural habitats, green-blue Infrastructure and soils?	Biomass and Waste combustion	--	--	--

7.2.2: AoS Objective 3: Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network

7.2.2.1: Anticipated effects

EN-3 identifies non-generic effects on biodiversity from all renewable energy projects other than biomass/ energy from waste combustion plants. This is due to biomass/ energy from waste combustion plants biodiversity effects being covered by generic provisions in EN-1 for electricity generating infrastructure.

EN-3 identifies a number of non-generic effects on marine biodiversity from offshore wind farms. These include impacts on fish; seabed habitats and species including intertidal and subtidal; marine mammals; and birds. EN-3 also recognises the need for strategic level assessments, as a result of the cumulative effects from multiple offshore wind farms. In addition, the construction, operation and decommissioning of offshore energy infrastructure can impact the physical offshore environment, which can affect biodiversity. The following elements can be affected: the water quality, as a result of the disturbance of sediments or the release of contaminants; waves and tides from the presence of turbines; the scour effect from the presence of wind turbines and other infrastructure; the sediment transport; suspended solids as a result of the release of sediment; sand waves, as a result of any modifications or clearance; and the water column, as a result of a change in hydrodynamics and turbulence around wind turbine structures. Fish species can be affected from energy emissions into the environment such as noise or electromagnetic fields, as well as from the seabed sediments. Intertidal habitats and species can be affected by the installation of cable across the intertidal/ coastal zone. Marine mammals can be affected by noise from construction activities, which can be high enough to cause disturbance, injury, or even death; by collision with construction and maintenance vessels; by entanglement from floating wind structures, and indirectly by impacts on fish upon which the marine mammals prey. Birds can be affected by: collisions with rotating blades; direct habitat loss; disturbance from construction activities; displacement during the operational phase resulting in loss of foraging/ roosting area; impacts on bird flight lines i.e. barrier effect, and associated increased energy use by birds for commuting flights between roosting and foraging areas; and impacts on prey species and habitat. Subtidal habitats and species can be affected by loss and temporary disturbance of subtidal habitat and benthic ecology, during the construction, maintenance and decommissioning phases.

Specific non-generic effects on biodiversity from pumped hydro storage plant include: habitat loss or alteration resulting from flooding of land or vegetation clearance; removal and damage of soil arising from alterations to landscape hydrology and/ or construction of infrastructure; and compromised water quality impacting aquatic flora and fauna.

Specific considerations identified by EN-3 which apply to solar farms include the impact on habitats, ground nesting birds, wintering birds, bats, dormice, reptiles, great crested newts, water voles and badgers.

Specific considerations which apply to tidal stream energy identified in EN-3 include fish; seabed habitats – intertidal and subtidal; and marine mammals. These could potentially be adversely affected by underwater noise and emission of electromagnetic fields, and also by collision with underwater turbine structures.

7.2.2.2: Approach to development and mitigation in EN-1 and EN-3

EN-3 (and EN-1) note that good design of a project should be applied to all energy infrastructure, to mitigate impacts such as the effects on ecology.

For offshore wind farms, the applicant should undertake an assessment of the impacts on offshore ecology, biodiversity and the physical environment for all stages of its lifespan, and to consider biodiversity and environment net gain. The applicant should undertake consultation with appropriate statutory consultees at the early stages of the project. Reference must be made to best practice advice provided by the Offshore Wind Enabling Actions Programme (OWEAP), as well as to relevant scientific research and literature on the impacts of offshore wind farms, and to data from existing offshore wind farms where appropriate.

With reference to fish, the applicant should identify the fish species most likely to be affected with respect to: spawning grounds; nursery grounds; feeding grounds; over-wintering areas for crustaceans; migration routes; and protected sites; and the potential effects arising from underwater noise and electromagnetic fields.

With reference to intertidal/coastal habitats and species, the applicant should undertake an assessment of the effects of installing cable across the intertidal/coastal zone to demonstrate compliance with mitigation measures identified by the Crown Estate in any plan level HRA produced as part of its leasing round, and include information, where relevant, about: any alternative landfall sites that have been considered; any alternative cable installation methods that have been considered; potential loss of habitat; disturbance during cable installation, maintenance, and removal; increased suspended sediment loads in the intertidal zone during installation and maintenance; predicted rates at which the intertidal zone might recover from temporary effects; and protected sites.

With reference to marine mammals, the applicant should include within their assessment details of: likely feeding areas and impacts on prey species and habitats; known birthing areas/ haul out sites for breeding and pupping; migration routes; protected sites; baseline noise levels; predicted construction and soft start noise levels; operational noise; duration and spatial extent of the impacting activities; collision risk; entanglement risk and barrier risk. The applicant should consult with the relevant statutory bodies regarding the scope, effort and approach for surveys, and regarding any proposed noisy activities. Where noise thresholds are likely to be exceeded the applicant should look at alternatives or mitigation. A Site Integrity Plan should be developed to allow the cumulative impacts of underwater noise to be reviewed.

With reference to birds, the applicant should consult with the relevant statutory bodies regarding the scope, effort and approach for surveys, taking into consideration baseline and monitoring data from existing wind farms. The applicant must undertake collision risk modelling, and displacement and population viability assessments for certain species of birds.

With reference to subtidal habitats and species, the applicant should demonstrate compliance with mitigation measures identified by the Crown Estate in any plan level HRA produced as part of its leasing round. The assessment should include: loss of habitat due to foundation type; environmental appraisal of inter-array and export cable routes and installation/ maintenance methods including predicted loss of habitat; habitat disturbance; increased suspended sediment loads; predicted rates at which the subtidal zone might recover from temporary effects; potential impacts from EMF on benthic fauna; protected sites; and potential for invasive/non-native species introduction.

The Secretary of State should be satisfied that the applicant has used up to date research within their assessment, and assessed the impact on any protected species or habitats. With specific reference to the physical environment, the Secretary of State should be satisfied that the design of the windfarm and methods of construction reasonably minimise the potential for impact on the physical environment. In terms of mitigation, general requirements and considerations are provided in EN-1.

Additionally, the applicant should consider the best ecological outcomes in terms of mitigation, such as avoiding areas sensitive to physical effects, considering the micro-siting of array and cables, the alignment and density of the array, the design of the foundations, ensuring that sediment moved is retained as locally as possible, burying cables to a necessary depth, and using scour protection techniques around offshore structures. An Environmental Improvement Package including nature-based design standards and minimum requirements could be used to mitigate impacts.

With specific reference to fish, the Secretary of State should consider the negative impacts on benthic habitats from external cable protection used to mitigate effects from electromagnetic fields. The applicant should ensure the latest research on mitigation options for electromagnetic fields is presented. Construction activities should be timed to reduce impacts on spawning or migration on fish, and underwater noise mitigation used to prevent death or injury to fish species. With specific reference to intertidal and coastal habitats, the

Secretary of State should be satisfied that cable installation and decommissioning has been designed sensitively, noting that the conservation status of the habitat is of relevance. Mitigation measures will not be able to prevent all adverse impacts.

Review of up to date research should be undertaken and all potential avoidance, reduction and mitigation options presented. Where applicable, use of horizontal directional drilling should be considered to avoid impacts on sensitive habitats and species. Where cumulative effects are predicted as a result of multiple cable routes, it may be appropriate for applicants of various schemes to work together to ensure that the number of cables crossing the intertidal zone are minimised. With specific reference to marine mammals, the Secretary of State may refuse consent where significant noise effects cannot be minimised, and should be satisfied that the preferred methods of construction are designed to minimise significant impacts. Before and during piling, monitoring of the surrounding area should be undertaken, and acoustic deterrent devices used to actively displace marine mammals outside potential injury zones. Soft start procedures during pile driving may be implemented to enable marine mammals in the area to move away from the piling before injury is caused. Where noise impacts cannot be avoided or reduced to acceptable levels, other mitigation should be considered including spatial/ temporal restrictions on noisy activities, alternative foundation types, alternative installation methods and noise abatement technology. The applicant should undertake a review of up-to-date research and present all potential mitigation options as part of the application. The Government intends to develop minimum design standards as part of the Environmental Improvement Package, which may include mandatory minimum requirements to reduce noise levels. With specific reference to birds, the Secretary of State must be satisfied that the collision risk and displacement assessments have been conducted to a satisfactory standard, and that advice from the relevant statutory bodies has been taken into account. The applicant should undertake a review of up-to-date research and present all potential mitigation options. Collision risk should be minimised by: considering how the wind turbines are laid out taking into account other constraints; and optimising turbine parameters. Construction and maintenance vessels should avoid rafting seabirds during sensitive periods, where practicable and compatible with operational requirements and navigational safety, and follow agreed navigation routes to and from the site, and minimise the number of vessel movements overall. Shutting down turbines within migration routes during estimated peak migration periods is considered unlikely to offer suitable mitigation.

With specific reference to subtidal habitats and species, the applicant should design appropriate construction, maintenance, and decommissioning methods to minimise effects on subtidal habitats. The applicant should undertake a review of up-to-date research and present all potential avoidance, reduction and mitigation options. The Secretary of State should expect the applicants to consider the following mitigation measures: surveying and micrositing of the turbines, or re-routing of the export and inter-array cables to avoid adverse effects on sensitive/protected habitats, biogenic reefs or protected species; burying cables at a sufficient depth, taking into account other constraints, to allow the seabed to recover to its natural state; and minimising the use of anti-fouling paint on subtidal surfaces to encourage species colonisation on the structures. The Secretary of State should be satisfied that activities have been designed considering sensitive subtidal environmental aspects, and that discussions with relevant conservation bodies have taken place. Ecological monitoring should be undertaken during the pre-construction, construction, and operational phases to identify the actual impacts and compare them to those predicted. Where impacts are greater than those forecast, an adaptive management process may need to be implemented and additional mitigation required.

For pumped hydro storage projects, the applicant should particularly take into account the ecological status of the water environment. No further specific mitigation measures to those identified in EN-1 are included in EN-3. However, some pumped hydro storage projects can provide benefits to local biodiversity through habitat creation and/or enhancement, fish re-stocking and bankside planting.

For solar farms, the applicant should identify any particular ecological risk from developing on the proposed site, and should use an advising ecologist during the design process to ensure that adverse impacts are avoided, minimised or mitigated in line with the mitigation hierarchy, and biodiversity enhancements are maximised. The applicant's assessment should consider earthworks associated with construction compounds, access roads and cable trenching, to minimise soil damage; how security and lighting installations may impact on the local ecology; how site boundaries are managed, and whether any hedges/ scrub are to be removed; the enhancement, management and monitoring of biodiversity in line with the 25 Year Environment Plan; any relevant measures or targets, including those in the Environment Act; and whether geotechnical and hydrological information should be provided, including identifying the presence of peat and the risk of landslide. A Flood Risk Assessment may also be required to consider the impact of drainage. The Secretary of State should consider the maximum adverse effects from water management in the consideration of the application. The Secretary of State should also specifically take into consideration where the location of the solar farm is on peat, to ensure minimal disruption to the ecology, or release of carbon. Specific mitigation measures could include maintaining or extending existing habitats and potentially creating new important habitats. An ecological monitoring programme is recommended to monitor impacts upon the flora and any particular features at the site, the results of which would inform any changes needed to the land management of the site. Proposed enhancements should aim to achieve environmental and biodiversity net gain in line with the 25 Year Environment Plan and any measures or targets in the Environment Act.

For tidal stream energy, applicants must undertake a detailed assessment of the offshore ecological and biodiversity impacts for all phases in accordance with policy in EN-1. Applicants should also demonstrate that their site selection, project design and mitigation plans have been determined with regard to the evidence base of ecological and biodiversity impacts developed for intermediate-scale developments. Applicants should also assess the potential of their proposed development to have net positive effects on marine ecology and biodiversity. The Secretary of State should be satisfied that the applicant has made appropriately extensive use of the evidence base developed through monitoring at intermediate-scale tidal stream projects. Where adverse effects on site integrity or conservation objectives are predicted within a protected site, the Secretary of State should consider the extent to which the effects are temporary or reversible and the timescales for recover. Where the Secretary of State determines that evidence within the application could be usefully supplemented, monitoring requirements for specific receptors may be imposed on the applicant, and the Secretary of State must be satisfied that the results of the monitoring will be made publicly available for other projects to draw upon. The primary form of mitigation is expected to be the careful design and siting of the development, along with the choice of construction and installation techniques.

7.2.2.3: Assessment made in respect of EN-3

Non-generic effects on biodiversity are likely to occur with all renewable energy generation projects covered in EN-3 with regards to biodiversity, some of which could be significant. This includes impacts on fish; seabed habitats and species including intertidal and subtidal; marine mammals; and birds in marine environments and in terrestrial environments habitat loss or alteration resulting from land clearance and soil compactation; and/ or construction of infrastructure; and compromised water quality impacting aquatic flora and fauna.

Specific considerations identified by EN-3 which apply to solar farms include the impact on habitats, ground nesting birds, wintering birds, bats, dormice, reptiles, great crested newts, water voles and badgers.

Specific considerations which apply to tidal stream energy identified in EN-3 include fish; seabed habitats – intertidal and subtidal; and marine mammals. These could potentially be adversely affected by underwater noise and emission of electromagnetic fields, and also by collision with underwater turbine structures.

Effects on biodiversity may occur at all stages of the project, and may be direct or indirect, temporary or permanent. The significance of these effects will be determined during EIA and appropriate mitigation measures in accordance identified to minimise any adverse effects.

Positive specific effects associated with the technologies may occur on the fishing industry from offshore wind farms acting as fish nurseries; on biodiversity from solar farms, where land is no longer managed intensively; on biodiversity from pumped hydro storage schemes, as a result of habitat creation and fish re-stocking; and on resources where residues from biomass can be recovered and re-used rather than being sent to landfill

EN-3 emphasises the importance of ensuring that the applicant has used up to date research within their assessments, and that consultation has been carried out with relevant bodies to ensure where monitoring needs to take place the scope and approach is agreed, and appropriate mitigation measures are agreed. There could also be cumulative impacts which will need to be taken into account, where mitigation measures alone may not be able to address these issues, meaning that compensation may be required.

The non-generic effects on biodiversity are considered to be minor negative over all timeframes for all infrastructure projects. All effects will clearly vary according to the type of impact, the specific location of the site, and the habitats and species affected, and there may be opportunities for enhancement and biodiversity net gain.

Table 7-3 - Enhancing biodiversity objective summary

AoS Objective	**Technology**	**Assessment of non-generic effects (by timescale)**		
		S	M	L
Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network Guide questions: • Protect and enhance nationally designated sites such as SSSIs, National Nature Reserves and Marine Conservation Zones, including those of potential or candidate designation? • Protect and enhance valued habitat and populations of protected/scarce species on locally designated sites, including Key Wildlife Sites, Local Wildlife Sites and Local Nature Reserves? • Prevent development on irreplaceable habitats, such as ancient woodland and ancient and veteran trees except in exceptional circumstances and with appropriate compensation measures?	Offshore wind	-	-	-
	Pumped hydro storage	-	- +	- +
	Solar Photovoltaic Generation	-	- +	- +
	Tidal Stream Energy	-	-	-

• Protect and enhance the Nature Recovery Network? • Protect and enhance priority habitats, and the habitat of priority species? • Promote new habitat creation or restoration and linkages with existing habitats? • Reduce or avoid impacts to habitats with important roles in carbon sequestration? • Increase the resilience of biodiversity to the potential effects of climate change? • Encourage sensitive or nature inclusive design in terrestrial and marine environments? • Ensure energy activities protect fish stocks and marine mammals? • Ensure energy activities do not exacerbate disturbance to bird populations? • Promote Biodiversity Net Gain for any new major infrastructure development in England using latest Defra metric? • Promote Net Benefit for Biodiversity for any new major infrastructure development in Wales? • Contribute to meeting relevant statutory targets in the Environment Act? • Prevent spread of invasive species (native and non-native), including new invasive species because of climate change?	

7.3.1: AoS Objective 6: Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity

7.3.1.1: Anticipated effects

EN-3 identifies that that there may be specific concern of the impact on landscape from biomass/ waste combustion generating stations, given the overall size of the buildings.

There will also be specific considerations on seascape and visual impact associated with offshore wind farms. Seascape is an important environmental, cultural and economic asset, especially where the seascape provides the setting for a nationally designated landscape and supports the delivery of the designated area's statutory purpose, and for Heritage Coasts.

Pumped hydro storage projects have the potential to specifically impact the landscape resulting from: construction of a concrete dam; construction of the generating station; substantial civil works for the scheme foundations and digging the reservoir; and flooding of land or disused quarries or pits to create the reservoir.

Regarding effects from solar farms, these are likely to be in low lying areas of good exposure and as such may have a wider zone of visual influence than other types of onshore energy infrastructure. In addition, they may cover a significant surface area.

EN-3 also identifies that there may be impacts on seascape and visual impacts from tidal stream energy projects.

7.3.1.2: Approach to development and mitigation in EN-3

Regarding biomass/ energy from waste, the Secretary of State should be satisfied that the design of the proposed generating station is of appropriate quality and minimises adverse effects on the landscape character and quality. Good design that is sympathetic and contributes positively to the landscape character and quality of the area will go some way to mitigate adverse landscape and visual effects. Development proposals should consider the design of the generating station including the materials to be used in the context of the local landscape character. Mitigation is achieved primarily through aesthetic aspects of site layout and building design, although micro-siting within the development can help. Applicants should seek to visually enclose the generating station buildings at low level as seen from surrounding external viewpoints to help reduce the scale of impacts. Consideration could be given to using earth bunds and mounds, and / or tree planting to soften visual intrusion.

For offshore wind farms, a seascape and visual impact assessment (SLVIA) will be required where a coastal National Park, the Broads or AONB, or a Heritage Coast may be affected, and may be required in other circumstances in accordance with relevant offshore windfarm EIA policy. The SLVIA should be proportionate to the scale of the potential impacts. Where the offshore wind farm will not be visible from the shore, then a SLVIA is not likely to be required. Where necessary, assessment of the seascape should include an assessment of four principal considerations on the likely effect of the offshore wind farm on the coast: the limit of visual perception from the coast; the effects of navigation and hazard prevention lighting on dark night skies; individual landscape and visual characteristics of the coast and the special qualities of designated landscapes; and how people perceive and interact with the coast and seascape. Photomontages will be required, and the viewpoints should be selected in consultation with statutory consultees. The Secretary of State should not refuse to grant consent for a development solely on the ground of an adverse effect on the seascape or visual amenity unless: it considers that an alternative layout within the identified site could be reasonably proposed which would minimise any harm taking into account any other constraints; or the harmful effects are considered to outweigh the benefits of the proposed scheme. Where adverse effects are anticipated, the Secretary of State should take into account the extent to which the effects are temporary or reversible. In terms of mitigation it should be considered unlikely that mitigation in the form of reduction in scale will be feasible, however, the siting layout of the turbines should be designed appropriately to minimise harm, taking into account other constraints.

Regarding pumped hydro storage projects, the Secretary of State should be satisfied that the design of the proposed scheme is of appropriate quality and minimises adverse effects on the landscape character and quality. Good design that is sympathetic and contributes positively to the landscape character and quality of the area will go some way to mitigate adverse landscape and visual effects. Development proposals should consider the design of the generating station and dam if required, including the materials to be used in the context of the local landscape. If spoil heaps arising during construction are kept within the locality, they should be located in a way that minimises their visual impact. Mitigation is achieved primarily through the aesthetic aspects of site layout and building design to minimise intrusive appearance in the landscape as far as engineering requirements permit. For example, it may be possible to house some of the station underground or inside the dam. Applicants should seek to visually enclose the dam and generating station at low level as seen from surrounding external viewpoints to help reduce the scale of impacts.

Consideration could be given to using earth bunds and mounds, and / or tree planting to soften visual intrusion.

For solar farms, the applicant may be required to show visualisations to demonstrate the effects of a proposed solar farm on the setting of heritage assets and any nearby residential areas or viewpoints. Applicants should follow the criteria for good design set out in EN-1 and will be expected to direct considerable effort towards minimising the landscape and visual impact of the solar PV arrays. Security measures such as fencing should take into account the need to minimise the landscape and visual impact. The applicant should have regard in both the design layout and future maintenance plans for the retention of growth of vegetation on boundaries. Existing hedges and established vegetation should be retained wherever possible, and if necessary tree surveys or arboricultural/hedge assessments should be undertaken to inform the impact of the proposed development. In terms of mitigation, applicants should consider the potential to mitigate landscape and visual impacts through screening with native hedges, trees and woodlands, to minimise the use and height of security fencing, to use existing features to screen security fencing or to assist in site security. The use of security lighting should be minimised, and any lighting should use a passive infra-red technology and its impact minimised through design and installation practices.

Potential effects on seascape may also occur with tidal array projects, although there is not yet sufficient evidence for these types of projects. Effects may be similar to those associated with offshore wind farms, and generic guidance in EN-1 should be followed.

7.3.1.3: Assessment made in respect of EN-3

Specific effects on landscape or seascape and on visual impact are expected to occur with all types of renewable infrastructure projects. EN-3 notes that assessment of effects should be undertaken in accordance with EN-1, with the impact on seascape addressed where relevant. As set out in EN-1, proposals should demonstrate good design in respect of landscape and visual amenity.

Adverse effects may occur at all stages of the project. The significance of these effects will be determined during EIA and appropriate mitigation measures identified to minimise any adverse effects. The effects on landscape and visual impact are therefore considered to be minor negative over all timeframes although there is uncertainty associated with these effects.

Table 70-4 - Protect and enhance landscapes objective summary

AoS Objective	Technology	Assessment of non-generic effects (by timescale)		
		S	M	L
Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity Guide questions:	Biomass and Waste combustion	-	-	-
	Offshore wind	-	-	-
	Pumped hydro storage	-	-	-

• Support the integrity and uphold the statutory purposes of any areas designated for landscape value ie, National Parks and AONBs, including in conjunction with the provisions of any relevant Management Plan? • Conserve and enhance the intrinsic character or setting of designated landscapes, townscapes and seascapes? • Conserve, protect and enhance natural environmental assets (e.g. parks and green spaces, common land, woodland / forests etc) as they contribute to landscape and townscape quality? • Support measures to enhance the resilience of ecosystems at a landscape scale and also to maximise benefits including public access and enjoyment of landscapes? • Support functional landscapes e.g. those which reduce flood risk, sequester carbon or offer recreational opportunities in peri urban areas? • Minimise noise and light pollution from construction and operational activities on residential amenity and on sensitive locations, receptors and views?	Solar Photovoltaic Generation	-	-	-
	Tidal Stream Energy	-	-	-

7.4.1: AoS Objective 8: Protect and enhance air quality

7.4.1.1: Anticipated effects

As detailed in AoS-1, energy infrastructure projects have the potential for a number of generic adverse effects on air quality during construction, operation and decommissioning which include:

- emissions generated as a result of construction activities (transport emissions from the transport of materials, resources and personnel; dust and fumes from machinery operation, excavation and drilling);
- emissions from project operation (operation of plant, transport of materials, resources and personnel); and
- emissions from plant, machinery and vehicles during the decommissioning of projects (including transport to and from site).

Specific effects on air quality are only expected to occur with biomass and energy from waste infrastructure projects.

Pollutants of concern arising from the combustion of waste and biomass may include NOx, SOx, NMVOCs and particulates. In addition, emissions of heavy metals, dioxins and furans are a consideration for waste combustion generating stations but limited by the Environmental Permitting Regulations and waste incineration BAT conclusions and regulated by the EA. Changes in air quality could affect both sensitive human health and ecological receptors, however, EN-3 notes that where the proposed plant meets the requirements of the IED and BAT conclusions and will not exceed the local air quality standards the Secretary of State should not regard the proposed plant as having adverse impacts on health.

A particular effect of NOx from some energy infrastructure may be eutrophication, which is the excessive enrichment of nutrients in the environment. The main emissions from energy infrastructure are from generating stations. Eutrophication can affect plant growth and functioning, altering the competitive balance of species and thereby damaging biodiversity. In aquatic ecosystems it can cause changes to algal composition and lead to algal blooms, which remove oxygen from the water, adversely affecting plants and fish. The effects on ecosystems can be short term or irreversible and can have a large impact on ecosystem services such as pollination, aesthetic services and water supply.

7.4.1.2: Approach to development and mitigation in EN-1 and EN-3

The approach is the same as noted in EN-1, with the added requirement to ensure that the proposed plant meets the requirements of the IED and BAT conclusions. The significance of effects will depend upon local site-specific factors, such as transport routes and proximity to sensitive receptors and these will be dealt with during the project level EIA. For combustion plant using CCS, the ES should reflect the latest evidence on the air quality impacts of carbon capture using amine-based solvents.

EN-3 notes that abatement technologies should be those set out in the relevant sector guidance notes as produced by the EA. The Secretary of State does not need to consider equipment section in its determination process.

7.4.1.3: Assessment made in respect of EN-3

Non-generic effects on local air quality are only expected to occur with biomass and energy from waste infrastructure projects.

EN-1 notes that adverse effects may occur at all stages of the project, as a result of emissions released during construction, operation, and decommissioning. The significance of these effects will be determined during EIA and appropriate mitigation measures in accordance identified to minimise any adverse effects. The effects on air quality from biomass and energy from waste projects are therefore considered to be minor negative over all timeframes.

EN-3 notes which pollutants should be considered within an assessment, but is clear that where a proposed project meets the requirements of the IED and BAT conclusions and does not exceed local air quality objectives then there should not be any adverse effects on human health. There may, however, be effects on sensitive ecological receptors which are not specifically mentioned in EN-3, although these effects are already included in EN-1.

Table 07-5 - Protect and enhance air quality objective summary

AoS Objective	**Technology**	**Assessment of non-generic effects (by timescale)**		
		S	M	L
Protect and enhance air quality Guide questions: • Minimise emissions of dust and other air pollutants that affect human health or biodiversity? • Improve air quality within AQMAs and avoid the need for new AQMAs? • Promote enhancements to green infrastructure networks to help improve air quality?	Biomass and Waste combustion	-	-	-

• Contribute to meeting relevant statutory targets in the Environment Act 2021?				

7.5.1: AoS Objective 11: Improve health and well-being and safety for all citizens and reduce inequalities in health

7.5.1.1: Anticipated effects

Biomass and waste combustion may give rise to air pollution, as noted in the section above, noise and vibration, on odour, insect and vermin infestation. Sources of noise and vibration may include: delivery and movement of fuel and materials; processing waste for fuel at generating stations; the gas and steam turbines that will operate continuously; and external noise sources such as externally-sited air-cooled condensers that also operate continuously during normal operation. Insect and vermin infestation may be a particular issue with regard to storage of fuels for energy from waste generating stations as they may be attracted to biodegradable waste stored and processed at the facility. Odour is also likely to arise during the storage, handling and processing of biodegradable waste.

Specific effects are also identified from pumped hydro storage on noise and vibration as a result of the noise from the turbines and other power generation equipment during operation, and during construction, in particular if blasting is required to create new reservoirs.

Solar Photovoltaic generation is identified as potentially causing glint and glare which could affect residents, motorists, public rights of way, and aviation infrastructure, when the solar panels are located at certain angles between the sun and the receptor, and noise and vibration associated with traffic during the construction phase. This is considered specifically for solar farms, given their likely location in rural areas where a large number of vehicles may be necessary to transport necessary infrastructure along minor roads.

7.5.1.2: Approach to development and mitigation in EN-1 and EN-3

For biomass and waste combustion projects, the applicant should include a noise assessment of the impacts on amenity in case of excessive noise in accordance with EN-1. In addition to mitigation measures set out in EN-1, noise from gas turbines should be mitigated by attenuation of exhausts to reduce any risk of low-frequency noise transmission, and the unavoidable noise from the sorting and transport of material during operation of the biomass or EfW generating stations and the apparatus external to the main generating stations should be mitigated through careful plant selection. The Secretary of State should be satisfied that noise and vibration will be adequately mitigated through requirements attached to the consent, and the extent to which operational noise will be separately controlled by the EA or NRW. The Secretary of State should not grant consent unless satisfied that the proposals will meet the aims set out in EN-1. The applicant should also assess the potential for insect infestation and emissions of odour as set out in EN-1. In addition to the mitigation measures set out in EN-1, reception, storage and handling of waste and residues should be carried out within defined areas, within enclosed buildings at EfW generating stations. The Secretary of State should be satisfied that the proposal sets out appropriate measures to minimise impacts on local amenity.

For pumped hydro storage projects, a noise assessment of the impacts on amenity in the case of excessive noise should be undertaken in accordance with EN-1. In addition to the mitigation measures identified in EN-1, it is noted that noise from the operation of the pumped hydro storage generating stations and from the apparatus external to the main generating station may be unavoidable. Mitigation will be through careful plant selection.

Noise during construction, particularly from blasting, will also be unavoidable. Careful consideration should be given to mitigating the impact of this on noise sensitive receptors.

For solar farms, it may be necessary in some instances for the applicant to undertake a glint and glare assessment as part of the application, to assess the potential for the combined reflective quality from solar panels, frames and supports. This may need to take into account tracking panels which can cause differential diurnal and/or seasonal impacts. Solar PV panels are designed to absorb, not reflect, irradiation. However, the Secretary of State should assess the potential impact of glint and glare on nearby homes, motorists, public rights of way and aviation infrastructure. Consideration should be given to the use of solar panels with an anti-glare/ anti-reflective coating with a specified angle of maximum reflection attenuation, to screening between affected receptors and reflecting panels, and adjusting the alignments or angles of the solar panels. The applicant should also consider any impact from noise resulting from construction traffic associated with solar farm proposals. Cumulative effects on the local road network should also be considered and disruption to local residents minimised through a transport delivery plan. Mitigation measures other than those specified in EN-1 may include temporary road widening.

7.5.1.3: Assessment made in respect of EN-3

The specific negative effects on health from renewable technologies identified in EN-3 as arise from air pollution, noise pollution, odour, insect and vermin infestation and from glint and glare from solar panels. These effects could occur over all timeframes, with some effects such as those on noise being unavoidable. For all of the specific effects identified, mitigation measures should be considered where possible. The assessment has shown that minor negative impacts are expected from biomass and energy from waste plants, and solar farms over all timescales, while those for pumped hydro storage are likely to be significant negative, as some of the effects may be unavoidable.

Table 70-6 - Improve health and well-being objective summary

AoS Objective	**Technology**	**Assessment of non-generic effects (by timescale)**		
		S	M	L
Improve health and well-being and safety for all citizens and reduce inequalities in health Guide questions: • Protect the health of communities through prevention of accidental pollutant discharges, exposure to electric and magnetic fields, shadow flicker or radiation? • Minimise nuisance on communities and their facilities including air, noise and light pollution? • Provide for facilities that can promote more social interaction and a more active lifestyle and enjoyment of the countryside and coasts? • Promote initiatives that enhance safety and personal security for all? • Promote access to Greenspace and Green Infrastructure Standards?	Biomass and waste combustion	-	-	-
	Pumped hydro storage	--	--	-
	Solar photovoltaic generation	-	-	-

• Support enhanced security, reliability and affordability of the national energy supply?	

7.6.1: AoS Objective 13: To promote a strong economy with opportunities for local communities

7.6.1.1: Anticipated effects

Offshore wind farms may have non-generic effects on commercial fisheries and fishing, and on navigation and shipping due to their location at sea. While the footprint of an offshore windfarm and associated infrastructure may hinder certain types of commercial fishing activity such as trawling , other fishing activities, such as potting, may be able to take place without being unduly disrupted. Offshore wind farms could potentially affect fish that is of both commercial interest and ecological value.

Offshore wind farms will also impact on navigation and shipping in and around the area of the site, affecting both commercial and recreational users of the sea who may be affected by disruption or economic loss. Consent should not be given to projects which pose intolerable risks to navigational safety after all mitigation measures have been adopted.

Power generated from offshore windfarms can be transmitted to onshore networks through multi-purpose interconnectors to multiple neighbouring North Sea countries, reducing costs for consumers and maximising market access for generators.

On the other hand, the siting of offshore infrastructure associated with offshore wind farms will often occur in or close to areas where other offshore infrastructure such as telecommunication cables, oil or gas pipelines, and emerging technologies, such as CCUS or co-location of electrolysers for hydrogen production is located, thus affecting economic activity.

Pumped hydro storage stores electricity ready for release when supply exceeds demand, and acts to maintain the resilience and stability of the grid. The need for electricity storage will rise as the amount generated by the more variable sources of wind and solar power increases, and demand is increased through the electrification of heat and transport. Specific effects from pumped hydro storage can occur on recreational activities such as watersports and fishing.

For solar photovoltaic generation, there may be socio-economic benefits in retaining site infrastructure after the operational life, although no other specific economic effects are noted.

Potential effects on commercial fisheries and fishing, and navigation and shipping may also occur with tidal array projects, although there is not yet sufficient evidence for these types of projects. Effects may be similar to those associated with offshore wind farms.

7.6.1.2: Approach to development and mitigation in EN-1 and EN-3

Regarding offshore wind farms, EN-3 states that the Secretary of State should be satisfied that the site selection process has been undertaken in a way that reasonably minimises adverse effects on fish stocks. Where the Secretary of State considers the wind farm would significantly impede the protection of sustainable fisheries or fishing activity at recognised important fishing grounds, this should be attributed a correspondingly significant weight. The Secretary of State should also consider adverse or beneficial impacts on different types of commercial fishing on a case by case basis. The Secretary of State should be satisfied that the applicant has sought to design the proposal with relevant consultees, and tried to minimise the loss of any fishing activities. The Secretary of State will need to consider the extent to which disruption to the fishing industry has been mitigated where reasonably possible. Mitigation proposals should result from detailed consultation with relevant consultees, and mitigation should be designed to enhance where reasonably possible any potential medium and long-term positive benefits to the fishing industry.

Applicants should establish stakeholder engagement with interested parties in the navigation sector early in the development phase of the proposed offshore wind farm and continue to ensure that solutions are sought that allow offshore wind farms and navigation uses of the sea to successfully co-exist. Assessment should be underpinned by consultation with relevant representatives. Applicants should also undertake a Navigational Risk Assessment in accordance with relevant Government guidance. The Secretary of State should not grant development consent in relation to the construction or extension of an offshore wind farm if it considers that intolerable interference with the use of recognised sea lanes essential to international navigation is likely to be caused by the development. The Secretary of State should be satisfied that the site selection has been made with a view to avoiding or minimising disruption or economic loss to the shipping and navigation industries with particular regard to approaches to ports and to strategic routes essential to regional, national and international trade, lifeline ferries, and recreational users of the sea. Where the proposed development is likely to adversely affect major commercial navigational routes, the Secretary of State should give these adverse effects substantial weight in its decision making. Mitigation measures should be identified following proactive engagement with key sector representatives. Where less strategically important shipping routes are likely to be affected, a pragmatic approach should be adopted, with negative impacts minimised as low as reasonably practicable.

Regarding the impact on offshore infrastructure, where the proposed wind farm is in close proximity to this infrastructure, the applicant should undertake an assessment of the potential effects of the proposed development on such infrastructure in accordance with EN-1. Early consultation between the applicant, the interested parties and the Secretary of State where relevant, should be held as early as possible in the process and continue throughout the lifetime of the project. Where a proposed offshore wind farm potentially affects other offshore infrastructure, the Secretary of State should expect the applicant to minimise negative impacts and reduce risks to as low as reasonably practicable. The Secretary of State should be satisfied that the site selection and site design of the offshore wind farm has been made with a view to avoiding or minimising disruption or economic loss or any adverse effect on safety to other offshore industries. Where a proposed development is likely to affect the future viability or safety of an existing or approved/ licensed offshore infrastructure or activity, the Secretary of State should give these adverse effects substantial weight in its decision making. Providing proposed schemes have been carefully designed, and that the necessary consultation with relevant bodies has been undertaken at an early stage, mitigation measures may be possible to negate or reduce effects on other offshore infrastructure to a level sufficient to enable the Secretary of State to grant consent.

Where a pumped hydro storage project is likely to have impacts on recreational activities the applicant should undertake a full assessment, accounting for the views of relevant representational bodies and taking measures to minimise adverse impacts. The Secretary of State should be satisfied that these projects are designed to minimise, and where possible enhance, impacts on existing recreational activities.

7.6.1.3: Assessment made in respect of EN-3

The renewable technologies identified in EN-3 could have negative effects on economic activities isuch as commercial fishing, navigation on recreational activities such as watersports, and on offshore infrastructure over all timeframes, of which some effects could carry substantial weight. However, there are some benefits, for example the interconnectors associated with offshore wind generation will deliver cheaper consumer costs; pumped hydro storage will provide storage of electricity for times when demand exceeds supply; and some of the infrastructure associated with solar photovoltaic generation may provide socio-economic benefits post operation. For all of the specific adverse effects identified, mitigation measures identified in consultation with relevant bodies should be adopted, and where possible specific effects should be taken into account in the design of the project. The assessment has shown that on balance minor negative impacts are expected over all timescales, given that the majority of adverse effects should be able to be mitigated.

Table 07-7 - To promote a strong economy objective summary

AoS Objective	**Technology**	**Assessment of non-generic effects (by timescale)**					
		S		M		L	
To promote a strong economy with opportunities for local communities Guide questions: • Support enhanced security, reliability and affordability of the national energy supply? • Support creation of both temporary and permanent jobs and increase skills, particularly in areas of need? • Have wider socio-economic effects such as changes to the demographics, community services or house prices?	Offshore Wind	-	+	-	+	-	+
	Pumped hydro storage	-		-		-	
	Solar photovoltaic generation						

7.7.1: AoS Objective 14: Promote sustainable use of resources and natural assets

7.7.1.1: Anticipated effects

Waste and biomass combustion generating stations will produce waste residues that require further management, much of which can be used for commercial purposes.

Generating stations that burn waste produce two types of residues: combustion residue-inert material from the combustion chamber; and fly ash, a residue from flue gas emission abatement technology. These two residues cannot be mixed.

Biomass combustion generating stations will also produce both combustion and flue gas treatment residues, however, these can be mixed and managed as one product for disposal.

Left unchecked, waste combustion generating stations may disadvantage reuse or recycling initiatives if the proposed development doesn't accord with the waste hierarchy and burns materials which should have been reused or recycled otherwise.

7.7.1.2: Approach to development and mitigation in EN-1 and EN-3

The applicant should undertake an assessment of the proposed waste combustion generating station that examines the conformity of the scheme with the waste hierarchy, and the effect on the relevant Waste Local plans. The applicant should set out the extent to which the generating station and capacity proposed is compatible with and supports the long-term recycling targets. If appropriate, reference should be made to the waste authorities' annual monitoring reports. The Secretary of State should be satisfied that the proposed waste combustion generating station is in accordance with the waste hierarchy and of an appropriate type and scale so as not to prejudice the achievement of relevant waste management targets.

The applicant should include the production and disposal of residues as part of the ES. In addition, applicants should set out the consideration they have given to the existence of accessible capacity in waste management sites for dealing with residues for the planned life of the power station. The Secretary of State should consult the Environment Agency on the suitability of the proposals. The Secretary of State should be satisfied that management plans for residue disposal satisfactorily minimise the amount that cannot be used for commercial purposes. The Secretary of State should give substantial positive weight to development proposals that have a realistic prospect of recovering residues. The Secretary of State should consider what requirements it may be appropriate to impose following consultation with the Environment Agency. In terms of mitigation, the environmental burdens associated with the management of combustion residues can be mitigated through recovery of secondary products, for example aggregate or fertiliser, rather than disposal to landfill. The Secretary of State should give substantial positive weight to proposals that have a realistic prospect of recovering these materials.

7.7.1.3: Assessment made in respect of EN-3

Biomass and combustion from waste could have a positive effect where it is in accordance with the waste hierarchy and is of an appropriate scale. A positive effect could also occur where the applicant is planning to recover much of the residual component. However, there could also be negative effects in terms of the residues that are produced from burning waste.

Table 07-8 - Resources and natural assets objective summary

AoS Objective	Technology	Assessment of non-generic effects (by timescale)					
		S		M		L	
Promote sustainable use of resources and natural assets Guide questions: • Reduce consumption of materials, energy and resources during construction, operation and decommissioning of energy infrastructure? • Promote sustainable waste management practices in line with the waste hierarchy? • Encourage the use of recycled and / or secondary materials? • Promote the use of low carbon materials and technologies? • Produce waste by-products that require appropriate management?	Biomass and waste combustion	-	+	-	+	-	+

• Provide for safe and secure interim storage of waste, where necessary? • Promote the use of local suppliers that use sustainably-sourced and locally produced materials?	

7.8: Cumulative effects

Offshore wind will have a hugely important role in supplying renewable energy. It is therefore highly likely that a number of offshore wind farms could be proposed in areas with good wind resources, such as the North Sea. Multiple offshore wind facilities could, potentially, result in cumulative effects on biodiversity, with impacts beyond identified thresholds for numbers of species and habitats. The BESS recognises that a more strategic approach may be required to assessment and that an Environmental Improvement Package may be implemented to maintain or enhance the environment while accelerating offshore wind deployment. It is also recognised that compensation measures may be required where adverse effects on site integrity cannot be ruled out, and that applicants should work collaboratively together where there are cumulative impacts from more than one development. EN-3 also proposes that effects of multiple cable routes could be mitigated by cooperation between developers of these facilities. The cumulative impacts of underwater noise should be examined and a Site Integrity Plan developed and reviewed closer to the construction date, once there is more certainty over the equipment to be used. Further cumulative impacts are likely to relate to visual and seascape effects, skills and economy (through fishing impacts), shipping and navigation, and health and well-being effects resulting from visual impacts and impacts on employment (potentially positive or negative).

Cumulative impacts may occur where solar farms are situated in proximity to other existing energy generating stations and infrastructure, to maximise existing grid infrastructure, thus minimising local effects and reducing costs. There may also be cumulative landscape and visual impacts with other existing or proposed infrastructure, particularly where the solar farm is located in a low lying area with good exposure. Cumulative transport assessments may also be needed where several energy infrastructure developments are proposed that use a common port or access route.

Since these facilities would need to comply with the regulatory emissions limits and local Air Quality limits, it is unlikely that there will be cumulative air quality emissions that would impact on human health in the medium to long term (during the operational phase). Cumulative air emissions may also adversely impact ecology. Further cumulative impacts in the short, medium and long term (up to 35 years, depending on the design life of the facilities) may include:

- adverse noise and vibration impacts;
- adverse traffic and transport impacts, especially if residues are not transported by rail or water;
- adverse water resource and water quality impacts relating to the large water demands, especially during low flow or drought periods;
- positive impacts on skills and economy if numerous skilled employment opportunities develop to support these facilities;
- adverse impacts on visual effects;
- adverse impacts on health and well-being from the noise and vibration effects;
- positive health and well-being effects as a consequence of increased employment and possible development of supporting skills for the facilities;

- for facilities with CHP, the health and well-being impacts may be increased since these facilities would be located close to communities.

It is not considered likely that there will be clustering of waste combustion facilities. Since the facilities will be located where sufficient fuel is available or can be readily transported to the facility, these are not likely to be located in close proximity. It is anticipated that each facility would have a fuel ‘catchment’ area. However, in the event that facilities are clustered, the effects are considered to be similar to those outlined for biomass combustion above. Since these facilities would not necessarily be located at or near ports, the potential impact on traffic and transport from additional HGV movements would be increased, unless rail transport is used. Cumulative effects are likely to be experienced as a result of development of any of the technologies discussed in EN-3 (onshore wind, offshore wind and biomass/energy from waste) with the related transmission lines addressed in EN-5. Adverse cumulative effects are, therefore, likely to be experienced in the short term in relation to air quality, dust, noise, landscape and visual effect, traffic and transport and noise. Visual impact of the renewable energy facilities and transmission lines are also cumulative. There are potential benefits from development of renewable energy facilities and transmission lines to these facilities. These are in relation to employment with potentially linked impacts on health and well-being and equality.

7.9: Summary of Key Findings of Appraisal

Renewable energy infrastructure development has similar generic strategic effects to other types of energy infrastructure. These result from impacts associated with large facilities at single sites. For the majority of the AoS objectives, the generic strategic effects of EN-3 are considered to be aligned with those identified in AoS-1.

There are a number of specific effects associated in particular with eight AoS objectives: Carbon emissions, Biodiversity; Landscape/ Seascape; Water Quality; Air Quality; Health; Economy; and Resources. These effects have been found to be generally negative across short, medium and long terms.

Consistency with the national target of reducing carbon emissions to Net Zero by 2050 is considered significantly negative over the short, medium and long terms reflecting residual emissions from unabated waste combustion plants, in particular if negative emissions technologies are not used.

Significant effects from renewable technologies can potentially affect biodiversity, landscape/ seascape, noise, commercial fishing, and commercial navigation routes. However, the effects are uncertain at this level of appraisal, as the actual effects are dependent on the sensitivity of the environment and the location and design of infrastructure.

There are, however, a few positive specific effects associated with the technologies. Positive effects may occur on the fishing industry from offshore wind farms; on biodiversity from solar farms, where land is no longer managed intensively; on biodiversity from pumped hydro storage schemes, as a result of habitat creation and fish re-stocking; and on resources where residues from biomass or energy from plants can be recovered and re-used rather than being sent to landfill. Again, there is uncertainty associated with these effects at this level of appraisal.

EN-1 (informed by AoS-1) includes extensive mitigations to ensure these effects are considered by applicants and the Planning Inspectorate when preparing and determining applications. EN-3 (informed by AoS-3) contains a range of specific mitigation measures, along with those proposed in EN-1, which seek to address the range of non-generic negative effects identified. In some cases, such as for noise impacts, which are included under the

Health AoS objective, it is recognised that the effect may not be able to be mitigated completely. Overall, it is considered that residual negative but uncertain effects will remain for the AoS objectives considered.

It should be noted, however, that these technologies have an important role to play in meeting the UK's energy needs and supporting delivery towards the UK's net zero target, and EN-3 notes that the benefits of meeting this target may outweigh some negative effects.

A summary of the likely non-generic effects arising specifically from renewable energy infrastructure is set out in the following Table 7-9 – 7-13.

Table 7-9 - Summary of Key AoS Findings Specific to Biomass and Waste Combustion

AoS Objective	Assessment of non-generic effects (by timescale)					
	S		M		L	
1. Consistent with the national target of reducing carbon emissions to Net Zero by 2050	--		--		--	
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-		-		-	
8. Protect and enhance air quality	-		-		-	
11. Improve health and well-being and safety for all citizens and reduce inequalities in health	-		-		-	
14. Promote sustainable use of resources and natural assets	-	+	-	+	-	+

Table 07-10 - Summary of Key AoS Findings Specific to Offshore Wind

AoS Objective	Assessment of non-generic effects (by timescale					
	S		M		L	
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-		-		-	
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-		-		-	
13. To promote a strong economy with opportunities for local communities	-	+	-	+	-	+

Table 07-11 - Summary of Key AoS Findings Specific to Pumped Hydro

AoS Objective	Assessment of non-generic effects (by timescale		
	S	M	L
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	- +	- +
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-	-	-
11. Improve health and well-being and safety for all citizens and reduce inequalities in health	--	--	-
13. To promote a strong economy with opportunities for local communities	-	-	-

Table 7-12 - Summary of Key AoS Findings Specific to Solar Photovoltaic

AoS Objective	Assessment of non-generic effects (by timescale		
	S	M	L
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	- +	- +
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-	-	-
11. Improve health and well-being and safety for all citizens and reduce inequalities in health	-	-	-

Table 07-13 - Summary of Key AoS Findings Specific to Tidal Stream Energy

AoS Objective	Assessment of non-generic effects (by timescale		
	S	M	L
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	-	-
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider	-	-	-

landscapes, seascapes and townscapes and enhance visual amenity			

7.10: Appraisal of Alternatives

7.10.1: Introduction

The scope and methods of appraisal of alternatives are detailed in AoS-1. The strategic alternative identified for renewable energy infrastructure in Section 1 were assessed using Sustainable Development themes that better keep the appraisal at the higher and strategic level. The results are set out below.

Note that in consideration of Alternatives, the assessment is undertaken in comparison to EN-3. As such, the findings of the AoS in respect of EN-3 in Section 2 broadly apply to the alternative – the key differentiator being the inclusion or absence of particular aspects related to the Technology and the relative outcomes of such inclusion or absence. To draw comparison between the alternative and EN-3 on a broad level, the following scale has been used.

Table 7-14 - Differentiator scale for Alternatives

Scale	Description
Large Positive	A materially different positive outcome is anticipated compared to EN-3
Positive	A more positive outcome is anticipated compared to EN-3
Neutral	This alternative is anticipated to have the same outcome as EN-3
Negative	A more adverse outcome is anticipated compared to EN-3
Large Negative	A materially different adverse outcome is anticipated compared to EN-3

7.10.2: Appraisal Results

The findings of the appraisal of the strategic alternative for EN-3 are set out below, arranged by Sustainable Development (SD) theme.

The alternative under consideration is:

- EN3 (a): only consent biomass/ waste combustion plant with Combined Capture and Storage (CCS).

7.10.2.1: Climate Change (Net Zero)

Alternative (a) only consenting biomass or waste combustion plant with CCS has the potential to further reduce CO2 emissions from biomass or waste combustion plant compared with EN-3. However, the commercial viability will need to be demonstrated at a larger scale in the UK, although CCS in conjunction with biofuels is being deployed at small scale in Europe[13]. The need for scale increases the challenges in demonstrating economic viability but this alternative in conjunction with sustainable biomass could be beneficial in meeting Net Zero targets. However, this assessment is highly uncertain and would depend on what happens to the waste if not used within the power sector (as energy recovery from residual waste has a lower greenhouse gas impact than landfill) and the extent to which

[13] EBTP-ZEP-Report-Bio-CCS-The-Way-Forward.pdf (etipbioenergy.eu)

biomass may be more cost effective in decarbonising other sectors (such as heat and transport) over the long-term.

Headline SD themes	EN-3	Alternative (a)
Climate Change (Net Zero)		Positive / Negative

7.10.2.2: Security of Energy Supply

Alternative (a), only consenting biomass/ waste combustion plant with CCS, may result in fewer proposals coming forward for such plant in the short term, given that developers will need to be confident of economic viability as CCS as yet to be proven at scale in the UK. This could have a negative effect on security of supply but given the relatively small capacity provided by these technologies may not be material.

Headline SD themes	EN-3	Alternative (a)
Security of Energy Supply		Negative

7.10.2.3: Health and Well-Being

Alternative (a), only consenting biomass or waste combustion plant with CCS, could potentially change effects on health and well-being compared with EN-3. There may be increases in emissions of air pollutants as a result of the CCS technology required to be used14, although there are unlikely to be changes in noise associated with the plant. Alternative (a) may also increase negative effects on health and well-being on a wider regional and national scale if security of energy supply cannot be maintained, and this has impacts on employment opportunities and economic growth. However, if CCS is demonstrated to be economically viable on a larger scale, then impacts on health and well-being are likely to be more positive through increased employment opportunities associated with CCS technology.

Headline SD themes	EN-3	Alternative (a)
Health & Well-Being		Positive / Negative

7.10.2.4: The Economy

Alternative (a), only consenting biomass or waste combustion plant with CCS is likely to result in reduced benefits to the economy compared with EN-3 under current market conditions. Fewer proposals are likely to come forward, given that investors will need to be confident of the economic viability of CCS, unless incentives are provided. A reduced electricity generating capacity is also likely to increase reliance on more expensive energy generating technologies as nuclear in the transition to a low carbon economy or require an even faster expansion of renewables that may not be achievable within the required timescales, and therefore potentially increase energy bills to consumers. However, if CCS in conjunction with sustainable biomass plants and waste-to-energy plants are demonstrated to be economically viable on a larger scale, then the positive effects on the economy are likely to be greater than with the adoption of EN-3. This is related to greater employment opportunities in CCS and the likelihood that energy bills will be lower in the transition to a low carbon economy if there is more electricity generating capacity with CCS.

[14] Air pollution impacts from carbon capture and storage (CCS) — European Environment Agency (europa.eu)

Headline SD themes	EN-3	Alternative (a)
The Economy		Positive / Negative

7.10.2.5: The Built Environment

Alternative (a), only consenting biomass or waste combustion plant with CCS, may result in reduced negative effects on the built environment compared with EN-3. This alternative is likely to result in fewer proposals for these types of plant and therefore likely to result in reduced negative effects on flood risk (plant tend to be located in coastal areas or estuarine sites where flood risk is elevated). There are also likely to be reduced negative effects on traffic and transport, although those that remain, as with EN-3, are likely to be localised and short term in duration associated with construction and decommissioning. Effects on archaeology and cultural heritage with adoption of alternative (a) are also likely to be less negative compared with EN-3, again associated with likely fewer generating stations, although those that remain are again likely to be local in extent. However, if CCS is demonstrated to be economically viable on a larger scale, then negative impacts on the built environment are likely to be larger compared with adoption of EN-3, because the footprint of plant with CCS is greater than that of plant without CCS.

Headline SD themes	EN-3	Alternative (a)
The Built Environment		Positive / Negative

7.10.2.6: The Natural Environment

Alternative (a), only consenting biomass or waste combustion plant with CCS, may result in reduced negative effects on the natural environment compared with EN-3. This alternative is likely to result in fewer proposals for such electricity generating stations and therefore likely to result in reduced negative effects on biodiversity as there will be less land take. Effects on landscape, townscape and visual character are also likely to be less than would be the case with EN-3, again because there will be less land take. Those effects that remain are likely to be local in extent. However, if CCS is demonstrated to be economically viable on a larger scale, then impacts on the natural environment are likely to be of greater negative magnitude compared with adoption of EN-3 as there will potentially be more land take.

Headline SD themes	EN-3	Alternative (a)
The Natural Environment		Positive / Negative

7.10.2.7: Summary of Alternatives Findings and Preferred Approach for the NPS

Headline SD themes	EN-3	Alternative (a)
Climate Change		Positive / Negative
Security of Energy Supply		Negative
Health & Well-Being		Positive / Negative
The Economy		Positive / Negative
The Built Environment		Positive / Negative

The Natural Environment		Positive / Negative

Alternative (a), only consenting biomass or waste combustion plant with CCS, could be beneficial in meeting Net Zero targets. However, there is uncertainty depending on what happens to the waste if not used within the power sector (as energy recovery from residual waste has a lower greenhouse gas impact than landfill) and the extent to which biomass may be more cost effective in decarbonising other sectors (such as heat and transport) over the long-term. The requirement to demonstrate the economic viability on a larger scale for CCS than required under EN-3 may result in fewer applications for development consent which could in turn negatively impact Security of Supply and affordability of energy but given the relatively small capacity provided by these technologies may not be material. Widening the CCS requirement to all biomass or waste combustion plant could carry significant risks while (as at present) the technology remains unproven at large scale and it is unclear how much it will cost to install and operate and may also present economic barriers to developers. There may be even more uncertainty associated with waste combustion plant. Alternative (a) could also have greater positive effects on the Economy than EN-3 associated with the greater potential for employment with CCS and a positive impact in lowering energy prices. However, there are uncertainties associated with these positive effects from alternative (a).

Across the remaining sustainable development themes (Health & Well-Being, Built Environment and Natural Environment), the adoption of alternative (a) compared with EN-3 could therefore result in either greater positive or negative effects. Where CCS economic viability is not demonstrated on a wider basis, then there are likely to be smaller negative effects compared with EN-3. This is related to reduced land use as well as reduced footprint on health and well-being resulting from the narrower application of sustainable biomass/ waste plant with CCS. Where CCS viability is demonstrated on a wider basis for electricity generating capacity, then there are likely to be greater negative effects on these same topics.

The key difference between this alternative and EN-3 would seem to be a benefit for the achievement of Net Zero due to reduction of emissions from energy from waste and negative emissions through BECCS. This assessment is highly uncertain and would depend on what happens to the waste if not used within the power sector (as energy recovery from residual waste has a lower greenhouse gas impact than landfill) and the extent to which biomass may be more cost effective in decarbonising other sectors (such as heat and transport) over the long-term.

However, the use of CCS with biomass and energy from waste could present a more sustainable alternative than the policies set out in EN-1 and EN-3, if implemented in a way which minimises unintended consequences. As set out in the Energy White Paper, published in December 2020, the government is committed to consult on proposals to update the Carbon Capture Readiness requirements to reflect technological advances, such as conversion to low carbon hydrogen and apply them more broadly, by removing the 300MW threshold and including all combustion technologies within scope. If that consultation leads to changes in the relevant legal or policy framework then those new requirements will apply and this NPS will be updated to reflect any revised requirements ahead of designation.

8: Assessment for Gas Supply Infrastructure and Gas and Oil Pipelines Infrastructure EN-4 (AoS-4)

8.1. The NPS for Gas Supply Infrastructure and Gas and Oil Pipelines

The NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) in conjunction with the Overarching NPS for Energy (EN-1) sets out the relevant planning factors that should be considered by the Secretary of State when determining whether development consent should be granted for a proposed scheme.

As for EN-1, EN-4 has been developed via an iterative process, taking account of the appraisal of the predicted sustainability effects both for EN-4 preferred polices and reasonable alternatives.

8.2. Appraisal Findings for EN-4

Gas Supply Infrastructure and Gas and Oil Pipelines may have various impacts on communities and the environment depending on the nature of the development and its location. As noted in EN-4, all of the generic impacts detailed in EN-1 are likely to be relevant to energy infrastructure, even if only during specific stages of the development (such as construction), or at one specific part of the development (such as a pipeline).

While reference should be made to AoS-1 for consideration of all effects in full, this AoS-2 focuses on those potentially significant sustainability effects associated with the technologies set out in EN-4. The effects considered relate to:

- Carbon Emissions (Methane);
- Biodiversity;
- Landscape and Visual;
- Water Quality and Resources;
- Air Quality;
- Soil Resources and contamination; and
- Noise and Vibration.

The likely significant effects of the technology specific policies, requirements and guidance in EN-4 have been appraised against the corresponding objectives in the AoS framework as set out in Section 4.

Section 2.3 of this report explains how the significance of likely effects is shown. For ease of reference, the table is reproduced below.

Table 8-1 - Key to Appraising Significance of Predicted Effects

Significant positive effect likely	++	Policy is expected to address an existing sustainability problem or deliver sustainability enhancements, such as substantial environmental net gain above existing/emerging policy.
Minor positive effect likely	+	Policy is expected to lead to environmental net gain in line with existing or emerging Government policy OR result in protection and conservation of a sustainability asset (for example, a designated biodiversity site or designated heritage asset).
No effect likely or not applicable	0	No perceptible effects expected, or the objective is not relevant to the part of the NPS being assessed.
Minor negative effect likely	-	Policy is expected to result in adverse effects of a lower magnitude or smaller scale, which can be mitigated through standard measures and best practice.
Significant negative effect likely	--	Policy is expected to result in adverse effects of a greater magnitude or larger scale, which cannot be mitigated OR will require extensive and bespoke mitigation solutions (further studies may be required to identify appropriate solutions).

The appraisal focused on the identification of technology specific effects (non-generic) with consideration of mitigation measures as set out in AoS-1, in order to establish whether additional mitigation would be required as part of AoS-4. It is noted that an initial assessment was undertaken on a draft EN-4 document dated April 2021 and that this resulted in suggestions of additional mitigation (in the form of recommendations) to be considered in the drafting of EN-4 for public consultation.

An assessment of residual non-generic effects is provided for the EN-4 document as presented for public consultation in the following sections. The likely non-generic effects arising specifically from Gas Supply Infrastructure and Gas and Oil Pipelines are presented together with a summary of the residual non-generic effects for each AoS objective over the short, medium and long term. In this context, for the purposes of the appraisal, the "short term" has been defined as the effects arising generally during the infrastructure construction period typically 2-7 years (different technologies have different construction times); the "medium term" as typically between 5 and 30 years (operational lifetimes vary with the characteristics of different technologies); and the "long term" as beyond 30 years (and including decommissioning where relevant).

In addition, consideration is given to the cumulative effects associated with the adoption of EN-4.

8.3: AoS Objective 1: Consistent with the national target of reducing carbon emissions to Net Zero by 2050

8.3.1: Anticipated effects

Gas Reception Facilities

EN-4 (Section 2.9.21) notes that there may be specific gas emission impacts which result from gas storage and supply infrastructure, for example due to the need to flare or vent gas.

The most significant emissions are likely to come from gas reception facilities where flaring of gas is used to deal with a continuous stream of low volume waste gas from the processing. The venting of gas may be undertaken occasionally at facilities when there are relatively low volumes of hydrocarbon gas that need to be disposed of safely, usually associated with commissioning, decommissioning and maintenance operations.

The release of GHGs, including methane, through flaring or venting will negatively effect upon the climate change agenda.

Underground Natural Gas Storage

Methane, the main constituent of natural gas, is a potent greenhouse gas, significantly more potent than CO2. Releases of methane to the atmosphere from underground natural gas storage facilities are therefore in opposition to the climate change agenda.

It is estimated that 70% of methane emissions from U.S. underground natural gas storage facilities come from fugitive emissions[15] .

Fugitive emission sources could include:

- Unintentional leaks caused by mechanical and thermal stresses in piping, valves, compressor seals, flanges, fittings and other components;
- Methane leakage from improperly plugged and abandoned wells (and to a lesser extent from the geologic formation due to over-pressurising)

Vented emission sources could include:

- Vents from pneumatic devices
- Compressor startup
- Compressor shutdown
- Gas dehydration
- Condensate storage tank venting
- Equipment depressurisation

8.3.2. Approach to Development and Mitigation as set out in EN-1 and EN-4

Gas Reception Facilities

The flaring or venting of gas during the operation of a facility is regulated by the Environmental Permitting Regulations (EPR) which are administered by the EA. Section 4.11 of EN-1 provides guidance on the Environmental Permitting regime. Applicants are advised to make early contact with the EA to discuss the requirements at or before the pre-application stage.

EN-4 notes that the NSTA is responsible for ensuring that the waste of a national resource (hydrocarbons) through flaring or venting is minimised and applicants should contact the NSTA to check if flaring and venting consents are required regardless of maximum flowrate.

EN-4 notes that the routine or periodic release of natural gas should be avoided as far as possible, and, where it takes place, its impacts should be minimised.

Mitigation measures to minimise the production of waste gas and effects on air quality include the use of emission control measures, the recovery and re-use of waste gas (for

[15] Reducing Methane Emissions from Underground Natural Gas Storage Operations (epa.gov)

example at an LNG facility by exporting it to the low pressure gas network), or by combusting the processed gas to reduce greenhouse gas emissions by converting the methane to the less harmful carbon dioxide. Mitigation measures to reduce the hazards of gas flares to birds could include reducing or shielding light from the flare and/or site during high-risk periods.

The North Sea Transition Authority (NSTA), expects operators and existing developments to strive for continuous emissions reductions, deploying best available technology and practices to minimise flaring and venting and that all new developments should be planned on the basis of zero routine flaring and venting.

Underground Natural Gas Storage

EN-4 notes that there could be specific gas emission impacts which result from gas storage and supply infrastructure. The most significant emissions are likely to come from gas reception facilities where flaring of gas is used to deal with a continuous stream of low volume waste gas from the processing. There may also be emissions from underground gas storage. It is noted that the applicant's assessment should include an assessment of gas emissions and any adverse effects. The ES should include an assessment of the effects of gas emissions on air quality in accordance with Section 5.2 of EN-1 and on greenhouse gas emissions in accordance with section 5.2 of EN-1. In addition, EN-4 notes that the Secretary of State should follow the principles for decision making as set out in the relevant sections of Parts 4 and 5 of EN-1. It is further noted in EN-4 that underground storage operators must demonstrate that they have taken all reasonable actions in collaboration with underground storage owners to prevent or reduce the leakage of gas within underground storage facilities through their infrastructure and from operation. Measures could include periodic leak inspection and repair work or using work practices and new equipment types to minimise leakage and venting.

8.3.3. Assessment made in respect of EN-4

Despite the development of gas reception facilities and underground natural gas storage sites aiding transition to a low carbon economy, in line with the AoS objective, the releases of methane from venting and flaring could lead to a direct increase in GHG emissions throughout all time scales (commissioning, decommissioning and maintenance operations). With mitigation in place, as described above, it is likely that effect will be reduced to minor negative in line with the target of reducing carbon emissions to Net Zero by 2050.

Taking this into account, Table 3-1 provides the assessment of EN-4 with minor negative effects predicted in the short, medium and long term reflecting the residual emissions from underground natural gas storage and natural gas facilities.

Table 8-2 – Reducing Carbon emissions to Net Zero Objective Summary

AoS Objective	Technology	Assessment of non-generic effects (by timescale)		
		S	M	L
Consistent with the national target of reducing carbon emissions to Net Zero by 2050 • Reduce carbon emissions of the national portfolio of major energy infrastructure consistent with the contribution share of the energy sector to the carbon budgets and Net Zero targets? • Reduce direct and indirect emissions of all greenhouse gases, including carbon dioxide, during construction, operation and decommissioning? • Maximise supply of energy from low carbon/renewable energy sources / use of low carbon/renewable energy? • Maximise opportunities for making use of waste heat? • Use carbon removals to offset residual emissions from energy such as Bioenergy with Carbon Capture & Storage (BECCS) and Nature Based Solutions? • Create new carbon sinks/removals through natural sequestration including that by natural habitats, green-blue Infrastructure and soils?	**Gas Reception Facilities**	-	-	-
	Underground Natural Gas Storage	-	-	-

8.4 AoS Objective 3: Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network

8.4.1: Anticipated effects

Underground Natural Gas Storage (Disposal of Brine)

Underground storage of gas within salt strata has the potential for aquatic ecological impacts from the disposal of large quantities of brine (water with a high saturation level of salt) to the sea/estuary. Gas is stored within specially created caverns, created through the solution mining of the salt using water. The resulting saltwater must be disposed of to a suitable location with enough energy to ensure effective mixing and dilution. Brine is denser than seawater and freshwater, and will sink to the bottom, impacting on benthic communities and bottom feeding fish and other species. Whilst fish can avoid these areas, benthic communities may not be able to due to limited mobility, and exposure to plumes of highly saline water could lead to death or injury . The saltwater plume may also act as a physical barrier to fish migration. These effects will be temporary (short-term), occurring throughout the duration of the solution mining activity although recovery of the benthic communities is likely to take longer.

LNG Import Facilities (Dredging)

Dredging is likely to be required to maintain declared depths and to deepen waters to accommodate large LNG tanker deliveries, along with associated construction such as deep water jetties and this may have specific effects on the biodiversity of local marine, coastal and estuarine environments, particularly fish and bird life. EN-4 also recognises that the deposition of the dredging spoil must be undertaken responsibly.

The specific effects of dredging include the smothering of nearby habitats and benthic communities, increased suspended solids and contaminant release. Aquatic vegetation and invertebrates provide valuable food sources for fish and birds. If these sources are affected, impacts to the populations of the species that feed on them are also likely. Increases in suspended solids within the water have the potential to impact on fisheries, leading to the migration of fish. Disturbed sediments may also release contaminants into the water, which can also impact on biodiversity. Impacts on biodiversity can also be caused through excavation and physical disturbance of seabed habitats, with impacts on coastal dynamics and coastal geomorphological changes, further impacting on marine biodiversity. Construction impacts include loss of seabed habitat, shading, increased underwater noise; and the physical presence of a jetty may impact on local hydrology affecting sediment distribution.

The cessation of dredging operation in the long-term may also affect the local coastal environment, and the ecology it supports, with either positive or negative effects on ecosystems which have become accustomed to the influences of dredging operations.

Gas and Oil Pipelines

The construction of pipelines can effect the ecology, with regard to the effect upon habitats within and adjacent to the pipeline route, such as grasslands, field boundaries (hedgerows, hedgebanks, drystone walls, fences), trees, woodlands, and watercourses.

The working width of the pipeline will vary depending on the surrounding terrain. Temporary impacts could include large excavations where deep pits are needed for boring beneath rivers, roads, and sensitive features. Pipeline maintenance or protection may also be required and could also have associated effects on habitats.

8.4.2. Approach to Development and Mitigation as set out in EN-1 and EN-4

Underground Natural Gas Storage (Disposal of Brine)

EN-1 notes the requirement for an ES and EN-4 notes that this ES should include measures to dispose of brine which mitigate its potential adverse environmental effects. Where pipelines are required to carry the brine away, these should be located outside of source protection zones 1 and 2. If it is not possible to avoid these zones, the applicant will need to demonstrate the use of best available techniques for pollution prevention (details of pollution control regimes are set out in Section 4.11 of EN-1).

EN-4 notes that, wherever possible, measures should include disposing of the brine for commercial use by industry so that mineral resources are used sustainably. Applicants should only propose disposing of brine to an underground reservoir (for example, a disused salt mine) or to the sea as a last resort where there is no practical option for re-use.

Where the proposed development involves any discharges to water bodies, including to groundwater or to the sea, the EA should be contacted early in the process, at or before the pre-application consultation stage, to discuss the requirements (including the information required from the applicant).

Section 4.11 of EN-1 notes that issues relating to discharges or emissions from a proposed project and which lead to other direct or indirect impacts on terrestrial, freshwater, marine, onshore and offshore environments, or which include noise and vibration may be subject to separate regulation under the pollution control framework or other consenting and licensing regimes. EN-4 notes that measures to discharge brine into an underground reservoir or the sea, where either is an appropriate course of action, will need to be covered by environmental permits or discharge consents.

Taking account of these and any EA advice, the Secretary of State should consider whether any mitigation measures are necessary by way of requirements in the development consent order. Where the brine is discharged to the sea, for example, these could relate to the siting offshore of the outflow pipe (to reduce impact on sensitive flora and/or fauna) and the rate of discharge (to reduce saline concentration levels). Discharge of brine to sea from outflow pipes should be a last resort.

LNG Import Facilities (Dredging)

EN-4 notes that the applicant should include an assessment in the ES (see Section 4.2 of EN-1) of the dredging required (a) to construct the LNG import facility and (b) to maintain an access channel or berth integral to the facility. The assessment should take into account the magnitude and frequency of dredging and the method selected.

The ES is required to set out any effects on designated sites, protected species and on other biodiversity afforded conservation priority. Where relevant, applicants are required to undertake sediment transfer modelling to predict and understand impacts and help identify relevant mitigating or compensatory measures. The assessment should include the effects on water quality and resources, and on coastal change.

EN-4 requires the applicant to assess the scope for mitigating impacts such as by avoiding dredging at certain times of the year or using methods to reduce sediment suspension and uncoordinated dispersal. Where relevant, applicants should undertake modelling to predict and understand both dredging and construction impacts on hydrology, sediment transport and geomorphology, as well as direct habitat loss, and impacts on species from increased underwater noise.

In addition, it is noted that the applicant should be careful to identify the effects on Marine Conservation Zones and designated protected areas. Applicants should consult the Marine Management Organisation (MMO) in England and Natural Resource Wales (NRW) at an early stage about this. EN-4 also notes that due to risk of contamination, dredged spoil should not only be deposited responsibly using the waste disposal hierarchy, but also the applicant should seek beneficial use wherever possible in accordance with policy commitments within the Marine Plans (see EN1 4.4). In addition to consulting the MMO and NRW it would be helpful to highlight engagement with the relevant SNCB at an early stage which would be helpful in exploring impacts and potential mitigating measures for Marine Protected Areas.

EN-4 identifies that the applicant should propose appropriate mitigation measures to address the adverse effects of dredging, including the demonstration that best practices will be followed during construction and operation to avoid or minimise risk of disturbance or damage to species and habitats.

Gas and Oil Pipelines

EN-1 recognises that careful siting and use of appropriate technologies can help to mitigate adverse impacts on the environment. Applicants are required to demonstrate how the design process was conducted and how it evolved. Where several different designs were considered, the applicant should explain why the favoured choice was selected. This may offer scope for avoidance and mitigation of impacts on biodiversity assets at the design stage. EN-1 suggests that that development proposals provide opportunities for building in beneficial biodiversity features as part of good design, which can offer opportunities to deliver biodiversity net gain. To aid this, EN-1 requires that the Secretary of State should maximise opportunities for biodiversity within developments, using planning obligations. EN-1 also notes that wider ecosystem services and benefits of natural capital should also be considered when designing enhancement measures.

EN-1 ensures that any proposals for energy generating infrastructure are subject to robust consideration by requiring that they are accompanied by an Environmental Statement (ES) under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 in England and the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 in Wales , which describes the significant likely effects of the proposal on the environment, including specific reference to biodiversity. Through this requirement, EN-1 ensures that the direct, indirect, secondary, cumulative, transboundary and short to long term effects of the development on biodiversity will be considered, as these are requirements in The EIA Regulations. EN-1 suggests that consideration of potential effects should include potential benefits, which include biodiversity net gain.

EN-1 sets out an overarching principle in relation to protecting biodiversity, which is that development should at the very least aim to avoid significant harm to biodiversity interests, including through mitigation and consideration of reasonable alternatives. It is suggested that in cases where significant harm is unavoidable, then appropriate compensation measures should be sought. Where this is not possible, it is suggested that the Secretary of State gives significant weight to any residual harm. Note that in Wales, applicants should refer to the step wise approach as set out in Planning Policy Wales (PPW) paragraph 6.4.21. EN-1 also notes that the Secretary of State will give positive weight to environmental and biodiversity enhancements, although any weight given to gains provided to meet a legal requirement (for example under the Environment Act 2021) is likely to be limited.

In terms of designations, EN-1 notes that the Secretary of State should ensure that appropriate weight is given to designated sites of international, national and local importance, protected species, habitats and other species of importance for the conservation of biodiversity. At the national and local scale, EN-1 suggests that Local Nature Reserves and Local Wildlife Sites require due consideration, but given the need for new nationally significant infrastructure, these designations should not be used as the sole reason to refuse development consent.

In addition, EN-4 notes that mitigation measures to protect ecology could include reducing the working width required for the installation of the pipeline to reduce the impact ecology where it will not be possible to fully reinstate the route. In circumstances where the habitat to be crossed contains ancient woodland, trees subject to a Tree Preservation Order, or hedgerows subject to the Hedgerows Regulations 1997, the applicant should consider whether it would be feasible to use horizontal direct drilling under the ancient woodland or thrust bore under the protected tree or hedgerow and the Secretary of State should consider requiring this, where not included in the proposal.

8.4.3. Assessment made in respect of EN-4

Underground Natural Gas Storage (Disposal of Brine)

The creation of underground gas storage caverns within salt strata has the potential for aquatic ecological impacts from the disposal of large quantities of brine. This saltwater is denser than seawater and freshwater and will sink to the bottom impacting on benthic communities and bottom feeding fish and other species. The saltwater plume may also act as a physical barrier to fish migration. Measures to discharge brine into an underground reservoir or the sea, where either is an appropriate course of action, will need to be covered by environmental permits or discharge consents. Mitigation, such as siting offshore of the outflow pipe and reducing the rate of discharge will reduce the effects. These effects will be temporary (short-term), occurring throughout the duration of the solution mining activity, although recovery of the benthic communities is likely to take longer. However, the application of the discussed mitigation measures will help to reduce the effect.

LNG Import Facilities (Dredging)

The dredging requirements of LNG facilities, to facilitate navigation by large LNG tankers, as well as the construction of associated infrastructure such as jetties, may have adverse effects on the biodiversity of local marine, coastal and estuarine environments, including the smothering of nearby habitats and benthic communities, increased suspended solids and contaminant release. Even with the use of appropriate mitigation e.g avoiding dredging at certain times of the year, or using methods to reduce sediment suspension and uncoordinated dispersal, it is likely the dredging and associated construction activities will have short term adverse impacts on the biodiversity of the aquatic ecology.

The cessation of dredging operation in the long-term may also affect the local coastal environment, and the ecology it supports, with either positive or negative effects on ecosystems which have become accustomed to the influences of dredging operations. The installation of jetties may also continue to exert an influence on coastal dynamics and very local biodiversity habitats for as long as they are present, with natural processes becoming re-established only following the removal of the jetty.

Gas and Oil Pipelines

EN-4 notes that the construction of pipelines can adversely impact on ecology in the short term, with regard the effect upon habitats within and adjacent to the pipeline route, such as grasslands, field boundaries, trees, woodlands, and watercourses. EN-4 notes that mitigation measures to protect ecology could include reducing the working width required for the installation of the pipeline to reduce the impact biodiversity where it will not be possible to fully reinstate the route.

Table 8-3 – Enhancing biodiversity Objective Summary

AoS Objective	Technology	Assessment of non-generic effects (by timescale)		
		S	M	L
Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network • Protect and enhance nationally designated sites such as SSSIs, National Nature Reserves and Marine Conservation Zones, including those of potential or candidate designation? • Protect and enhance valued habitat and populations of protected/scarce species on locally designated sites, including Key Wildlife Sites, Local Wildlife Sites and Local Nature Reserves? • Prevent development on irreplaceable habitats, such as ancient woodland and ancient and veteran trees except in exceptional circumstances and with appropriate compensation measures? • Protect the structure and function/ecosystem processes, including in the marine environment? • Protect and enhance the Nature Recovery Network? • Protect and enhance priority habitats, and the habitat of priority species? • Promote new habitat creation or restoration and linkages with existing habitats? • Reduce or avoid impacts to habitats with important roles in carbon sequestration? • Increase the resilience of biodiversity to the potential effects of climate change? • Encourage sensitive or nature inclusive design in terrestrial and marine environments? • Ensure energy activities protect fish stocks and marine mammals? • Ensure energy activities do not exacerbate disturbance to bird populations? • Promote Biodiversity Net Gain for any new major infrastructure development in England using latest Defra metric? • Promote Net Benefit for Biodiversity for any new major infrastructure development in Wales? • Contribute to meeting relevant statutory targets in the Environment Act?	**Underground Natural Gas Storage**	-	-	0
	Gas and Oil Pipelines	-	-	0
	LNG Import Facilities (Dredging)	-	0	0

• Prevent spread of invasive species (native and non-native), including new invasive species because of climate change?				

8.5 AoS Objective 6: Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity

8.5.1: Anticipated effects

LNG Import Facilities

Effects that are specific to EN-4 include negative landscape and visual effects from permanent above ground infrastructure associated with each element. This is particularly pertinent to LNG facilities that include large scale structures, such as storage tanks and there is a potential that these will be located within already constrained and busy estuarine environments.

These effects occur during construction (short-term) and operation (medium-term) but can be reversed in the long-term if decommissioned. The magnitude of these effects will be dependent on the sensitivity of the receiving environment, for example, the negative effects caused by development in AONBs or National Parks are likely to be considered more strategically significant than in a local landscape designation (although this will be an important local consideration for the Secretary of State).

Gas and Oil Pipelines

There are likely to be a range of temporary (short-term) construction effects to specific elements of the landscape within or adjacent to pipeline routes, such as grasslands, field boundaries (hedgerows, hedgebanks, drystone walls, fences), trees, woodlands and watercourses. Medium-term effects are likely with specific elements of the landscape, such as hedgerows and woodlands, as the landscape recovers and the vegetation re-establishes.

EN-4 also identifies limited longer-term effects to landscape from planting restrictions over and immediately adjacent to the pipelines. Other longer-term effects of pipelines include the small structures and indication points necessary to identify the pipeline route and provide it with service access. Note though that there may be ongoing maintenance effects.

8.5.2: Approach to Development and Mitigation in EN-1 and EN-4

LNG Import Facilities

Section 4.10 of EN-1 sets out the generic considerations to be given to landscape and visual impacts. EN-1 suggests that one way to mitigate the landscape and visual effects is to reduce the scale of a development but recognises that this may result in significant operational constraint and reduction in function. As noted in EN-4 (2.14.4), the appearance of some large gas supply infrastructure, such as the large storage tanks required at LNG import facilities, can be improved through countersinking or the use of squat tanks, without any significant operational constraint or reduction in function.

Gas and Oil Pipelines

EN-1 requires the ES to include an assessment of the landscape and visual effects of the proposed route and of the main alternative routes considered. As noted in EN-4, consideration should also be made of any pipeline maintenance or protection that may be additionally required and associated impacts.

EN-4 also identifies that reducing the working width required for the installation of a pipeline should be considered, where feasible, to reduce effects to the landscape particularly where it is not possible to fully reinstate the route.

EN-4 also identifies that where protected trees and hedgerows are to be crossed, e.g. ancient woodlands, trees subject to Tree Preservation Orders and hedgerows subject to the Hedgerow Regulations 1997, alternative construction methods, such as horizontal directional drilling or thrust bore should be considered.

EN-4 further notes that where it is unlikely to be possible to restore landscape to its original state, the applicant should set out measures to avoid, mitigate, or employ other landscape measures to compensate for, any adverse effect on the landscape. Note also that requirements within the Marine Licence should also be duly considered for infrastructure within coastal and marine zones.

8.5.3: Assessment made in respect of EN-4

Through promoting the expansion of the gas supply infrastructure and gas and oil pipeline infrastructure, EN-4 with EN-1 has the potential for increased strategic negative visual effects on landscape across England and Wales. Although both EN-1 and EN-4 include robust mitigations which will help to minimise negative effects, it is considered that the overall effects are likely to be of minor negative significance for the short and medium-term and unknown for the longer-term, as effects will be dependent on decommissioning and remediation.

LNG Import Facilities

Negative landscape and visual effects from permanent above ground infrastructure are associated to LNG facilities. Whilst mitigation measures are available to reduce the effects, full mitigation of large scale structures can be difficult. Increased negative landscape and visual effects are associated with the construction and operation of LNG import facilities however application of the mitigation discussed within EN-1 and EN-4 will help to minimise negative effects. It is considered that the overall effects are likely to be of minor negative significance for the short and medium-term and unknown for the longer-term, as effects will be dependent on decommissioning and remediation.

It is noted that the conditions that have been set out in EN-4 only provide further context rather than additional conditions to those contained in EN-1.

Gas and Oil Pipelines

Short-term construction effects to specific elements of the landscape within or adjacent to pipeline routes, such as grasslands, field boundaries, trees, woodlands and watercourses have been identified. In most instances it is possible to fully mitigate for these effects. Medium-term effects are likely with specific elements of the landscape, such as hedgerows and woodlands, as the landscape recovers and the vegetation re-establishes itself. Long term impacts upon the landscape for pipelines are likely to be limited, as once operational the main infrastructure is usually buried and ongoing maintenance or protection is likely to be an established feature.

Table 8-4 – Protect and enhance landscapes Objective Summary

AoS Objective	Technology	Assessment of non-generic effects (by timescale)		
		S	M	L
Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity • Support the integrity and uphold the statutory purposes of any areas designated for landscape value ie, National Parks and AONBs, including in conjunction with the provisions of any relevant Management Plan? • Conserve and enhance the intrinsic character or setting of designated landscapes, townscapes and seascapes? • Conserve, protect and enhance natural environmental assets (e.g. parks and green spaces, common land, woodland / forests etc) as they contribute to landscape and townscape quality? • Support measures to enhance the resilience of ecosystems at a landscape scale and also to maximise benefits including public access and enjoyment of landscapes? • Support functional landscapes e.g. those which reduce flood risk, sequester carbon or offer recreational opportunities in peri urban areas? • Minimise noise and light pollution from construction and operational activities on residential amenity and on sensitive locations, receptors and views?	**LNG Import Facilities**	-	-	0
	Gas and Oil Pipelines	-	-	0

8.6 AoS Objective 7: Protect and enhance the water environment

Underground Natural Gas Storage

It is anticipated that during the construction of an underground gas storage facility in a salt bed or in an aquifer there could be effects on the water environment. The effects depend on the type of storage facility:

- In a salt bed storage construction, there will be a large demand for water. The specific issue to be considered is the abstraction of water to leach the salt caverns. The Secretary of State needs an accurate picture of this to understand the environmental impacts of the proposed underground storage project.
- In the case of aquifer storage, the issue is likely to be the displacement of groundwater. In addition, following solution mining of underground storage caverns, large volumes of 'brine', or water with a high saturation level of salt, require disposal.

LNG Import Facilities (Dredging)

Dredging and the disposal of dredging spoil in coastal and estuarine locations, as well as the associated construction of facilities such as deep water jetties required for the operation of LNG facilities, can result in local increases in suspended sediments and the disturbance of potentially contaminated sediments. Impacts on water quality and resource subsequently lead to effects on to fisheries, fish migration and important biodiversity.

Direct impacts on water quality tend to rise when sediments are disturbed in the dredge location. The release of heavy metals, hydrocarbons, organo-halogen compounds etc from the sediment into the water column, either by solution or re-suspension of particulate matter can cause toxic effects on aquatic biota. The release of organic wastes can cause localised oxygen depletion of the water, again creating stressful conditions for aquatic biodiversity.

Gas and Oil Pipelines

Constructing pipelines creates corridors of surface clearance and excavation that can potentially affect watercourses, aquifers, water abstraction and discharge points, areas prone to flooding and ecological receptors. Pipeline impacts could include:

- inadequate or excessive drainage;
- interference with groundwater flow pathways;
- mobilisation of contaminants already in the ground;
- the introduction of new pollutants;
- flooding;
- disturbance to water ecology;
- pollution due to silt from construction; and
- disturbance to species and their habitats.

One further specific effect associated with pipelines concerns the abstraction and disposal of water used for hydrostatic testing during commissioning. Although this water can be moved along the pipeline to test different sections, it will often require considerable volumes.

8.6.1: Approach to Development and Mitigation in EN-1 and EN-4

Underground Natural Gas Storage

EN-4 refers the applicant to section 5.16 of EN-1 which sets out generic policy on the protection of the water environment during the construction, operation and decommissioning of a project. Section 4.11 of EN-1 sets out considerations on the pollution control framework. EN-1 emphasises the need for good design and planning to ensure the efficient use of water, including water recycling.

EN-4 notes that in a salt cavity development, the applicant should provide an assessment of the effect of abstracting water for solution mining on groundwater resources, the natural environment, and the public water supply. The applicant should assess whether water abstraction for the new development is likely to result in the loss or reduction of water available to any licensed or unlicensed groundwater abstractions or ecological receptors such as rivers and wetlands dependent upon groundwater. The applicant should also assess the impact of the mobilisation of salt and other pollutants, with respect to groundwater quality within the ES.

In the case of aquifer storage, EN-4 states the applicant should assess the impact of the displacement of groundwater with respect to its potential interference with groundwater flow pathways, mobilisation of contaminants, flood risk, and potential effects on groundwater dependant ecosystems.

EN-4 confirms that measures to control abstractions and discharges of water are covered by abstraction licences and environmental permits.

With regard the removal of brine water, a by-product of the salt cavern gas storage construction, EN-4 notes that where pipelines are required to carry brine away, these should be located outside of source protection zones 1 and 2. If it is not possible to avoid these zones, the applicant will need to demonstrate the use of best available techniques for pollution prevention (details of pollution control regimes are set out in Section 4.11 of EN-1). Wherever possible, measures should include disposing of the brine for commercial use by industry so that mineral resources are used sustainably. Applicants should only propose disposing of brine to an underground reservoir (for example, a disused salt mine) or to the sea as a last resort where there is no practical option for re-use. Where the proposed development involves any discharges to water bodies, including to groundwater or to the sea, the EA should be contacted early in the process, at or before the pre-application consultation stage, to discuss the requirements (including the information required from the applicant).

Similarly, EN-4 confirms that measures to discharge brine into an underground reservoir or the sea, where either is an appropriate course of action, are also required to be covered by Environment Agency permits or discharge consents.

EN-4 suggests specific mitigation measures to reduce the effects of brine discharge to the sea including the siting of the offshore outflow pipe, adjustments to the rate of discharge and reductions in the saline concentration levels. Note that EN-4 makes it clear that discharge of brine to sea from outflow pipes should be a last resort. Where a developer proposes discharge of brine to sea, the application should provide an impact assessment of impacts within the marine environment.

LNG Import Facilities (Dredging)

EN-4 notes dredging is a licensable activity under Part 4 of the Marine and Coastal Access Act (note this is determined by NRW in Wales).

EN-4 notes mitigation measures for dredging include the undertaking of sediment transfer modelling to predict and understand the impacts and assist with the identification of further mitigation and compensatory measures. EN-4 further notes avoiding dredging at certain times of the year, using methods to reduce sediment suspension and uncoordinated dispersal.

The applicant should be careful to identify the effects on Marine Conservation Zones and designated protected areas. Applicants are required to consult the Marine Management Organisation (MMO) in England, or NRW in Wales, at an early stage about this.

Gas and Oil Pipelines

EN-4 notes that impacts during construction should be avoided as far as possible through route selection or mitigated if unavoidable and ground should be reinstated after construction. It is also to be noted that when considering the route of the pipeline, further consideration to the potential maintenance of the pipeline should also be factored in and the impacts that maintenance or additional protection of the pipeline may have.

EN-4 notes that abstraction and disposal of large volumes of water through hydrostatic testing of pipelines during commissioning may also impact on water quality. Abstraction and discharges are regulated by the Environment Agency, under an abstraction licence and Environmental Permit respectively.

EN-4 notes that where the project is likely to give rise to effects on water quality, for example through siltation or spillages, discharges from maintenance activities or the discharge of disposals such as wastewater or solvents, the applicant should provide an assessment of the impacts within the ES.

The Secretary of State should liaise with the EA, NRW or SEPA as appropriate over the potential for the new development to result in loss or reduction of supply to any licensed abstraction or unlicensed groundwater abstraction, or any potential interference with current legitimate uses of groundwater or surface waters, taking account of the terms of any relevant environmental permits or any negative effect on a groundwater dependent ecosystem.

Mitigation measures to protect the water environment and water quality may include techniques for crossing rivers and managing surface water before and after construction, including restoring vegetation and using sustainable drainage systems to control run-off, as well as:

- the avoidance of vulnerable groundwater areas or appropriate use of above ground pipeline facilities;
- use of the highest specification pipework and best practice in the storage and handling of pollutants to prevent spillage;
- careful storage of excavated material away from watercourses and facilities for the disposal of sewage and waste;
- use of sustainable drainage systems; and
- careful reinstatement of riverbanks and reed beds.

8.6.2: Assessment made in respect of EN-4

There are a number of generic effects on the water environment that are applicable to all energy infrastructure development, including gas supply infrastructure and gas and oil pipelines. The significance of the effects and effectiveness of mitigation depends on the location of development and will need to be evaluated during studies for project level EIAs. The mitigation measures outlined in EN-1 with regard to water quality and resources, including the requirement for an assessment of the impacts of new development on the water environment, should help to minimise negative effects on the water environment.

Underground Natural Gas Storage

Salt cavity development has the potential to negatively effect groundwater resources in the short term (construction). The mobilisation of salt and other pollutants can affect groundwater quality and in the case of aquifer storage, the potential displacement of groundwater can interfere with groundwater flow pathways, mobilisation of contaminants, flood risk, and potential effects on groundwater dependant ecosystems. Measures to control abstractions and discharges of water are covered by abstraction licences and environmental permits,

The disposal of brine water to an underground reservoir or the sea has the potential to impact on water quality. The measures to discharge brine are also required to be covered by permits or discharge consents, and in some cases abstraction licences. In addition, specific mitigation measures to reduce the effects of brine discharge to the sea including the siting of the offshore outflow pipe, adjustments to the rate of discharge and reductions in the saline concentration levels will help to reduce the effect.

With mitigation in place it is likely the potential adverse effects associated with salt cavity development and disposal of brine will be reduced to an acceptable level.

LNG Import Facilities (Dredging)

Dredging and the disposal of dredging spoil in coastal and estuarine locations throughout the operational period of an LNG facility, can res

ult in local increases in suspended sediments and the disturbance of potentially contaminated sediments. Such dredging activities will be licensed under the Marine and Coastal Act. The Marine Licence will recommend mitigation such as avoiding dredging at certain times of the year, using methods to reduce sediment suspension and uncoordinated dispersal and following best practice during construction and operation to avoid or minimise these effects.

With the cessation of dredging operations, after decommissioning, it is likely that water quality will return.

Gas and Oil Pipelines

Constructing pipelines create corridors of surface clearance and excavation that can potentially affect watercourses, aquifers, water abstraction and discharge points and areas prone to flooding during construction (short term). In addition, the abstraction and disposal of large volumes of water through hydrostatic testing of pipelines during commissioning may also impact on water quality. Mitigation measures to protect the water environment may include techniques for crossing rivers and managing surface water before and after construction, including restoring vegetation and using sustainable drainage systems to control run-off, in addition to the mitigation contained within the abstraction licence and Environmental Permit for abstraction and discharges. With the mitigation in place, as detailed in EN-4, it is likely that any short term effects are reduced to minor adverse.

Table 8-5 – Protect and enhance water environment Objective Summary

AoS Objective	Technology	Assessment of non-generic effects (by timescale)		
		S	M	L

Protect and enhance the water environment • Protect ground, surface, estuarine and coastal water quality, including during periods of increased summer temperatures due to climate change? • Safeguard the availability of water resources (surface and groundwater), including during periods of increased summer temperatures due to climate change? • Minimise the use of water resources / water consumption? • Protect the integrity of coastal and estuarine processes? • Reduce operational and accidental discharges to the water environment? • Protect the quality of the seabed and its sediments, and avoids significant effects on seabed morphology and sediment transport processes? • Support measures to attain good environmental status of both marine and coastal/estuarine waters as determined by the WFD and MSFD? • Contribute to meeting relevant statutory targets in the Environment Act 2021?	**Underground Natural Gas Storage**	-	0	0
	LNG Import Facilities	-	-	0
	Gas and Oil Pipelines	-	0	0

8.7 AoS Objective 8: Protect and enhance air quality

8.7.1: Anticipated Effects

Gas Reception Facilities

It is anticipated that there could be specific gas emission impacts associated with gas reception facilities where flaring of gas is used to deal with a continuous stream of low volume waste gas from the processing. The venting of gas may also be undertaken occasionally when there are relatively low volumes of hydrocarbon gas that need to be disposed of safely, usually associated with commissioning, decommissioning and maintenance operations.

8.7.1: Approach to Development and Mitigation in EN-1 and EN-4

Gas Reception Facilities

EN-4 notes that the flaring or venting of gas during the operation of a facility is regulated by the Environmental Permitting Regulations (EPR). In addition, it is noted that NSTA is responsible for ensuring that the waste of a national resource (hydrocarbons) through flaring or venting is minimised and applicants should therefore contact NSTA to check if flaring and venting consents are required regardless of maximum flowrate.

The ES should include an assessment of the effects of gas emissions on air quality in accordance with Section 5.2 of EN-1.

EN-4 states that the routine or periodic release of natural gas should be avoided as far as possible, and, where it takes place, its impacts should be minimised.

EN-4 further notes mitigation measures to minimise the production of waste gas and effects on air quality as including use of emission control measures, the recovery and re-use of waste gas (for example at an LNG facility by exporting it to the low pressure gas network) or by combusting the process gas to reduce greenhouse gas emissions by converting the methane to the less harmful carbon dioxide (flaring). Mitigation measures to reduce the hazards of gas flares to birds could include reducing or shielding light from the flare and/or site during high risk periods. It is also the case that NSTA expects operators and existing developments to strive for continuous emissions reductions, deploying best available technology and practices to minimise flaring and venting and that all new developments should be planned on the basis of zero routine flaring and venting.

8.7.2: Assessment made in respect of EN-4

Gas Reception Facilities

EN-4 identifies the potential for some adverse effects with regard to air quality due to the need to flare gas at some facilities to deal with a continuous stream of low volume waste gas from processing. The venting of gas may also take place on a less frequent basis. These activities are generally subject to environmental controls to ensure they do not exceed acceptable levels. With mitigation in place e.g the recovery and re-use of waste gas or flaring, as well as striving for continuous emissions reductions, deploying best available technology and practices to minimise flaring and venting and that all new developments should be planned on the basis of zero routine flaring and venting it is likely negative effects will be reduced to acceptable levels, particularly on a local to regional scale.

No specific air quality effects are identified in the short (construction) or long-term (decommissioning).

Table 8-6 – Protect and enhance water environment Objective Summary

AoS Objective	Technology	Assessment of non-generic effects (by timescale)		
		S	M	L

Protect and enhance air quality • Protect ground, surface, estuarine and coastal water quality, including during periods of increased summer temperatures due to climate change? • Safeguard the availability of water resources (surface and groundwater), including during periods of increased summer temperatures due to climate change? • Minimise the use of water resources / water consumption? • Protect the integrity of coastal and estuarine processes? • Reduce operational and accidental discharges to the water environment? • Protect the quality of the seabed and its sediments, and avoids significant effects on seabed morphology and sediment transport processes? • Support measures to attain good environmental status of both marine and coastal/estuarine waters as determined by the WFD and MSFD? • Contribute to meeting relevant statutory targets in the Environment Act 2021?	**Gas Reception Facilities**	**0**	**-**	**0**

8.8 AoS Objective 9: Protect soil resources and avoid land contamination

8.8.1: Anticipated Effects

Gas and Oil Pipelines

New pipelines will be installed in a variety of geological conditions. It will be important for applicants to understand the soil types and the nature of the underlying strata. Underground cavities and unstable ground conditions may present particular risks to pipeline projects. Impacts could include sterilisation of mineral resources or loss of soil quality.

8.8.1: Approach to Development and Mitigation in EN-1 and EN-4

Gas and Oil Pipelines

EN-4 states that the applicants should assess the stability of the ground conditions associated with the pipeline route and incorporate the findings of that assessment in the ES as appropriate. Desktop studies, which include known geology and previous borehole data, can form the basis of the applicant's assessment. In addition, sinking new boreholes if necessary to better understand the ground conditions present. The assessment should cover the options considered for installing the pipeline and weigh up the impacts of the means of installation. Where the applicant proposes to use horizontal directional drilling (HDD) as the means of installing a pipeline under a National or International Site and mitigating the impacts, the assessment should cover whether the geological conditions are suitable for HDD.

EN-4 notes that when considering any application where the pipeline goes under a designated area of geological or geomorphological interest, the applicant should submit details of alternative routes, which either bypass the designated area or reduce the length of pipeline through the designated area to the minimum possible, and the reasons why they were discounted.

Applicants are required to consult with the relevant statutory consultees at an early stage.

The Secretary of State should take into account the impact on and from geology and soils when considering a pipeline project. A proposal will be acceptable from the point of view of soil and geology if the applicant has proposed a route and other measures (if applicable) that either eliminates any adverse impacts on soil and geology or reduces them to an acceptable level, and that the route chosen does not adversely affect the integrity of the pipeline, for example, by increasing materially the risk of fracture or impact on areas of high population. The HSE can advise on the suitability of the pipeline route and on the design of the pipeline (including providing their views on soil stability and susceptibility to landslip).

EN-4 notes that mitigation measures to minimise any adverse effects on soil and geology should include measures to ensure that residual impacts on the surface are minor, for example some differential vegetation growth. Further mitigation measures identified include the appropriate treatment of soil (and in particular topsoil) during site construction and other infrastructure activity) and appropriate soil storage and reinstatement in line with the principles and practices outlined in the Code of Practice for the Sustainable Management of Soils on Construction Sites and the Agricultural Land Classification which provides guidelines on soil handling and restoration criteria and land quality. The Secretary of State may also attach appropriate conditions to the consent. It is also noted in EN-4 that where HDD is proposed, the applicant should provide an alternative plan for installing the pipeline in the event that HDD fails. Such alternative means could include open cut, micro-tunnelling and tunnelling.

8.8.2: Assessment made in respect of EN-4

Gas and Oil Pipelines

Through promoting the expansion of the gas supply infrastructure and gas and oil pipeline infrastructure, EN-4 has the potential for specific limited negative effects identified associated with long distance pipelines and the effects on and of the underlying ground conditions.

However, EN-4 includes robust mitigation which will help to reduce negative effects, principally through avoidance of sensitive areas, areas of high risk, areas of mineral resources etc. However, in some instances it may be difficult or impossible to avoid these areas, although alternative mitigation measures are available to address the issues. It is, therefore, considered that the overall effects of EN-4 are likely to be of neutral significance in the short, medium and long-term, throughout all stages of the development. As the significance is dependent on the location of the development and the sensitivity of the receiving environment, some uncertainty exists with regard to the overall significance.

EN-4 also recognises that effects to soils may result in some minor residual effects at the surface, such as differential vegetation growth in the short-term.

Table 8-7 – Protect soil resources and avoid land contamination Objective Summary

AoS Objective	Technology	Assessment of non-generic

		effects (by timescale)		
		S	**M**	**L**
Protect soil resources and avoid land contamination • Assist in facilitating the re-use of previously developed land? • Avoid the loss of Best and Most Versatile agricultural land? • Protect soil resources and ensure their sustainable use and management? • Seek to remediate contaminated land? • Increase the resilience of soils to the potential effects of climate change through minimising erosion and pollution and promoting good water management to keep soil moisture in balance?	**Gas and Oil Pipelines**	**0**	**0**	**0**

8.9 Cumulative Effects

Cumulative effects of construction (e.g. air quality, dust, noise, visual, traffic, socio-economic etc.) may arise with the development of the elements within EN-4 as most will not be developed in isolation, i.e. LNG facility + pipeline, gas receptor facility + pipeline, underground storage facility + pipeline. It is likely that both elements would be constructed within the same timeframe and connecting to each other, resulting in cumulative effects of a temporal and spatial nature.

Similarly, cumulative effects of construction may arise in conjunction with the development of other energy technologies, particularly those contained in EN-2 where pipeline connections may be required to supply new natural gas power stations.

Cumulative effects may also arise due to location/proximity. LNG facilities and gas reception facilities within EN-4 require coastal locations, as may other energy technologies within EN-2, EN-3 and EN-5. There could also be common elements such as deep water jetties. Cumulative effects on coastal landscapes and coastal change may arise should energy developments be concentrated in areas that provide the specific requirements of that development. Such effects would be permanent and long-term (until decommissioned), and also difficult to mitigate due to the scale of the energy developments, particularly where LNG facilities are involved.

Cumulative effects of location/proximity may also arise with the underground storage of gas, particularly those within solution mined salt caverns. The presence of suitable rocksalt strata is restricted to a small number of areas within England and Wales and, as such, underground gas storage facilities may be concentrated in specific locations.

8.10 Summary of Key Findings of Appraisal

Generally, the development of oil and gas supply infrastructure and gas and oil pipelines has similar effects to other types of energy infrastructure, although due to the linear nature of cross-country, long distance pipelines, effects are often more dispersed and spread across a wider area. For the majority of the AoS objectives, the strategic effects of EN-4 are considered to match those identified in AoS-1.

However, associated with additional detail provided about the technologies in EN-4, non-generic effects were further considered for six AoS objectives (Carbon Emissions, Biodiversity, Water Environment, Landscape and Townscape, Soil and Air Quality). The non-generic effects have been found to be generally negative across short and medium terms, neutral in the long term.

With regards to GHG emissions minor negative effects are predicted in the short, medium and long term reflecting the residual emissions from underground natural gas storage and natural gas facilities. Biodiversity non-generic negative effects due to disposal of brine from Underground Gas Storage, dredging from LNG Import Facilities and construction of Gas and Oil Pipelines. Large scale structures for LNG Import Facilities may give rise to non-generic negative impacts on Landscape/Townscape. Dredging and disposal of spoils for LNG Import Facilities, along with construction of associated facilities such as jetties, in coastal and estuarine locations may negatively affect water quality in such locations and Oil and Gas Pipeline construction may negatively affect watercourses, aquifers etc. Air quality may be negatively affected by venting of gas from Gas Reception Facilities and sterilisation of mineral resources or soil pollution may occur as a result of Gas Pipelines construction and operation.

Uncertainty is associated with this assessment, as at this level of appraisal, actual effects are dependent on the sensitivity of the environment and the location and design of infrastructure.

EN-1 (informed by AoS-1) includes extensive mitigations to ensure these effects are considered by applicants and the Planning Inspectorate when preparing and determining applications. EN-4 (informed by AoS-4) contains a range of technology specific mitigation measures, along with those proposed in EN-1, which seek to address the range of negative effects identified. Nevertheless, it is considered that residual negative, but uncertain, effects will remain in most cases for the six AoS objectives considered.

A summary of the likely non-generic effects arising specifically from gas and oil infrastructure is set out in Tables 8-8 – 8-11:

Table 8-1 - Summary of Key AoS Findings Specific to Underground Natural Gas Storage

AoS Objective	**Assessment of non-generic effects (by timescale)**		
	S	**M**	**L**
1. Consistent with the national target of reducing carbon emissions to Net Zero by 2050	-	-	-
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	-	0
7. Protect and enhance the water environment	-	0	0

Table 8-2 - Summary of Key AoS Findings Specific to LNG Import Facilities

AoS Objective	Assessment of non-generic effects (by timescale		
	S	M	L
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	0	0
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-	-	0
7. Protect and enhance the water environment	-	-	0

Table 8-3 - Summary of Key AoS Findings Specific to Gas Reception Facilities

AoS Objective	Assessment of non-generic effects (by timescale		
	S	M	L
8. Protect and enhance air quality	0	-	0

Table 8-4 - Summary of Key AoS Findings Specific to Gas and Oil Pipelines

AoS Objective	Assessment of non-generic effects (by timescale		
	S	M	L
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	-	0
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	-	-	0
7. Protect and enhance the water environment	-	0	0
9. Protect soil resources and avoid land contamination	0	0	0

8.10 Appraisal of Alternatives

8.10.1: Introduction

The scope and methods of appraisal of alternatives are detailed in AoS-1. The strategic alternative identified for Gas Supply Infrastructure and Gas and Oil Pipelines in Section 1 was assessed using Sustainable Development themes that better keep the appraisal at the higher and strategic level (see table 2.3). The results are set out below.

Note that in consideration of Alternatives, the assessment is undertaken in comparison to EN-4 and not to each other alternative. As such, the findings of the AoS in respect of EN-4 in Section 2 broadly apply to the alternative identified – the key differentiator being the inclusion or absence of particular aspects related to the Technology and the relative outcomes of such inclusion or absence. To draw comparison between the alternative and EN-4 on a broad level, the following scale has been used.

Table 8-5 – Differentiator scale for Alternatives

Scale	Description
Large Positive	A materially different positive outcome is anticipated compared to EN-4
Positive	A more positive outcome is anticipated compared to EN-4
Neutral	This alternative is anticipated to have the same outcome as EN-4
Negative	A more adverse outcome is anticipated compared to EN-4
Large Negative	A materially different adverse outcome is anticipated compared to EN-4

8.10.2: Appraisal Results

The findings of the appraisal of the strategic alternatives for EN-4 are set out below, arranged by Sustainable Development (SD) theme.

The alternative under consideration is:

- EN-4 (a): only consent new gas infrastructure (gas pipelines and underground gas storage) which can demonstrate that it can convert to a low carbon alternative in future.

8.10.3: Climate Change (Net Zero)

Alternative (a), only consenting new gas infrastructure (gas pipelines and underground gas storage) which can demonstrate that it can convert to a low carbon alternative in future, will be beneficial in the medium to longer term from a Net Zero point of view as the facilities switch to store and carry hydrogen instead of natural gas and allow the transition to net zero quicker than that of EN-4.

Headline SD themes	EN-4	Alternative (a)
Climate Change (Net Zero)		Positive

8.10.4: Security of Energy Supply

Alternative (a), only consent new gas infrastructure (gas pipelines and underground gas storage) which can demonstrate that it can convert to a low carbon alternative in future, may reduce the number of proposals submitted to the Planning Inspectorate and Secretary of State for gas pipelines and underground gas storage facilities. This is because natural gas pipelines need adaptations to transport hydrogen, in particular to compress the hydrogen to the operating pressure of the pipeline, compressor stations are required along the way. A complete switch to a 100 percent hydrogen pipeline requires installing new and more turbines or motors and more powerful compressors to deliver the three-times higher volume flow of hydrogen compared to natural gas[16]. In addition, with regards to underground storage not all depleted oil or gas fields or man-made salt caverns that are suitable for natural gas are suitable for low carbon alternatives such as hydrogen (for example hydrogen has a smaller molecular size and diffusion rate than that of natural gas and it may therefore leak from depleted oil and gas field storage reservoirs more readily and rapidly than natural gas, in addition not all salt mines and salt caverns are suitable for the storage of hydrogen) As such, the opportunities to develop both gas pipelines and storage facilities will be reduced and likely to result in approval of a smaller total natural gas transport and storage capacity than would be the case with EN-4. This may therefore increase the risk of insufficient natural gas being available to provide energy supply through the transition to a low carbon economy.

Headline SD themes	EN-4	Alternative (a)
Security of Energy Supply		Large Negative

8.10.5: Health and Well-being

Alternative (a), only consent new gas infrastructure (gas pipelines and underground gas storage) which can demonstrate that it can convert to a low carbon alternative in future, will likely have positive effects on health and well-being from decreased air emissions (for example through the need to vent), as there will be less underground natural gas facilities operational due to the incompatibility of some potential natural storage sites to hydrogen[17].

Levels of noise at underground natural gas storage facilities during construction and operation will remain, but these are likely to be felt at a smaller number of localities as the number of proposals submitted to the Planning Inspectorate will likely reduce. In addition, landscape and visual effects from pipelines are likely to reduce due to the lesser number of pipelines required.

However, alternative (a) may also increase indirect negative effects on health and well-being on a wider regional and national scale if security of energy supply cannot be maintained, and this has impacts on employment opportunities and economic growth.

Headline SD themes	EN-4	Alternative (a)
Health & Well-Being		Positive / Negative

[16] https://www.siemens-energy.com/global/en/news/magazine/2020/repurposing-natural-gas-infrastructure-for-hydrogen.html

[17] Stone, Veldhuis, Richardson_2009_Underground hydrogen storage in the UK.pdf

8.10.6: The Economy

Alternative (a), only consent new gas infrastructure (gas pipelines and underground gas storage) which can demonstrate that it can convert to a low carbon alternative in future, may lead to the Planning Inspectorate approving a smaller total of natural gas storage capacity than would be the case with EN-4 (due to incompatibility of some sites to storing hydrogen). This is likely to increase negative effects on the economy if security of energy supply cannot be maintained, and this has impacts on employment opportunities and economic growth.

A reduced natural gas storage capacity is also likely to increase reliance on more expensive energy generating technologies such as nuclear in the transition to a low carbon economy, or require an even faster expansion of renewables that may not be achievable within the required timescales, and therefore potentially increase energy bills to consumers.

Lower potential uptake of decarbonised gas storage is also likely to result in reduced employment opportunities compared with EN-4.

Headline SD themes	EN-4	Alternative (a)
The Economy		Negative

8.10.7: The Built Environment

Alternative (a), only consent new gas infrastructure (gas pipelines and underground gas storage) which can demonstrate that it can convert to a low carbon alternative in future, is likely to result in fewer applications for both storage sites and the gas pipelines serving them, due to a lower number of suitable sites for both natural gas and hydrogen storage. As such, there is likely a more positive effect on the built environment as the number of pipelines being constructed is reduced, than would be the case with EN-4.

Headline SD themes	EN-4	Alternative (a)
The Built Environment		Positive

8.10.8: The Natural Environment

Alternative (a), only consent new gas infrastructure (gas pipelines and underground gas storage) which can demonstrate that it can convert to a low carbon alternative in future, is likely to result in fewer applications for both storage sites and the gas pipelines serving them, due to a lower number of suitable sites for both natural gas and hydrogen storage. As such, whilst the effects from construction and operation of pipelines and storage facilities on the natural environment will remain (for example habitat fragmentation, deterioration in soil quality, water quality impacts) they will be felt at a smaller number of localities.

. Headline SD themes	EN-4	Alternative (a)
The Natural Environment		Positive

8.10.9: Summary of Alternative Findings and Approach for the Preferred NPS

Headline SD themes	EN-4	Alternative (a)
Climate Change (Net Zero)		Positive

Security of Energy Supply		Large Negative
Health & Well-Being		Positive / Negative
The Economy		Negative
The Built Environment		Positive
The Natural Environment		Positive

Alternative policy (a), only consent new gas infrastructure (gas pipelines and underground gas storage) which can demonstrate that it can convert to a low carbon alternative in future, may lead to fewer applications being presented than would be the case with EN-4. This may therefore reduce employment opportunities and affect the Economy in this part of the energy sector. In addition, alternative (a) is likely to result in approval of a smaller total natural gas transmission and storage capacity than would be the case with EN-4. This may therefore increase the risk of insufficient storage being available to provide electricity supply through the transition to a low carbon economy.

However, the impacts of this alternative on the contribution to Net Zero in comparison with EN-4, could be more positive, where later storing low carbon alternatives, such as hydrogen, occurs.

Because the opportunities to develop storage facilities will be reduced (not all depleted oil or gas fields or man-made salt caverns that are suitable for natural gas are suitable for low carbon alternatives such as hydrogen[18]) it is likely that, alternative (a) will result in positive effects on the build and natural environment. There are also positive effects with regard to air quality from alternative policy (a).

The key material difference between this alternative and EN-4 is that the alternative may compromise security of supply and affordability through providing less confidence for developers to come forward with planning applications. This may result in energy shortages which will in turn may compromise the economy. Accordingly, the policies set out in the revised EN-4 are preferred. Note that the British Energy Security Strategy emphasises the importance of addressing underlying vulnerability to international energy prices by reducing dependence on imported oil and gas, and accelerating deployment of renewables, nuclear, hydrogen, CCUS, and related network infrastructure and EN-4 is now set out to reflect these wider requirements by introducing greater flexibility in gas transport and storage infrastructure provision at the national level.

[18] Stone, Veldhuis, Richardson_2009_Underground hydrogen storage in the UK.pdf

9: Assessment for Electricity Networks Infrastructure EN-5 (AoS-5)

9.1: The NPS for Electricity Networks Infrastructure

The NPS for Electricity Network Infrastructure (EN-5), in conjunction with the Overarching NPS for Energy (EN-1), sets out the relevant planning factors that should be considered by the Secretary of State when determining whether development consent should be granted for a proposed scheme. As for EN-1, EN-5 has been developed via an iterative process, taking account of the appraisal of the predicted sustainability effects both for EN-5 preferred polices and reasonable alternatives.

9.2: Appraisal Findings for EN-5

9.2.1: Introduction

Electricity networks infrastructure may have various impacts on communities and the environment depending on the nature of the development and its location. As noted in EN-5, all the generic impacts detailed in EN-1 are likely to be relevant to electricity network infrastructure, even if only during specific stages of the development (such as construction), or at one specific part of the development (such as a substation).

While reference should be made to AoS-1 for consideration of all generic sustainability effects in full, this AoS-5 focuses on those potentially significant sustainability effects associated with the technologies set out in EN-5 (henceforth referred to as non-generic effects). The non-generic effects considered relate to the following AoS Objectives:

- Reducing Carbon Emissions to Net Zero (with regard SF6) – AoS Objective 1;
- Biodiversity and Geological Conservation- AoS Objective 3;
- Landscape and Visual – AoS Objective 6; and
- Health and Well Being and Safety of all Citizens (including Electro-magnetic fields and noise and vibration) – AoS Objective 11.

The likely significant effects of the technology specific policies, requirements and guidance in EN-5 have been appraised against the corresponding objectives in the AoS framework as set out above.

The results of the assessment of likely significant effects are scored using the table below.

Table 9-1 - Key to Appraising Significance of Predicted Effects

Likely Significance of Effects		
Significant positive effect likely	++	Policy is expected to address an existing sustainability problem or deliver sustainability enhancements, such as substantial environmental net gain above existing/emerging policy.
Minor positive effect likely	+	Policy is expected to lead to environmental net gain in line with existing or emerging Government policy OR result in protection and conservation of a sustainability asset (for example, a designated biodiversity site or designated heritage asset).

No effect likely or not applicable	**0**	No perceptible effects expected, or the objective is not relevant to the part of the NPS being assessed.
Minor negative effect likely	**-**	Policy is expected to result in adverse effects of a lower magnitude or smaller scale, which can be mitigated through standard measures and best practice*.
Significant negative effect likely	**--**	Policy is expected to result in adverse effects of a greater magnitude or larger scale, which cannot be mitigated OR will require extensive and bespoke mitigation solutions (further studies may be required to identify appropriate solutions).

The appraisal focused on the identification of technology non-generic effects with consideration of generic mitigation measures as set out in AoS-1, in order to establish whether additional mitigation would be required as part of AoS-5 for EN-5. It is noted that initial assessments were undertaken on a draft EN-5 document dated April 2021 and that this resulted in suggestions of additional mitigation (in the form of recommendations, see Appendix E) to be considered in the drafting of EN-5 for public consultation.

Having considered comments received from the public consultation and any changes made to EN-5 as a result, a re-assessment of non-generic effects is provided for the draft EN-5 document (as presented for the second round of public consultation) in the following sections.

The likely non-generic effects arising specifically from electricity network infrastructure are presented together with a summary of the residual non-generic effects of EN-5 for each relevant AoS objective over the short, medium and long term. In this context, for the purposes of the appraisal, the “short term” has been defined as the effects arising generally during the infrastructure construction period typically 2-7 years (different technologies have different construction times); the “medium term” as typically between 5 and 30 years (operational lifetimes vary with the characteristics of different technologies); and the “long term” as beyond 30 years (and including decommissioning where relevant). It is to be noted that EN-5 sets out that decommissioning of electricity networks is not covered, as it is generally understood that nationally significant electricity networks are not likely to be decommissioned, but to instead have an ongoing function.

In addition, consideration is given to the cumulative effects associated with the adoption of EN-5 in section 2.6.

9.3: AoS Objective 1: Consistent with the national target of reducing carbon emissions to Net Zero by 2050

9.3.1: Anticipated effects

Electricity networks are needed to connect the output of other types of electricity infrastructure with consumers and with each other. Therefore, as new generation, storage and interconnection facilities are built, the need to build the electricity networks that connect these sources of electricity with each other, and with centres of consumer demand will increase.

Specifically, the significant number of additional connections to the electricity grid that are required will result in a rise in the number of electrical switches and circuit breakers that are needed to prevent serious accidents. Collectively, these safety devices are called switchgear. The vast majority use Sulphur Hexafluoride (SF_6) gas to quench arcs and stop short circuits.

SF_6 is an extremely potent and persistent greenhouse gas with the highest global warming potential (GWP) of any known substance. It is 23,500 times more warming than CO2 and therefore of concern in light of the UK's commitment to net zero by 2050.

The most important means by which SF6 gets into the atmosphere is from leaks in the electricity industry. Across the entire UK network of power lines and substations, there are around one million kilograms of SF_6 installed. A study from the University of Cardiff found an average SF_6 emission level of 1149 kg per year for England, Scotland, and Wales combined in the period 2010-16 and that the amount of SF6-insulated distribution equipment on the network increased steadily, with an average increase of 9401 kg of SF_6 being introduced into the power distribution network every year. In the year 2015–2016, the total amount of SF_6 used on the electrical network was approximately 1,119,880 kg and the amount of SF_6 released into the atmosphere was approximately 11,320 kg which is the equivalent of 258,110 tonnes of CO_2 being released into the environment[19].

This rise was also reflected across Europe with total emissions from the 28 member states in 2017 equivalent to 6.73 million tonnes of CO_2 (equivalent to the emissions from 1.3 million extra cars on the road for a year) and representing an increase of 8.1% year over year[20].

Unlike CO_2, SF_6 emissions can't be sequestered from the atmosphere, so the only option is to eliminate the use of SF_6 altogether. There are, however, currently no commercially viable alternative gases to SF_6 and so it tends to be replaced, when necessary, on a like for like basis. The industry is actively looking for environmentally friendly solutions and trials in this area have shown that certain fluorinated gas mixtures that also have less greenhouse gas potential than SF_6 and 'clean air solutions' can replace SF_6[21] .

9.3.2: Approach to Development and Mitigation as set out in EN-1 and EN-5

Whilst EN-1 does not refer specifically to SF_6 emissions, EN-5 details that the climate-warming potential of SF6 is such that applicants should, as a rule, avoid the use of SF6 in new developments. However, where no proven SF_6-free alternative is commercially available, and where the cost of procuring a bespoke alternative is grossly disproportionate, the continued use of SF_6 is acceptable, provided that emissions monitoring and control measures compliant with the F-gas regulations and/or their successors are in place.

Specifically, EN-5 notes that the Secretary of State should grant consent for an electricity networks development only if the applicant has demonstrated either that i) the development will not use SF_6; or iia) that there is no proven commercially available alternative to the use of SF_6, and iib) that a bespoke alternative would be grossly disproportionate in terms of cost, and iic) that emissions monitoring and control measures compliant with the F-gas regulations or their successors are in place.

9.3.3: Assessment made in respect of EN-5

In light of the policy in EN-5 as set out above which indicates a clear preference for avoidance of the use of SF_6 and their replacement for SF6-free alternatives, the non-generic effects of EN-5 are considered minor negative reflecting residual SF6 emissions from continued use of SF_6, in the cases where no proven SF_6-free alternative is commercially

[19] https://www.mdpi.com/1996-1073/11/8/2037
[20] https://www.eea.europa.eu/data-and-maps/daviz/fluorinated-gases-f-gases-emissions-5#tab-googlechartid_chart_31
[21] https://www.siemens-energy.com/global/en/news/magazine/2020/alternatives-for-sf6.html

available or the cost of procuring a bespoke alternative is disproportionate. These cases are expected to become rarer as the use of alternative gases will most likely become the norm over time.

Table 90-2 – Reducing Carbon emissions to Net Zero Objective Summary

AoS Objective	Technology	Assessment of non-generic effects (by timescale)		
		S	M	L
Consistent with the national target of reducing carbon emissions to Net Zero by 2050 Guide questions: • Reduce carbon emissions of the national portfolio of major energy infrastructure consistent with the contribution share of the energy sector to the carbon budgets and Net Zero targets? • Reduce direct and indirect emissions of all greenhouse gases, including carbon dioxide, during construction, operation and decommissioning? • Maximise supply of energy from low carbon/renewable energy sources / use of low carbon/renewable energy? • Maximise opportunities for making use of waste heat? • Use carbon removals to offset residual emissions from energy such as Bioenergy with Carbon Capture & Storage (BECCS) and Nature Based Solutions? • Create new carbon sinks/removals through natural sequestration including that by natural habitats, green-blue Infrastructure and soils? • Use approaches to appraisal and evaluation of energy projects aligned with HM's Green Book for Greenhouse Gas Emissions?	Electricity Networks	-	-	-

9.4: AoS Objective 3: Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network

9.4.1: Anticipated Effects

The linear and often long distance nature of overhead transmission lines has the potential to affect designated and non-designated ecology over a large area through, for example, disturbance and terrestrial habitat loss and fragmentation during construction and operation. A particular anticipated effect is bird collisions with overhead transmission lines, in particular for large bird species such as swans and geese which sometimes collide with overhead line conductors in poor visibility, resulting in their injury or death. This risk is greater when overhead power lines intersect migration routes and/or the breeding and feeding grounds of bird species. Large raptors sometimes use power lines and pylons as vantage points for hunting, which can also result in electrocution if they touch more than one line at once. Perching birds can be killed as soon as their wings touch energised parts of the infrastructure. Another particular issue is that high voltage overhead lines can generate noise under certain conditions, which could have negative effects on wildlife and biodiversity

When transmission lines are placed underground (instead of over ground), additional issues arise during construction as to match overhead line performance several separate cables in several separate trenches may be needed, resulting in an enlarged intervention area. Clearance of vegetation along and to the side of trenches to allow for construction and associated access for vehicles may result in temporary loss of habitat for terrestrial species and where transmission lines cross rivers, cables may be placed in ducts on river beds, and any necessary river diversions may result in significant local impacts for aquatic wildlife.

Transmission lines over the sea bed and foreshore result in the loss of habitat due to foundations and associated seabed preparation during construction; habitat disturbance from construction and maintenance/repair vessels; increased suspended sediment loads during construction and from maintenance/repair; potential impacts from EMF on benthic fauna; and potential for invasive/non-native species introduction.

9.4.2: Approach to Development and Mitigation as set out in EN-1 and EN-5

EN-1 sets out comprehensive provisions for the protection of biodiversity of Energy NSIP proposals through requiring the applicant to set out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England), on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats. Specifically, EN-1 also sets out that the design of such proposals will need to consider the movement of mobile / migratory species such as birds, fish and marine and terrestrial mammals and their potential to interact with infrastructure.

EN-5 follows through the issue of bird collision with overhead transmission lines and notes that the applicant will need to consider whether the proposed line will cause such problems at any point along its length and take this into consideration in the preparation of the Environmental Statement as part of Environmental Impact Assessment. Particular consideration is required to be given to feeding and hunting grounds, migration corridors and breeding grounds, where they are functionally linked to sites designated or allocated under the ‘national site network’ provisions of the Conservation of Habitats and Species Regulations. Mitigation has been listed in EN-5 and includes:

- Careful siting of a line away from, or parallel to, but not across, known flight paths can considerably reduce the numbers of birds colliding with overhead lines.
- Making lines more visible by methods such as the fitting of bird flappers and diverters to the earth wire, which swivel in the wind, glow in the dark and use fluorescent colours designed specifically for bird vision can also reduce the number of deaths.
- The design and colour of the diverters will be specific to the conditions – the line and pylon/transmission tower specifications and the species at risk.
- Electrocution risks can be reduced through the design of tower crossarms, insulators and the construction of other parts of high voltage power lines so that

birds find no opportunity to perch near energised power lines on which they might electrocute themselves.

Although EN-5 doesn’t specifically address the potential adverse noise effects of high voltage overhead lines on wildlife and biodiversity, this is considered to be covered under the provisions for Noise and Vibration in EN-1 where it is stated that noise effects of the proposed development on ecological receptors should be assessed by the Secretary of State.

EN-5 recognises that cases will arise where – though no part of the proposed development crosses a designated landscape – a high potential for widespread adverse landscape and/or visual impacts along certain sections of its route may result in recommendations to use undergrounding or subsea options and requires consideration of the potentially very disruptive effects of undergrounding on local communities, habitats, archaeological and heritage sites, soil, geology, and, for a substantial time after construction, landscape and visual amenity. (Undergrounding an overhead line will mean digging a trench along the length of the route, and so such works will often be disruptive – albeit temporarily – to the receptors listed above than would an overhead line of equivalent rating).

Equally, the potentially very disruptive effects of subsea cables on the seabed and the species that live in and on it, including physical damage to and full loss of seabed habitats will require consideration. Cable protection can also be required where cables cross each other, or where they cannot be buried deep enough to protect them from becoming exposed. Such protection causes additional impacts that are often greater than those of the cable itself due to the large areas covered. There can also be issues where subsea cables make landfall, as much coastal land is protected habitat and landfall connections could cause additional disruption to coastal communities.

EN-1 sets out that Energy NSIP proposals, whether onshore or offshore, should also seek opportunities to contribute to and enhance the natural environment by providing net gains for biodiversity where possible. EN-5 further supplements this generic guidance through recognising that the linear nature of electricity networks infrastructure can allow for excellent opportunities to reconnect important terrestrial habitats via green corridors, biodiversity stepping zones, and reestablishment of appropriate hedgerows; and/or connect people to the environment, for instance via footpaths and cycleways constructed in tandem with environmental enhancements.

9.4.3: Assessment made in respect of EN-5

EN-5 clearly recognises that migratory and feeding birds sometimes collide with overhead line conductors in poor visibility, resulting in their injury or death and that large raptors can also be accidently electrocuted when using power lines and pylons as vantage points to hunt. Mitigation measures for these technology-specific effects set out in EN-5 include the careful planning and design of overhead power lines so that they avoid migration routes and feeding/ breeding areas as well as providing alternative areas for large raptors to perch.

EN-5 also acknowledges the effects of undergrounding and subsea options on biodiversity and sets out mitigation measures to address these.

The significance of the effects and the effectiveness of the mitigation identified will depend upon the specific sensitivities of the location of the electricity network structure together with details of design and site layout. This will be addressed alongside wider effects on biodiversity during the project level HRA and EIA assessments as set out in EN-1 to the satisfaction of the Secretary of State.

As such, it is appraised that the non-generic effect of enabling the development of new electricity networks infrastructure on biodiversity (both terrestrial and marine) in the short, medium and long term is minor negative but uncertain.

Table 90-3 – Enhancing biodiversity Objective Summary

AoS Objective	Technology	Assessment of non-generic effects (by timescale)		
		S	M	L
Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network Guide questions: • Protect and enhance nationally designated sites such as SSSIs, National Nature Reserves and Marine Conservation Zones, including those of potential or candidate designation? • Protect and enhance valued habitat and populations of protected/scarce species on locally designated sites, including Key Wildlife Sites, Local Wildlife Sites and Local Nature Reserves? • Prevent development on irreplaceable habitats, such as ancient woodland and ancient and veteran trees except in exceptional circumstances and with appropriate compensation measures? • Protect and enhance the Nature Recovery Network? • Protect and enhance priority habitats, and the habitat of priority species? • Promote new habitat creation or restoration and linkages with existing habitats? • Reduce or avoid impacts to habitats with important roles in carbon sequestration? • Increase the resilience of biodiversity to the potential effects of climate change? • Encourage sensitive or nature inclusive design in terrestrial and marine environments? • Ensure energy activities protect fish stocks and marine mammals? • Ensure energy activities do not exacerbate disturbance to bird populations? • Promote Biodiversity Net Gain for any new major infrastructure development in England using latest Defra metric? • Promote Net Benefit for Biodiversity for any new major infrastructure development in Wales? • Contribute to meeting relevant statutory targets in the Environment Act?	Electricity Networks	-	-	-

• Prevent spread of invasive species (native and non-native), including new invasive species because of climate change? • Use approaches to appraisal and evaluation of energy projects aligned with HM's Green Book for Assessing and Valuing Effects on the Natural Environment?				

9.5: AoS Objective 6: Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity

9.5.1: Anticipated Effects

New overhead transmission lines can give rise to adverse landscape, townscape and visual impacts. These impacts depend on the type (for example, whether lines are supported by towers or monopole structures), scale, siting, and degree of screening of the lines, as well as the characteristics of the landscape and local environment through which they are routed. Underground transmission lines present less of an issue in this respect, apart from during construction.

In forested areas for example, the entire right-of-way width is cleared and maintained free of tall-growing trees for the life of the transmission line and as a result a permanent change to the land cover occurs. In agricultural areas, heavy construction vehicles temporarily suspend the use of the land for crop production. But after construction ends and the soils are properly restored, the land beneath the line can continue under agricultural use. For this reason, the area permanently affected by the line is usually much smaller than the area temporarily affected during construction. Where transmission lines are routed through areas that are valued for their scenic qualities, the visual impacts of the line tend to extend well beyond the local area.

The development of overhead transmission lines, which unlike overhead lines of 132kV and below, generally require to be supported on steel towers, add an industrial element and impact natural landscapes.

Sub-sea and foreshore cables due to their underwater nature are unlikely to impact landscapes and seascapes.

Cumulative adverse impacts may arise where new overhead lines are required along with other related developments such as substations, wind farms, and/or other new sources of generation.

9.5.2: Approach to Development and Mitigation as set out in EN-1 and EN-5

EN-1 sets out comprehensive provisions for the protection of landscapes and seascapes. The existing planning regime for electricity networks infrastructure includes requirements under EIA regulations for assessment of visual impacts and use of the Guidelines for the Routeing of new overhead lines (The Holford Rules) and the Guidelines for the design and siting of substations (The Horlock Rules) which tend towards mitigation of adverse visual impacts.

While it is the position of EN-5 that overhead lines should be the default option for electricity networks development, in certain cases overhead lines will be unacceptable in planning terms. Specifically, where a route crosses part of a nationally designated landscape (a National Park or AONB), and mitigation or re-routing to avoid harm to that landscape is not feasible, then the starting point will be that a developer should underground that section of the line. However, undergrounding will not be required where doing so is unfeasible in engineering terms, or where the harm caused by undergrounding is not outweighed by the visual impact/landscape benefits.

Additionally, cases will arise where – though no part of the proposed development crosses a designated landscape – a high potential for widespread adverse landscape and/or visual impacts along certain sections of its route may result in recommendations to use undergrounding for relevant segments of the line or alternatively consideration of using a route including subsea cabling.

In such cases the Secretary of State should only grant development consent for underground or subsea sections of a proposed line over an overhead alternative if it is satisfied that the benefits accruing from the former proposal clearly outweigh any extra economic, social, or environmental impacts that it presents, and that any technical obstacles associated with it are surmountable.

In addition to good design in accordance with the Holford and Horlock rules, EN-5 notes the consideration of undergrounding or rerouting the line, the principal opportunities for mitigating adverse landscape and visual impacts of electricity networks infrastructure are:

- consideration of network reinforcement options (where alternatives exist) which may allow improvements and/or extensions to an existing line rather than the building of an entirely new line; and
- selection of the most suitable type and design of support structure in order to minimise the overall visual impact on the landscape. In particular, ensuring that towers are of the smallest possible footprint and internal volume.
- The rationalisation, reconfiguration, and/or undergrounding of existing electricity networks infrastructure in the vicinity of the proposed development.

Additionally, there are more specific measures that might be taken, and which the Secretary of State could mandate through DCO requirements if appropriate, as follows:

- Landscape schemes, comprising off-site tree and hedgerow planting, are sometimes used for larger new overhead line projects to mitigate potential landscape and visual impacts, softening the effect of a new above ground line whilst providing some screening from important visual receptors. These may be implemented with the agreement of the relevant landowner(s), or the developer may compulsorily acquire the land or land rights in question. Advice from the relevant statutory authority may also be needed.
- Screening, comprising localised planting in the immediate vicinity of residential properties and principal viewpoints can also help to screen or soften the effect of the line, reducing the visual impact from a particular receptor.

EN-5 notes where landscape schemes and/or screening mitigation of the kind described above is required, rights over the land necessary for such measures may be compulsorily acquired as part of the development's consent order. In addition, EN-5 recognises that since long-term management of the selected mitigation schemes is essential to their mitigating function, a management plan, developed at least in outline at the conclusion of the examination and which sets out proposals within a realistic timescale, should secure the integrity and benefit of these schemes and uphold the landscape commitments made to achieve consent, alongside any pertinent commitments to environmental and biodiversity net gain.

9.5.3: Assessment made in respect of EN-5

Through facilitating the expansion of the electricity transmission network, EN-5 is likely to have significant negative non-generic effects for landscape and townscape. This is despite some undergrounding or sub-sea cabling potentially taking place on a case by case basis due to potential widespread landscape impacts, and/or overhead line routes otherwise avoiding nationally designated landscapes such as National Parks and AONBs, design selection and the implementation of screening and landscape schemes.

For overhead lines, these effects will likely occur during construction (short-term) and with ongoing effects during operation (medium-term). These effects could be reversed in the long term if the infrastructure is decommissioned, though EN-5 recognises that it is generally understood that nationally significant electricity networks are not likely to be decommissioned, but to instead have an ongoing function so effects will be permanent into the long term.

For underground lines, minor negative effects on landscape are likely during construction only.

Therefore, the overall non-generic effect of transmission lines is likely to be major negative in the short, medium and longer term, despite the inclusion of mitigations, in both EN-1 and EN-5, which will help to minimise negative effects but are unlikely to reduce their significance, in particular for overhead transmission lines.

Table 90-4 – Protect and enhance landscapes Objective Summary

AoS Objective	**Technology**	**Assessment of non-generic effects (by timescale)**		
		S	M	L
Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity Guide questions: • Support the integrity and uphold the statutory purposes of any areas designated for landscape value ie, National Parks and AONBs, including in conjunction with the provisions of any relevant Management Plan? • Conserve and enhance the intrinsic character or setting of designated landscapes, townscapes and seascapes? • Conserve, protect and enhance natural environmental assets (e.g. parks and green spaces, common land, woodland / forests etc) as they contribute to landscape and townscape quality? • Support measures to enhance the resilience of ecosystems at a landscape scale and also to maximise benefits including public access and enjoyment of landscapes?	Electricity Networks	--	--	--

• Support functional landscapes e.g. those which reduce flood risk, sequester carbon or offer recreational opportunities in peri urban areas? • Minimise noise and light pollution from construction and operational activities on residential amenity and on sensitive locations, receptors and views?				

9.6: AoS Objective 11: Improve health and well-being and safety for all citizens and reduce inequalities in health

9.6.1: Anticipated Effects

Electric and Magnetic Fields (EMFs) are produced by overhead electricity lines (and to a lesser extent by underground electricity lines due to their buried nature) and these may have direct and indirect effects on human health. Small, charged particles, known as corona ions, originating from power lines have direct effects in terms of stimulus to the central nervous system resulting in its normal functioning being affected. Indirect effects occur through electric charges building up on the surface of the body producing a microshock on contact with a grounded object, or vice versa.

There is also a history of concern around the negative health effects of human exposure to EMFs, which can potentially lead to depressive and neurotic symptoms for some members of the population[22].

The potential health effects of the electromagnetic fields generated by high voltage cables has been a highly controversial issue for more than 20 years. The results of some studies of human populations have suggested that there may be an increase in risk of childhood leukaemia at higher than usual magnetic field exposures in homes, some of which are near to large power lines. It is estimated that 2 to 5 cases from the total of around 500 cases of childhood leukaemia per year in the UK could be attributable to magnetic fields. This number is based on the assumption that exposure has to be above a certain threshold before there could be a health effect. The overall evidence, however, is not strong enough to draw a firm conclusion that magnetic fields cause childhood leukaemia. The evidence that exposure to magnetic fields causes any other type of illness in children or adults (such as cancer and Alzheimer’s disease) is far weaker[23]. However, a recent study by doctors at the University of Bristol Medical School, has found that living near high voltage electrical pylons substantially increases the risks of contracting cancer[24].

There is also potential for noise effects from high voltage transmission lines. The audible noise emitted is caused by the discharge of energy that occurs when the electrical field strength on the conductor surface is greater than the 'breakdown strength' (the field intensity necessary to start a flow of electric current) of the air surrounding the conductor. The highest noise levels generated by a line generally occur during rain. Water droplets may collect on the surface of the conductor and initiate corona discharges with noise levels being dependent on the level of rainfall. Audible noise effects can also arise from substation

[22] https://pubmed.ncbi.nlm.nih.gov/9501332/
[23] https://www.gov.uk/government/publications/electric-and-magnetic-fields-health-effects-of-exposure/electric-and-magnetic-fields-assessment-of-health-risks
[24] https://cordis.europa.eu/article/id/15541-research-breakthrough-on-health-effects-of-pylons

equipment such as transformers, quadrature boosters and mechanically switched capacitors[25].

9.6.2: Approach to Development and Mitigation as set out in EN-1 and EN-5

EN-1 doesn't address the effects of EMFs on human health from electricity lines specifically. To prevent the known effects of EMFs, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) developed health protection guidelines in 1998 for both public and occupational exposure. Government policy is that exposure of the public should comply with the ICNIRP (1998) guidelines. The electricity industry has agreed to follow this policy. EN-5 states that applications should show evidence of this compliance.

In addition, EN-5 sets out that before granting consent to an overhead line application, the Secretary of State should be satisfied that the proposal is in accordance with the guidelines, considering the evidence provided by the applicant and any other relevant evidence. It may also need to take expert advice from the Department of Health and Social Care.

EN-5 advises industry to follow the voluntary Code of Practice, 'Optimum Phasing of high voltage double-circuit Power Lines – A Voluntary Code of Practice', published in March 2012 and developed by government and industry, that defines the circumstances where industry can and will optimally phase lines with a voltage of 132kV and above.

EN-5 notes that where the applicant cannot demonstrate that the line will be compliant with the Electricity Safety, Quality and Continuity Regulations 2002, with the exposure guidelines as specified in the Code of Practice on compliance, and with the policy on phasing as specified in the Code of Practice on optimal phasing then the Secretary of State should not grant consent.

EN-5 acknowledges that undergrounding of a line would reduce the level of EMFs experienced, but high magnetic field levels may still occur immediately above the cable. It is not the government's policy that power lines should be undergrounded solely for the purpose of reducing exposure to EMFs. In order to avoid unacceptable adverse impacts of EMFs from electricity network infrastructure on aviation, the Secretary of State will take account of statutory technical safeguarding zones defined in accordance with Planning Circular 01/03, or any successor, when considering recommendations for DCO applications.

EN-5 notes that where it can be shown that the line will comply with current public exposure guidelines (in terms of EMF) and the policy on phasing, no further mitigation should be necessary.

With regard noise, EN-5 notes that the assessment of noise from substations, standard methods of assessment and interpretation using the principles of the relevant British Standards are satisfactory. EN-1 already provides comprehensive generic planning conditions to address noise and vibration from NSIPs.

For the assessment of noise from overhead lines specifically, EN-5 sets out that the Applicant must use an appropriate method to determine the sound level produced by the line in both dry and wet weather conditions, in addition to assessing the impact on noise-sensitive receptors. For instance, the Applicant may use an appropriate noise modelling tool or tools for the prediction of overhead line noise and its propagation over distance. When assessing the impact of noise generated by overhead lines in wet weather relative to existing background sound levels, the Applicant should consider the effect of varying background sound levels due to rainfall. The Secretary of State is likely to regard it as acceptable for the Applicant to use a methodology that demonstrably addresses these criteria.

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[25] https://www.scientificamerican.com/article/what-causes-the-noise-emi/

Typical mitigation measures are noted as being:

- the positioning of lines to help mitigate noise;
- ensuring that the appropriately sized conductor arrangement is used to minimise potential noise;
- quality assurance through manufacturing and transportation to avoid damage to overhead line conductors which can increase potential noise effects;
- ensuring that conductors are kept clean and free of surface contaminants during stringing/installation; and
- the selection of quieter cost-effective plants.

In addition, the ES should include information on planned maintenance arrangements. Where detail is not included, the Secretary of State should consider stipulating appropriate maintenance arrangements by way of requirements attached to any grant of development consent.

9.6.3: Assessment made in respect of EN-5

The effect of EMFs on health is considered to be negative in the short, medium and long term (unless decommissioned, though it is to be noted that decommissioning is considered unlikely for overhead powerlines). Mitigations are provided in EN-5, including requiring the application of voluntary international guidelines on non-ionizing radiation (ICNIRP) and UK relevant regulations and code of practices. However, given that evidence regarding the seriousness of health effects associated with EMFs is somehow contradictory, and that undergrounding is unlikely to occur for the sole reason of reducing ENFs, residual non-generic minor negative health effects as a result of exposure to EMFs cannot be ruled by this assessment.

Noise from overhead lines is unlikely to lead to the Secretary of State refusing an application, but it may need to consider the use of appropriate requirements in the DCO to ensure noise is minimised as far as is practicable as set out in EN-1. As such, noise from overhead lines is considered to have a neutral non-generic effect on the health and well-being of citizens.

Table 90-5 – Improve health and well-being objective Summary

AoS Objective	**Technology**	**Assessment of non-generic effects (by timescale)**		
		S	M	L
Improve health and well-being and safety for all citizens and reduce inequalities in health Guide questions: • Protect the health of communities through prevention of accidental pollutant discharges, exposure to electric and magnetic fields, shadow flicker or radiation? • Minimise nuisance on communities and their facilities including air, noise and light pollution? • Provide for facilities that can promote more social interaction and a more active lifestyle and enjoyment of the countryside and coasts?	Electricity Networks	-	-	-

• Promote initiatives that enhance safety and personal security for all? • Promote Access to Greenspace and Green Infrastructure Standards? • Support enhanced security, reliability and affordability of the national energy supply?				

9.7: Cumulative Effects

Cumulative effects have been considered during the AoS-5 appraisal and noted where relevant under each topic. The following summarises the cumulative effects identified for EN-5:

- **Climate change (Net Zero) effects:** Through helping to facilitate the delivery of low carbon energy, EN-5 will contribute to the UK meeting its renewables targets and minimising greenhouse gas emissions. This is a cumulative effect already considered in AoS-1.
- **Economic effects:** EN-5 is likely to contribute cumulatively to the overall positive effect of the Energy NPS documents for the UK Economy through ensuring a secure supply of energy required by industry and business and in supporting the transition to a low carbon economy. This is a cumulative effect already considered in AoS-1.
- **Landscape, townscape and visual effects:** Negative cumulative landscape and townscape effects, can occur where new overhead lines are required alongside energy infrastructure, such as generating stations and related developments, such as substations. These are specific cumulative effects arising from EN-5.
- **Equality effects:** EN-5 will contribute cumulatively to energy security and affordability, with positive effects for all socio-economic groups, especially low-income groups susceptible to fuel poverty. This is a cumulative effect already considered in AoS-1.

9.8: Summary of Key Findings of Appraisal

Generally, electricity networks infrastructure development has similar generic effects to other types of energy infrastructure, although due to the linear nature of electricity lines, effects are often more dispersed and spread across a wider area. For the majority of the AoS objectives, the non-generic effects of EN-5 are considered to match those generic effects identified in AoS-1.

EN-1 (as informed by AoS-1) includes extensive mitigations to ensure these effects are considered by applicants and the Planning Inspectorate when preparing and determining applications. EN-5 (as informed by AoS-5) contains a range of technology specific mitigation measures, along with those proposed in EN-1, which seek to address the range of non-generic negative effects identified.

Nevertheless, it is considered that residual non-generic negative, but uncertain, effects will remain in most cases for the four AoS objectives considered (Carbon Emissions, Biodiversity, Landscapes, Townscapes and Seascapes and Health and Well-being).

The non-generic effects have been found to be generally negative across short, medium and long terms for all four AoS objectives.

In relation to the national target of reducing carbon emissions to Net Zero by 2050, technology specific effects have been found minor negative across the short, medium and long term, due to the potentially unavoidable use of SF6 in switchgear in certain circumstances.

Minor non-generic negative effects of technology on biodiversity in the short, medium and long term, due to the possibility of overhead lines continuing to affect birds in certain circumstances, despite mitigations proposed.

Significant and ongoing negative technology effects across the short, medium and long term are expected in terms of landscape and townscape / visual amenity due to overhead lines permanently affecting character and setting of landscapes and townscapes.

Regarding health and well-being, minor negative technology specific effects expected to arise across short, medium of long term, due to potential EMF exposure by people living near power lines.

Uncertainty is associated with this assessment, as at this level of appraisal, actual effects are dependent on the sensitivity of the environment and the location and design of infrastructure.

EN-1 (informed by AoS-1) includes extensive mitigations to ensure these effects are considered by applicants and the Planning Inspectorate when preparing and determining applications. EN-5 (informed by AoS-5) contains a range of technology specific mitigation measures, along with those proposed in EN-1, which seek to address the range of negative effects identified. Nevertheless, it is considered that residual negative, but uncertain, effects will remain in most cases for the four AoS objectives considered.

A summary of the likely non-generic effects arising specifically from electricity networks infrastructure is set out in the following Table 9-6.

Table 90-6 - Summary of Key AoS Findings Specific to Electricity Networks

AoS Objective	**Assessment of non-generic effects (by timescale)**		
	S	M	L
1. Consistent with the national target of reducing carbon emissions to Net Zero by 2050	-	-	-
3. Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	-	-	-
6. Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and enhance visual amenity	--	--	--
11. Improve health and well-being and safety for all citizens and reduce inequalities in health	-	-	-

9.9: Appraisal of Alternatives

9.9.1: Introduction

The scope and methods of appraisal of alternatives are detailed in AoS-1. The strategic alternative identified for Electricity Network infrastructure in Section 1 was assessed using Sustainable Development themes that better keep the appraisal at the higher and strategic level (see table 2.3). The results are set out below.

Note that in consideration of Alternatives, the assessment is undertaken in comparison to EN-5 and not to each other alternative. As such, the findings of the AoS in respect of EN-5 in Section 2 broadly apply to the alternative identified – the key differentiator being the inclusion or absence of particular aspects related to the Technology and the relative outcomes of such inclusion or absence. To draw comparison between the alternative and EN-5 on a broad level, the following scale has been used.

Table 90-77 8910- Differentiator scale for Alternatives

Scale	Description
Large Positive	A materially different positive outcome is anticipated compared to EN-5
Positive	A more positive outcome is anticipated compared to EN-5
Neutral	This alternative is anticipated to have the same outcome as EN-5
Negative	A more adverse outcome is anticipated compared to EN-5
Large Negative	A materially different adverse outcome is anticipated compared to EN-5

9.9.1: Appraisal Results

The findings of the appraisal of the strategic alternatives for EN-5 are set out below, arranged by Sustainable Development (SD) theme.

The alternative under consideration is:

- EN-5 (a): adopt a blanket presumption that all electricity lines should be put underground.

9.9.1.1: Climate Change (Net Zero)

The provision of an improved/ upgraded electricity network infrastructure would facilitate the distribution of energy, including from low carbon energy sources. There are potential long term, positive impacts from improving clean energy distribution to help meeting net zero targets. These positive effects are shared by the preferred option as set out in EN-5. However, alternative EN-5 (a) adopting a presumption that all electricity lines should be put underground, would likely result in additional carbon emissions associated with energy intensive excavation and/or tunnelling technologies, with negative long term effects as compared to a preferred approach of selective undergrounding on a case by case basis. As for overhead power transmission, there will also be embodied energy (and carbon) in the material used for construction underground but this is not appraised as being significantly different from overground construction.

Headline SD themes	EN-5	Alternative (a)
Climate Change (Net Zero)		Negative

9.9.1.2: Security of Energy Supply

Alternative EN-5 (a), adopting a presumption that all electricity lines should be put underground, will facilitate the transmission of energy, including from low carbon sources, and contribute overall to the delivery of secure, clean, affordable energy, with positive long term effects in the security of energy supply, in line with EN-5. Construction will require the use of raw materials for cabling, tunnelling and supporting infrastructure. Undergrounding will lead to significantly higher material costs given the additional structural requirements when compared with overhead power transmission. Where repairs are required to be undertaken on the underground lines, these can be costly and disruptive, and this can affect the security of supply through lines being out of service for longer periods. These higher financial costs are potentially negative effects against security of supply objectives.

A presumption in favour of undergrounding for all electricity lines is also likely to result in higher generation of waste products from excavation (soil, rocks etc) which will have accompanying transport and disposal demands. Minor negative effects are possible over all timescales dependent on the location and scope of the transmission requirements.

Headline SD themes	EN-5	Alternative (a)
Security of Energy Supply		Negative

9.9.1.3: Health and Well-Being

Alternative EN-5 (a), adopting a presumption that all electricity lines should be put underground, will lead to minor negative effects for noise objectives throughout the construction phase for electricity line undergrounding. The period of disruption would typically be longer than for equivalent overhead construction given the greater infrastructure demands. However, noise effects during operation and in the long term are appraised as project level/ local issues. Minor negative effects on air quality are also possible during the construction periods but are appraised as neutral in the medium to long term.

Potential electromagnetic field (EMF) effects arising from overhead lines require appropriate planning and mitigation. For underground lines, EMFs are typically more concentrated close to transmission lines but fall away rapidly at a distance from source. EN-5 requires that the Secretary of State seek evidence of compliance with the International Commission on Non-Ionizing Radiation Protection's guidelines for electric, magnetic and electromagnetic fields. Taking account of the required mitigation, the effects of the underground alternative are appraised as neutral in the short, medium and long term.

The alternative will facilitate the transmission of energy, contributing positively to the overall security and affordability of supply for all population groups. However, the increased cost of undergrounding is likely to have negative impacts for affordability of electricity supply, especially on the part of the fuel poor. There is potential for the negative impacts of the development/construction phases to be more significant for populations in rural/remote areas, which are forecast to receive additional/new infrastructure to meet the demands of emergent (for example, offshore) technology types. The impacts for equality issues in the context of wider health and safety objectives are therefore appraised as uncertain, due to the negative effects on affordability.

Headline SD themes	EN-5	Alternative (a)
Health & Well-Being		Positive / Negative

9.9.1.4: Economy

EN-5 (a): Adopt a presumption that all electricity lines should be put underground.

Alternative EN-5 (a), adopting a presumption that all electricity lines should be put underground, may contribute negatively to economic objectives during the construction and development phases, in comparison with the preferred approach (EN-5).

Although underground electricity lines are unlikely to affect negatively property prices (as opposed to overground lines where values of the property within 100m can be reduced by 6-17%, undergrounding will likely result in higher land take demands and construction footprint (when compared to EN-5) with substantially higher financial costs of which may negatively affect deliverability and economic viability of the electricity lines.

Headline SD themes	EN-5	Alternative (a)
The Economy		Negative

9.9.1.5: Built Environment

Alternative EN-5 (a), adopting a presumption that all electricity lines should be put underground, may in the short-term, have significant negative effects for electricity networks through disruption given the higher land footprint requirement than overhead power. This may be more significant in rural areas where networks are less extensive, although these effects are appraised as localised and short term. Mitigation at a local level in line with requirements set out in EN-5 would be necessary for this alternative.

The effect of the excavation for underground lines on soil and surface characteristics is considered under the Natural Environment. A potential consequence of the excavation is that it could alter surface and ground water flows leading to increased risk of both localised and wider regional flood events. The impacts of excavation on surface and groundwater flows may be mitigated by suitable design and construction. Any residual impacts on flood risk could be mitigated through Flood Risk Assessment (FRA) and would be necessary for developments in sensitive locations. Where mitigation is effectively incorporated, long term effects are likely to be neutral.

A presumption in favour of undergrounding may provide some resilience to the predicted effects of climate change (overhead power lines are more at risk from extreme weather events), however, undergrounding may also exacerbate localised vulnerabilities to the effects of climate change, for example by altering soil properties and drainage characteristics in flood prone areas. Mitigation measures would be necessary to ensure that undergrounding power lines does not contribute to greater flood risk in the long term.

The effects of undergrounding on archaeology are potentially significant and will depend on the sensitivities of the receiving location. Excavation requirements, and the associated financial costs, are substantially higher than for overhead lines and any negative effects are likely to be long term given the permanence of the structures.

Mitigation measures set out in EN-5, including survey, Environmental Statement and avoidance of designated areas, should address negative impacts. In the long term, however, overall effects are location dependent and therefore uncertain.

Overall this alternative supports the distribution of energy, including from low carbon sources with potentially positive effects for climate change objectives in the long term. There is uncertainty given that the overall mix of energy types is not known.

Headline SD themes	EN-5	Alternative (a)
The Built Environment		Negative

9.9.1.6: The Natural Environment

Alternative EN-5 (a), adopting a presumption that all electricity lines should be put underground, has potentially significant negative impacts and effects for ecology in the short, medium and long term, due to direct habitat loss, disturbance and fragmentation. Undergrounding requires a substantially larger footprint than overhead power lines and its effects, for example on the soil and water environment, may have additional indirect negative effects on habitats and species integrity and survival. The disturbance and removal of soil (including when maintenance work is required) will require specific mitigation to prevent overall loss of quality in the long term. The negative effects for ecology are likely for the terrestrial and possibly fluvial environments. In the long term, the effects on mobile species (for example birds) from undergrounding may be less than those that occur from overhead lines, which can act as obstructions/barriers to migration routes.

The effect of excavation on soil and surface characteristics may also produce effects on surface and ground water flow leading to negative impacts on water quality and resources. Where mitigation is effectively incorporated, long term effects are likely to be neutral. The potential for changes in surface and ground water flow to affect flood risk is considered under the Built Environment theme.

Significant negative effects on both landscape and townscape are possible in the short term during the construction phases for undergrounding. The larger footprint required by undergrounding may enhance these short term negative effects.

A presumption in favour of undergrounding for all electricity lines will have significant positive effects for landscape receptors in the medium to long term by removing long term visual impacts associated with overhead lines. However, the short-term effects from undergrounding on the landscape may be more significant due to the larger construction footprint and disruption of soil.

The effects on the natural environment of undergrounding, or of undergrounding in particular locations (for example AONBs) are therefore considered to be significant and positive for landscape in the medium to longer term, but more likely to lead to negative impacts on ecology, soil and the water environment.

Headline SD themes	EN-5	Alternative (a)
The Natural Environment		Positive / Negative

9.9.1.7: Summary of Alternatives Findings and Preferred Approach for NPS

Headline SD themes	EN-5	Alternative (a)
Climate Change		Negative
Security of Energy Supply		Negative
Health & Well-Being		Positive /

		Negative
The Economy		Negative
The Built Environment		Negative
The Natural Environment		Positive / Negative

Alternative EN-5 (a), adopting a presumption that all electricity lines should be put underground, would likely have minor negative effects compared to the EN-5 policy in relation to the AoS objective for climate change (Net Zero) due to the additional emissions associated with energy intensive tunnelling technologies.

Undergrounding electricity network infrastructure has significantly higher costs than the installation of overhead power lines and this aspect is appraised as having negative effects, which may be cumulative, for security of supply and economic objectives. The increased disruption caused by maintenance and repair of underground lines can also have effects on security of supply. On affordability and longer term security of supply issues, the preferred option is, therefore, more likely to ensure that the plan is delivered in the timescales necessary to support the transmission of energy supplied.

Undergrounding also demands a substantially higher footprint than overhead lines, and effects on soil, water, and archaeology are all likely to be negative in the short term and will require appropriate mitigation. There is some uncertainty as to the long term effects which will depend on the specific location and the sensitivity of the receiving environment. Significant negative effects in the short term are also appraised for biodiversity objectives, as direct loss and disturbance from extensive linear excavations are likely and will require extensive mitigation measures as detailed in EN-1 and EN-5. In common with the appraisal findings for other elements of the natural environment, the exact nature of the effects and their duration will depend on the specific location and the sensitivity of the receiving environment.

Negative effects of undergrounding all electricity lines on landscape are appraised as short term (construction phase). In the long term, landscape, townscape and visual impacts will be positive given the removal of electricity lines from the line of sight of local and wider population receptors.

Given that underground lines are not without a range of adverse impacts of their own, and that they are significantly more expensive, it is considered better to adopt the policies set out in the revised draft EN-1 and EN-5 and not to prefer presumption in favour of undergrounding for all electricity lines. This is because the range of factors to be taken into account means that any decision to underground is best taken within a more flexible policy framework that follows a case by case evaluation of all of the impacts of a particular project and supports the use of both undergrounding and overhead lines as appropriate, in line with the appraisal findings.

10: Cumulative and Transboundary Effects

10.1: Cumulative, Synergistic and Indirect Effects of energy NPSs

It is a requirement to consider cumulative, synergistic and indirect effects of implementation of the energy NPSs. Secondary and indirect effects are effects that are not a direct result of the NPSs, but which occur away from the original effect or as the result of a complex pathway. Cumulative effects arise where several proposals or elements of the NPSs, individually may or may not have significant effect but in-combination have a significant effect due to spatial crowding or temporal overlap. Synergistic effects occur when two or more effects act together to create an effect greater than the simple sum of the effects when acting alone.

As required by the SEA Regulations, cumulative, synergistic and indirect effects have also been considered during the AoS. The identification of these effects already takes into account the fact that earlier recommendations have taken on board to improve the sustainability performance of the NPSs.

Of particular note and a key element to the NPSs is the recognition of the need to reduce GHG emissions in order to help combat climate change. As such, there is a key focus within the NPSs for low or net zero carbon energy generation and transmission. In addition to reducing emissions at source, the NPSs provide for new technologies that will remove carbon emissions and store these (Carbon Capture and Storage). However, given the likely costs associated with the development of such infrastructure and the offshore location for the storage of the captured CO_2, there is likely to be a clustering of installations around strategically located land based transfer stations prior to onward pumping of the CO_2 to offshore head works.

Clustering of installations can have benefits, but also negatives and this is recognised within the NPSs. For example, it is noted in a number of areas that if development consent were to be granted for a number of projects within a region and these were developed in a similar timeframe, there could be short term negative effects. This could be on local economies through impacts of large scale construction activities leading to an influx of workers to an area driving up demand for housing and accommodation and local services. Similarly, this could lead to a shortage of skilled workers in the local area. On the other hand, beneficial cumulative effects could be accrued through increased spend in the local area, as well as increased opportunities for secure and well paid employment and development of skills / training, with potentially beneficial indirect effects on health. Such cumulative effects are more likely to be more pronounced in rural areas. It is considered that the NPSs provide a cumulative benefit to the population as a whole by helping to ensure certainty of investment and security of energy supplies that will help provide robust and low cost energy.

As well as cumulative effects on the local and wider population, there can also be effects experienced on environmental issues. Cumulatively this will again be most pronounced where infrastructure is clustered and it is to be noted that it does not all need to be of the same technology – combinations of technologies can act both cumulatively and synergistically together, with effects on landscape being of particular note. Particular significance of these effects would depend on the location of the infrastructure and the sensitivity of the area, but it is to be noted that many of the areas where it could be expected that large scale energy infrastructure may be developed (due for example to the need for large amounts of cooling water), are also frequently the most prized landscapes or seascapes.

Technological drivers are a key consideration in respect of the potential for cumulative effects and the NPSs do place careful emphasis on the need to analyse all such aspects. For example and as noted, many energy installations need availability of large amounts of water resources to meet process water demands and cooling water requirements, as well as suitable discharge locations. They may also require to be located close to ports to receive imported fuel stock and other raw materials and for outward transport of residues to export markets. Renewable technologies are not immune from such demands, which may also lead to clustering of such facilities.

Due to the potential for technological drivers leading to cumulative effects, each of the technology specific EN's were considered for the potential for cumulative effects. Across all technologies it was considered that cumulative effects of construction (e.g. air quality, dust, noise, visual, traffic, socio- economic etc.) may arise with the development of the specific technologies and it is to be recognised that these are not likely to be developed in isolation – for example, within EN-4 (Gas and Oil) an LNG facility will also require a pipeline, gas receptor facility and pipeline, underground storage facility and pipeline. It is likely that both elements would be constructed within the same timeframe and connecting to each other, resulting in cumulative effects of a temporal and spatial nature, though such effects would likely be temporary.

It is also to be recognised that even technologies that could be anticipated to be dispersed and spread across a wider area such as the linear electricity networks noted in EN-5, can have potential for cumulative effects. Such effects can include those relating to landscape and townscape including potentially within areas noted for tourist-dependent economies. Effects could occur where new overhead lines are required alongside energy infrastructure, such as generating stations and related developments, such as substations.

These potential cumulative effects will be felt across a number of AoS objectives in an adverse manner including air quality, water quality, resource use, biodiversity and traffic and transport amongst others. These would for the most part arise during construction and they may be difficult to mitigate. As such, the NPS places careful emphasis for decision makers to balance such competing issues. It also places a strong emphasis on the need for further consideration of all issues and effects (including cumulative effects) through applicable assessment types such as EIA, or through socio-economic assessment.

The NPSs also ensure consideration needs to be made of cumulative effects across the full timescale of the energy infrastructure, through to decommissioning and beyond. It is to be recognised that this could be many decades in respect of some technologies.

In short therefore, while the lack of clarity relating to location of infrastructure means it is not possible to be precise as to cumulative, synergistic and indirect effects, it is possible to conclude that the significance and nature of cumulative effects may vary with the mix of technology projects proposed and the sensitivity of the receiving communities and environment. The NPSs though set out a series of approaches that will address and manage these issues.

10.3: Cumulative effects in-combination with other plans and policies

Cumulative effects can also arise due to effects from the energy NPSs combining with effects from other plans and policies. However, due to the strategic and high level nature of the energy NPSs and the lack of any locational and specific detail on any infrastructure developments that are likely to be brought forward, as well as that inevitably there is going to be a delay between the adoption of the energy NPSs and any subsequent energy infrastructure development, it is not possible to know when (or indeed if) any subsequent project proposal will come forward and it is not therefore possible to predict what other plans and projects will be relevant to future project assessments.

The type of PPPs that could have cumulative or in-combination effects with infrastructure developed under the NPSs are:

- Applications lodged but not yet determined;
- Projects subject to periodic review;
- Projects authorised but not yet started;
- Projects started but not yet completed;
- Known projects that do not require external authorisation;
- Proposals in adopted plans; and
- Proposals in draft plans formally published or submitted for final consultation, examination or adoption.

Typical types of effects that could lead to cumulative or in-combination effects include (but are not limited to):

- Resilience to climate change
- Noise, vibration and light disturbance;
- Air, land and water pollution;
- Changes to water quantity / flow and coastal change,
- Landscape;
- Species injury and mortality;
- Changes in habitat extent, composition and structure;
- Health and Wellbeing;
- Sustainable transport; and
- Economy

Such in-combination effects are more likely to arise when multiple projects have similar impacts; due to effects exceeding the limit of what the relevant sustainability parameters can tolerate and becoming significant effects. Note that projects that include non-energy infrastructure development and smaller scale development that is not an NSIP can also lead to cumulative or in-combination effects and should be considered at the appropriate point. In-combination effects can be by virtue of proximity, connectivity and/or timing. The most common combined effects include additive air quality, water quality/quantity and habitat/species disturbance impacts.

10.4: Transboundary effects

Potential transboundary effects from the NPSs have been approached in a similar way to other cumulative effects, only that the assessment looks at effects that originate within the UK but have the ability to extend across national borders. Transboundary effects are addressed through Regulation 14 of the SEA Regulations, which requires notification to Member States of the European Union of any Plan or Programme which is considered likely to have significant effect on the environment of that Member State.

Two types of technology have been considered in this assessment of transboundary effects: nuclear and offshore wind.

Transboundary effects from nuclear power stations are addressed in the AoS of EN-6[26]. Unintended release of radiation from nuclear power stations may result in transboundary effects. In the UK, the nuclear regulatory bodies will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit. As part of the site licensing process, a potential operator will be required to demonstrate that the nuclear facility is designed and can be operated such that several levels of protection and defence are provided against significant faults or failures, that accident management and emergency preparedness strategies are in place and that all reasonably practicable steps have been taken to minimise the radiological consequences of an accident. The robustness of the regulatory regime surrounding these installations in the UK thus result in a low probability of an unintended release and therefore any significant transboundary effects.

Radioactive releases from nuclear power stations are strictly controlled in accordance with limits laid down in permits issued by the Nuclear Installations Inspectorate and the Environment Agency under the Environmental Permitting (England and Wales) Regulations 2016. This regulatory system ensures that permitted radioactive discharges are within authorised limits. These releases are likely to remain sufficiently localised so as not to impact significantly on neighbouring countries.

Transboundary effects of offshore wind farms have been identified in relation to fish, marine mammals and birds as their movements are independent of national geographical boundaries. The biodiversity assessment for this technology concluded that there are likely significant transboundary effects on these receptors. The HRA concludes that there is potential for adverse effects on International Sites in other nations (transboundary), particularly as a result of offshore wind and coastal development.

Transboundary effects of offshore wind farms have also been identified on human activities such as on navigation, wind energy, grid connection and other.

Therefore, it is considered that Ireland, France, Belgium, Germany, Denmark, Sweden and the Netherlands should be consulted on the potential for significant environmental effect from implementation of the NPS. For the same reasons, there would also be potential effects on Norway and the Crown Dependencies of the Isle of Man and the Channel Islands as well as in each of the four nations within the United Kingdom.

The transboundary effects (if any) of individual proposals for both new nuclear and offshore wind farms (including any associated infrastructure such as cables) will be considered at project-level as part of the development consent process. The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (‘the EIA Regulations’) set out the requirements governing statutory notification and consultation in respect of transboundary effects of projects on EEA States. Regulation 32 of the EIA Regulations establishes the procedural duties necessary where an NSIP is likely to have significant effects on the environment in an EEA State. The duties under Regulation 32 apply until the decision on the DCO is made. As such, identification of the relevant State will be made in light of the technology being developed and the location within which the development is to take place.

26 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47778/1925-appl-of-sust-of-revised-draft-en6.pdf

11: Monitoring

Monitoring helps to examine the effects predicted through the AoS process against the actual effects of the NPSs when they are implemented. It is also a requirement of the SEA Regulations to describe the measures envisaged concerning how significant effects of implementing the NPS will be monitored – Section 17 (1) notes "the responsible authority shall monitor the significant environmental effects of the implementation of each plan or programme with the purpose of identifying unforeseen adverse effects at an early stage and being able to undertake appropriate remedial action". As ODPM Guidance[27] advises, it is not necessary to monitor everything, or monitor an effect indefinitely, but rather monitoring needs to be focused on significant sustainability effects. Monitoring should therefore focus upon significant effects that may give rise to irreversible damage, with a view to identifying trends before such damage is caused, and significant effects where there was uncertainty in the AoS and where monitoring would enable preventative or mitigation measures to be undertaken.

While significant effects have not been identified in relation to all Objectives and it is considered that in many instances the NPS text provides robust policy to address issues, the non-specific spatial nature of the NPS does mean that there is in some instances a degree of uncertainty in findings and as such a potential for unforeseen individual or cumulative effects to arise. Therefore it was considered important to take a precautionary approach to monitoring.

Table 110-1 – Overall effects and Monitoring Requirements for EN-1 to EN-5

AoS Objective	Overall effects of EN-1 to EN-5 and need for monitoring
Objective 1 Consistent with the national target of reducing carbon emissions to net zero by 2050	Generally, the NPS is predicted to perform significantly positive in respect of this Objective through the promotion of a variety of zero and low carbon technologies and will likely be transformational in enabling England and Wales to transition to a low carbon economy and thus help to realise UK Net Zero commitments sooner than continuation under the current planning system. However, there is some uncertainty about the exact level of transformation as it is difficult to predict the mix of technology that will be delivered by the market against the framework set by the Government and its cumulative contribution in terms of GHG emissions. The promotion of three particular technologies (unabated gas, unabated waste incineration and electricity distribution networks) by the NPS have been identified as resulting in negative effects across the short, medium and long term, due to the potential use of unabated carbon technologies and of SF6 in switchgear, respectively. It is thus important that these particular effects are monitored.
Objective 2 Maximise adaptation and	The NPS generally performs well in respect of adaptation and resilience to climate change through the requirements that are placed on developers to address this extremely important topic in the face of unavoidable climate change. There is a degree of uncertainty over

[27] Practical Guide to the Strategic Environmental Assessment Directive (ODPM, September 2005).

resilience to climate change	the severity of such climatic events, how technologies may adapt to such circumstances and in combination effects with other non-energy infrastructure projects may affect such adaptation. As such there is a high chance of unforeseen effects arising against this objective which will need to be carefully monitored.
Objective 3 Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	The technologies promoted by the NPS could result in significant adverse effects on biodiversity, both onshore and offshore, particularly in the short term but also in the medium to long term. The effects could be direct, indirect, cumulative or synergistic. Longer term, there are opportunities for counteracting positive effects through achievement of Biodiversity Net Gain as part of the implementation of the energy projects. There is, however, a degree of uncertainty associated with the effects identified due to the non-spatial nature of the NPS and a potential for unforeseen effects, due to issues such as clustering of technology and in combination effects with other non-energy projects which will need to be carefully monitored.
Objective 4 Protect and enhance sites designated for their international importance for nature conservation purposes	There is potential for significant negative effects on sites designated for their international importance and nature conservation purposes (as a result of the implementation of energy projects promoted by the NPS or in combination with other non-energy projects) in the short, medium and long term. This could include effects on sites which are in the jurisdiction of other countries (transboundary). The effects identified are uncertain as they will depend on the specific locations and scale of development, which is largely unknown at this given that the NPSs do not outline specific proposals. Such effects will require monitoring.
Objective 5 Protect and enhance cultural heritage assets and their settings, and the wider historic environment	For the most part, it is anticipated that there is the potential for minor negative effects (including cumulative effects) on heritage assets and their settings (designated and non-designated) on land and at sea in the short, medium and long term. It is considered that there are sufficient requirements planned by the NPS on developers to address the anticipated adverse effects associated with this Objective. However, it is considered that there is also a potential for unforeseen potentially significant effects to occur due to issues such as clustering of technologies which cannot be determined at this stage due to the non-specific / spatial elements of the NPS as well as in-combination effects with non-energy infrastructure projects. Such effects will require monitoring.
Objective 6 Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes,	Significant negative effects for landscape, seascape and townscape and visual receptors are likely as a result of the NPS implementation in the short, medium and long term and it is to be noted that due to the considerable size of energy infrastructure projects supported by the NPS, opportunities for mitigation of such effects will be limited. It is also considered that there is also a potential for unforeseen significant effects to occur due to issues such as clustering of technologies due to the non-specific / spatial elements of the NPS as

protect wider landscapes, seascapes and townscapes and enhance visual amenity	well as in combination effects with non-energy infrastructure projects. It is thus important that such effects are monitored.
Objective 7 Protect and enhance the water environment	Minor negative effects for water quality are likely as a result of the NPS implementation in the short term through to the long term as it will not be possible to avoid all negative effects on the water environment, given the likely scale and nature of the technologies being supported by the NPS. The effects may occur, for example, through construction activities releasing pollutants into the water environment and cooling water abstraction and discharge for technologies such as nuclear and gas fired power stations. While it is considered that the NPS provides a robust approach to dealing with these issues, there remains the potential for significant effects to occur due to unforeseen issues associated with the non-specific / spatial elements of the NPS and the potential for clustering of certain types of energy infrastructure and in combination effects with other non-energy infrastructure projects. Such effects will require monitoring.
Objective 8 Protect and enhance air quality	While the NPS notes a robust approach to managing effects on air quality, it is anticipated that such effects will likely be slightly adverse, due to the potential for emissions of air pollutants during construction of projects and residual operational emissions for some types of technologies. While it is considered that the NPS provides a robust approach to dealing with these issues, there remains the potential for significant effects to occur due to unforeseen issues associated with the non-specific / spatial elements of the NPS and the potential for clustering of certain types of energy infrastructure and in combination effects with other non-energy infrastructure projects. Such effects will require monitoring.
Objective 9 Protect soil resources and avoid land contamination	Minor negative effects on soil resources are likely as a result of the NPS implementation in the short, medium and long term due to the potential for loss of agricultural land and contamination of soil, potentially from spills of oil or chemicals used in the construction, operations and decommissioning of certain types of energy infrastructure. The effects identified are uncertain (and as such potentially unforeseen) as they will depend on the specific nature, location and scale of development. It is thus important that such effects are monitored.
Objective 10 Protect, enhance and promote geodiversity	There is potential for negative effects on geodiversity due to NPS implementation in the short, medium and long term, through loss of land / seabed, changes to coastal processes etc., particularly during construction impacting geodiverse sites. However, due to the potential for enhancement of access to geological features, there is also potential for minor positive effects in the medium to long term. The effects identified are uncertain (and as such potentially

	unforeseen) as they will depend on the specific location, nature, design and scale of development.
Objective 11 Improve health and well-being and safety for all citizens and reduce inequalities in health	Reliable energy supplies nationally promoted by the NPS will contribute to positive effects generally on the economy and skills with indirect positive effects for health and well-being in the medium to longer term through helping to secure affordable supplies of energy and minimising fuel poverty. Opportunities for employment (across the short, medium and long term) are also likely, with consequent beneficial effects on wellbeing. The NPS makes clear the need to identify potential adverse health impacts, including on vulnerable groups within society and notes that opportunities should be taken to mitigate direct impacts by promoting local improvements to encourage health and wellbeing. The potential for in combination effects with other non-energy infrastructure projects will also need to be considered. The success of such approach would be informed through effective monitoring.
Objective 12 Promote sustainable transport and minimise detrimental impacts on strategic transport network and disruption to basic services and infrastructure	The NPS provides for a robust approach to promoting sustainable transport, as well as minimising detrimental impacts on the strategic transport network and disruption to services and infrastructure. It also describes the need to promote sustainable transport modes (including water borne transport, as well as improving access by active, public and shared transportpublic transport, walking and cycling), as well as to reduce the need for parking. As such, it is anticipated that uncertain (and as such unforeseen) effects may be experienced in the short (construction) term but with benefits experienced across the later timescale of the development. There remains, however, the potential for significant effects to occur due to unforeseen issues associated with the non-specific / spatial elements of the NPS and the potential for clustering of certain types of energy infrastructure and in combination effects with other non-energy infrastructure projects. Such effects will require monitoring.
Objective 13 Promote a strong economy with opportunities for local communities	Development of new energy infrastructure as promoted by the NPS will support the security, reliability and affordability of the national energy supply and lead to the provision of jobs in local areas to the development and further afield. Some of these jobs are likely to be specialist in nature, but others will be lower skilled, or suitable for apprenticeships or will provide opportunities to further develop skills. It is anticipated that most jobs would be during the construction phase, with significantly less fewer jobs during operation and then an increase during any decommissioning phase. As noted though, a significant increase in workers can lead to stress on local housing and labour markets (particularly in more rural areas / smaller towns) and it is considered monitoring would help to inform approaches to these issues. As such, some slight adverse effects are anticipated in the short term, but overall, there should be significant benefits in local areas during construction, with ongoing benefits through the medium to long term. There remains, however, the potential for significant effects to occur due to unforeseen issues associated with the non-specific / spatial elements of the NPS and the potential for clustering of certain types of energy infrastructure and in combination effects

	with other non-energy infrastructure projects. Such effects will require monitoring.
Objective 14 Promote sustainable use of resources and natural assets	The NPS provides a robust approach to promoting sustainable use of resources and natural assets and notes how good design can reduce the requirement for consumption of materials and applying this to a project at as early a stage as possible will act to reduce consumption. Clear note is also made of a number of key aspects such as the waste hierarchy, and the requirement to set out the arrangements that are proposed for managing any waste produced for waste management plans, as well as the sourcing of materials from recycled or reused sources and the use of low carbon materials. While there will be a high level of consumption of sources in the short term (construction phases), including virgin material, this will reduce during the operational phase and techniques such as the use of Building Information management tools (or similar) will provide opportunities in the long term for realising the recovery and reuse of materials used at the construction stage. Use of resources and waste arisings will need to be monitored as part of scheme development.

The sustainability effects of the energy NPSs may be monitored through the monitoring frameworks already carried out by the environmental regulators and the local authorities. Pollution control and environmental management monitoring, including status of water quality and resources, protected habitats and species, is carried out by the environmental agencies; human health protection is the responsibility of the health authorities and Public Health England (now replaced by UK Health Security Agency and Office for Health Improvement and Disparities); and the extent of nuclear generating activities will be monitored through the nuclear licensing procedures. Local Planning Authorities monitor the effectiveness of their spatial plans, including indicators such as employment and access to community facilities and services. Nationally, Government[28] assesses and reports annually on progress against sustainable development indicators (including greenhouse gas and carbon dioxide emissions), energy use (including renewables), and resources (including water).

[28] Defra national SD indicators [Sustainable development indicators (SDIs) - GOV.UK (www.gov.uk)]

Table 11-1 - Proposed Monitoring

No.	AoS Objective against which a significant effect has been predicted	Monitoring Measure / Indicator	Target	Data Source	Suggested frequency of monitoring	Responsibility for undertaking monitoring
1	Consistent with the national target of reducing carbon emissions to net zero by 2050	CO_2 and other GHG emissions such as SF6 from energy sector (by source)	Reduce to pathway consistent with Net Zero targets	DESNZ: UK greenhouse gas emissions national statistics	Annual	DESNZ
		% output from low carbon sources	To be consistent with Net Zero target	DESNZ: Digest of UK Energy Statistics (DUKES)	Annual	DESNZ
		electricity generation by technology	To be consistent with Net Zero target	DESNZ: Digest of UK Energy Statistics (DUKES)	Annual	DESNZ
2	Maximise adaptation and resilience to climate change	Area of flood risk (from all sources) constructed upon by new Energy Schemes	Zero	Environment Agency, Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Energy Scheme developers (in respect of individual projects) – reporting to DESNZ
		Number of new Energy Schemes designed for successful adaptation to climate change	All	Environment Agency, Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Energy Scheme developers (in respect of individual projects) – reporting to DESNZ
		Number of new Energy Schemes designed to include best practice SuDS (where	Increase	Environment Agency, Local Authorities and Energy Scheme	Annual	Energy Scheme developers (in respect of individual

No.	AoS Objective against which a significant effect has been predicted	Monitoring Measure / Indicator	Target	Data Source	Suggested frequency of monitoring	Responsibility for undertaking monitoring
		appropriate) and / or upstream Natural Flood Management		developers (in respect of individual projects)		projects) – reporting to DESNZ
3	Enhance biodiversity, promote ecosystem resilience and functionality and contribute to the achievement of Biodiversity Net Gain and the delivery of the Nature Recovery Network	Net Gain in Biodiversity (using the DEFRA metric) due to Energy Schemes	Increase in Biodiversity Net Gain	Natural England, Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Energy Scheme developers (in respect of individual projects) – reporting to DESNZ
		Number of Energy Schemes with overall adverse impact on sites designated for nature conservation	Year on year decrease	Natural England, Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Natural England, Local Authorities and Energy Scheme developers (in respect of individual projects)
		Changes in areas of biodiversity importance (priority habitats and species by type) and areas designated for their intrinsic environmental value including sites of national, regional or sub regional significance	Year on year increase in area (ha)	Natural England, Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Natural England, Local Authorities and Energy Scheme developers (in respect of individual projects)
		Area of Green Infrastructure	Year on year increase in area (ha)	Natural England, Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Natural England, Local Authorities and Energy Scheme developers (in respect of individual projects)

No.	AoS Objective against which a significant effect has been predicted	Monitoring Measure / Indicator	Target	Data Source	Suggested frequency of monitoring	Responsibility for undertaking monitoring
4	Protect and enhance sites designated for their international importance for nature conservation purposes (linked to separate HRA process for Energy NPS)	Condition of International and or International Sites	Year on year increase in improvement	Natural England, Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Natural England, Local Authorities and Energy Scheme developers (in respect of individual projects)
5	Protect and enhance cultural heritage assets and their settings, and the wider historic environment	Change to heritage assets and their settings compared to a baseline assessment Number of heritage assets that are placed on or removed from the Heritage at Risk register as a result of development	Reduction in direct impacts from energy infrastructure as it is developed.	Natural England, Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	DESNZ
6	Conserve and enhance the natural beauty of protected landscapes, seascapes and townscapes, protect wider landscapes, seascapes and townscapes and	Change in the quality of character or status of a designated area	Reduction in direct impacts from energy infrastructure as it is developed.	Natural England, National Parks and AONB Management Groups, Environment Agency and Energy Scheme developers (in respect of individual projects)	Annual	DESNZ
		Changes in settings and views	Reduction in direct impacts from	Natural England, National Parks and	Annual	DESNZ

No.	AoS Objective against which a significant effect has been predicted	Monitoring Measure / Indicator	Target	Data Source	Suggested frequency of monitoring	Responsibility for undertaking monitoring
	enhance visual amenity		energy infrastructure as it is developed.	AONB Management Groups, Environment Agency and Energy Scheme developers (in respect of individual projects)		
7	Protect and enhance the water environment	Number of water pollution incidents attributable to the Energy Sector (across all waterbodies)	Zero	Environment Agency, Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Energy Scheme developers and Operators (in respect of individual projects / facilities) – reporting to DESNZ
8	Protect and enhance air quality	No exceedances of Air Quality Objectives or limit values	Zero	DEFRA / Environment Agency, Local Authorities and Energy Scheme developers and Operators (in respect of individual projects)	Annual	Energy Scheme developers and Operators (in respect of individual projects / facilities) – reporting to DESNZ
		Meet Air Quality emission targets	Reduce to emissions consistent with aim to meet emissions targets to Ceiling Directive	DESNZ and Energy Scheme developers and Operators (in respect of individual projects).	Annual	Energy Scheme developers and Operators (in respect of individual projects / facilities) – reporting to DESNZ
9		Area (in hectares) of best and most versatile land (BVAL) (grades 1,2 or 3a) included	Year-on-year reduction in the area of BVAL within or	Local Authorities and Energy Scheme	Annual	Energy Scheme developers and Operators (in

No.	AoS Objective against which a significant effect has been predicted	Monitoring Measure / Indicator	Target	Data Source	Suggested frequency of monitoring	Responsibility for undertaking monitoring
	Protect soil resources and avoid land contamination	within or impacted by new Energy Schemes	impacted by new Energy schemes subject to loss or degraded quality.	developers (in respect of individual projects)		respect of individual projects / facilities) – reporting to DESNZ
		Area (in hectares) of previously contaminated land included within or impacted by new Energy Schemes	100% of previously contaminated land covered by new Energy Schemes subject to decontamination measures	Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Energy Scheme developers and Operators (in respect of individual projects / facilities) – reporting to DESNZ
10	Protect, enhance and promote geodiversity	Area (in hectares) of designated geodiversity sites (RIGS and / or SSSIs) included within or impacted by Energy schemes	100% of designated geodiversity sites retained at their current condition or subject to improvement in their condition Year-on-year reduction in the % of geodiversity sites within or impacted by Energy schemes subject to loss or degraded condition.	Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual (subject to data availability)	DESNZ

No.	AoS Objective against which a significant effect has been predicted	Monitoring Measure / Indicator	Target	Data Source	Suggested frequency of monitoring	Responsibility for undertaking monitoring
11	Improve health and well-being and safety for all citizens and reduce inequalities in health	Households living in fuel poverty	Year on year reduction in numbers living in fuel poverty	Environment Agency, Public Health bodies including those in Devolved Administrations and Agencies	Annual	DESNZ supported by relevant authorities
12	Promote sustainable transport and minimise detrimental impacts on strategic transport network and disruption to basic services and infrastructure	Proportion of new Energy Schemes with Transport Management Plans that emphasise sustainable transport modes including public and active travel	100% of new Energy schemes	Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Energy Scheme developers and Operators (in respect of individual projects / facilities) – reporting to DESNZ
13	Promote a strong economy with opportunities for local communities	GVA per capita and percentage change in employment and or number of apprenticeships / training schemes in areas of proposed Energy Schemes	Increase employment and apprenticeships / training schemes	NOMIS / Office for National Statistics	Annual	DESNZ supported by relevant authorities
		Monitoring of social issues and level of social / health provision in areas of proposed energy schemes.	To inform scheme development – ensure appropriate level of provision	Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Energy Scheme developers and Operators (in respect of individual

No.	AoS Objective against which a significant effect has been predicted	Monitoring Measure / Indicator	Target	Data Source	Suggested frequency of monitoring	Responsibility for undertaking monitoring
						projects / facilities) – reporting to DESNZ
14	Promote sustainable use of resources and natural assets	Proportion of construction materials used in new Energy schemes derived from alternative secondary and / or recycled sources.	100% of Energy schemes employing reuse, recovery and recycling practices during construction	Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Energy Scheme developers and Operators (in respect of individual projects / facilities) – reporting to DESNZ
		Proportion (by mass) of waste arising associated with new Energy schemes which is reused or recycled	Year-on-year increase in % of waste materials generated during construction being reused on-site	Local Authorities and Energy Scheme developers (in respect of individual projects)	Annual	Energy Scheme developers and Operators (in respect of individual projects / facilities) – reporting to DESNZ

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