

# ENVIRONMENTAL STATEMENT (VOLUME II)

## Chapter 10 – Greenhouse Gas

### Padeswood Carbon Dioxide Spur Pipeline Proposed Development

Town and Country Planning Act 1990

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## 10. GREENHOUSE GAS

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### 10.1. INTRODUCTION

10.1.1. This Chapter reports the assessment of the likely significant effects of the Padeswood Spur Pipeline Proposed Development on greenhouse gases (GHG) and describes:

- Relevant, legislation, policy and guidance;
- Consultation undertaken;
- Assessment methodology;
- Baseline conditions
- Potential effects of the Construction, Operational and Decommissioning Stages of the Padeswood Spur Pipeline Proposed Development;
- Potential design, mitigation and enhancement measures;
- Residual effects; and
- Next steps.

10.1.2. This chapter (and its associated figures and appendices) is intended to be read as part of the wider Environmental Statement (ES).

### 10.2. LEGISLATIVE AND POLICY FRAMEWORK

10.2.1. A summary of the international, national, and local legislation, planning policy and guidance relevant to the GHG assessment for the Padeswood Spur Pipeline Proposed Development is set out below.

#### LEGISLATIVE FRAMEWORK

##### International

- United Nations Framework Convention on Climate Change (United Nations, 1992) – The UK is a member of the United Nations Framework Convention on Climate Change (UNFCCC) which drives international action on climate change. The UK has pledged to reduce emissions under the Paris Agreement, as a part of a joint pledge by members of the European Union (EU). This provides an overarching commitment by the UK.

##### National

- **Environment Act 2021** (UK Government, 2021) – The Act is the UK's new framework of environmental protection. The Act sets

out clear statutory targets for the recovery of the natural world in four priority areas and includes the requirement for the production of an Environmental Improvement Plan by the Secretary of State to significantly improve the natural environment. The targets are aligned with the government's Net Zero Strategy and will play a key role to play in reducing GHG emissions through actions to improve air quality as well as across the agriculture, waste and land-use and forestry sectors.

- Environment (Wales) Act 2016 (Welsh Government, Environment (Wales) Act, 2016); - The Act provides a framework to ensure that the management natural resources sustainably is at the core of decision-making in Wales. The Act places a duty on Welsh Ministers to set targets for reducing greenhouse emissions and to set carbon budgets.
- Climate Change Act 2008 (2050 Target Amendment) Order 2019 (UK Government, 2019) – The 2019 amendment to the Climate Change Act 2008 established a legal requirement for reaching net zero GHG emissions in the UK economy by 2050, which is reflected in the UK Net Zero Strategy. The 2008 Act also created the Committee on Climate Change, with a responsibility for:
  - Setting five-year carbon budgets;
  - Advising and scrutinising the UK Government's; associated climate change adaptation programmes; and
  - Producing a national adaptation plan for the UK Government to implement.
- **The Climate Change (Carbon Budgets) (Wales) Regulations 2018** (Welsh Government, 2018) – These Climate Change (Carbon Budgets) (Wales) Regulations set out the maximum net emissions in Wales for the periods 2016 to 2020 and 2021 to 2025, which are limited to an average of 23% and 33% lower than the baseline respectively.
- **The Carbon Budget Order 2021** (UK Government, 2021) – This Order set the sixth carbon budget to limit the net amount of GHG emissions that the UK can release to 965 MtCO<sub>2</sub>e during the five-year period from 2033 to 2037. The sixth carbon budget implies reducing GHG emissions by 78% by 2035 compared to 1990 levels.
- The Greenhouse Gas Emissions Trading Scheme Order 2020 (UK Government, 2020) – The Order establishes the UK Emissions Trading Scheme (UK ETS), which provides the continuity of

emissions trading for UK businesses following the UK's departure from the European Union in 2016.

- **The Town and Country Planning (Environmental Impact Assessment) Regulations (Wales) 2017** (Welsh Government, 2017) – The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (the TCPA EIA Regulations) set out the procedures to be followed in relation to environmental impact assessments linked to certain types of developments in Wales. The TCPA EIA Regulations requires the EIA process to identify, describe and assess the direct and indirect significant effects of a project on the climate. It also stipulates that the information to be included within the Environmental Statement should include where relevant “impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change”.

## POLICY

### National

- **Planning Policy Wales** (Welsh Government, 2024) – This policy sets out key principles to “ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales”:
  - Chapter 5: Productive and Enterprising Places – states that “in determining applications for the range of renewable and low carbon energy technologies, planning authorities should take into account:
    - the contribution to cutting greenhouse gas emissions”.
- **National Planning Policy Framework** (Department for Levelling Up, Housing & Communities, 2012, Updated 2025) – This policy sets out the core planning principle of supporting “the transition to a low carbon future in a changing climate...”:
  - Chapter 14: Meeting the Challenge of Climate Change, Flooding and Coastal Change – states that “new development should be planned in ways that:
    - (b) help to reduce GHG emissions, such as through its location, orientation and design”.
- **Infrastructure Carbon Review** (HM Treasury, 2013) – In 2013, the UK government published the Infrastructure Carbon Review,

aiming to “release the value of lower carbon solutions and to make carbon reduction part of the DNA of infrastructure in the UK.” The review provided increased emphasis on “capital carbon” (GHG emissions associated with raw materials, activities and transport for construction, repairs, replacement, refurbishment and de-construction of infrastructure) while acknowledging that “operational carbon” (associated with energy consumption for the operation and use of infrastructure) will continue to dominate overall emissions to 2050 and beyond. The Infrastructure Carbon Review highlighted the importance of assessing GHG emissions early in the lifecycle of an infrastructure scheme when there is the greatest carbon reduction potential.

- **Net Zero Strategy: Build Back Greener** (UK Government, 2021) – The UK’s Net Zero Strategy sets out the policies to decarbonise all sectors to meet the UK’s net zero target by 2050. Key GHG removals policies include deploying at least 5 MtCO<sub>2</sub>/year of engineered removals by 2030, developing markets and incentives for investment in greenhouse gas removal methods and launching a call for evidence exploring the role of the UK ETS as a potential long-term market for GGRs.

#### Local

- **Flintshire County Council - Environment and Sustainability Policy** (Flintshire County Council, Environment and Sustainability Policy) – This policy commits Flintshire County Council (FCC) to “reduce the Council’s negative impact on climate change through the implementation of various projects including a Carbon reduction Plan”.
- **Flintshire County Council – Climate Change Strategy 2022-2030** (Flintshire County Council, 2022) – This strategy sets out the key objectives and actions to reduce FCC’s direct carbon emissions as well as those of the wider county to achieve a net zero carbon Flintshire.

#### GUIDANCE

- Institute of Environmental Management and Assessment (IEMA) (2022) *Assessing Greenhouse Gas Emissions and Evaluating their Significance 2nd Edition* (IEMA, 2022);
- Publicly Available Specifications: 2080 Carbon management in Buildings and Infrastructure (2016) (hereafter referred to as PAS

2080) (BSI, PAS 2080: Carbon Management in Buildings and Infrastructure, 2023);

- Royal Institute of Chartered Surveyors (RICS) Whole life carbon assessment for the built environment 2nd Edition (RICS, 2023).
- ISO 50001 Energy Management (ISO)

### **10.3. SCOPING OPINION AND CONSULTATION**

#### RESPONSE TO THE SCOPING OPINION

- 10.3.1. An EIA Scoping Opinion was received by the Applicant from the Local Planning Authority (LPA) on 8 May 2024, including formal responses from Statutory Consultees. The responses from the LPA in relation to GHG and how these requirements should be addressed by the Applicant are set out in **Appendix 1.3 Scoping Opinion Responses (Volume III) (Document Reference: PW.3.3.1.3)**.

#### CONSULTATION UNDERTAKEN TO DATE

- 10.3.2. No consultation has been undertaken to inform the GHG assessment to date.

### **10.4. SCOPE OF THE ASSESSMENT**

- 10.4.1. The scope of this assessment has been established through an ongoing scoping process. Further information can be found in **Chapter 5: EIA Methodology (Document Reference:PW.3.2.5)** of this ES.

- 10.4.2. This section provides an update to the scope of the assessment and re-iterates the evidence base for scoping out elements following further iterative assessment.

#### ELEMENTS SCOPED OUT OF THE ASSESSMENT

- 10.4.3. The elements shown in **Table 10-1** are not considered to give rise to likely significant effects as a result of the Padeswood Spur Pipeline Proposed Development and have therefore not been considered within this assessment.

**Table 10.1 - Elements Scoped Out of the Assessment**

<b>Element Scoped Out<sup>1</sup></b>	<b>Stage</b>	<b>Justification</b>
Disposal of waste (A5)	Construction	Emissions from the disposal of waste are unlikely to be material due to a large proportion of the construction waste being inert.
Land use, land use change and forestry (A5)	Construction	Emissions from the disposal of biomass are not expected to be large as hedge and tree clearance will only be required at field boundaries.
Land use, land use change and forestry (B1)	Operation	The reduction in carbon sequestration is not considered to be large as hedge and tree clearance will only be required at field boundaries.
Maintenance, repair, replacement and refurbishment (B2-5)	Operation	No major maintenance, repair, refurbishment, or replacements are expected throughout the Padeswood Spur Pipeline Proposed Developments lifespan. Therefore, emissions are anticipated to be negligible.
Decommissioning process (C1)	Decommissioning	Emissions from energy consumption during the decommissioning process (e.g. decommissioning plant equipment use) are not considered to be large

<sup>1</sup> (as per the PAS2080 and BS EN 17472:2022 lifecycle stages) (BSI, PAS 2080: Carbon Management in Buildings and Infrastructure, 2023) (BSI, 2022)

Element Scoped Out <sup>1</sup>	Stage	Justification
		due to the expectation that the pipeline will remain in situ and decommissioning the Above Ground Installation (AGI) will not require large quantities of energy use.
Transport and disposal of waste (C2-4)	Decommissioning	Emissions from the transport and disposal of decommissioning waste materials are not considered to be large due to the expectation that the pipeline will remain in situ and small quantities of inert waste will arise from decommissioning the AGI.

## ELEMENTS SCOPED INTO THE ASSESSMENT

### Construction Stage

- Product stage (manufacture and transport of raw materials to suppliers) (A1-3).
- Transport of materials to site (A4).
- Plant and equipment use during construction (A5).
- Transport of waste from site (A5).

### Operation Stage

- Venting (B1).
- Fugitive gas emissions (B1).
- Operational energy use (B6).

### Captured emissions

- 10.4.4. The captured emissions from the entire Hynet network have been included in the assessment for context. This is because the Padeswood Spur Pipeline Proposed Development cannot function in isolation from the other wider Hynet network components.

However, the apportioned captured emissions as a result of the Padeswood Spur Pipeline Proposed Development have been presented for further detail.

## 10.5. ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

### STUDY AREA

10.5.1. The assessment of GHG is not restricted by geographical area but instead includes any increase or decrease in emissions as a result of the Padeswood Spur Pipeline Proposed Development, wherever that may be. This includes:

- **Construction emissions** from the Padeswood Spur Pipeline Proposed Development footprint but also relating to the transport of materials to and from site and their manufacture. This may be distant from the Padeswood Spur Pipeline Proposed Development location, for example, GHG emissions associated with the manufacture of steel in terms of embodied carbon and energy in the production process.
- **Operational emissions** (increase or reduction) which result from the end-use of the Padeswood Spur Pipeline Proposed Development. In this case, GHG emissions include on-site energy use, venting, fugitive gas emissions.
- **Captured emissions**

### METHOD OF BASELINE DATA COLLECTION

#### Site Visits and Surveys

10.5.2. For this assessment, no site visits or surveys were required.

### IMPACT ASSESSMENT METHODOLOGY

10.5.3. The assessment approach considers the likely magnitude of GHG emissions (or captured emissions) in comparison to the baseline scenario without the Padeswood Spur Pipeline Proposed Development.

10.5.4. Where data was available, GHG emissions have been quantified using the methodologies described below. Please refer to the assumption and limitations in **paragraph 10.5.16** for further information. Where data was unavailable, the impact on GHG emissions was assessed qualitatively using professional judgement and experience on projects of a similar nature and scale.

### Calculation of GHG Emissions

Product stage (manufacture and transport of raw materials to suppliers) (A1-3)

- 10.5.5. To quantify the product stage emissions of construction materials, data (for example the type and quantity of materials) was sourced from the Applicant. The quantity of materials was multiplied by emissions factor data, sourced from ICE v3.0 (ICE, 2019).

Transport of materials to site (A4)

- 10.5.6. To estimate the emissions associated with transporting materials and waste during construction, the expected mass of materials and waste were multiplied by transport distance assumptions provided by RICS (RICS, 2023), resulting in tonne kilometres. The tonne kilometres were then multiplied by an appropriate Department for Energy Security and Net Zero (DESNZ) (DESNZ, Greenhouse Gas Reporting: Conversion Factors 2023, 2023) emission factor.

Plant and equipment use during construction (A5)

- 10.5.7. To quantify the emissions associated with plant and equipment during construction, typical plant data (for example the type and quantity of fuel to be used) was sourced from the Applicant. The estimated quantities of fuel used during the construction were multiplied by an appropriate DESNZ emission factor (DESNZ, Greenhouse Gas Reporting: Conversion Factors 2023, 2023).

Operational energy use (B6)

- 10.5.8. To estimate the emissions associated with operational electricity use of the Padeswood Spur Pipeline Proposed Development, the expected electricity consumption was multiplied by the DESNZ Greenbook grid decarbonisation forecasts (DESNZ, 2023).

- 10.5.9. Quantities of diesel expected to be used have been estimated based on the figures for the Hynet Main Onshore Carbon Dioxide Pipeline DCO (PINS Reference: EN070007) as this is an expected source of emissions during the use-phase. It is assumed that this diesel will be used by maintenance and inspection vehicles and occasional diesel generators for any unplanned maintenance works.

Venting and Fugitive Gas emissions (B1)

- 10.5.10. To quantify the GHG emissions associated with venting of the Padeswood Spur Pipeline Proposed Development, the estimated

volume of CO<sub>2</sub> to be vented from each source was sourced from the Applicant.

- 10.5.11. To quantify fugitive gas emissions associated with the operation of the Padeswood Spur Pipeline Proposed Development, the number of flanged connections and valves at the AGIs and hours of operation was multiplied by an appropriate emission factor published by the American Petroleum Institute (API) (API, 2021).

Captured Emissions (D)

- 10.5.12. The captured emissions (from the entire Hynet network) were provided by Liverpool Bay CCS Ltd. As the captured emissions from the Padeswood Carbon Capture Storage (CCS) Project will be transported along the Padeswood Spur Pipeline Proposed Development, the apportioned captured emissions for the Padeswood Spur Pipeline Proposed Development have been sourced from Chapter 7, Volume 2, of the proposed Padeswood Carbon Capture and Storage (CCS) Project (DNS Reference: CAS-02009-W1R1Z7).

#### SIGNIFICANCE CRITERIA

- 10.5.13. There are currently no thresholds for what level of GHG emissions is considered significant for EIA. The significance of GHG emissions is assigned with reference to the magnitude of emissions, their context on the UK's trajectory towards net zero, guidance from IEMA (IEMA, 2022) and the use of professional judgement.
- 10.5.14. As climate change impacts are global in nature, it is not possible to link a specific project with a specific environmental impact. Recently published guidance from IEMA (IEMA, 2022) sets out five distinct levels of significance based on the GHG emissions relative contribution towards achieving a science-based 1.5 °C aligned transition towards net zero by 2050. The UK carbon budgets are outlined in (**Table 10-2**) and Wales carbon budgets (**Table 10-3**).

**Table 10.2 - National Carbon Budgets Set by the UK Government (MtCO<sub>2</sub>e) (Committee on Climate Change, 2021)**

Carbon budget period	UK carbon budget
Third: 2018-2022	2,544 MtCO <sub>2</sub> e
Fourth: 2023-2027	1,950 MtCO <sub>2</sub> e
Fifth: 2028-2032	1,725 MtCO <sub>2</sub> e
Sixth: 2033-2037	965 MtCO <sub>2</sub> e

**Table 10.3 - Wales Carbon Budgets Set by the Welsh Government (Welsh Government, 2021)**

Carbon budget period	Wales carbon budget
2021-2025	37% average reduction against 1990 baseline
2026-2030	58% average reduction against 1990 baseline

10.5.15.

The following terms are used to define the significance of the effects identified as set out in IEMA guidance (IEMA, 2022):

- **Major adverse (significant):** the GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy and does not make a meaningful contribution to the UK's trajectory towards net zero;
- **Moderate adverse (significant):** the GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but will not fully contribute to decarbonisation in line with local and national policy goals, falling short of fully contributing to the UK's trajectory towards net zero;
- **Minor adverse:** the GHG impacts are fully consistent with applicable existing and emerging policy requirements and good practice design standards, fully in line with measures necessary to achieve the UK's trajectory towards net zero;
- **Negligible:** the GHG impacts are reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050; and

- **Beneficial (significant):** the net GHG impacts are well below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline, substantially exceeding net zero requirements with a positive climate impact.

## ASSUMPTIONS AND LIMITATIONS

10.5.16. To ensure transparency, the following limitations and assumptions have been identified:

- Where specific material data was not available an appropriate emissions factor has been selected based on professional judgement.
- The transportation of materials and waste to and from Site (for example, the source of materials and destination of waste) has been taken from RICS assumptions for transportation scenarios (RICS, 2023)
- Professional judgement and guidance from IEMA have been used to assess significance.
- It is assumed that all the design elements of the Padeswood Spur Pipeline Proposed Development have a design life of 25 years.
- GHG emissions from construction plant have been calculated based on data sourced from the Applicant covering the main types of plant to be used.
- A worst-case scenario has been assumed for the fuel type used for construction plant.
- A worst-case scenario has been assumed for the embodied carbon of the copper cables.
- A worst-case scenario has been assumed for steel.
- Material specification of 70 % polyethylene and 30 % glass fibre has been assumed for the fibre optic cables and 57 % copper and 43 % PVC for copper cables with PVC sheaths.
- The emissions over the 25-year Operation and Maintenance Stage were calculated using the following assumptions:
  - For the venting (B1), the conversion of Nm<sup>3</sup> to kg for CO<sub>2</sub> used is at 0°C and 1 atmosphere pressure.
  - Vented gas and fugitive gas emissions are assumed to be 100 % CO<sub>2</sub>.

- A reasonable worst-case scenario has been assumed for the frequency of pigging to clean and maintain the pipeline (four pig trap volumes every two years).
- A worst-case scenario has been assumed for the frequency of AGI manifold venting (every five years).
- The design team confirmed the material and fuel quantities as a result of the addition of the trenchless crossing at Foundry Drain was minimal and as such has not been considered in this assessment.

## BASELINE CONDITIONS

- 10.5.17. In the baseline (Do Minimum) scenario, GHG emissions occur constantly and widely as a result of natural and human activity, including land use and land use change, transport, energy consumption (e.g. fossil fuels for purchased energy from the grid and / or other sources) and industrial processes.
- 10.5.18. The GHG assessment will only consider instances in which the Padeswood Spur Pipeline Proposed Development results in additional or captured emissions in comparison to the baseline scenario and the Padeswood Spur Pipeline Proposed Development's assumed evolution. The baseline conditions therefore focus on those sources of emissions subject to change between the baseline scenario and the scenarios that include the Padeswood Spur Pipeline Proposed Development.

### EXISTING BASELINE

- 10.5.19. The baseline scenario involves no construction activities and therefore the construction baseline is zero emissions. The operational baseline is also zero emissions as there are no operational activities currently on-site.

### FUTURE BASELINE

- 10.5.1. The future baseline scenario for the Padeswood Spur Pipeline Proposed Development involves no construction activities and therefore the construction baseline is zero emissions. The operational baseline is also zero emissions as there are no operational activities currently on-site.

## **10.6. SENSITIVE RECEPTORS**

- 10.6.1. As climate change impacts are global in nature, no local sensitive receptors have been identified in relation to GHG emissions. The

assessment considers increases in or captured GHG emissions in relation to the global atmosphere, which is the only identified sensitive receptor.

## **10.7. DESIGN DEVELOPMENT, IMPACT AVOIDANCE AND EMBEDDED MITIGATION**

10.7.1. The following embedded mitigation has been agreed to increase energy efficiency during the operation of the Padeswood Spur Pipeline Proposed Development, reducing GHG emissions associated with operational energy use:

- Use of high efficiency transformers;
- Use of light-emitting diode (LED) based illumination systems instead of traditional lights (such as high-pressure sodium vapor (HPS) and fluorescent lights) for both outdoor and indoor areas;
- Low-voltage electrical installations will comply with IEC60364, Part 8-1: Energy Efficiency; and
- Integrate in the existing energy monitoring system the CCS new facilities to comply with ISO 50001 certification.

10.7.2. The Padeswood Spur Proposed Development will implement a leak detection and maintenance programme to mitigate potential leaks from the system.

10.7.3. The Padeswood Spur Proposed Development has been designed to capture GHG emissions which are estimated to exceed the GHG emissions generated during construction and operation, mitigating its overall impact.

## **10.8. ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS**

10.8.1. This section details the assessment of predicted impacts and effects for the Padeswood Spur Pipeline Proposed Development during the Construction and Operational Stages.

### **CONSTRUCTION STAGE**

10.8.2. The likely significant effects for GHG associated with the Construction Stage are set out below.

10.8.3. The total estimated GHG emissions arising from the product stage (A1-3), transport of materials to Site (A4), transport of waste from Site (A5) and construction plant and equipment use (A5) have been quantified as outlined in the **Section 10.6** and are presented in **Table**

10-4, Table 10-5, Table 10-6 and Table 10-7 respectively. Please note that these may contain rounding discrepancies.

10.8.4. The total GHG emissions arising from product stage (A1-3), transport of materials to Site (A4), transport of waste from Site (A5) and construction plant and equipment use (A5) for the construction of the Padeswood Spur Pipeline Proposed Development are estimated to be approximately 19,320 tCO<sub>2</sub>e.

**Table 10.4 - Estimated Product Stage Emissions (A1-3)**

Material	Product Stage (tCO <sub>2</sub> e)
Steel	5,326
Concrete	326
FBE	171
Aggregate	76
Sand and Sand/Cement Mix	46
Power Cable - Copper	28
Instrumentation Cable	17
Paint	4
Polyethylene	4
Glass	1
<b>Total</b>	<b>5,999</b>

10.8.5. The highest hotspot in A1-A3 is emissions from steel. This is predominantly from the steel needed for the pipeline itself with secondary impacts from piping and valves.

**Table 10.5 - Estimated Emissions for the Transport of Materials to Site (A4)**

Material	Transport to Site (tCO <sub>2</sub> e)
Aggregate	91
Sand and Sand/Cement Mix	45
Steel	40

Material	Transport to Site (tCO2e)
Concrete	9
FBE	0.7
Power Cable - Copper	0.5
Instrumentation Cable	0.5
Paint	0.2
Polyethylene	0.1
Glass	<0.1
Total	186

**Table 10.6 - Estimated Emissions for the Transport of Waste from Site (A5)**

Material	Transport from Site (tCO2e)
Aggregate	11
Concrete	2
Excavated Materials (Earthworks)	1
Plastic Consumables	<0.1
Timber	<0.1
Steel	<0.1
Hazardous Waste	<0.1
Cable - Copper w/PVC Sheath	<0.1
Organic Waste	0
Total	15

**Table 10.7 - Estimated Plant and Equipment Use Emissions During Construction (A5)**

Plant Type	Total (tCO <sub>2</sub> e)
Construction Plant and Equipment	13,121
<b>Total</b>	<b>13,121</b>

10.8.6. Based on the results presented in **Table 10-4, Table 10-5, Table 10-6, and Table 10-7** the magnitude of GHG emissions from the product stage (A1-3), transport of materials (A4), construction plant and equipment use (A5) and transport of waste (A5) for the Padeswood Spur Pipeline Proposed Development predicted to have a **Minor Adverse (Significant) effect** (outlined in **paragraph 10.5.15**).

**OPERATIONAL STAGE**

10.8.7. The likely significant effects for GHG associated with the Operational Stage are set out below.

10.8.8. The total estimated GHG emissions arising from venting (B1), fugitive gas emissions (B1), operation energy use (B6) and captured emissions have been quantified as outlined in the **Section 10.6** and are presented in **Table 10-8, Table 10-9, Table 10-10 and Table 10-11** respectively. Please note that these may contain rounding discrepancies.

10.8.9. The total GHG emissions arising from venting (B1), fugitive gas emissions (B1) and operation energy use (B6) during the operation of the Padeswood Spur Pipeline Proposed Development are estimated to be approximately **1,032 tCO<sub>2</sub>e**.

10.8.10. Complete data on fugitive gas emissions was not available due to their unintentional nature, making them difficult to estimate. Fugitive emissions from the AGIs have been assessed quantitatively. There is also the potential for fugitive gas emissions to arise from various valves, flanges, seals and other equipment that could leak. However, GHG emissions from these sources are expected to be minimal and are not expected to materially affect the outcome of this assessment.

**Table 10.8 - Estimated Emissions from Venting (B1) Over 25-Year Lifetime**

Venting type	Vented Emissions (tCO2e)
Padeswood AGI manifold maintenance	6
Padeswood AGI pigging operation	23
Northop Hall AGI manifold maintenance	6
Northop Hall pigging operation	45
<b>Total</b>	<b>80</b>

**Table 10.9 - Estimated Fugitive Gas Emissions from the AGIs (B1) Over 25-Year Lifetime**

Source	Fugitive Gas Emissions (tCO2e)
Valves	515
Flanged Connections	48
<b>Total</b>	<b>562</b>

**Table 10.10 - Estimated Emissions from Operational Energy Use (B6) Over 25-Year Lifetime**

Energy Source	Energy Use (tCO2e)
Diesel	47
Electricity	343
<b>Total</b>	<b>390</b>

- 10.8.11. Based on the results presented in **Table 10-8, Table 10-9 and Table 10-10** the magnitude of GHG emissions from venting (B1), fugitive gas emissions (B1) and operation energy use (B6) as a result of the operation of the Padeswood Spur Pipeline Proposed Development are predicted to have a **Minor adverse (not significant) effect**.
- 10.8.12. With reference to paragraph **10.4.4, Table 10-11** below outlines the emissions captured from the whole of the Hynet network over 25 years and the apportioned captured emissions for the Padeswood CCS Project and Padeswood Spur Pipeline Proposed Development.

**Table 10.11 - Estimated Captured Emissions (D) Over 25-Year Lifetime**

Item	Total (tCO <sub>2</sub> )
CO <sub>2</sub> Captured Emissions from the Padeswood CCS Project	-14,983,000
CO <sub>2</sub> Captured Emissions – Project wide	-110,250,000

10.8.13. As a result of captured emissions(D), the Padeswood Spur Pipeline Proposed Development is expected to result in a **Beneficial (Significant) effect**.

## **10.9. MITIGATION AND ENHANCEMENT MEASURES**

10.9.1. This Section sets out the preliminary avoidance, mitigation and compensation measures which are likely to be required to address the significant effects as assessed in **Section 10-8**.

10.9.2. The magnitude of GHG emissions associated with the design and Construction Stage of the Padeswood Spur Pipeline Proposed Development can be minimised by, amongst others:

- Design optimisation to reflect the carbon reduction hierarchy (detailed below and found in clause 6.1.4 of PAS 2080 (BSI, 2023)):
  - Reduce the elements required for the Padeswood Spur Pipeline Proposed Development.
  - Reduce the requirement for construction materials.
  - Substitute-in and use alternative raw materials and resources (for example, procuring steel with a higher-than-average recycled content (UK steel is typically 50-60 % recycled content)). Given the large quantity of steel required from the Padeswood Spur Pipeline Proposed Development, there is the opportunity to work with partners to catalyse change to low carbon steel beyond this Project.
  - Use efficient construction processes, such as embracing design for manufacture and assembly.
- Maximising the opportunity to use more sustainable materials by specifying in tender documentation that materials and products with reduced embodied carbon emissions and materials/resources featuring recycled content (where safe and of sufficient integrity for engineering), eventually supported with eco- and carbon labels or verified Environmental Product Declarations (EPD), are preferred.

- Using locally sourced materials and local waste disposal facilities where available and practicable to minimise the distance materials are transported from source to Site and from Site to disposal.
- Avoid disposal of construction waste to landfill, maximising recycling, and reuse of waste where possible.
- Using more modern and efficient low emission construction plant and delivery vehicles, and/or those powered by electricity from alternative/lower carbon fuels. The Construction Contractor should ensure high performance of plant and equipment through correct and efficient operation, maintenance, and servicing of vehicle fleet to avoid polluting emissions.
- The Construction Contractor should have training policies and management protocols in place to avoid idling of engines, spills of fuels (for example, when refuelling) and safe/environmentally sensitive driving techniques to maximise fuel saving.
- Consider using suppliers and companies in the supply chain that have strong environmental, social and governance (ESG) ratings and possibly certifications that enhance their sustainability performance.
- Using innovative construction methods (for example, optimising gradients of haul and access roads/points) to reduce plant use and minimise the need for sharp acceleration and braking to save fuel.

10.9.3. The magnitude of GHG emissions associated with the eventual operation of the Padeswood Spur Pipeline Proposed Development can be minimised by, amongst others:

- Designing, specifying, and constructing the Padeswood Spur Pipeline Proposed Development with a view to maximising the operational lifespan.
- Specifying efficient mechanical and electrical equipment that is long-lasting and based on its durability, repairability and energy efficiency credentials.
- Minimising the requirement for venting where safe and practicable.

## **10.10. MONITORING**

10.10.1. No operational monitoring is proposed in relation to the GHG assessment.

## **10.11. RESIDUAL EFFECTS**

10.11.1. Table 10-13 below summarises the residual effects associated with the Padeswood Spur Pipeline Proposed Development during the Construction and Operation Stages.

## **10.12. IN-COMBINATION CLIMATE IMPACTS**

Anthropogenic GHG emissions are contributing to global warming and therefore anything that increases or decreases GHG emissions is inherently linked to climate change. No In-Combination climate impacts have been identified.

**Table 10.12 - Summary of Residual Effects**

Receptor	Pre-mitigation significance of effects	Mitigation measure	Residual effect
<b>Construction</b>			
Construction Stage GHG emissions	<i>Minor Adverse (Significant)</i>	Construction emissions could be minimised though design optimisation to reflect the carbon reduction hierarchy as well as other measures detailed in <b>Section 10.9</b> .	<i>Minor Adverse (not significant)</i>
<b>Operation</b>			
Operational Stage GHG emissions	<p><i>Minor adverse (not significant) for the operation of the Padeswood Spur Pipeline Proposed Development alone.</i></p> <p><i>Beneficial (Significant) when including the emissions captured from the plants that feed into the Carbon Dioxide Pipeline system as part of the Project.</i></p>	Operational emissions could be minimised by specifying high efficiency mechanical and electrical equipment and operating, maintaining, and refurbishing the Padeswood Spur Pipeline Proposed Development using best practices in energy efficiency and low carbon energy sources as well as other measures detailed in <b>Section 10.9</b> .	<p><i>Minor adverse (not significant) for the operation of the Padeswood Spur Pipeline Proposed Development alone.</i></p> <p><i>Beneficial (Significant) including the emissions captured from the plants that feed into the Carbon Dioxide Pipeline system as part of the Project.</i></p>

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