

The Lighthouse Green Fuels Order

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Abbreviations

Abbreviation	In full
ASTM	American Society for Testing and Materials
ASU	Air Separation Unit
CCS	carbon capture and storage
CO ₂	carbon dioxide
DCO	Development Consent Order
EIA Regulations	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017
EN-1	Overarching National Policy Statement for Energy Infrastructure
ES	Environmental Statement
EWP	Energy White Paper – Powering our Net Zero Future
HEFA	Hydrotreated Esters and Fatty Acids
SAF	Sustainable Aviation Fuel
SoS	Secretary of State
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
WFD	Water Framework Directive

6 Alternatives

6.1 Introduction

6.1.1 This chapter of the Environmental Statement (ES) sets out a short summary of the need case for the Proposed Development, and then outlines the alternatives considered. These include reasonable alternative site locations, feedstocks and technologies and also the 'Do Nothing' alternative of not progressing the development of the Sustainable Aviation Fuel (SAF) production facility and associated infrastructure at all.

6.1.2 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (EIA Regulations) [Ref 1] Regulation 14(2)(d) states that an ES should include:

“a description of the reasonable alternatives studied by the applicant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment.”

6.1.3 Under the EIA Regulations, there is no requirement to assess the alternatives studied, only a requirement to provide information regarding the reasonable alternatives that have been considered.

6.1.4 Requirements for consideration of the alternatives studied by the Applicant within an ES are also set out under paragraph 4.3.15 of Section 4.3 (Environmental Effects / Considerations) of the Overarching National Policy Statement (NPS) for Energy Infrastructure (EN-1) [Ref 2].

6.1.5 Paragraph 4.3.9 of EN-1 established that that document “*does not contain any general requirement to consider alternatives or to establish whether the proposed project represents the best option from a policy perspective*”. However, Paragraph 4.3.15 of EN-1 also requires that “*applicants are obliged to include in their ES, information about the reasonable alternatives they have studied. This should include an indication of the main reasons for the applicant’s choice, taking into account the environmental, social and economic effects and including, where relevant, technical and commercial feasibility.*” Paragraph 4.3.22 of EN-1 also states that “*Given the level and urgency of need for new energy infrastructure, the Secretary of State should, subject to any relevant legal requirements (e.g. under the Habitats Regulations) which indicate otherwise, be guided by the following principles when deciding what weight should be given to alternatives:*

- a. the consideration of alternatives in order to comply with policy requirements should be carried out in a proportionate manner; and*

- b. only alternatives that can meet the objectives of the proposed development need to be considered.”*

Paragraphs 4.3.22-4.3.29 of EN-1 [Ref 2] go on to set out the various considerations that the Secretary of State (SoS) should take into account in considering alternatives.

- 6.1.6 In this context, the consideration of alternatives and design evolution has been undertaken with the aim of avoiding and/or reducing adverse environmental effects (following the mitigation hierarchy of avoid, reduce and, if possible, remedy), while maintaining viability, operational efficiency and cost-effectiveness, considering other relevant matters such as available land and planning policy, and taking into account the alternatives considerations that apply under the Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017 (2000/60/EC) [Ref 3], The Conservation of Habitats and Species Regulations 2017 (Habitats Regulations) [Ref 4], common law and compulsory acquisition regimes.
- 6.1.7 The design of the Proposed Development has evolved through engineering design work, in response to consultation feedback, and with regard to survey data and environmental considerations. Detailed design parameters will remain within the design as assessed within the ES and secured in the **Development Consent Order (DCO) (Application Document Ref. 3.1)**.

6.2 The Do Nothing alternative

- 6.2.1 The “Do Nothing” alternative would mean that the UK’s and one of Europe’s largest and most technologically advanced biomass to SAF projects would not be developed. The facility is designed to produce 180 million litres of low-carbon SAF and 30 million litres of renewable naphtha each year, equivalent to the fuel required for 25,000 short haul flights to Europe or 4,500 transatlantic flights. The technology would help to avoid emissions of approximately 500,000 tonnes of carbon dioxide (CO₂) a year compared with use of conventional aviation fuel.
- 6.2.2 In the event that the plant is not built, the use of existing conventional aviation fuel would continue to contribute towards unsustainable carbon dioxide (CO₂) emissions. The Government’s Jet Zero Strategy [Ref 1] commits to having SAF contributing 10% of the UK aviation fuel mix by 2030 as secured by the UK Government’s SAF Mandate [Ref 6] and this project is widely regarded as being the most credible domestic project to help meet SAF Mandate targets beyond 2030.
- 6.2.3 The development of SAF plants such as the Proposed Development is thus recognised as being essential to meet the UK Government’s targets set out

within the Jet Zero Strategy and the overall strategic target of delivering net zero aviation by 2050.

- 6.2.4 Given the urgent need for domestic SAF production facilities, the “Do Nothing” alternative scenario is not considered to be a credible option, as this would hinder the UK’s ability to meet the Jet Zero Strategy [Ref 5] and the Government’s SAF Mandate [Ref 6].

6.3 Alternative technologies

- 6.3.1 The Government mandate for development of UK SAF production at scale by 2030 is clear. Biomass processing represents the most technologically advanced pathway to deliver SAF to that timescale. The Proposed Scheme has been designed to use a gasification and Fischer Tropsch (FT) technology that converts feedstocks into liquid fuels, namely low-carbon SAF and renewable naphtha.
- 6.3.2 Alternatives for SAF production are available which still use gasification but using different conversion and refinement processes. Upon review of these alternatives, the Applicant considered that the use of gasification and FT technology offered the greatest proven technology readiness to enable SAF production at the scale required to meet the timescales in the UK SAF Mandate.
- 6.3.3 Gasification and FT routes to produce SAF have been shown to offer the lowest carbon intensity SAF compared to alcohol-to-jet routes (a process considered second-generation as feedstocks are waste and residues). Gasification and FT routes also offer improved carbon intensity compared to first-generation Hydrotreated Esters and Fatty Acids (HEFA) routes (produced from materials including used cooking oils, tallows, fats). Combined with potential future use of Carbon Capture and Storage (CCS), the gasification and FT production route can also offer appreciable negative emissions.
- 6.3.4 Gasification and FT routes to produce SAF are approved by the American Society for Testing and Materials (ASTM) which serves as the international standard for jet fuel quality. Currently, SAF can be blended up to 50% with conventional fossil-derived kerosene according to standard ASTM D7566.
- 6.3.5 Alternatives such as Alcohol-to-Jet (AtJ) routes are currently expected to be more complex to develop, require more processing steps, and ultimately result in higher SAF production risks and costs. Gasification and FT routes offer stronger carbon intensity benefits when coupled with CCS when compared to AtJ routes.
- 6.3.6 The decision to use sustainably sourced biomass instead of waste as the primary feedstock for the SAF production was taken because it was

considered that the technology readiness level of homogenised biomass gasification is higher than it is for waste gasification. The Applicant is aware of a number of waste gasification projects that have run into operational difficulties due to the nature of the feedstock, and while The Applicant are confident that such issues can and will be addressed by the industry, this would risk being able to deliver a project at scale to help meet the UK Government SAF Mandate timescales.

- 6.3.7 Alternatives to on-site power and steam generation were considered and the electricity grid network operators were consulted about the availability of sufficient electrical capacity from the local and national distribution networks. The operators confirmed that insufficient capacity was available to support the Proposed Development within the timescales required. Alternative grid connection options have been and continue to be explored and optionality for use of such connections has been retained within the Proposed Development should viable options be identified. The use of on-site generation was therefore selected. Given the desire for that to also be low-carbon to help minimise the SAF carbon intensity, biomass was selected as the fuel for the CHP plant.
- 6.3.8 The Applicant is also currently exploring options with other local projects to potentially utilise green or blue hydrogen produced off-site within the operational production of SAF in the future. This opportunity recognises the prospects within surrounding hydrogen production and transport projects (both publicly announced and anticipated future projects) in proximity to the Proposed Development and would provide multiple wider benefits if implemented. However, the Proposed Development does not rely on other such projects being consented and implemented; any future utilisation of hydrogen in SAF production would not occur until post-2031 at the earliest.

6.4 [Location of the Proposed Development](#)

- 6.4.1 A primary consideration for the selection of a location for the Proposed Development was finding a site containing suitable characteristics to meet the requirements of the chosen technology.
- 6.4.2 The selected site needed to be in the UK in order to support the use of domestically produced SAF. The Site also needs to be located in an area suitable for the development of heavy industry, ideally on a brownfield plot with sufficient size for construction and operation of the required infrastructure, and with good potential access to utility connections including electricity, natural gas, industrial gases (oxygen and nitrogen), water (both for industrial and potable use) and a means of managing treated wastewater.

- 6.4.3 Given the use of sustainable biomass as the feedstock for the SAF production process, a site with direct marine access was strongly favoured in order to minimise the double handling of feedstock deliveries and to allow the Proposed Development to utilise both domestic and international supplies of suitable feedstock.
- 6.4.4 It was also preferable to locate the Proposed Development in close proximity to consented carbon dioxide transport and storage infrastructure as this would enable the carbon intensity of the produced SAF to be further reduced through carbon capture and storage.
- 6.4.5 The selected site also needed to be located away from residential receptors sensitive to air and noise emissions; minimises connection routes and located in an area with a suitably skilled workforce; and to not cause potential significant adverse effects on designated sites, habitats and species during construction or operation.
- 6.4.6 A review of potential industrial cluster locations where a potential future connection to carbon dioxide storage transport infrastructure could be made and which satisfied the other requirements above was therefore undertaken. This identified Teesside and the north west of England as the two industrial locations where Track 1 clusters had reached financial investment decision (East Coast Cluster and HyNet respectively). Of the two alternatives, the East Coast Cluster was identified as having the greater potential to be able to meet the carbon dioxide transport and storage capacity required for the Proposed Development within the proposed development timescales. On this basis Teesside was selected as the preferred regional location for the Site.
- 6.4.7 As the Track 1 process had already allocated capacity to a number of shortlisted projects in Teesside, no immediate capacity in the East Coast Cluster was available. Therefore it was recognised that the SAF production process would, at least initially, need to use sustainable feedstock that would only produce biogenic carbon dioxide since that carbon dioxide could be vented to atmosphere until capacity was available in the carbon transport and storage network. This therefore drove the choice of SAF production technology toward the use of biomass and/or waste feedstocks.
- 6.4.8 Rail access is desirable for feedstock import, but is less critical for the Proposed Development than marine access due to the sourcing and nature of the feedstock required and to avoid double handling of that feedstock. Given the choice of biomass and/or waste as feedstocks, the Proposed Development site requires access to a deep water port either on-site or close by, capable of handling large vessels for delivery of the necessary quantities of feedstock for the scale of SAF production proposed. As a side

benefit. the harbour facilities can also be used for the import of waste wood as a low carbon feedstock for the CHP plant.

- 6.4.9 Marine access, or proximity to existing commercial bulk liquids handlers (for pipeline export to their facilities for onward export by marine) is also preferred for export of SAF and renewable naphtha product.
- 6.4.10 In addition to import of feedstock, it is beneficial for marine infrastructure to be available to be utilised to facilitate deliveries of construction modules and abnormal loads during the development of the Site. This reduces the construction time and cost and also diverts abnormal loads from the public highway.
- 6.4.11 Use of brownfield land is also desirable to avoid development on previously undisturbed land and the site needed to be located away from receptors sensitive to air and noise emissions and near to suitably skilled employment.
- 6.4.12 Good road access is required irrespective of marine provision, due to the potential for material movements during construction and operation, and to facilitate site access for construction and operational staff.
- 6.4.13 All the above requirements are met by development of a site in Teesside.

6.5 [Alternative sites in Teesside](#)

- 6.5.1 Three alternative sites on Teesside have been considered as suitable potential locations for the Main Site of the Proposed Development:
- the former Air Products TV1/TV2 site in North Tees (“the Huntsman Drive site”) located to the southwest of the current Main Site of the Proposed Development - for which a DCO application was commenced, a Preliminary Environmental Information Report was prepared and Statutory Consultation undertaken;
 - another former industrial site in South Tees with access to marine infrastructure; and
 - the former INEOS site in North Tees which is proposed as the Main Site in this DCO application.
- 6.5.2 These are discussed in turn below.

[The Huntsman Drive site](#)

- 6.5.3 The Application for the Proposed Development replaces an application that was previously being progressed by Lighthouse Green Fuels Ltd. for a similar scale SAF development on a site off Huntsman Drive, Port Clarence, Stockton-on-Tees, TS2 1TT. The proposed development on the Huntsman

Drive site intended to use residual waste as the main feedstock, in the form of Refuse Derived Fuel (RDF).

- 6.5.4 The development of that site is no longer being progressed and that application (PINS Reference: EN010150) has been discontinued. This is because of the switch in principal feedstock for SAF production from RDF to sustainably sourced biomass (bearing in mind the issues of technology selection described above) and size restrictions on the Huntsman Drive site itself. It would not have been possible to carry out the full range of operations required for SAF production using biomass feedstock on the Huntsman Drive site. For example, it would have been necessary to use feedstock that had undergone the necessary pre-treatment processes off-site rather than being processed on the site, resulting in a requirement for double handling and transport of the feedstock.
- 6.5.5 In addition to size limitations, the Huntsman Drive site also does not have the benefit of direct access to a deep-water quay for delivery of pre-constructed equipment modules, other construction materials and import of feedstock. Instead, waterborne access for import of modular plant and construction materials would have had to use an existing quay located off-site and upstream of the Tees Transporter Bridge, and a new access for abnormal loads would have had to be created for road movements of these from the wharf to the Huntsman Drive site.
- 6.5.6 The quay was of insufficient size to accommodate the required ships suitable for import of feedstock to the Huntsman Drive site and, instead import of feedstock would have had to be by rail and road. This would have had the potential for operational impacts on the capacity of the rail freight handling facility and greater impacts on the capacity of the local road network in Seal Sands than alternative sites.
- 6.5.7 For these reasons, the Applicant searched identified two alternative sites in Teesside for consideration:
- a former industrial site in South Tees; and
 - the former INEOS Nitriles site in North Tees.

Former industrial site in South Tees

- 6.5.8 This former industrial site was initially considered large enough to accommodate all the elements of the proposed SAF plant and has direct access to an existing quay on the Tees Estuary which could potentially be used for import of both construction materials and feedstock. However, on more detailed review, there were a number of constraints identified which made this site unviable:

- Part of the site is subject to a recent and live planning permission for transportation, storage and export of mineral by ship using the existing quay. This use would overlap with the development and operation of the Proposed Development. There was therefore insufficient space known to be available for construction and operation of the Proposed Development at this site.
- The site has no access to third party liquids export infrastructure for export of finished products. Existing export facilities are located in North Tees and there is no viable route for developing a crossing under the Tees for such an export pipeline. Export facilities would therefore need to be created on the site, further conflicting with the existing planning permission and quay access for space.

6.5.9 Based on these constraints, this industrial site was therefore not selected for the location of the Proposed Development.

[The Proposed Development Site](#)

- 6.5.10 The chosen Site is well suited to the Proposed Development requirements, comprising an existing brownfield site in an industrial area 2.5 km from the nearest residential properties. The site has access to the River Tees to allow construction of a quay for import of modular plant and other materials during construction, and for import of feedstock during operations. It is also located in close proximity to bulk liquids handling infrastructure and associated marine infrastructure to which it can be connected by pipeline for the marine export of the produced low-carbon SAF and renewable naphtha. Low-carbon SAF and renewable naphtha can also be exported by road from the above facilities.
- 6.5.11 The Proposed Development site also has access to potential connections including natural gas, industrial gases, the electricity transmission network and water supply and discharge pipelines. There is also sufficient space on-site for an Air Separation Unit (ASU) for the supply of industrial gases to be developed should one be required. As such the site in Seal Sands was selected as the chosen site for the Proposed Development.
- 6.5.12 While the Site requires a new quay to be constructed and maintained within the Teesmouth and Cleveland Coast designated ecological site, for construction module and feedstock deliveries, the quay is a replacement of two existing and formerly operational jetties and would be developed within an existing modified part of the designated site that continues to be well used by operational industrial shipping alongside existing material loading and offloading operations. Careful design of the quay has been considered so as to minimise the effects of its construction and operation on the designated site and its qualifying species, as outlined in Section 6.7.

6.6 Alternative quay designs

6.6.1 A number of alternative options for the new quay have been identified and assessed, namely:

- suspended deck quay;
- combi wall quay;
- set back diaphragm wall; and
- set back combi wall.

The choice of a combi wall quay was made following a multi-criteria assessment which included a review of each alternative for constructability and associated environmental effects.

6.7 Summary

6.7.1 In summary, alternatives to the Proposed Development have been considered with regards to alternative sites, feedstock, process technologies and quay design.

6.7.2 The chosen Site at Seal Sands in North Tees is considered to offer a highly suitable location with good access to marine and road transport options during construction and operation. It also has good potential access to connections to electrical, natural gas, industrial gas and raw water supplies. Wastewater disposal and third party industrial gas supplies are available in South Tees but these can be connected to the site using a mixture of existing and newly constructed pipelines using existing infrastructure to cross under the River Tees.

6.7.3 The Site's location is also well placed to potentially connect in future to a carbon transport and storage network.

6.7.4 The choice of primary feedstock for SAF production has been considered against potential alternatives. The Applicant considers that sustainably sourced biomass provides the only commercially available solution at scale, with that feedstock able to be readily imported and/or sourced from the UK supply chain in the required quantities to meet the operational needs of the Proposed Development.

6.7.5 Additionally, the chosen gasification process can produce low-carbon SAF and renewable naphtha using fewer processing steps and more readily demonstrated technology at commercial scale than other technologies. This provides a commercially viable, ASTM certified production process, that offers a high level of technological readiness compared to alternative routes to SAF production.

References

- Ref 1 HM Government (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (EIA Regulations) (SI 2017 No. 572). Available online: <https://www.legislation.gov.uk/uksi/2017/572/contents> (Accessed June 2026)
- Ref 2 Department for Energy Security and Net Zero (2025) Overarching National Policy Statement for Energy (EN-1). Available online: <https://www.gov.uk/government/publications/overarching-national-policy-statement-for-energy-en-1-2025> (Accessed June 2026)
- Ref 3 HM Government (2017) Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017 (2000/60/EC). Available online: <https://www.legislation.gov.uk/uksi/2017/407> (Accessed June 2026)
- Ref 4 HM Government (2017) The Conservation of Habitats and Species Regulations 2017 (Habitats Regulations). Available online: <https://www.legislation.gov.uk/uksi/2017/1012/contents> (Accessed June 2026)
- Ref 5 Department for Transport (2022) Jet Zero Strategy – Delivering net zero aviation by 2050. Available online: <https://assets.publishing.service.gov.uk/media/62e931d48fa8f5033896888a/jet-zero-strategy.pdf> (Accessed June 2026)
- Ref 6 HM Government (2025) Sustainable Aviation Fuel (SAF) Mandate. Available online: <https://www.gov.uk/government/collections/sustainable-aviation-fuel-saf-mandate> (Accessed June 2026)



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