APPENDIX 4.3
UPDATED ENERGY POLICY COMPLIANCE REPORT

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Energy Policy Compliance Report - Updated

Herbata Data Centre Campus

Naas, County Kildare
June 20, 2025
Document Number: 10360452-HDR-XX-XX-RP-ZZ-000003

Status: Issue for planning

Prepared By: Robert Thorogood HDR

Edited By: Robert Thorogood HDR

Authorized By: Ulrich Groenewald HDR

Contents

Tables

Figures

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Forward

This report is an updated version of the Energy Policy Compliance Report submitted to Kildare County Council (KCC) as part of the application for planning permission (Register Reference 24/60787) for the proposed Herbata Ltd data centre campus (the Proposed Development) at Jigginstown near Naas, Co. Kildare.

HDR was commissioned by Herbata Ltd to undertake an assessment of the Proposed Development against Ireland's current national, and local energy, climate, and planning policies.

Following the submission of the application for planning permission, KCC has issued a Request for Further Information (RFI), which includes a number of queries relating to Energy Policy.

As part of its response to the RFI; Herbata Ltd has refined and enhanced the Proposed Development (as set out in detail in Section 2 of the *Response to Request for Further Information Report*, prepared by RPS, and has asked HDR to prepared this updated *Energy Policy Compliance Report* to reflect those enhancements and refinements, and to inform Herbata Ltd's response to the KCC RFI.

1 Executive Summary

This report considers the relevant energy policies in Ireland, and the compliance requirements relevant to the Proposed Development, and sets out how the Proposed Development aligns with and supports the relevant national and local policies.

This is an updated version of the Energy Policy Compliance Report submitted to Kildare County Council (KCC) as part of the application for planning permission, and has been updated to reflect the refinements and enhancements made to the Proposed Development in response to the KCC RFI, and to inform the applicant's response to Items 1 and 3 of the KCC RFI, which response is set out in more detail Section 2 of the *Response to Request for Further Information Report,* prepared by RPS.

1. In that regard, as set out in detail in Section 2 of the *Response to Request for Further Information Report* in response to the RFI the applicant has refined and enhanced the proposals to *inter alia*:

    - Increase the utilisation of renewable energy sources from the outset of operations from a minimum of 30% as per the planning application proposals to at least 50% as set out in this report and in the documents submitted as part of the RFI Response;

    - Utilisation of Combined Cycle Gas Turbines (CCGT) instead of Open Cycle Gas Turbines (OCGT) to provide for up to 50% of the energy required to power the data centres. The use of CCGT will improve the efficiency of the electricity generated on site from circa 30.8% to near 45% thereby reducing required gas consumption by 978 GWh per annum at full operating condition and a consequent reduction of 552,000 tonnes in greenhouse gas emissions; and

    - Modify the design of proposed Data Hall 4 to avoid all direct impacts on the previously unrecorded sub-surface archaeological remains.

These refinements and enhancements are considered in this updated Energy Policy Compliance Report, which forms part of the Applicant's response to RFI Items 1 and 3 and should be read in conjunction with the RFI Response Report contained at Sections 4.1 and 4.3 respectively of the *Response to Request for Further Information Report,* prepared by RPS,, and with the other documents submitted as part of the response to the KCC RFI:

RFI Item No. 1

RFI Item No. 1 raised by KCC is as follows:

"*Policy RE P12 of the Kildare County Development Plan 2023-2029 seeks to ensure that economic and enterprise related development is provided in a manner which facilitates a reduction in greenhouse gas emissions and accelerates the transition towards a sustainable, low carbon and circular economy. Furthermore, Policy RE P11 and Policy EC P18 seeks to support the accommodation of Data Centres at appropriate locations in line with the objectives of the National Planning Framework and the principles for Sustainable Data Centre Development of the Government*

Statement on the Role of Data Centres in Ireland's Enterprise Strategy (July 2022) subject to appropriate Transport, Energy and Environmental Assessments and all relevant planning conditions.

The Data Centre development as proposed would result in the emission of 28.6 million tCO2e (tonnes of carbon dioxide equivalent) during its lifetime which represents c. 49.35% of the Sectoral Emissions Ceiling for the entire Commercial Built Environment Sector to 2030. This level of emission is considered to be excessive for one development and would have wider implications for the sector to remain within its emission ceiling, with a consequent negative impact on climate change. The proposed development, as proposed, would run counter to the provisions of National Policy as set out in Ireland's Integrated National Energy and Climate Plan 2021-2030 and in the Government Statement on the Role of Data Centres in Irelands Enterprise Strategy 2022, both of which require decarbonisation through emissions reduction/removal and design. The development would therefore be contrary to Policy REP12, RE P11 and EC P18 of the Kildare County Development Plan 2023-2029, would set an undesirable precedent for similar developments of this nature and would be contrary to the proper planning and sustainable development of the area.

The Applicant is requested to comment."

Response to RFI Item No. 1

Greenhouse Gas Emissions

As discussed in detail in section 6 below, the Greenhouse Gas Emissions assessment has been updated in this *Updated Energy Policy Compliance Report* to reflect the enhancements and refinements made to the Proposed Development in response to the KCC RFI, and to inform Herbata's response to Item No.1 and Item No. 3 of the KCC RFI.

In that regard, as discussed in section 6 below, the GHG emissions cited within Table 16.7 of the EIAR submitted with the application for planning permission and quoted in RFI item No. 1 (namely lifetime emissions of 28.6 million tCO_2e of carbon dioxide equivalent*)* is based on a theoretical and highly conservative worst-case scenario consisting of the following elements:

- Direct emissions from construction of the data centre building: 211,936 tonnes GHG
- Direct unregulated emissions from the operational phase: 14,933,067 tonnes GHG
- Direct regulated/battery emissions from the operational phase: 324,240 tonnes GHG
- Indirect emissions from embodied carbon in the server manufacture: 13,177,597 tonnes GHG

Were such a quantum of emissions to be projected to arise over an assumed 50-year lifetime of the construction and operation of this data centre it would rightly be of concern. However, there are a number of reasons why this level of GHG emissions presented in the EIAR (hereafter "EIAR Worst Case Scenario") is highly conservative and is not a realistic assessment of the likely GHG emissions arising from the proposed development, including:

- The figure of 28.6 million tCO_2e set out in the EIAR is calculated over an assumed 50-year lifetime, which is based on the standard timeframe for carbon life cycle assessment. On review of other consented data centres in Ireland, the typical operational lifetime of such operations is up to 20 years. A calculation over a realistic 20-year timeframe results in lifetime emissions of circa 11.6 million tCO_2e, illustrating that the data presented in Chapter 16 of the EIAR is based on a significantly over-estimated timeframe and is therefore not a realistic estimate of the likely lifetime emissions of the proposed development. This is further discussed, and a more realistic assessment of likely lifetime carbon emissions is presented, in section 6 below and in the the EIAR Addendum to Chapter 16 Climate Change submitted as part of the response to the KCC RFI.
- The direct emissions from the operation of the data centre presented in the EIAR assumed that there would be no decarbonisation of the gas network and excluded a number of commitments presented in the original *Energy Policy Compliance Report* submitted with the application for planning permission (which commitments all form an integral part of the proposed development) to present a highly conservative worst case assessment of operational direct emissions which did not reflect the actual likely emissions arising from the proposed development. This is further discussed in section 6 below.
- The assessment of indirect emissions from embodied carbon in the manufacture of servers that will be used in the operation of the data centres is inherently speculative given there is a level of unknown in relation to the server choices that will ultimately be made by the tenants of the data centres, and the assessment presented in the EIAR assumed the highest possible embodied carbon in the production of the servers, and the highest frequency of server replacement, to present a highly conservative worst-case assessment of indirect emissions. However, this assessment set out in the EIAR did not take account of the obligations placed on the tenants of the Data Centres by the Carbon Neutral Data Centre Pact, which will lead to a significant reduction in the likely embodied carbon arising from the manufacture of servers as set out in section 6 below.

As set out in detail in section 6 below:

- A comparison of the Likely Emissions Scenario for the direct operational emissions relative to the EIAR Worst Case Scenario demonstrates an **85% reduction** in emissions though a combination of (i) the energy commitments already set out as part of the application for permission which were not fully reflected in the assessments set out in the EIAR, and (ii) further enhancements made in response to the KCC RFI (see 4.1 in the *Response to Request for Further Information Report,* prepared by RPS, and section 6 below);
- A comparison of the Likely Emissions Scenario for the indirect emissions from embodied carbon in the servers relative to the EIAR Worst Case Scenario shows an **62% reduction** in emissions as a result of the obligations placed on the tenants of the Data Centre arising from the Climate Neutral Data Centre Pact (see section 6 below);
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- There is an overall net reduction in emissions in the order of **84%** compared to that presented in the EIAR, based on the assumed 50-year lifespan set out in the EIAR (see section 6 below);
- A review of the direct operational emissions relative to the appropriate emissions ceiling, shows that the reduced operational emissions equate to **1.78%** of the relevant Sectoral Emissions Ceiling, and not 49.3% as originally set out in the EIAR and as quoted in RFI Item 1 (see section 6 below); and
- A further reduction in lifetime emissions from the Likely Emissions Scenario of the order of **39%** when a more realistic lifespan of 20 years is considered (see section 6 below).

For further detail please see the enclosed:

Energy Strategy Report prepared by BOS Energy Ltd; (see Section 4.2 of the *Response to Request for Further Information Report,* prepared by RPS)

Planning Report Addendum prepared by RPS; (see Section 3 of the *Response to Request for Further Information Report*, prepared by RPS*)*

EIAR Addendum Chapter 16 Climate Change; and

The use of more energy efficient CCGT has necessitated minor revisions to the proposed site layout and is shown, in particular, in the following drawings:

Proposed Site Layout showing amended DC 04 prepared by HDR; and

Combined Cycle Gas System Compound Section prepared by HDR.

RFI Item No. 3

RFI Item No. 1 raised by KCC states:
"*Natural gas is a fossil fuel. The energy supply to serve the proposed development, as proposed, is largely fossil fuel driven. Notwithstanding the national target of decarbonising gas supply by 2050 and to produce 5.7TWh of biomethane by 2030, it is considered that the volume of biomethane required to serve the fully operational proposal would be c.50% of the national target which is considered to be unsustainable. The proposed gas fueled electricity generation will allow the proposed data centre to be an independent Operator, outside of the National Grid and, to this end, it is an example of an "islanded" Data Centre, not connected to the grid and powered mainly by on site fossil fuel generation. Such developments as identified in the Government Statement on the Role of Data Centres in Irelands Enterprise Strategy 2022, run counter to emissions reduction objectives and would not serve the wider efficiency and decarbonisation of our energy system and could result in the security of supply risk being transferred from electricity to gas supply, which would be a significant challenge given Ireland's reliance on gas importation.*

In this regard, having regard to the lack of significant on site renewable energy to power the development, the reliance on gas powered turbines to provide energy to the development and the lack of detailed evidence for Corporate Power Purchase Agreements, the proposed "islanded" Data Centre would be contrary to the provisions of Policy RE P11 and EC P 18 of the Kildare County Development Plan 2023-2029 which support the accommodation of Data Centres in line with, inter alia, the Government Statement on the Role of Data Centres in Irelands Enterprise Strategy 2022, would set a precedent for similar proposals of this nature and would therefore be contrary to the proper planning and sustainable development of the area.

The Applicant is requested to comment."

Response to RFI Item No. 3

Item No. 3 raises several points in regard to the proposed energy supply, which can be summarised as follows;

1. The proposed energy supply including the proposed use of biomethane;
2. Consideration of the Proposed Development as an "Islanded" Data Centre;
3. Certainty of delivery of CPPAs; and
4. Compliance with the *Kildare County Development Plan 2023-2029* - Policy RE P11 and Policy EC P18 and the *Government Statement on the Role of Data Centres in Irelands Enterprise Strategy 2022*. – see Section 4 of this Report for detailed responses by policy.

The proposed energy supply for the Proposed Development is not fossil fuel driven. From the commencement of operation, it is proposed that a minimum of 50% of the operational energy demands of the Proposed Development will be supplied from renewables through CPPAs. It is projected by 2039 the Proposed Development would operate at Net Zero Carbon.

In addition:

- With respect to the use of biomethane, the Proposed Development will consume less than 3% of the national biomethane target in 2030. Herbata have commenced discussions with biomethane producers and intend to put in place agreements akin to a CPPA to source such biomethane.
- The Proposed Development will be connected to the national electricity grid and therefore cannot be considered an "Islanded" Data Centre. This connection is fundamental to the procurement of CPPAs and to support the grid as an Autoproducer.
- Herbata Limited have commenced the process of securing CPPAs and there is c. 6,000MW of wind and solar projects with planning consent in place but which have not proceeded to construction and are potentially open to entering into CPPAs with Herbata following the granting of planning permission to the Proposed Development.

Further details can be found in the full response to RFI Item No. 3 provided by RPS and included at Section 4.3 in the *Response to Request for Further Information Report* prepared by RPS.

2 Introduction

HDR was commissioned by Herbata Ltd to undertake a review of the Proposed Development against Ireland's current national, regional, and local energy, climate, and planning policies, including government policy in relation to data centre developments. This was set out in the Energy Policy Compliance Report submitted with the Application for Planning Permission.

As mentioned above, this Updated Energy Policy Compliance Report has been prepared as part of the applicant's response to the KC RFI, to reflect the refinements and enhancements made to the Proposed Development in response to the KCC RFI, and to inform the applicant's response to Items 1 and 3 of the KCC RFI, which response is set out in more detail in Sections 4.1 and 4.3 respectively of the *Response to Request for Further Information Report,* prepared by RPS.

The Proposed Development is part of an overall data centre development which includes two main elements, namely:

a) The Proposed Development, which as mentioned above is the subject of the application for planning permission to Kildare County Council; and,

b) A proposed grid substation and 110kV transmission connection which are the subject of a separate application to An Bord Pleanála for approval under section 182A of the Planning and Development Act 2000 (as amended) (the Substation Application).

The Proposed Development and the Substation Application together constitute the "Project" for the purposes of Environmental Impact Assessment. The likely significant impacts of the Project on the environment, including on climate change, have been considered and assessed in the Environmental Impact Assessment Report submitted with the application for planning permission, and in the Addenda to Chapters 8 (Air Quality), 9 (Noise and Vibration) and 16 (Climate Change) of the EIAR submitted as part of the Response to the KCC RFI. Chapter 16 (Climate Change) of the EIAR submitted with the application for planning permission, and the Addendum to Chapter 16 of the EIAR submitted as part of the response to the KCC RFI, both concluded that the whole life greenhouse gas emissions from the Project are not likely to have a significant effect on climate.

Further, the manner in which the Proposed Development complies with and supports national, regional, and local planning policy is set out in the *Planning Report* submitted with the application for planning permission, and further updated in Sections 3 and 4 of the *Addendum to the Planning Report* and in the *Addenda to (Noise and Vibration) and 16 (Climate Change)* of the *EIAR* submitted as part of the response to the KCC RFI, which both conclude that the Proposed Development aligns with national, regional and local policy.

This report draws on the matters considered and assessed in those documents and sets out how the Proposed Development, and in particular the energy strategy developed to supply the power demands of the data centres, and incorporating the refinements and enhancements made in response to the RFI (as set out in more detail in Sections 4.1 and 4.3 of the *Response to Request for Further Information Report,* prepared by RPS, and the Addendum to Chapter 4, in particular Section

4.2.4 of the *EIAR* and align**s** with and supports national, regional, and local climate, energy, and planning policies, including those specific to data centre development in Ireland. In that regard, this report should be read in conjunction with sections 3, 4.1 and 4.3 of the *Response to Request for Further Information Report*, and section 3 of the *Addendum to the Planning Report*, both prepared by RPS.

It is recognized that that these policies have evolved in recent years, reflecting the need to reduce greenhouse gas emissions and decarbonise our energy system. This report describes in section 3 below the nature of the Proposed Development, its location, key elements and building arrangement, and describes in sections 5 and 6 below the changes that have been made in response to the KCC RFI. The report then sets out in section 3 below how the Proposed Development will be supported in terms of how its energy requirements will be met (through on-site generation and supply from the electricity grid via CPPAs), and (in section 6 below) how the energy strategy developed complies with and supports the relevant national and local policies and objectives.

Respecting the desire to manage energy demand and meet the energy demand with as much energy as possible from zero carbon sources and low carbon sources, the following key strategies have been developed and implemented as an integral part of the energy strategy for the Proposed Development:

- Adopt highly efficient cooling systems by the use of direct air and exhaust arrangements for each data centre building topped up with adiabatic elements for peak summer conditions.
- Provide high quantities of water storage, sufficient for a whole year or more, collected from rainwater only (not from mains water), to provide for the few weeks a year when the adiabatic cooling top up is needed. This has the benefit of not impacting the local area in terms of water demand and keeps the power demand to reasonable levels.
- A commitment to meet and exceed Kildare County Council's policy of a minimum of 30% of the operational energy demand of the data centres being met by renewable sources, by using Corporate Power Purchase Agreements (CPPAs) from wind and solar farm projects located within Ireland, supplemented by using on-site solar arrays, to supply a minimum of 50% of the operational energy demands of the data centres from renewable sources. This is discussed in more detail in section 6 below, and in section 4.3 of the RFI Response Report and section 5 of the BOS Energy Report submitted as part of the response to the KCC RFI at 4.3. This is a significant increase from the commitment made in the original application for planning permission to supply 30% of the operational energy demands of the data centres from renewable sources.
- The remaining 50% of the operational energy demands of the data centres is to be generated on-site using highly efficient gas turbines adjacent to each data centre building. As discussed in section 3 below, in response to the KCC RFI it is now proposed to use Combined Cycle Gas Turbines (CCGT) instead of Open Cycle Gas Turbines (OCGT). The use of CCGT will improve the efficiency of the electricity generated on site from circa 30.8% to near 45% thereby reducing required gas consumption by 978 GWh per annum at full operating condition and a consequent reduction of 552,000 tonnes in greenhouse gas emissions. The gas turbines will be

linked directly to BESSs located at each data centre building. This arrangement significantly reduces losses normally found in the transmission of power by ensuring that the energy required is generated at point of use, enabling the electricity generated from gas turbines to be stored and used on-site. Natural gas is considered a transitional fuel by the EU and one of the stated objectives of the Directive of the European Parliament and of the Council on common rules for the internal markets for renewable gas, natural gas and hydrogen, amending Directive (EU) 2023/1791 and repealing Directive 2009/73/EC (recast), which was adopted by the Council on 21 May 2024, is to ensure a gradual phase-out of natural gas, while noting that natural gas still plays a key role in energy supply. Gas Networks Ireland (GNI), Ireland's gas network operator, is working towards the decarbonisation of the gas network by replacing natural gas with renewable gases, such as biomethane and green hydrogen, with a goal of ultimately reducing to zero dependency on fossil fuel gasses by 2050. To support the decarbonisation of the gas network, a biomethane injection point is included as part of Gas Networks Ireland equipment which will be installed on the site as part of the Proposed Development.

- Each of the data centre building's gas turbines will have the capacity to produce electricity in excess of the 50% of the energy demand of the data centres which is proposed to be met from this energy source. The BESS units will be charged from this excess electricity generated by the gas turbines, meaning that the Proposed Development (i) will be able to feed excess electricity back into the Irish electricity grid (ii) and provide frequency stability support to the grid.

The combination of all the above strategies is both forward looking and in compliance with Ireland's current climate, energy, and planning policies. These strategies and how they align with, and support Ireland's current climate, energy, and planning policies are discussed further in the body of this report.

3 Nature of the Development

3.1 Site Location

The site is located approximately 2.5 km to the west of Naas town centre in County Kildare, 33 kilometers to the west of Dublin and 20km from Kildare Town. The travel time from Dublin city centre takes an estimated 45min and from Dublin Airport approximately 40-45 minutes. The site address is Jigginstown, Naas, Co Kildare, Ireland (Lat. 53°13'07'' N / Long. 6°42'00'' W) and is shown in *Figure **3-1*** below.

Figure 3-1. Site Location

Area the subject of the Substation Application to An Bord Pleanála

Area the subject of this application for planning permission to Kildare County Council

The site is 'green field' and has a gentle slope from North to South. The entire site measures 37.5ha (92.9 acres).

The Northern site boundary measures approximately 730m and runs along the regional R409 road which provides access to the site. This road starts in Naas and travels northwest to end at the intersection with the R403 road. There is a small area of farmland located at the north-east part of the site in the triangle formed between the M7 motorway and the R409. The boundary between the site and this small triangular area of farmland is formed by a line of scattered trees. The western site boundary measures approximately 380m and it is formed by a line of trees and hedges. To the East the site is facing the M7 Motorway, positioned between Junctions 9a and 10, with a line of trees and hedges located along the boundary. This eastern site boundary measures approximately 630m.

Since 1st December 2021 this site is zoned in the Naas Local Area Plan 2021-2027 for specific use as a Data Centre P (1).

The lands are located between the existing ‘M7 Business Park’ and ‘Osberstown Business Park’. The Osberstown Wastewater Treatment Plant is located nearby to the north. The site is bounded to the east by the M7 motorway and to the west by agricultural lands. The ‘Newhall Retail Park’ is located to the south of the site, on the east side of the M7 motorway. There has been significant development in the locality in recent years, particularly light industry, logistics and services.

The site is currently in agricultural use and comprises a number of fields which are bounded by hedgerows. There is a cluster of farm buildings located within the site, accessed from the R409.

The proposed substation will be located to the North-West of the site as indicated on Figure 3-1 above. As mentioned above, the substation is not part of the Proposed Development, but is the subject of the Substation Application to An Bord Pleanála. The Proposed Development and the Substation Application together constitute the “Project” for the purposes of Environmental Impact Assessment.

3.2 Proposed Development

The planning application, **Reg. Ref. 24/60787**, is for the development of a Data Centre in the townlands of Halverstown, Jigginstown and Newhall at Naas, County Kildare.

The Data Centre application includes the provision of:

- 6 no. data centre buildings (DCBs);
- Administration / management and water treatment building;
- Incoming gas supply compounds, including a gas injection point and fuel storage facilities;
- District heating facilities; and
- Car parking, security building, landscaping, and all associated site works.

The site will have a secure boundary with security for the entire site including a transportation lock and rejection facility.

There are various ancillary buildings to be provided as part of the Proposed Development which include those dealing with incoming gas supplies from GNI using Above Ground Infrastructure (AGI) compounds as well as electrical and heat connections for the campus together with workshops and facilities for campus personnel.

Further, to the North-West of the site as indicated on Figure 3-2 below, a newly constructed substation will be provided, operated by EirGrid, to provide power connectivity for the Proposed Development. As mentioned above, the substation is not part of the Proposed Development, but is the subject of the Substation Application to An Bord Pleanála. The Proposed Development and the Substation Application together constitute the "Project" for the purposes of Environmental Impact Assessment

During construction, it is expected that operatives and managers will number up to 1100 people on site dependent on the construction schedule and phasing. Once constructed, it is expected that employment will come from both direct and indirect forms e.g., from 3rd party providers for ICT technicians to facilities maintenance engineers and general services.

Proposed Development Enhancements

As set out in detail in Sections 2, 4.1 and 4.3 of the *Response to Request for Further Information Report,* prepared by RPS*,* and the Addendum to Chapter 4 of the EIAR, in responding to the KCC RFI it is proposed to enhance the energy efficiency of the proposed development while maintaining the key elements described in the submitted planning application documentation. The proposed Data Centre continues to comprise 6 no. two storey Data Centre buildings, an administration/management building, car parking, landscaping, energy infrastructure and other associated works.

The applicant has refined and further enhanced the proposals to inter alia:

- Increase the utilisation of renewable energy sources from the outset of operations from a minimum of 30% as per the planning application proposals to at least 50% as set out in the enclosed RFI response documents;
- Utilisation of CCGT to provide for up to 50% of the energy required. The use of CCGT instead of OCGT will improve the efficiency of the electricity generated on site from circa 30.8% to near 45% thereby reducing required

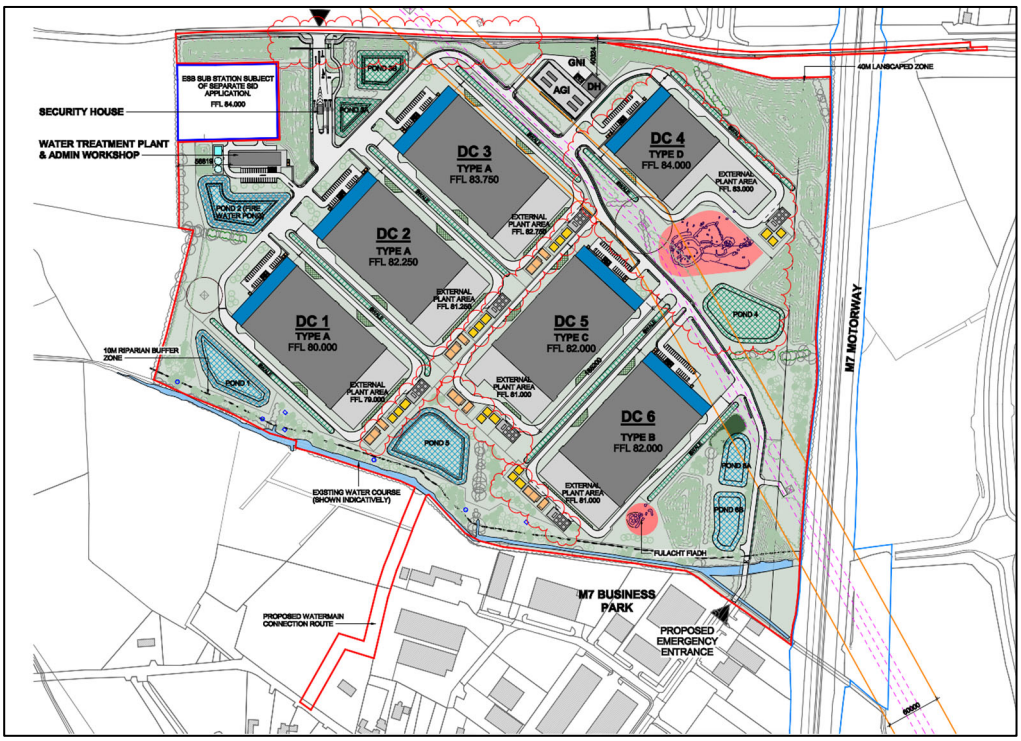
gas consumption by 978 GWh per annum at full operating condition, and a consequent reduction of 552,000 tonnes in greenhouse gas emissions; and

- Modify the design of proposed Data Hall 4 to avoid all direct impacts on the previously unrecorded sub-surface archaeological remains.

These enhancements are described in greater detail in section 2 of the enclosed *Planning Report Addendum* and section 2 of the enclosed *Response to Request for Further Information Report* and in the Addendum to Chapter 4 of the *EIAR* submitted as part of the response to the KCC RFI.

The updated proposed site layout including changes to Data Hall 4 and the CCGT infrastructure is shown in Figure 3-2 below.

Figure 3-2. Proposed Site Plan (22217-RKD-ZZ-ZZ-DR-A-1010-OVERALL PROPOSED SITE PLAN)
Source: RKD Architecture



Reference should be made to key sections of the *EIAR*, in particular Chapter 16 (Climate Change) of the *EIAR* submitted with the application for planning permission, and the Addendum to Chapter 16 of the *EIAR* submitted as part of the response to the KCC RFI and Sections 4.1 and 4.3 of the *Response to Request for Further Information* for further detail of the energy enhancements and their positive impacts.

3.3 Sources of Energy

Power Generation

The Proposed Development's primary sources of power will be a combination of off-site renewable energy (sourced via new Commercial Power Purchase Agreement or CPPAs) providing for at least 50% of the operational energy demands of the data centres, supplemented by high efficiency on-site generation. The on-site generation of electricity will primarily use Combined Cycle Gas Turbines (CCGTs) to provide for up to 50% of the energy required, supplemented by back-up Open Cycle Gas

Turbines (OCGTs) and smaller reciprocating engines (for load stepping). During the first few years of operation, energy sources will be used in a hierarchical manner as shown below, with the top of the listing the most preferred:

1. Renewable energy sourced via CPPAs using the grid connection (to provide at least 50% from CPPAs in line with the commitment to do so and as will be required by the planning condition proposed and discussed further in the section titled "Sources of Energy" below);

and, for the remainder of the operational energy demands of the Project:-

2. On-site CCGTs
3. On-site OCGTs
4. Reciprocating Engines

This arrangement is consistent with recent the European Union's (EU) direction (the Hydrogen and Decarbonised Gas Market Package, discussed further in section 4.2 below) and Irish Government direction on the use of gas for generation as a transitional fuel. The on-site generation, which will be connected to the electricity grid as an Autoproducer, is also consistent with the CRU's policy position from November 2021, supported by EirGrid and the CRU's programme of work in September 2021 that discusses the delivery of *"over 2,000 MW of enduring flexible gas fired generation capacity by 2030"* see link below:

https://cruie-live-96ca64acab2247eca8a850a7e54b-5b34f62.divio-media.com/documents/CRU202317_Electricity_Security_of_Supply_Programme_of_Work_Update_February_2023.pdf.

It also means that the Proposed Development will not add any additional demands to the electricity grid and allows for any excess power generated on-site to be exported to the grid. The on-site electricity generation capacity will be in excess of that required for the operation of the data centres (namely up to 50% of its overall energy demand which will be met from this source) and will provide an opportunity for the export of electricity to the grid to participate in the wholesale electricity market if and when required. More importantly to the data centre operator who is always concerned with security of supply of electricity and it being resilient, is that if the electricity grid fails or if there is insufficient electricity available on the grid to power the data centre, then the excess on-site generation capacity can be used in these occasional times of need. This is also in line with the draft LEU (Large Energy User) Connection Policy published by the CRU, which says:

> *"Data centres connecting to the electricity network will be required to provide dispatchable onsite or proximate generation and/or storage capacity which matches their MIC (subject to derating requirements), with this generation required to participate in the wholesale electricity market."*

The gas turbines will be able to provide the full MIC of 100MW either using the available gas supply, or under the very rare conditions of a gas network supply failure, to then run on fuel (HVO or diesel) that has been stored on site. It is a requirement as an Autoproducer to have sufficient storage to provide these obligations for Security of Supply.

Sources of Energy

The primary sources of energy will be off-site renewable energy from renewable generators (sourced via CPPAs) and gas from the Irish gas network which will provide the primary energy supply to the gas turbines at each data centre building. As noted above, at least 50% of the operational energy demands of the data centres will be supplied by off-site renewable energy sources via CPPAs, with the remainder of the operational energy demands generated on-site.

Due to the quantum of energy that will be consumed, the project will be considered a Large Energy User and therefore be required to comply with the earlier mentioned draft LEU Connection Policy, which is currently in draft form. Details of the Proposed Development's compliance with the draft LEU Connection Policy are discussed further in section 4.3 below, and contained in BOS Energy Ltd's Herbata *Energy Strategy Report* included at section 3, also referenced in section 4.3.1.1 titled Proposed Energy Supply of the Response to Request for Further Information Document prepared by RPS..

For the renewable energy supplies, Herbata will enter into CPPAs with new, additional renewable generators gradually over a period of 8 years, sourcing 21MW of wind energy and 42MW of solar energy each time, up to a maximum of 168MW of wind energy and 336MW of solar energy. The mix of energy source types is deliberate in order to achieve a good overlap and target as close as reasonably possible to 24/7 coverage, given that most data centre loads are fairly flat and constant throughout the year.

As discussed further below, Herbata are proposing that a condition be attached to any grant of planning permission requiring that the necessary CPPAs be secured in advance of the proposed development becoming operational.

For the gas supply, GNI is the system operator of the gas network and currently transports gas mainly imported from the UK derived from the UK's or Norway's North Sea gas fields. GNI have clearly stated that it intends to decarbonise the gas network by 2050 by incorporating a series of changes, which in summary are:

- Introduction of bio-methane from agricultural sources injected into different parts of the gas network, primarily at high usage sites. GNI are already arranging for high usage sites to have bio-methane injection points and a bio-methane injection point is included within this Project's design.
- Introduction of a 20% hydrogen mix with natural gas and bio-methane. This will gradually increase over time, but tests and introduction of hydrogen in parts of the network have already started. As set out in detail in section 6 below, from 2039 100% hydrogen gas will be available through the GNI network to power the Proposed Development.

The use of gas supplied through the GNI network will therefore lead to a significant reduction in the carbon footprint of the power generated on site over the next 20-30 years, as a result of the ongoing decarbonisation of the GNI network.

In response to Further Information Request Item No. 2 (see section 4.2 of the *Response to Request for Further Information Report,* prepared by RPS), a letter from GNI is included at Appendix A to the RFI Response Report which confirms that dialogue has been ongoing with GNI, that an application for gas connection to the site has been received and furthermore, that initial high-level modelling undertaken in 2022 confirmed that there was sufficient capacity within the GNI transmission

network to accommodate the forecasted demands of the Proposed Development, and that a preliminary high-level connection solution for the proposed development had been identified.

Battery Energy Storage System (BESS)

Turbines operate at Medium Voltage (MV) level and are coupled with Battery Energy Storage Systems (BESS) to provide low emission 365/24/7 support to critical loads. Each of the BESS units are independent of each other but will link to the load point to provide support in the event of a short disconnection. There is also the opportunity to allow export of excess power to the grid.

For the purposes of providing uninterrupted and conditioned power, each data centre building will have a dedicated BESS. This system will consist of individual modules connected in parallel, with the total quantity of modules for each building as required to match the load of the data centre. These modules will be housed in outdoor-rated enclosures and will be located in each building's exterior plant compound. The BESS will consist of rack mounted lithium iron phosphate battery modules connected to a DC bus. Rectification from AC to DC is achieved via an input inverter and conversion back to AC is achieved via an output inverter.

The inverters are contained within the BESS enclosures. Each BESS enclosure contains its own dedicated cooling and fire protection systems. The Proposed Development includes a significant energy storage component. An energy storage unit for each data centre building (six in total) is proposed. The storage capacity provides a backup energy source and in addition adds resilience to the wider grid, having the capacity to provide immediate export of energy to the national grid, or the capacity to import and store excess electricity generated externally, if required.

Electrical Grid Connection

An electrical grid substation is proposed to be located on site and will be formed from breaking into and partially undergrounding EirGrid's existing 110kV overhead lines that currently cross the site. A full 8-bay EirGrid standard GIS substation will allow connectivity to the data centre campus for both import and export of electricity. The substation will also allow for development outside of the site by third parties to be enabled by including spare 110kV circuits which can be made available for other development if required.

The provision of the substation is crucial to the Proposed Development for multiple reasons, in summary they are:

1) To allow 100% renewable energy sourced through CPPAs to be delivered to the site.
2) As an Autoproducer, it enables the export of energy generated on-site to the grid.
3) To enable the energy storage facility to be connected to the grid and provide the ability to aid frequency stability of the grid.
4) To allow import and storage of electricity from the grid when available, particularly during periods where there is an over-supply of renewable energy on the grid.

As noted above, the GIS substation and partial undergrounding of EirGrid's 110kV overhead lines will be subject of a separate Strategic Infrastructure Development (SID) application to An Bord Pleanála for approval under section 182A of the Planning and Development Act 2000 (as amended), as it involves changes to

electricity transmission (the Substation Application). It should be noted that the Proposed Development and the Substation Application together constitute the "Project" for the purposes of the Environmental Impact Assessment, and have been considered and assessment in the Environmental Impact Assessment Report submitted with the application for planning permission.

There is a 220kV overhead line also crosses the site. It is not proposed to make any alteration to the 220kV line, and the Project will not impact the line.

Heat Recovery and District Heating

Each of the data centre buildings will have either two or three CCGTs all with waste heat thermal boilers installed within their exhaust flues to recover the medium to high grade heat from the turbines. Normally the heat will be taken to a steam turbine to allow additional electricity capacity to be generated, lifting the overall efficiency of the CCGTs to around 44%.

As an alternative to the heat being used to run the steam turbines, the heat can be used to supply an off-site district heating system. DC05 (constructed in Phase 3) has been identified to allow heat from 2 of its turbines to be used for district heating. Each turbine has a nominal electrical output rating of 7MWe, the available maximum heat output is assumed at over 10MWth per turbine, with a total capacity of at least 20MWth possible when both turbines are available and running. Both turbines will be prioritized in terms of running whenever possible.

The heat from the thermal boilers will then be pumped via heat exchangers to the perimeter of the data centre campus to be connected to district heating pipework.

For the purpose of this Updated Energy Policy Compliance Report it is assumed that the average electrical load of the site associated with ICT (information and communications technology) and cooling, when fully operational, is likely to max out at 230MW, however typically data centres don't achieve 100% utilization of the power, more normally they max out at 70-80% so in this case with all phases completed an annual power demand from the on-site generation of around 100MW is anticipated. It is acknowledged that this load is unlikely to be present on the first operational day, with a phased approach being employed by the data centre developer, and on-site power generation will be ramped-up in tandem, in accordance with the draft LEU Connection Policy. This will have to be considered in any detailed district heating assessment.

Having established the quantum and form of the heat that can be made available to the local area, a heat mapping assessment included within HDR's District Heat Report submitted with the application for planning permission has been developed to identify where the heat could be best used in: existing facilities; significant facilities that have recently received planning; and areas of development that would benefit from using a connection to a district heating system.

Renewable Energy Sources

Herbata will seek to contract 21MW of Wind and 42MW of Solar per individual Data Hall, entering CPPAs in advance of construction which it anticipates will be each year for 8 years. This totals 168MW of Wind and 336MW of Solar.

There exists currently in excess of 6,000MW of assets with planning permission in place which have not yet been constructed, and the volume of renewable energy

required to supply the data centres represents less than 10% of this market. Further, there are many more assets in the planning pipeline in addition to that 6,000MW figure. Therefore, the requirement to source a minimum of 50% of the data centre's energy demand from renewable sources via CPPAs is eminently achievable in the current market.

Entering into a CPPA is the final and critical phase before the construction of renewable generating assets. Herbata Ltd's CPPAs will be completed in line with project financing and immediately prior to project construction. Parties will only enter into a CPPA when all commercial terms are agreed and both the generating asset and the offtaker project are sufficiently well advanced. As such, the CPPAs will only commence once both parties have all the necessary consents and permits to allow them to construct, which includes planning, grid connection and lender finance.

Herbata Ltd has engaged with various developers throughout Ireland, who are supportive on entering a CPPA arrangement should planning be granted. These developers, nearly all outside of Kildare, have a pipeline of projects progressing through the various stages of development and grid connection and have expressed a strong willingness to engage in CPPA negotiations with Herbata. Once certainty of demand is confirmed then legal engagement will commence to ensure CPPAs are in place in advance of energy needs for the operation of the data centres.

Herbata proposes that Kildare County Council attach a condition to any grant of permission for the Proposed Development requiring the CPPAs to be secured in advance of the proposed development becoming operational. Wording for such a condition is provided below:

"Prior to the commencement of the operation of the development, the applicant shall submit for the written agreement of the Planning Authority details of one or more Corporate Purchase Power Agreements that the developer has entered into which demonstrates that at least 50% of the energy consumed by the development on site is matched by new renewable energy generation in line with the Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy.

REASON: In the interests of sustainable development."

4 National & Local Climate, Energy and Planning Policy

There is a cascading of policy on climate change and the need for decarbonisation of energy from a global level down to the local level. These are examined and discussed below.

4.1 Climate Policy and Decarbonisation of Energy

With Ireland being a member state of the European Union (EU), reference is needed to the commitments that the EU has made on behalf of all its member states. The key agreement is the Paris Agreement, referred to as COP21 (Conference of the Parties), which came into force in November 2016 and is a legally binding international treaty on climate change. The EU's response manifested itself into a comprehensive package of policy initiatives in the form of the European Green Deal in December 2019 which is designed to set the EU on a path to a green transition with the ultimate goal of achieving "Climate Neutrality" by 2050.

The key objective of COP21 is to ensure that "*the increase in the global average temperature to (kept) well below 2°C above pre-industrial levels*" and to pursue efforts "*to limit the temperature increase to 1.5°C above pre-industrial levels*".

Information on COP21 and its implementation by the EU can be found in the links below including the European Green Deal.

https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en#:~:text=The%20EU%20aims%20to%20be,AgreementEN%E2%80%A2%E2%80%A2%E2%80%A2

https://ec.europa.eu/clima/policies/strategies/2050_en

https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

Since COP21, the EU has also had to consider the role of natural gas until its use is phased out by the end of 2050. In May 2024 the Council adopted a regulation and a directive establishing common internal market rules for renewable and natural gases and hydrogen and reforming the existing EU gas legislation (the Hydrogen and Decarbonised Gas Market Package). The Hydrogen and Decarbonised Gas Market Package recognises the transitional role of natural gas which will gradually be phased out.

https://www.consilium.europa.eu/en/press/press-releases/2024/05/21/fit-for-55-council-signs-off-on-gas-and-hydrogen-market-package

This is an important Directive, for Ireland in particular, as it recognises that power generation can, for the time being, be gas based whilst infrastructure is being put in place to decarbonise both the gas supply and electricity supply networks.

4.2 National Policy

As part of the Clean Energy Package (2019), each EU member state is required to provide a 10-year *National Energy and Climate Plan* (NECP), which is assessed as to

how its goals and objectives are likely to fit with, inter alia, the commitments made by the EU pursuant to the Paris Agreement. This is an ongoing process and Ireland produced its first draft NECP in 2021

In 2021, following the Climate Action and Low Carbon Development (Amendment) Act 2021, the Irish Government published the Climate Action Plan 2021 to show how it could significantly reduce its Greenhouse Gas (GHG) emissions by 2030 and be net zero by 2050, as stated in the Government's opening statement, as quoted below:

"The Climate Action Plan 2021 provides a detailed plan for taking decisive action to achieve a 51% reduction in overall greenhouse gas emissions by 2030 and setting us on a path to reach net-zero emissions by no later than 2050, as committed to in the Programme for Government and set out in the Climate Act 2021."

The full version of the Climate Action Plan 2021, 2023, 2024, & the most recent approved Climate Action Plan being the *Climate Action Plan 2025*, can be found in the links below:

https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/
https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

https://www.gov.ie/en/publication/79659-climate-action-plan-2024/

https://www.gov.ie/en/department-of-the-environment-climate-and-communications/publications/climate-action-plan-2025/

Of relevance in these plans is the break-down of energy usage by sector, analysis of each sector and the targets set out to be achieved at a national level by each sector. Data centres are mentioned due to the likely growth in the sector and the need to decarbonise new and existing energy demand from these facilities. Within the *Climate Action Plan 2021*, the Government advised that it would be reviewing the data centre industry as a whole, this is now captured in the *Climate Action Plan 2025*.

The provisions of the *Climate Action Plan 2024* and the *Climate Action Plan 2025* are considered in more detail in Chapter 16 (Climate) of the *EIAR* and in the *EIAR* Addendum to Chapter 16 Climate Change respectively, which also set out how the Competent Authority, in granting planning permission for the proposed development, will be performing its functions, insofar as practicable, in a manner consistent with the most recent approved Climate Action Plan (being CAP25, which must be read in conjunction with CAP24) and the other matters specified in section 15 of the *Climate Action and Low Carbon Development Act 2015* (as amended).

This is intended to facilitate a focus on the delivery of outstanding actions from CAP24 and high-impact legacy actions from CAP23.

CAP25 presents the national carbon budgets and the sectoral emissions ceilings established by the government in July 2022, and commits the Climate Change Advisory Council (CCAC) to the following action:

"GV/25/2 Update sectoral emissions ceilings for the second carbon budget period (2026-2030)"

CAP25 reports that there has been a reduction in electricity generation emissions in 2023 of 22% (based on the 2021 emissions) (against a 3% increase in electricity demand). This is due, in part, to an increase in the share of renewable electricity generation, from 38.6% in 2022 to 40.7% in 2023, with targets to achieve 50% (in 2025) and 80% (in 2030) renewables. A renewables-led system is at the core of

Ireland's plan to radically reduce emissions in the electricity sector, protect energy security, and ensure economic competitiveness.

There are no specific actions in CAP25 relating specifically to the development of data centres, but regarding the demand management of Large Energy Users (LEU) (such as data centres as noted in the 'National Planning Framework', refer Section 3.2), CAP25 states that:

"A review of the Large Energy Users Connection Policy is ongoing and will ensure that new Large Energy User grid connections do not contribute to energy security challenges and that the power system decarbonises new demand in line with climate targets. A final decision is expected in 2025.

Recommendations for an Enhanced Electricity Emissions Reporting Framework for Large Energy Users is due to be published in late 2024, while actions under Powering Prosperity and the NEDS will contribute to developing a plan-led, spatial approach to facilitate the co-location of future renewable electricity supply and large-scale energy demand".

Supporting the Government and advising on progress against the Climate Action Plan up to and including 2025, is the Sustainable Energy Authority of Ireland (SEAI). SEAI have published many important reports on energy use and climate change, providing factual support and analysis. A key report was published by SEAI in 2022 which identified trends and achievements against targets within the Climate Action Plan 2021 for each sector and for each energy production type. For reference, data centres are considered as part of "electrical sector" in this report aligned with other facilities in Ireland of the same type. The full 2023 report published in 2024 is included in the link below and identifies progress against the Government energy policy to date.

https://www.seai.ie/publications/Energy-in-Ireland-2023.pdf

The Irish Government has also published a review of the role of data centres in Ireland, titled the "*Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy*". The statement clearly recognizes the need for the digital economy and all that it brings to the overall Irish economy, and acknowledges that data centres are core digital infrastructure and play an indispensable role in our economy and society, but at the same time recognises the need for decarbonisation of the energy system in order to achieve the targets set out in the Climate Action Plan 2021 (which was the most recent Climate Action Plan at that time). This document sits alongside EirGrid's document titled "*Shaping our Electricity Future*" (of which there are two iterations- see links below) which explicitly caters for significant increases in electricity demand (30-50%) up to 2030 whilst also providing for a power system which can deliver a substantial increase in RES-E (annual electricity from renewable energy sources) power systems by 2030. Within Ireland's 10-year NECP 2021-2031, a target is included for RES-E of 70% however since 2021, Ireland's Climate Action Plan has included a target to increase the share of electricity generated from renewable sources up to 80% in 2030 (see link below). Ireland achieved 40% RES-E in 2020.

https://www.eirgrid.ie/shaping-our-electricity-future

https://www.seai.ie/about/irelands-energy-targets/#:~:text=The%20renewable%20electricity%20target%20is,the%20coming%20decade%20and%20beyond.

These objectives of the provision of digital infrastructure and increasing electricity from renewable energy sources had not until recently been considered alongside each other to the degree that they both must be addressed. The first paragraph from the Government statement, repeated below, summarises what the data centre industry is now faced with:

> *"Government policy seeks to enable the 'twin transitions' of digitalization and decarbonization of our economy and society. These transitions can - and must be - complementary. For this to happen, digital and climate change policies need to move in tandem and this Statement sets out how this will be achieved in respect of data centres."*

The full statement can be found in the link below:

https://enterprise.gov.ie/en/publications/publication-files/government-statement-on-the-role-of-data-centres-in-irelands-enterprise-strategy.pdf

Within the Government's statement are six "Principles for Sustainable Data Centre Development", which the Government has agreed should inform and guide decisions on future data centre development, those six principles are: -

Economic Impact

Grid Capacity and Efficiency

Renewables Additionality

Co-Location or Proximity with Future-Proof Energy Supply

Decarbonised Data Centres by Design

SME Access and Community Benefits

Section 5.1 of this report sets out how the Proposed Development is fully consistent with each of these six guiding principles.

4.3 Electricity and Gas Policy

In response to national policy on energy, climate change and sustainability, the Commission for Regulation of Utilities (CRU) and both the electricity and gas system operators (SOs) have all published documents on their strategies for responding to the need to decarbonise the energy sector. These are summarized below:

The CRU

The CRU is Ireland's independent energy and water regulator and has responsibility for economic regulation and customer protection in the energy and water sectors and regulation of energy safety. Further information can be found at:

Energy | CRU.ie

The CRU have been highly focused on the capacity issues in the electricity market and now also the gas market. This is partially as a result of increasing demand by data centres and new facilities moving towards electrifying their activities, examples including using electric vehicles and heat pumps. In July 2021, the CRU published a direction to electricity system operators relating to data centre grid connections, requiring them to change their processes in response to capacity constraints, the link below relates:

https://cruie-live-96ca64acab2247eca8a850a7e54b-5b34f62.divio-media.com/documents/CRU21124-CRU-Direction-to-the-System-Operators-related-to-Data-Centre-grid-connection-.pdf

The CRU's direction, entitled "Direction to the System Operators related to Data Centre grid connection processing (CRU/21/124), is the culmination of a CRU consultation published in June 2021 (Consultation). The Consultation identified the power consumption requirements of data centres as a growing threat to the security of Ireland's grid. The CRU put three proposals out to consultation, namely:

1. do nothing, i.e., leaving EirGrid's bespoke Data Centre Connection Offer Process & Policy protocol as the sole determinant of data centre connection. The CRU flagged in the direction its view that demand would swiftly outstrip supply if this option was taken; or
2. impose a moratorium on the electrical connection of new data centres for several years; or
3. an intermediate approach requiring the electricity system operators, ESB Networks and EirGrid, to prioritize the processing of data centre connection applications based on:
    - location relative to existing levels of grid "constraint"
    - the level of dispatchable on-site electricity generation or storage that the data centre intends to install, and
    - the data centre's flexibility to reduce its electricity demand, including by using its own generators or storage assets.

Option 3, the intermediate approach was selected as it recognized the value of allowing the data centre market to continue to develop and grow in Ireland, while also recognizing the role that it needs to play in the stabilization of Ireland's grid.

In selecting Option 3, the CRU required that the SOs apply the following assessment criteria on a case-by-case basis, in determining whether a connection offer should be made to an applicant data centre:

- *The location of the data centre applicant with respect to whether they are within a constrained or unconstrained region of the electricity system.*
- *The ability of the data centre applicant to bring onsite dispatchable generation (and/or storage) equivalent to or greater than their demand, which meets appropriate availability and other technical requirements as may be specified by the relevant SO, in order to support security of supply.*
- *The ability of the data centre applicant to provide flexibility in their demand by reducing consumption when requested to do so by the relevant SO in times of system constraint through the use of dispatchable on-site generation (and/or storage) which meets appropriate availability and other technical requirements as may be specified by the relevant SO, in order to support security of supply.*
- *The ability of the data centre applicant to provide flexibility in their demand by reducing consumption when requested to do so by the relevant SO, in times of system constraint, in order to support security of supply.*

Large Energy User Policy Update 2025

On 18 February 2025, CRU published a proposed decision paper on the LEU Connection Policy (LEU Policy). The purpose of this proposed decision paper is to set out a potential pathway for connection applications for new data centre customers to the electricity grid with due regard to security of supply and network constraints while minimising, where possible, potential impacts on national renewable energy targets and carbon emissions. The LEU Policy is supportive of data centre connections with a few pre-conditions to be applied as outlined below.

The proposed decisions are as follows:

1. That the LEU policy applies to all data centres seeking to connect to the electricity network only (not the gas grid).
2. Data centres connecting to the electricity network will be required to provide dispatchable (i.e. available when it is needed by the system) on-site or proximate generation and/or storage capacity, which will participate in the wholesale electricity market.
3. The ramping up of a new data centre's demand to its full Maximum Import Capacity (MIC) will be linked to the delivery of the required dispatchable onsite or proximate generation or storage capacity.
4. The system operators should continue to take into account the location of any data centre connection applications and associated generation capacity in respect of whether it is in a constrained or unconstrained region of the electricity network.
5. The system operators will be required to publish regular information on existing and future grid network capacity to accommodate connections on the electricity network and to provide insight to new data centres and other developers.

6. Data centres will be required to self-report to the system operator annually in relation to their use of renewable energy and their sites' emissions. A summary of these reports will be published.

In compliance with points 2 and 3 above Herbata will install CCGTs sufficient to provide to at least 50% of the total energy needs of the data centres, and will further install OCGTs equivalent to the balance of the energy needs, so as to ensure, in accordance with the LEU Policy, that the on-site generation capacity is sufficient to meet the MIC of the data centres from the grid. This will also be in compliance with Eirgrid's requirements for connection of an Autoproducer to the grid.

Further compliance with point 2, Herbata will participate in the electricity market through demand side management arrangements thereby being available to the grid operator as and when required.

In compliance with point 3 above, installation of the CCGTs will be aligned to the development of each data centre phase of development as each building has commensurate plant that will be installed as it is developed. At all times the on-site generation will be capable of matching 100% of the energy needs of the data centre.

In respect of point 4 above and as further detailed in the *Energy Strategy Report* prepared by BOS Energy Ltd submitted as part of the response to the KCC RFI at Section 4.3, the location selected will benefit from the recent grant of planning permission by An Bord Pleanála (ABP Ref. 316372) in March 2025 for grid upgrades work that will add a high-capacity 400 kV underground electricity connection between Dunstown substation in Kildare and Woodland substation in Meath, further enhancing the grid infrastructure in the Kildare and surrounding area.

In compliance with point 6, this reporting will be undertaken as part of business-as-usual reporting requirements. In that regard we note that the LEU Policy supports CPPAs as a mechanism for data centres to procure their renewable energy requirements and supports their inclusion in the self-reporting requirements.

As such, Herbata welcomes the publication of the LEU Policy, as the energy strategy for the Proposed Development will meet the criteria set out therein and as such there appears to be a clear route to grid for the Proposed Development.

Eirgrid – Transmission System Operator (TSO)

EirGrid is responsible for operating the Irish electricity transmission system (i.e. the grid) along with its counterpart SONI, in Northern Ireland and ESB Networks as the distribution system operator. The Irish grid is standalone as an All-Ireland grid with common power generation throughout plus two 350MW HVDC interconnectors to the UK with a planned additional 700kW interconnector between Cork and France (Celtic) due to come online in 2026. Typically, the Irish grid runs at between 4GW and 6GW but has topped 7GW during severe cold winter periods. During such times EirGrid was required to bring on additional generation capacity, increase the electricity flow from interconnectors (if available) or ultimately drop demand.

EirGrid, as the transmission system operator in Ireland pursuant to a licence issued by the CRU, has a regulatory requirement to publish forecast information about the power system, including an assessment of the balance between supply and demand. EirGrid published the "All Island Generation Capacity Statement 2023-2032" which reports on the performance of the grid and assesses the likely capacity of the grid

over a 10-year projection. In addition, EirGrid also published their 20 year lookahead on the Energy Scenarios that Ireland faces in 2019 and subsequently in 2023, which directly responds to the EU's policy statements and Ireland's Climate Action Plan (see links below). EirGrid's publications, amongst other things, speak to sustained strong growth in electricity demand driven by Government policy, major investment in renewables generation technologies (particularly offshore wind), increased interconnection, the need for market reform and the critical role of gas as a "backstop" for renewables as Ireland moves from 40% RES-E in 2020 to an 80% target for RES-E by 2030.

All-Island-Generation-Capacity-Statement-2020-2029.pdf (eirgridgroup.com)

https://cms.eirgrid.ie/sites/default/files/publications/TES-2023-Final-Full-Report.pdf

Gas Networks Ireland – Gas Transmission and Distribution System Operator

GNI are responsible for operating the Irish gas transmission and distribution systems along with its subsidiary GNI (UK) in Northern Ireland. The Irish gas network is currently reliant on interconnectors from Scotland via the Isle of Man. However, there are also proposals for import of shipped gas using Liquified Natural Gas (LNG) in the future.

In response to the Climate Action Plan, GNI published its Vision 2050 document which sets out its targets for decarbonizing the gas network fully by 2050. GNI make the following statement on their website:

> *"Our vision is for a net zero carbon gas network by 2050, by replacing natural gas with renewable gases, such as carbon neutral biomethane made from agricultural and food waste and carbon free green hydrogen."* and *"The European Union, through its 2021 Climate Target Plan Impact Assessment, concluded that gas will continue to provide 20% of Europe's energy in 2050."*

GNI have already set about looking at how it introduces bio-methane and hydrogen to its network.. GNI's Vision 2050 publication is included in Appendix C of this report.

The vision provided by GNI is for the Irish gas network to evolve to become net zero carbon by 2050 and to support emissions reductions across every sector of the Irish economy at the lowest cost possible. The vision requires that half of the projected 2050 gas demand will be met by net zero carbon gases or zero carbon gases and that Carbon Capture and Storage (CCS) will be in place to abate the emissions from the remaining use of natural gas. GNI has already begun to invest in new technologies to facilitate renewable gas injection into the gas network, and to transport Compressed Natural Gas (CNG) in the gas network as a fuel source for commercial vehicles.

Government of Ireland

Recently, the Government of Ireland have published two important and relevant strategy documents which describe how both biomethane and hydrogen will be developed and provided nationally to all sectors. These documents have been used to inform the calculation of how this Proposed Development can reach a net zero carbon position as soon as reasonably possible, as they provide a robust and reasonable basis on which to calculate the availability of biomethane and green hydrogen into the future. The contents of these strategy documents, and the basis

on which they have informed the net zero carbon calculations, is set out in more detail in section 6 below and in Appendix A.

https://www.gov.ie/en/publication/d115e-national-biomethane-strategy/

https://www.gov.ie/en/publication/624ab-national-hydrogen-strategy/

4.4 Compliance with Energy Policy

The Herbata data centre project has carefully considered the current energy policy relevant to data centres. It is proposed that Herbata data centre will connect to both the electricity grid and gas network. The energy strategy proposed, which aligns with the CRU's Direction to the System Operators related to Data Centre grid connection processing and the draft LEU Policy, can be summarized as follows:

- Herbata propose to generate power on-site using gas and to therefore not be dependent on the import of electricity from the Irish grid.
- A connection to the Irish grid via a new grid substation is proposed, to allow Herbata to:
    - Export spare electrical capacity generated on-site to the grid.
    - Provide system frequency stability support.
    - Import renewable energy sourced through CPPAs which will meet a minimum of 50% of the Proposed Development's energy demand.
- On instruction from EirGrid as the TSO, Herbata will support their data centre demand using the on-site generation, as well as sourcing energy from renewable sources (via CPPAs) via the grid and make available to the grid excess capacity.
- By connecting to the gas network, Herbata will fully support the provision of a mixed gas / hydrogen supply. A bio-methane injection point will be installed on the site as part of the Proposed Development.

4.5 Local Planning Policy

The local authority, Kildare County Council (KCC), has adopted *the Kildare County Development Plan 2023-2029* (the Development Plan), which is available at the following link:-

https://kildarecoco.ie/AllServices/Planning/DevelopmentPlans/KildareCountyDevelopmentPlan2023-2029/

As part of the Development Plan, Chapter 7 titled "Energy & Communications" sets out the policies and objectives in relation to energy production and how it relates to planning policy. This is contained in the link below. The Chapter follows carefully the International, National and Local planning and energy policies and lists the majority, and more, of them.

https://consult.kildarecoco.ie/sites/default/files/Ch%207%20final.pdf

Also within the Development Plan is Chapter 4 which supports Chapter 7 in terms of renewable energy targets. This can be viewed in the link below:-

https://consult.kildarecoco.ie/sites/default/files/Ch%204%20final.pdf

Within Chapter 7 are a series of Policies, Objectives and Actions. The key policies that relate to a data centre development and need to be addressed are listed in Table

4-1. These policies have been selected that are considered relevant to a data centre campus development of the type proposed. Section 5 of this report sets out how the Proposed Development is fully consistent with and supports all of these policies, including the development plan policies specifically mentioned by KCC in Item No. 1 of the KCC RFI.

While this report has focused on the manner in which the Proposed Development complies with and supports the policies set out in Chapter 7 of the Development Plan titled “Energy & Communications” (which is most relevant to Data Centres as it sets out the policies and objectives in relation to energy production and how it relates to planning policy), the other policies, objectives, and actions set out in the Development Plan which are relevant to the Proposed Development, including for example the policies and objectives set out in Chapter 4 as mentioned above, are considered in detail in section 4.4 of the *Planning Report* submitted with the application for planning permission and in section 4.3 of the *Addendum to the Planning Report* submitted as part of the response to the KCC RFI. Further, the manner in which the Proposed Development complies with and supports the relevant objections of the *National Planning Framework* is set out in section 4.2.2 of the *Planning Report* submitted with the application for planning permission, and the First Revision of the *National Planning Framework* is conserved in section 3 of the *Response to Request for Further Information Report*, prepared by RPS, and section 3.1.1 of the *Addendum to the Planning Report*, both submitted with the response to the KCC RFI. Further, compliance with the *Regional Spatial and Economic Strategy for Eastern and Midlands Regional Assembly* is set out in section 4.3 of the *Planning Report* and the *Addendum to the Planning Report* submitted with the application for planning permission.

As noted above, the *Planning Report* submitted with the application for planning permission, and the *Addendum to the Planning Report* submitted as part of the response to the KCC RFI, both conclude that the Proposed Development fully aligns with national, regional and local policy supporting the ICT sector with data centres being a key component of this sector, and that it fully accords with sustainable development objectives and adopts an exemplary approach to data centre development within the State.

Table 4-1. Kildare Country Council Policies and Objectives

Policy Reference	Policy Description
Chapter 4 RE P11	Support the accommodation of Data Centres at appropriate locations in line with the objectives of the National Planning Framework and the principles for sustainable Data Centre Development of the Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy (July 2022) subject to appropriate Transport, Energy and Environmental Assessments and all relevant planning conditions. The location of data centres shall be situated where they will not have a potential likely significant effect on a European Site. Such developments shall be subject to an AA Screening Report, and where applicable, Stage 2 AA. They shall have regard for any hydrological connection shared with a European Site and shall account for any potential likely significant effects and provide mitigation and monitoring where appropriate.
Chapter 4 RE P12 (Energy points highlighted in blue)	Ensure that economic and enterprise related development is provided in a manner which facilitates a reduction in greenhouse gas emissions and accelerates the transition towards a sustainable, low carbon and circular economy. The following measures shall be supported: • An increase in employment densities within walkable distances of communities and on public transport routes. • Promotion of walking and cycling and use of public transport through increased permeability and mobility management measures within and outside employment areas. • The sourcing of power from district heating and renewables including wind and solar. Additional native tree planting and landscaping on existing and proposed enterprise zones and development sites to aid with carbon sequestration, contributing to the green infrastructure network of the County and promoting quality placemaking.
Chapter 4 RE O72	Require data centres to consider the use of sustainable renewable sources of energy to fuel their operations in whole in the first instance or in part (minimum of 30%) where this is not possible and where it has been satisfactorily demonstrated not to be possible, subject to all relevant and cumulative environmental assessments and planning conditions
EC P2	Promote renewable energy use and generation at appropriate locations within the built environment and open countryside to meet national objectives towards achieving a net zero carbon economy by 2050.
EC O19	Promote the development of solar energy infrastructure for on-site energy use, including solar PV and solar thermal technologies. On- site battery storage projects shall be considered subject to fire safety, environmental safeguards, and the protection of natural or built heritage features, biodiversity views and prospects.
EC O23	Support the installation of solar collectors and panels for the production of heat or electricity in commercial and industrial buildings in line with relevant design criteria, building regulations and technical guidance documents.
EC O24	Require the submission of a Glint and Glare Assessment as part of any solar energy development proposal where there is likely to be any impact on neighbouring uses, transportation, and aviation safety.
EC P11	Support Ireland's renewable energy commitments outlinedin national policy.
EC P12	Facilitate air to water heat developments at appropriate location and scale.
EC P13	Promote the appropriate development of waste heat technologies and the utilisation and sharing of waste heat in areas where feasibility is demonstrated for its use in the delivery of low carbon district heating technology.
EC P14	Require high levels of energy conservation, energy efficiencyand the use of sustainable and renewable energy sources in new and existing buildings.
EC P15	Promote the necessary infrastructure to support the continued roll out of electric vehicles.

EC O59	Consider applications for data centres having regard to the following criteria: • Accessibility/ease of connection to power • Availability of renewable energy to power any proposed data centre. • Availability of high-powered fibre optic infrastructure Transport/road accessibility • Compatibility of surrounding land uses/zoning • Avoidance of designated sites including specifically avoidance of development of data centres where they would adversely affect the integrity of a European Site • Availability of significant landbanks • Noise • Visual impact • Flood risk Such developments shall be subject to an AA Screening Report, and where applicable, Stage 2 AA. They shall have a regard for any hydrological connection shared with a European Site and shall account for any potential likely significant effects and provide mitigation and monitoring where appropriate.
EC O61	Require data centres to include strong energy efficiency measures to reduce their carbon footprint in support of national targets towards a net zero carbon economy, through the use of sustainable sources of energy generation in the first instance and then the use of renewable sources of energy to power their operations, where on site demand cannot be met in this way, to provide evidence of engagement with power purchase agreements (PPA) In Ireland. All data centre developments shall provide evidence of sign up to the Climate Neutral Data Centre Pact.
EC P18	Support the accommodation of Data Centres at appropriate locations in line with the objectives of the National Planning Framework and the Government Statement on the Role of Data Centres in Ireland subject to appropriate Transport and Environmental Impact Assessments.
EC P19	Support the development, reinforcement, renewal and expansion of the electricity transmission and distribution grid to provide for the future physical and economic development of Kildare.
EC P21	Support the infrastructural renewal and development of thegas networks in the county, subject to proper planning, heritage, environmental and amenity requirements.

5 Compliance with Data Centre Policy

This section of the report sets out how the Proposed Development complies with and supports the relevant parts of data centre policy at national and local levels including in relation to energy use.

5.1 The Six Principles

As noted earlier, the Irish Government reviewed the contribution of data centres to the Irish economy and issued a statement in July 2022 titled *Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy*. Within the statement are six guiding principles for the data centre industry as set out above. This report has considered each of these guiding principles in turn below, and set out how the Herbata data centre project, including it's energy strategy, is fully consistent with all six of these guiding principles: -

Economic Impact

Principle - The Government prefers data centre developments associated with strong economic activity and employment.

Response – The Herbata data centre project will have strong economic activity and employment during construction and operation. The construction period is projected to be phased over 8-years where the number employed on site will vary from around 150 up to 1100 people. This refers to direct employment on site, however there will also be high levels of equipment that will need to be procured over the 8-years. Irish companies have a very good track record in providing much of this equipment to data centres constructed in Ireland and in the rest of Europe.

Equipment and systems will include switchgear, battery systems, and air handling plant, all of which are of a high and critical value to the Proposed Development. These would typically be procured through mechanical and electrical sub-contractors; again, Ireland is rich in highly qualified sub-contractors of this type who have very good track records in the data centre industry.

Once the data centres are in operation, they will need to be maintained to a high level necessary for critical facilities of this type. There will be a significant number of people employed on site either directly or via third party contractors, increasing as the site is built out. In that regard, the Proposed Development is expected to generate c. 225 no. jobs during the operational phase, many of which will be highly skilled and well-paid employment. The quantum of engineering and technical staff required on site is expected to be much higher than most data centre projects due to the nature of the power systems proposed. As noted in earlier sections, energy is to be generated on site and so will require a high level of maintenance and monitoring throughout the life of the data centres. It is further expected that as the site is built out it will become a centre of excellence for engineering and technology and attract other companies and organisations to locate nearby.

Grid Capacity and Efficiency

Principle - The Government has a preference for data centre developments that make efficient use of our electricity grid, using available capacity and alleviating constraints.

Response - It is well documented by both the CRU and EirGrid that the Irish electricity grid is constrained in the near to medium horizon in terms of capacity and distribution to varying degrees across Ireland. Ireland has also experienced a security of supply generation constraint (predicated on a failure of the capacity market to secure the required investment in new generation) which has been alleviated by EirGrid's procurement of temporary emergency generation in 2023. For the reasons set out at section 3 of the *Energy Strategy Report* prepared by BOS, including the Kildare-Meath grid upgrade discussed therein, the proposed development will be in a region with available capacity. Furthermore, notwithstanding the default position that a minimum of 50% of its energy will come from renewable sources, the Herbata data centre will have the capacity to generate 100% of its own power on-site using gas turbines connected to each data centre building only where it is required to do so during times of constraints on the electricity system or where instructed to do so by the SO to support the grid.. A new 110kV grid substation is proposed, which is the subject of a separate Strategic Infrastructure Development (SID) application to An Bord Pleanála for approval under section 182A of the Planning and Development Act 2000 (as amended), and which will allow the site to export to the Irish grid and to allow import from renewable energy sources covered by CPPAs.

This is a highly effective and efficient format linked also to the ability for the electrical systems to provide capacity back to the grid and/or provide fast acting short term grid frequency response services. This ability has come about from a key electrical design format change, by moving the battery elements out of traditional UPS systems and locating them alongside the generating turbines at a higher voltage.

Renewables Additionality

Principle - The Government has a preference for data centre developments that can demonstrate the additionality of their renewable energy use in Ireland.

Response - The Herbata data centre project proposes three ways to incorporate renewable energy use for the project:

On-site – Solar PV panels are to be located on the roofs of each data centre building with a minimum peak output of 500kW for supporting the technology elements and a further 20kW for supporting the admin/support functions.

Off-site – Herbata have been actively negotiating and seeking agreements with solar and wind farm developers within Ireland and intend to enter into CPPAs on a phased basis to support the construction and operational build out. Herbata are committed to achieving this and as mentioned earlier in this report are proposing that a condition be attached to any grant of planning permission requiring that the necessary CPPAs be secured in advance of the proposed development becoming operational.

Decarbonisation of gas – as part of Gas Networks Ireland Vision 2050 for decarbonising the gas network, GNI intend to facilitate the provision of a mix of hydrogen within the gas network of 20% and the injection of bio-methane into the network in lieu of fossil fuel-based gas. To facilitate the use of additional bio-methane in the network, a bio-methane injection point will be installed on the site as part of the Proposed Development, which has been agreed with GNI.

There will be sufficient capacity from off-site generation from renewable sources via CPPAs to support a minimum 50% of the operational energy demand of the data centres with additional capacity from on-site solar PV.

These three methods will fully support this particular guiding principle.

Co-Location or Proximity with Future-Proof Energy Supply

Principle - The Government has a preference for data centre developments in locations where there is the potential to co-locate a renewable generation facility or advanced storage with the data centre, supported by a Corporate Power Purchase Agreements, private wire, or other arrangement.

Response – As mentioned above, solar PV panels are to be located on the roofs of each data centre building with a minimum peak output of 500kW (except DC4 which is 250kW) for supporting the technology elements and a further 20kW for supporting the admin/support functions. To achieve a minimum 50% of power from renewable energy, Corporate Power Purchase Agreements (CPPAs) will be used from a variety of sources within Ireland as the data centre load level increases over time.

In addition, the Herbata data centre buildings will incorporate BESS to protect the technology loads but also to facilitate fast acting frequency response support to the Irish grid.

Decarbonised Data Centres by Design

Principle – The Government has a preference for data centres developments that can demonstrate a clear pathway to decarbonize and ultimately provide net zero data services.

Response – The Herbata data centre project has incorporated pathways to decarbonise through to net zero in three ways, as outlined below:

- At least 50% of the total operational energy demands of the Proposed Development will be supplied from 100% renewable sources, sourced from the national electricity grid via CPPAs. These will be zero carbon sources and directly decarbonise the energy used on-site.
- The energy to be produced on site in each data centre building will be generated using gas imported from GNI's network to supply the gas turbines. GNI, in their Vision 2050 document (see Appendix C), have clearly shown how they intend to decarbonise the gas network through to net zero by 2050. This objective mirrors the Government's *Climate Action Plan 2025* and allows this project to benefit from a fuel source that will gradually be decarbonised over the coming years; it is projected that the gas network will reduce its carbon emissions by as much as 40% over the next decade alone.
- The project has already had a request from GNI to include a bio-methane injection point to aid the decarbonisation of the energy usage at the site, which is included as part of the Proposed Development. This is a valuable and direct method of decarbonization for the Herbata data centre project.

The combination of all the above will provide a very high level of decarbonisation from the start of the project, and gradually increase through to a net zero position by 2039.

SME Access and Community Benefits

Principle - The Government has a preference for data centre developments that provide opportunities for community engagement and assist SMEs, both at the construction phase and throughout the data centre lifecycle.

Response - The Herbata Data Centre project will result in several long-term planning gains to the local community and businesses in the Naas area, and will include the following:

- A connection point for a district heating system, to harness the waste heat associated with the data centre, will be provided on site to serve the area to the west of Naas. Such provision has been fully investigated and has been shown to be feasible, subject to the installation of the required local infrastructure. The provision of district heating in the local area would bring many benefits to the community and businesses by decarbonising the heating of buildings and by increasing local energy security at reduced cost to households, community facilities, and businesses.
- The provision of a substation at the Herbata data centre campus will enhance the local electricity grid and will include the provision of an 8-bay format grid substation. Two of these bays will be used for incoming and outgoing feeders to the existing transmission line, four further bays will be allocated to the Herbata Data Centre, leaving 2 bays as spare for future development in and around the Naas area. This additional future capacity will benefit the local area and help ensure future energy provision in the Naas area. In addition, spare capacity from the on-site generation can be made available to the local area and wider Irish grid when available and as required.
- As part of the development of the Herbata data centre it is proposed to upgrade the local road network (R409) serving the site and provide new footpath and cycling infrastructure along with a new Bus Stop on the R409. These improvements will not only help promote active travel among the workforce of the Data Centre but will also provide improved infrastructure for the local population living, working, and doing business in the vicinity of the Data Centre and Naas.
- The construction and operational phases of the Herbata data centre will result in a substantial increase in employment opportunities in the local area, with a focus on the employment of the local population especially during the construction phase.

It is therefore evident that the construction of the Herbata data centre in Naas will bring many benefits to the local community and local businesses during the construction phase and during the lifecycle of the data centre.

The Government statement also provided that ‘Islanded’ data centre developments, that are not connected to the electricity grid and are powered mainly by on-site fossil fuel generation, are not in line with national policy. The Herbata data centre is to be connected to the national electricity grid and as detailed in Section 3.3, will be mainly powered by renewable energy sources. A grid substation in the north-west corner of the site is proposed. This will allow one of the overhead lines that crosses the site to be undergrounded and connected into the proposed grid substation.

A connection to the grid is a fundamental part of the project. This is particularly so given that CPPAs for renewable electricity supply via grid is the only available option at this time. The imposition of the planning condition in relation to a minimum 50% of demand being met with electricity procured via CPPAs would mean that it will not be possible for the proposed development to operate in the absence of a connection to the electricity grid, and that at all times, with the rare exception of network connection failures or faults, at least 50% of the energy demand of the data centres will be met by renewable sources. There is therefore no question of the proposed development

being regarded as an “islanded” data centre, which is also defined in the LEU Connection Policy as referring to data centres that are “connected to the gas network that are **not connected to the electricity grid** and are **powered mainly by on-site fossil fuel generation**” (emphasis added).

5.2 Compliance with Planning Policy

Earlier in Section 4 it has been shown how International and National policies on climate change and energy flow down to local planning policy. Again, in Section 4.4, the relevant local planning policies which apply to the Proposed Development and its energy demands were listed; these are repeated below, and each is responded to in Table 5-1 below which demonstrates how the Proposed Development complies with and supports each policy and objective.

Further, as also set out in section 4.4 above, the other policies, objectives, and actions set out in the Development Plan which are relevant to the Proposed Development, are considered in detail in section 4.4 of the *Planning Report* submitted with the application for planning permission. The manner in which the Proposed Development complies with and supports the relevant objections of the National Planning Framework is set out in section 4.2.2 of the *Planning Report* submitted with the planning application, section 3.1.1 of the *Planning Report Addendum* and Section 3.2 of the *Response to the Request for Further Information Report* submitted as part of the RFI response (all prepared by RPS), and its compliance with the *Regional Spatial and Economic Strategy for Eastern and Midlands Regional Assembly* is set out in section 4.3 of the *Planning Report* and section 4.2 of the *Planning Report Addendum*.

Table 5-1. Responses to KCC Planning Policies

Policy Reference	Policy Description	Responses and Actions against policies
Chapter 4 RE P11	Support the accommodation of Data Centres at appropriate locations in line with the objectives of the National Planning Framework and the principles for Sustainable Data Centre Development of the Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy (July 2022) subject to appropriate Transport, Energy and Environmental Assessments and all relevant planning conditions. The location of data centres shall be situated where they will not have a potential likely significant effect on a European Site. Such developments shall be subject to an AA Screening Report, and where applicable, Stage 2 AA. They shall have regard for any hydrological connection shared with a European Site and shall account for any potential likely significant effects and provide mitigation and monitoring where appropriate.	The subject site in Naas is zoned for data centre use, as set out in the Naas LAP and is the only land use provided for at this location. Therefore, the proposed development meets the objectives of the 'National Planning Framework'. As set out above, section 4.2.2 of the 'Planning Report' submitted with the application for planning permission, Section 4.1.1.10 of the "Response to the Request for Further Information Report", *prepared by RPS and Section 4.3.1.1 of the* 'Addendum to the Planning Report' prepared by RPS outline how the Proposed Development complies with the relevant provisions of the 'National Planning Framework'. Section 5.1 of this report above, demonstrates how the Proposed Development is fully consistent with each of the six guiding principles set out in the Government's Statement on the Role of Data Centres in Ireland. Chapter 12 Traffic and Transportation of the *EIAR* originally submitted with the application and *Addendum to the EIAR*, concludes that the overall impact of the proposed development upon the surrounding highway network, at both construction and operational phases is considered to be negligible. A 'Natura Impact Statement' prepared by RPS is included as part of the RFI response, which concludes that the proposed development will not adversely affect (either directly or indirectly) the integrity of any European site, either alone or in combination with other plans or projects. **Status: Compliant with policy**

Chapter 4 RE P12 (Energy points highlighted in blue)	Ensure that economic and enterprise related development is provided in a manner which facilitates a reduction in greenhouse gas emissions and accelerates the transition towards a sustainable, low carbon and circular economy. The following measures shall be supported: • An increase in employment densities within walkable distances of communities and on public transport routes. • Promotion of walking and cycling and use of public transport through increased permeability and mobility management measures within and outside employment areas. • The sourcing of power from district heating and renewables including wind and solar. Additional native tree planting and landscaping on existing and proposed enterprise zones and development sites to aid with carbon sequestration, contributing to the green infrastructure network of the County and promoting quality placemaking.	In Section 6 of this report, GHG emissions are discussed and clear route to decarbonisation is set out to achieve a Net Zero Carbon position by 2038. In addition, Herbata Ltd have committed to sourcing at least 50% of the energy it uses from renewable sources via CPPAs and has also committed to providing a significant connection of high grade heat to a district heating system when available. **Status: Compliant with policy**
Chapter 4 RE O72	*Require data centres to consider the use of sustainable renewable sources of energy to fuel their operations in whole in the first instance or in part (minimum of 30%) where this is not possible and where it has been satisfactorily demonstrated not to be possible, subject to all relevant and cumulative environmental assessments and planning conditions*	Herbata will enter into CPPAs renewable energy agreements with solar and wind farm developers within Ireland to match a minimum of 50% of the operational demand load, significantly greater than the minimum requirement of 30%. Further detail on the CPPA process and the availability of new additional renewable energy is provided in the enclosed *Energy Strategy Report* prepared by BOS Ltd. The proposed data centre is on a pathway to net zero carbon by 2039 as set out in section 6.2 of this report. **Status: Compliant with policy**

Chapter 7 EC P2	Promote renewable energy use and generation at appropriate locations within the built environment and open countryside to meet national objectives towards achieving a net zero carbon economy by 2050.	Herbata will enter into CPPA with solar and wind farm developers within Ireland to match a minimum of 50% of the operational demand load, which is significantly greater than theminimum requirement of 30% of energy from renewable sources as set out in Objective RE O72.[1] This will be on a phased deployment basis. **Status: Compliant with policy**
Chapter 7 EC O19	Promote the development of solar energy infrastructure for on- site energy use, including solar PV and solar thermal technologies. On-site battery storage projects shall be considered subject to fire safety, environmental safeguards, and the protection of natural or built heritage features, biodiversity views and prospects.	All the data centre buildings are to be provided with a minimum of 500kW of solar PV roof mounted. In addition, each gas turbine will have 5 x 1MW battery energy storage system (BESS) to support the power systems and allow for grid support in the form of frequency stabilisation e.g. DS3. **Status: Compliant with policy**
Chapter 7 EC O23	Support the installation of solar collectors and panels to produce heat or electricity in commercial and industrial buildings in line with relevant design criteria, building regulations and technical guidance documents.	In addition to the Solar PV noted against policy EC 019 above, it is also proposed to provide 20kW of solar PV to support non-data/technology production areas to meet building regulations. **Status: Compliant with policy**
Chapter 7 EC O24	Require the submission of a Glint and Glare Assessment as part of any solar energy development proposal where there is likely to be any impact on neighbouring uses, transportation & aviation safety.	A Glint and Glare assessment report has been provided as part of the planning submission with no impact on local or transport systems. **Status: Compliant with policy**

[1] Objective RE O72 of the Development Plan is set out in Chapter 4 of the Development Plan and is "*Require data centres to consider the use of sustainable renewable sources of energy to fuel their operations in whole in the first instance or in part (minimum of 30%) where this is not possible and where it has been satisfactorily demonstrated not to be possible, subject to all relevant and cumulative environmental assessments and planning conditions.*" As set out in section 4.4.1.1 of the Planning Report submitted with this application for planning permission, the Proposed Development fully complies with Objective RE O72 of the Development Plan.

Chapter 7 EC P11	Support Ireland's renewable energy commitments outlined in national policy.	As well as the adoption of solar PV on the roofs of the data centre buildings, power generated on site will be from natural gas sourced from the GNI network and from biomethane producers. GNI have a programme to decarbonise the gas grid fully by 2050 in line with Ireland's national policy on energy. It is proposed that from the outset of operation at least 50% of the energy required will be sourced via CPPAs with new and additional wind / solar power generators. The proposed development is effectively funding the delivery of significant additional renewable energy through the entry into CPPAs with new renewable energy providers. This will support the development of different forms of renewable energy throughout Ireland. The proposed development will also include a solar PV installation. **Status: Compliant with policy**
Chapter 7 EC P12	Facilitate air to water heat developments at appropriate location and scale.	Heat pumps are to be provided to the admin areas of each data centre building to provide heating and cooling from electrical sources with the lowest carbon impact. **Status: Compliant with policy**
Chapter 7 EC P13	Promote the appropriate development of waste heat technologies and the utilisation and sharing of waste heat in areas where feasibility is demonstrated for its use in the delivery of low carbon district heating technology.	It is proposed to provide heat exchangers from all of the Combined Cycle gas turbines to provide medium to high grade heat to the local community up to the capacity previously identified. A *Feasibility Assessment report* has been provided as part of the planning application documentation to identify potential uses of the heat to the west of Naas.. **Status: Compliant with policy**

Chapter 7 EC P14	Require high levels of energy conservation, energy efficiency & the use of sustainable & renewable energy sources in new and existing buildings.	A full building control assessment has been carried out and reported upon. This gives full compliance. In addition, using further solar arrays on the roof of the data centre buildings and the provision of CPPAs to provide a minimum of 50% of the operational energy demands of the data centres from 100% renewable sources (which is well in excess of the 30% minimum set out in Objective RE O72 as set out above) further show the sustainable approach being taken. **Status: Compliant with policy**
Chapter 7 EC P15	Promote the necessary infrastructure to support the continued roll out of electric vehicles.	Infrastructure will be provided for all EVs including staff owned vehicles, visiting cars, small vans, and large lorries. Chargers will be sized for quick charging at each car park and lorry loading bay area. **Status: Compliant with policy**
Chapter 7 EC P18	Support the accommodation of Data Centres at appropriate locations in line with the objectives of the National Planning Framework and the Government Statement on the Role of Data Centres in Ireland subject to appropriate Transport and Environmental Impact Assessments.	The site in Naas has already been zoned for data centre use, it is not within Dublin and its regions and so meets the objectives of the *National Planning Framework*. Section 4.2.2 of the *Planning Report* submitted with the application for planning permission and Section 4.1.1.10 of the *Response to the Request for Further Information Report*, sets out how the Proposed Development complies with the relevant provisions of the *National Planning Framework* and the *First Revision of the National Planning Framework*. Section 5.1, above demonstrates how the proposed development is fully consistent with each of the six guiding principles set out in the Government's *Statement on the Role of Data Centres in Ireland*. **Status: Compliant with policy**

Chapter 7 EC O59	Consider applications for data centres having regard to the following criteria: • Accessibility/ease of connection to power • Availability of renewable energy to power any proposed data centre. • Availability of high-powered fibre optic infrastructure Transport/road accessibility • Compatibility of surrounding land uses/zoning • Avoidance of designated sites including specifically avoidance of development of data centres where they would adversely affect the integrity of a European Site • Availability of significant landbanks • Noise • Visual impact • Flood risk Such developments shall be subject to an AA Screening Report, and where applicable, Stage 2 AA. They shall have a regard for any hydrological connection shared with a European Site and shall account for any potential likely significant effects and provide mitigation and monitoring where appropriate.	All of these criteria have been fully considered in the current planning application. It is proposed that a minimum of 50% of the operational energy demands of the Proposed Development will be supplied from renewables through CPPAs. It is projected by 2039 the Proposed Development proposed data centre would operate at Net Zero Carbon. Section 3.3 of this report provides details of the sources of energy proposed as part of the development. The existing and proposed fibre optic infrastructure is described in the enclosed "*Updated Planning Engineering Report" prepared by HDR.* The proposed development includes enhanced pedestrian/ cycle facilities and a new bus stop on the R409. Transport and accessibility is considered within the "*Mobility Management Plan"* prepared by Systra and submitted as part of the planning application as an appendix to the "Planning Engineering Report*".* The Data Centre Application is on lands zoned for data centre use, detailed further in Section 4.8 of the "*Planning Report"* prepared by RPS and the zoning is considered to be compatible with surrounding land uses. An *EIAR* and Addendum to the EIAR have been prepared . *The Addendum to the EIAR* includes an updated *Landscape and Visual Impact Assessment (LVIA). A Flood Risk Assessment* and *AA Screening Report* were also submitted as part of the planning application. An *NIS* has also been prepared and submitted as part of the response to RFI. **Status: Compliant with Policy**

Chapter 7 EC O61	Require data centres to include strong energy efficiency measures to reduce their carbon footprint in support of national targets towards a net zero carbon economy, through the use of sustainable sources of energy generation in the first instance and then the use of renewable sources of energy to power their operations, where on site demand cannot be met in this way, to provide evidence of engagement with power purchase agreements (PPA) In Ireland. All data centre developments shall provide evidence of sign up to the Climate Neutral Data Centre Pact.	The proposed development will utilise a minimum of 50% of energy provided from renewable sources from the outset of operations. This renewable energy will be provided from new additional renewable energy generation procured via CPPAs. This renewable energy will be funded and delivered through CPPAs and is illustrative of the crucial role of large energy users (LEU) in the delivery of additional renewable energy generation, as further discussed in detail in the *Energy Strategy Report* prepared by BOS Energy Ltd. and in Section 3.3 of the *Response to RFI Report* prepared by RPS. Renewable energy will also be provided from onsite solar PV. The applicant is committed to the tenets of the Climate Neutral Data Centre Pact. The Climate Neutral Data Centre Pact may be signed by trade associations representing data centre operators and companies that own or operate data centres within the European Union. Herbata Limited intend to sign up to the Climate Neutral Data Centre Pact once they satisfy the above criteria (i.e., the data centre campus is built, and they own / operate same). **Status: Compliant with Policy**
Chapter 7 EC P19	Support the development, reinforcement, renewal and expansion of the electricity transmission and distribution grid to provide for the future physical and economic development of Kildare.	It is proposed to provide a new grid 110kV substation, which is the subject of a separate Strategic Infrastructure Deployment (SID) application to an Bord Pleanála for approval pursuant to section 182A of the Planning and Development Act 2000 (as amended). This proposed substation will enhance the electricity grid and will allow for development outside of the site to be enabled by including spare 110kV circuits which can be made available for other development if required. **Status: Compliant with policy**

Chapter 7 EC P21	Support the infrastructural renewal and development of the gas networks in the county, subject to proper planning, heritage, environmental and amenity requirements.	In discussion with GNI, a new connection to their gas network will be provided via an AGI. This will also include the facility to allow for injection of bio-methane into the gas network. **Status: Compliant with policy**

As can be seen from Table 5-1 above, it is clear that the proposed data centre development is fully consistent with all relevant local planning policies.

6 GHG Emissions Assessment / NZC

6.1 Introduction

A Greenhouse Gas (GHG) emissions assessment has been carried out for the proposed campus development over an operational lifetime of 2027 to 2047, to predict the anticipated year of Net Zero Carbon (NZC) for the Proposed Development.

As outlined below, a conservative approach has been adopted on the basis of national policy and strategies, to assess the pathway to decarbonisation of the Proposed Development. The strategy below enables a NZC timeline of 2039. Should the relevant national strategies be implemented more quickly than the conservative estimate adopted for the purposes of this assessment, there is a potential for NZC to occur in the early 2030's. The NZC calculations are set out in more detail in Appendix A.

The assessment's timeline pathway to NZC has been informed by the following documents:

- **Ireland's National Biomethane Strategy | May 2024 publication** by Government of Ireland, Department of Agriculture, Food and the Marine, in partnership with the Department of the Environment, Climate and Communications.
- **Climate Action Plan 2025 | publication** by Government of Ireland
- **Climate Action Plan 2024 | publication** by Government of Ireland
- **Climate Action Plan 2023 | publication** by Government of Ireland
- **National Hydrogen Strategy | July 2023 publication** by Government of Ireland, Department of the Environment, Climate and Communications.
- **Injecting green hydrogen blends into Ireland's gas network, Technical and safety feasibility study | December 2022 publication** by Gas Networks Ireland

Government of Ireland's Data Centre Strategy

The above strategy documents include summaries of key policy statements, including the *Government Statement on the Role of Data Centre in Ireland's Enterprise Strategy*, as per the insert below from Section 1.1 of the *National Hydrogen Strategy*:

Major Policy Statements 2020-2023 *(continued)*	
Government Statement on the Role of Data Centre in Ireland's Enterprise Strategy	• This Statement seeks to enable the 'twin transitions' of digitalisation and decarbonisation of our economy and society. These transitions can – and must be – complementary. For this to happen, digital and climate change policies need to move in tandem and this Statement sets out how this will be achieved in respect of data centres. • The Statement highlights the CRU Decision (CRU/21/124) that new data centre connections are required to have on-site generation (and/or battery storage) that is sufficient to meet their own demand and, to assist in full decarbonisation of the power system, this generation should also be capable of running on renewably sourced fuels (such as renewable gas or hydrogen) when supplies become more readily available.

The policy defines the need for a complimentary transition of digitalisation and decarbonisation supported by high-level expectations, summarised as:

- On-site generation to meet demand, and/or
- On-site battery storage, and
- Power generation capable of running on renewably sourced fuels (such as renewable gas or green hydrogen), when supplies become more readily available. It should be noted that from the outset of the project, all gas turbines whether OCGT or CCGT types will be specified to be able to run on natural gas, a mix of natural gas and hydrogen and also pure hydrogen.

6.2 Pathway to Decarbonisation

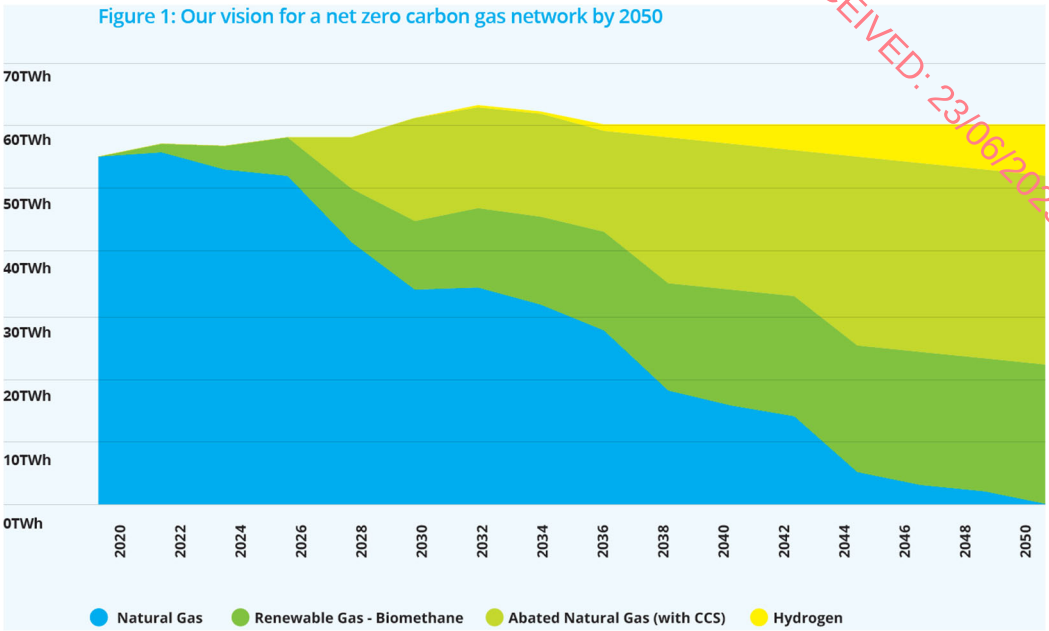
The two key sources of energy for the Herbata Data Centre Campus project are 100% renewable electricity sourced via CPPAs (at least 50% of energy demand) and power generated from highly efficient on-site gas turbines.

It has already been identified in Section 3.3 above how energy supplied from the electricity grid will be sourced from renewable generators such as onshore wind, offshore wind and solar PV arrays. This electrical energy will be provided through commercial agreements or CPPAs, discussed earlier in Section 3.3 to provide 100% renewable electricity. This is supported by both the CRU and Eirgrid as discussed earlier in Section 4.3.

Similarly, in the context of the power generated onsite via the gas turbines, Gas Networks Ireland (GNI) has plans to decarbonise the gas network over time such that these gas turbines will be able to operate on 100% green hydrogen in the future, allowing the Proposed Development to operate on a net zero carbon basis from 2039 onwards.

In that regard, GNI published a key document in 2020 that illustrated their vision for achieving this decarbonization, namely Vision 2050: A Net Zero Carbon Gas Network for Ireland, which is included at Appendix C to this report. As set out in Vision 2050, decarbonization of the gas network would be achieved by a combination of using hydrogen, biomethane and abated natural gas.

Figure 6-1. Extract from GNI's Vision 2050, Figure 1, page 05
Source: GNI Vision 2050



While the figure above from the GNI Vision 2050 Document indicates that a slower roll out of hydrogen was projected at that time, this has been significantly accelerated under the National Hydrogen Strategy as described in detail below.

As mentioned, partly in response to this Vision 2050 document, and to accelerate the timeline for decarbonization of the gas network and the introduction of green hydrogen, the Government published the *National Hydrogen Strategy* in July 2023, as discussed in more detail below. This set out a national strategy for the development of a new green hydrogen gas network to, in part, replace the current natural gas network particularly for heating and for large energy users (including developments such as the Herbata Data Centre).

The National Hydrogen Strategy recognised that the development of this network and the roll out of green hydrogen would take time, and so a target of 2039 was adopted for 100% green hydrogen to be available to large energy users.

The pathway to decarbonisation set out in the National Hydrogen Strategy, and how this introduction of green hydrogen will facilitate the decarbonisation of the electricity generated by the on-site gas turbines and allow the Proposed Development to operate on a net-zero carbon basis from 2039, is discussed in more detail below.

In light of the National Hydrogen Strategy, the Proposed Development has been designed so that it can take full advantage of the national roll out of biomethane and green hydrogen as part of its pathway to decarbonisation, and includes on-site:

- Electricity generation via Photovoltaic arrays
- Fuel adaptable gas-powered electricity generation
- Mains Gas supply, complete with:
    - The capacity for 100% green hydrogen gas supply, or for hydrogen to be mixed with natural gas, and
    - Biomethane injection point
- Battery storage for charging and discharging of electrical energy

- Electricity grid connection to deliver a minimum of 50% of the energy demand from 100% renewable energy sourced via CPPAs.

Therefore, on the basis of this design, the strategy for decarbonisation of the Proposed Development to ensure that it can operate on a Net-Zero Carbon basis from 2039 is based on Government and GNI policies and strategies, and focuses on opportunities to decarbonize the fuel supply to the Proposed Development, namely:

- To use a 20% mix of green Hydrogen with natural gas to power the on-site gas turbines from the outset of operations;
- Use of a mix of biomethane as part of the supply to the on-site gas turbines (noting that a biomethane injection point has been included as part of the Proposed Development); and,
- The use of 100% Green Hydrogen to power the gas turbines from, at the latest, 2039 onwards, sourced via a local network/cluster and/or the national hydrogen network in accordance with the National Hydrogen Strategy.

In order to promote the transition to renewable energy more widely, the opportunity to inject a combination of green hydrogen and biomethane into the national gas network has been considered for the purposes of this assessment and a biomethane injection point has been included as part of the Proposed Development.

Anticipated Green Hydrogen Consumption

Due to the properties of hydrogen and in accordance with GNI's '*Injecting green hydrogen blends into Ireland's gas network'*, December 2022, the maximum amount of hydrogen which can be mixed with natural gas in the national gas network at present is 20%. Therefore a 20% green hydrogen mix has been adopted for on-site injection into the gas supply pipeline, consistent with GNI's *'Injecting green hydrogen blends into Ireland's gas network'*, December 2022 as set out in the following extract:

1.1.1 Objective one - Conclusions

This report has considered the pilot hydrogen blending projects undertaken in both the UK and Europe. In particular, the HyDeploy project (undertaken on two discrete networks in the UK) has successfully demonstrated that hydrogen blends can be safely introduced on the distribution network with no negative impact on either the network itself, or domestic and commercial customers. The evidence generated from HyDeploy, particularly in the area of materials assessment where a significant evidence base has been developed, can be used to support hydrogen blending projects in Ireland. This evidence indicates that up to 20% hydrogen blends will not impact existing materials found on the British gas distribution network.

Source: GNI's 'Injecting green hydrogen blends into Ireland's gas network', December 2022, section 1.1.1 Objective one - Conclusions, page 9.

As green hydrogen ("GH") production is being developed with a target in place to provide 4TWh of green hydrogen by 2030, for the purposes of this report, the ramp up of GH has been based on an exponential curve from 2023 to 2030, and then a linear increase in supply from 2030 to 2050, representing a total supply of 35.6 TWh by 2030. This is based on GNI's national non-domestic demand prediction of 74.6TWh, minus 39TWh/annum domestic.

As mentioned above, in accordance with the *National Hydrogen Strategy* July 2023, from 2038 onwards a National Hydrogen Network will be in place which will enable the supply of 100% green hydrogen to developments such as the Herbata Data

Centre. Based on this, the Proposed Development has been designed so that a switch over to the use of 100% green hydrogen can occur in 2039. Further, the provision of local networks/clusters, as also envisaged in the National Hydrogen Strategy, provides the opportunity for the Proposed Development to accelerate the NZC programme, subject to development in the local area and such a local network or cluster being available.

This is further supported by the relatively close proximity of the Proposed Development to GNI's renewable gas entry point (marked in green in Figure 6-2 below) and Interconnector 2 (marked in blue in Figure 6-2 below) which demonstrate the opportunity for hydrogen to be injected into the network in close proximity to the Proposed Development or for a form of local network or cluster to be developed in the area. This is demonstrated in Figure 6-2 below which has been extracted from GNI's '*Injecting green hydrogen blends into Ireland's gas network*', December 2022:

Figure 6-2. Extract from Hydrogen Gas Network
Source: GNI's 'Injecting green hydrogen blends into Ireland's gas network', December 2022, Figure 2-2-1 Overview of Gas Networks Ireland's Transmission System, page 13

Furthermore, the Government's *National Hydrogen Strategy* July 2023 sets out a strategic development timeline or roadmap, which identifies a route to provide for the use of hydrogen on a phased basis over time, with connections to a 100% green hydrogen "niche" national network projected from as early as 2033, and local networks/clusters (where green hydrogen is made available via localised networks for specific users), to be available from as early as 2028.

The routes identified in the National Hydrogen Strategy by which green hydrogen can be made available on a phased basis over time are as follows, as set out in more detail below and illustrated in Table 1 of the National Hydrogen Strategy:

- **During the period 2023-28:** Renewable hydrogen will be produced from curtailed grid electricity or onshore renewables, with hydrogen blends available across the interconnectors for a small number of niche applications, either via network blending or trucked (non-pipeline) hydrogen, complemented by the option of large-scale deployment of small-scale storage applications for storage of hydrogen.

- **During the period 2028-33:** Renewable hydrogen will continue to be produced from curtailed grid electricity and/or onshore/offshore wind, including blends across niche interconnectors either via network blending, trucked (non-pipeline) for on-site use, or local networks/clusters, complete with large scale deployment of small-scale storage applications and niche network blending.
- **During the period 2033-38:** Renewable hydrogen produced from offshore wind will be available for large scale deployment, with continued blends across interconnectors, large scale local networks/clusters, niche national hydrogen network and small-scale storage applications.
- **During the period 2038-50:** At this point, there will be large-scale deployment of a national hydrogen network, complete with import/export routes established, and complemented by large-scale storage solutions of geographical scale and maintained niche networks/clusters. This means that in this period as set out in the National Hydrogen Strategy there will be 100% green hydrogen available for use by developments such as the Herbata Data Centre.

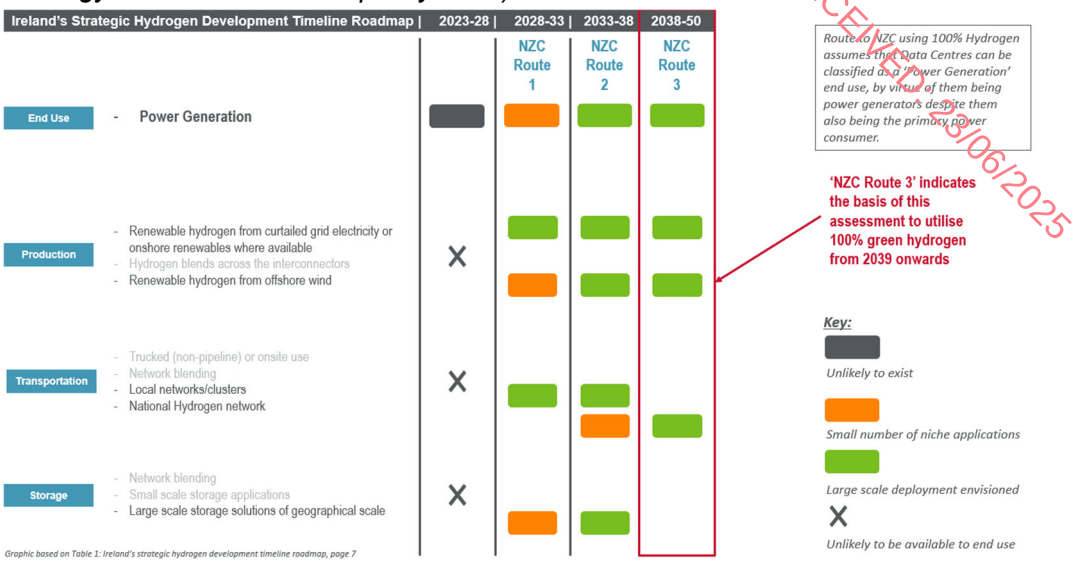
Therefore, in assessing and demonstrating the pathway to decarbonsation of the Herbata Data Centre, green hydrogen has been incorporated as a proportion of the gas supply to the Proposed Development, to ramp up on a linear scale until 2039 (based on a targeted national production opportunity of 35.6TWh by 2050 as discussed above). In 2039, as set out in the National Hydrogen Strategy, 100% green hydrogen supply will be available for use by the Proposed Development and so from 2039 onwards the gas turbines will be powered by 100% green hydrogen, and the Proposed Development will operate on a Net Zero Carbon basis.

To inform this assessment and to ensure that a robust and conservative approach was adopted in considering the carbon emissions of the Proposed Development, three possible routes for the Proposed Development to operate on a Net Zero Carbon basis were identified based on the National Hydrogen Strategy, as illustrated by Figure 6-3 below.

As can be seen from Figure 6-3 below:-

- Net Zero Carbon Route 1 envisages that the Proposed Development could operate on a Net Zero Carbon basis from as early as 2028, based on the large scale deployment of local hydrogen networks/clusters, which may be available for the Proposed Development.
- Net Zero Carbon Route 2 envisages that, from as early as 2033, there will be large scale deployment of local hydrogen networks/clusters, which may be available for the Proposed Development, with the addition of a National Hydrogen Network for a small number of niche deployments.
- However, Net Zero Carbon Route 3 reflects the fact that, as set out in the National Hydrogen Strategy, there will be large scale deployment of a National Hydrogen Network from 2038 onwards, meaning that by that stage 100% green hydrogen will be available, via the national hydrogen network, to power the Proposed Development.

Figure 6-3. Potential NZC Routes (developed on the basis of the National Hydrogen Strategy – Timeline Roadmap July 2023)



Net Zero Carbon Routes 1 and 2 potentially provide a route for the Proposed Development to reach Net Zero Carbon more quickly, but both are dependent on a local network or cluster being available to the Proposed Development, and/or on the roll out of a hydrogen network for "niche" applications only.

The National Hydrogen Strategy is clear, however, that there will be large scale deployment of a National Hydrogen Network by 2039, meaning that Net Zero Carbon Route 3 is a realistic and robust projection on the basis of national policy.

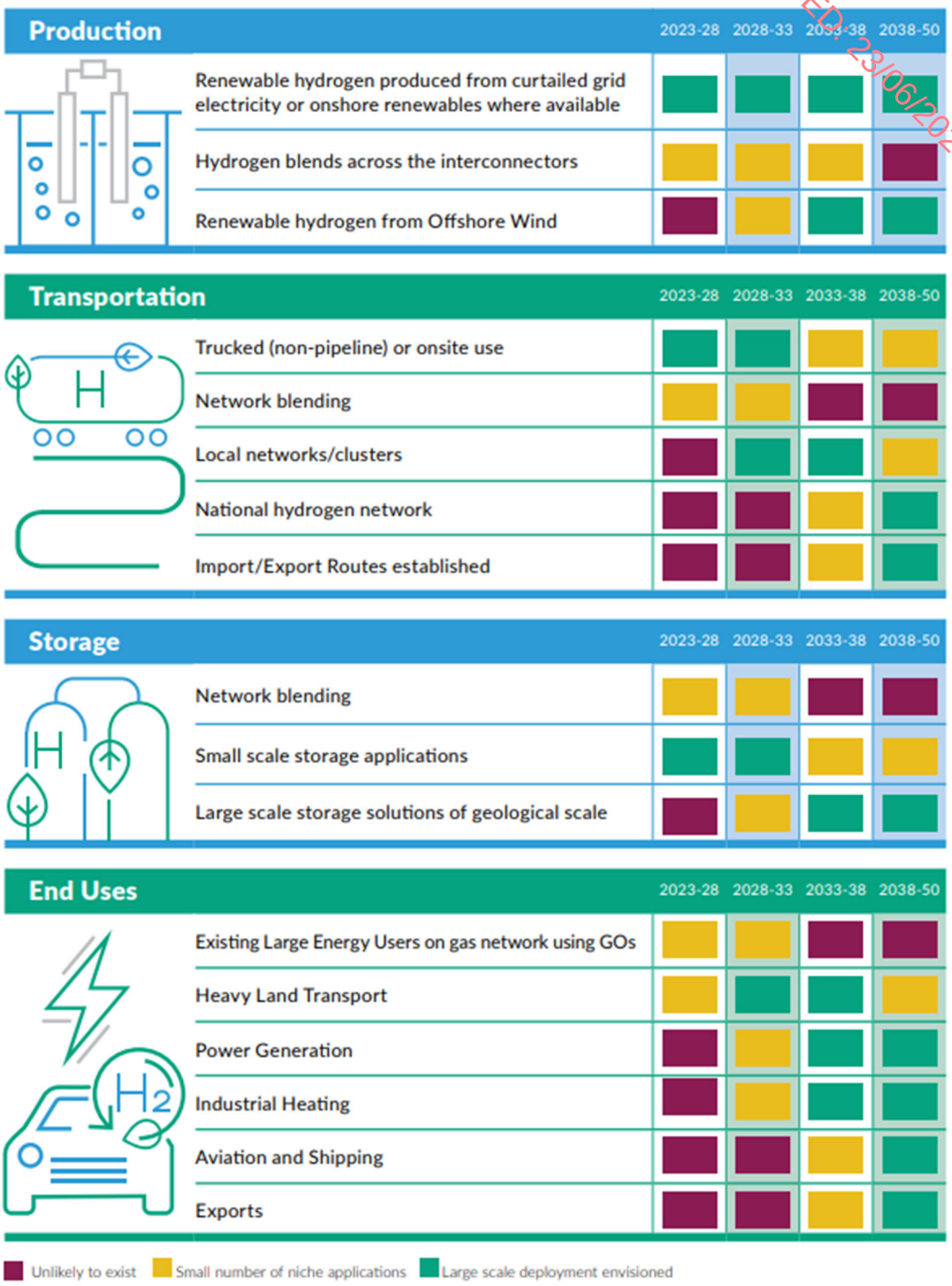
Therefore, while there may be opportunities for the Proposed Development to operate on a Net Zero Carbon basis from an earlier stage, in order to ensure a robust and conservative approach to the assessment of the Proposed Development it has been assumed that that will not occur, and that Net Zero Carbon Route 3, being the most conservative route based on the National Hydrogen Strategy, is the pathway for decarbonisation of the gas supply to the Proposed Development.

On that basis, it has been determined that the Proposed Development will operate on a Net Zero Carbon basis, and the gas turbines will be fueled by 100% green hydrogen, from 2039 onwards.

The three potential routes to Net Zero Carbon as described above are supported by Table 1 of the National Hydrogen Strategy, reproduced below:

Table 6-1. Table 1: Ireland's strategic hydrogen development timeline roadmap, p7
Source: Government of Ireland's 'National Hydrogen Strategy', July 2023

Table 1: Ireland's strategic hydrogen development timeline roadmap



As can be seen from the above table which is contained within the National Hydrogen Strategy:-

(a) under the heading "Transportation" (which addresses how green hydrogen will be transported to end users), the table indicates by use of a green box that-

(i) there will be large scale deployment of local networks and clusters in the period 2028-2033 and 2033-2038, and

(ii) that there will be large scale deployment of a National Hydrogen Network in the period 2038-2050;

and,

(b) under the heading “End Uses”, and specifically in relation to power generation (which would include the generation of power for the Proposed Development using the on-site gas turbines):-

(i) the table indicates by use of an orange box that green hydrogen will be available for power generation in a small number of niche applications during the period 2028 to 2033; and,

(ii) it indicates by use of a green box, that there will be large scale roll out of green hydrogen for power generation during the periods 2033-2038 and 2038-2050.

Further, as referenced in the letter from GNI mentioned above and included at Appendix A to the RFI Response Report, GNI has in 2024 published its *“Pathway to a Net Zero Carbon Network”* (2024), which sets out a pathway for decarbonization of the existing national gas network with a view to developing a fully decarbonised network by 2045. While this 2045 date relates to the decarbonisation of the wider national gas network, for the reasons set out in detail above and in the National Hydrogen Strategy, 100% green hydrogen will be available via the national hydrogen network for large energy users such as the Herbata Data Centre, from 2039 onwards.

All of the above supports the analysis set out herein that, taking a robust and conservative approach, it has been determined that 100% green hydrogen will be available to power the proposed on-site gas turbines, and the Proposed Development will be able to operate on a Net Zero Carbon basis, from 2039 onwards in accordance with the National Hydrogen Strategy.

Anticipated Biomethane Consumption

The Government of Ireland’s latest Biomethane Strategy published in May 2024 considers a limit of 2% biomethane mix per supplier for heat across an initial 3-year period. From year 4, this percentage annually increases to a final target level of 10% by 2030. Whilst this statement is not directly linked to Data Centre’s and / or the biomethane production industry, it forms the basis of the biomethane injection strategy for this assessment by way of a conservative approach using a single supplier.

The maximum biomethane national production value is stated as 14.8TWh, within GNI’s Biomethane Energy Report, September 2023, page 2, as a target to be achieved by 2050 via linear ramp-up from the 2030 target of 5.7TWh (CAP24, page 230). Given the limit noted above of 2% biomethane mix per supplier and assuming that only one supplier can be used up until 2030, Herbata Limited proposed to use only 0.17TWh of the cumulative 2030 total of 5.7TWh, this in percentage terms is less than 3% of the total quantity, and not anything close to the figure of 50% mentioned in Item No. 3 of the KCC RFI. This is also noted in section 4.3 of the *Response to Request for Further Information Report, prepared by RPS. .*

6.3 Net Zero Carbon (NZC) Basis of Calculations

The following summarises data input to the operational GHG assessment for the Proposed Development:

- *Part L Ireland Regulated Energy Report* for Herbata Jigginstown, as noted in *Appendix K - Energy Efficiency and Climate Change Adaptation Design Statement*, submitted as part of the Planning Submission
- Use of a representative Part L UK data hall and services model, extrapolated to represent the Proposed Development's data halls. Note, a UK model is used as directed under Irish Building Regulations for energy modelling.
- Chapter 16 (Climate Change) of the *EIAR* submitted with the application for planning permission, and its Appendices, together with the Addendum to Chapter 16 (Climate) of the *EIAR* submitted as part of the Response to the KCC RFI, for the Proposed Development in relation to associated system operational data inputs (including PV and BESS).
- Desktop analysis of the ramping up of the loading to the data halls based on anticipated operational programme to a maximum 80% loading across the Proposed Development.
- Carbon factors according to the following table:

Table 6-2. Fuel Carbon Factors
Source: Various, see notes below table

Fuel Carbon Factors		
Natural Gas*	0.204	kgCO2/kWh
Hydrogen**	0.000	kgCO2/kWh
Biomethane***	0.050	kgCO2/kWh
Electricity****	0.332	kgCO2/kWh

* Value taken from SEAI emission factors excel for 2022
** Based on hydrogen supply being 100% Green Hydrogen + 0% network losses
*** Average of Ave. 'Default' & Ave. 'Typical' GHG values from Department for Energy Security & Net Zero 'Methods of calculating greenhouse gas emissions: "actual value method" and default value method".
**** Digest of UK Energy Statistics, 'SEAI conversion and emission factors excel', for electricity in 2022

6.4 NZC / GHG Assessment

The NZC / GHG assessment originally included three scenarios which were compared to each other (full information was provided in Appendix A to the Energy Policy Compliance Report submitted with the application for planning permission). This NZC/GHG assessment has been updated in this Updated Energy Policy Compliance Report to reflect the enhancements and refinements made to the Proposed Development in response to the KCC RFI, and to inform Herbata's response to Item No.1 and Item No. 3 of the KCC RFI.

In that regard, as noted above, the GHG emissions cited within Table 16.7 of the *EIAR* submitted with the application for planning permission and quoted in RFI item No. 1 (namely lifetime emissions of 28.6 million tCO_2e of carbon dioxide equivalent) is based on a theoretical and highly conservative worst-case scenario consisting of the following elements:

- Direct emissions from construction of the data centre building: 211,936 tonnes GHG
- Direct unregulated emissions from the operational phase: 14,933,067 tonnes GHG
- Direct regulated/battery emissions from the operational phase: 324,240 tonnes GHG
- Indirect emissions from embodied carbon in the server manufacture: 13,177,597 tonnes GHG

Where such a quantum of emissions to be projected to arise over an assumed 50-year lifetime of the construction and operation of this data centre it would rightly be of concern. However, there are a number of reasons why this level of GHG emissions presented in the *EIAR* (hereafter "*EIAR* Worst Case Scenario") is highly conservative and is not a realistic assessment of the likely GHG emissions arising from the proposed development, including:

- The figure of 28.6 million tCO_2e set out in the *EIAR* is calculated over an assumed 50-year lifetime, which is based on the standard timeframe for carbon life cycle assessment. On review of other consented data centres in Ireland, the typical operational lifetime of such operations is up to 20 years. A calculation over a realistic 20-year timeframe results in lifetime emissions of circa 11.6 million tCO_2e, illustrating that the data presented in Chapter 16 of the *EIAR* is based on a significantly over-estimated timeframe and is therefore not a realistic estimate of the likely lifetime emissions of the proposed development. This is further discussed, and a more realistic assessment of likely lifetime carbon emissions is presented in section 6 below and in the the *Addendum to the EIAR* to Chapter 16 Climate Change submitted as part of this RFI Response.
- The direct emissions from the operation of the data centre presented in the *EIAR* assumed that there would be no decarbonisation of the gas network and excluded a number of commitments presented in the original *Energy Policy Compliance Report* submitted with the application for planning permission (which commitments all form an integral part of the proposed development) to present a highly conservative worst case assessment of operational direct emissions which did not reflect the actual likely emissions arising from the proposed development. This is further discussed in section 6 below.
- The assessment of indirect emissions from embodied carbon in the manufacture of servers that will be used in the operation of the data centres is inherently speculative given there is a level of unknown in relation to the server choices that will ultimately be made by the tenants of the data centres, and the assessment presented in the *EIAR* assumed the highest possible embodied carbon in the production of the servers, and the highest frequency of server replacement, to present a highly conservative worst-case assessment of indirect emissions. However, this assessment set out in the *EIAR* did not take account of the obligations placed on the tenants of the Data Centres by the Carbon Neutral Data Centre Pact, which will lead to a significant reduction in the likely embodied carbon arising from the manufacture of servers as set out in section 6 below.

This section provides a sensitivity analysis (hereafter the "Likely Emissions Scenario") for the likely significant effects of both the direct operational phase emissions and the indirect construction phase emissions. The likely significant effects of the proposed development on climate have been further considered and re-assessed in light of this analysis and are considered and assessed in the Addendum to Chapter 16 Climate Change submitted as part of this RFI, which concludes that the whole life effects of GHG emissions resultant from the Project is aligned with Ireland's net zero targets and have been determined as 'minor adverse' for climate, which is not significant in EIA terms.

As set out in detail below:

- A comparison of the Likely Emissions Scenario for the direct operational emissions relative to the *EIAR* Worst Case Scenario demonstrates an **85% reduction** in emissions though a combination of (i) the energy commitments already set out as part of the application for permission which were not fully reflected in the assessments set out in the *EIAR*, and (ii) further enhancements made in response to the KCC RFI (see Operational Greenhouse Gas Emissions assessment below);
- A comparison of the Likely Emissions Scenario for the indirect emissions from embodied carbon in the servers relative to the *EIAR* Worst Case Scenario shows an **62% reduction** in emissions as a result of the obligations placed on the tenants of the Data Centre arising from the Climate Neutral Data Centre Pact (see Operational Greenhouse Gas Emissions assessment below);
- A review of the direct operational emissions relative to the appropriate emissions ceiling, shows that the reduced operational emissions equate to **1.78%** of the relevant Sectoral Emissions Ceiling, and not 49.3% as originally set out in the *EIAR* and as quoted in RFI Item 1 (see Operational Greenhouse Gas Emissions assessment below); and
- There is a further reduction in lifetime emissions to **84%** when a more realistic lifespan of 20 years is considered (see Operational Greenhouse Gas Emissions assessment below).

Operational Greenhouse Gas Emissions of the Proposed Development

This section considers the direct operational greenhouse gas emissions of the Proposed Development based on (i) the commitments set out in the original *Energy Policy Compliance Report* submitted as part of the application for planning permission and (ii) the enhancements described in the Factors below, and compares these to the highly conservative assessment presented in the *EIAR* Worst Case Scenario, to illustrate what in fact are the likely greenhouse gas emissions arising from this aspect of the Project.

As set out in Appendix A of the original *Energy Policy Compliance Report* submitted as part of the planning application, various factors impacting on unregulated energy emissions and the actual projected level of emissions (all of which are an integral part of the proposed development) mean that the quantum of emissions presented in the *EIAR* will not in fact arise. The particular factors with regard to operational phase emissions in respect of unregulated energy are:

Factor 1: Phased Construction – The proposed Data Centre will be constructed over three phases (totalling 8 years) as set out in the phasing plan within the *EIAR*, meaning that there will be a gradual ramp up of operational demand.

Factor 2: Each building has a "load ramp-up" - It is not possible to simultaneously install all the IT equipment and servers at once, due to the logistics of installation. For a single phase of the deployment, it is estimated that it will take approximately 3 years to fully install all the IT equipment associated with that phase. As the equipment is installed and switched on, so the load increases and there is therefore a load ramp-up over these 3 years as each data centre building is brought online.

Factor 3: Operational Demand - When fully operational, functional data centres do not reach 100% utilisation of power. This is a design figure which is rarely reached during operation. Data centre operators and occupiers are extremely keen to ensure that their facilities work constantly with no interruptions. To accomplish this, they typically do not load their facilities to more than 80% of the design IT capacity.

Factor 4: Use of Renewable Energy – In the initial planning proposals it was proposed that a minimum of 30% of energy requirements will be met by renewable energy procured through CPPAs (Note: As discussed further below, this percentage has now been increased to a minimum of 50%).

Factor 5: Gas Supply – In accordance with the National Strategy for Biomethane (2024) and the National Hydrogen Strategy (2023) the public gas supply is set to include an increasing level of biomethane and hydrogen. From the outset of operations, 20% of the gas supply to the data centres will be hydrogen gas (as advised by GNI's Vision 2050), and by 2039 all gas used onsite will be biomethane or hydrogen

Unfortunately, while the above measures are all integral parts of the proposed development and were set out in the original version of this report submitted with the application for planning permission, they were not reflected in the figures presented in Table 16.7 of the Climate Chapter of the *EIAR*.

The actual projected unregulated energy demand for the application lodged are set out in Table 6-3 below, which reflects the impact of each of the above factors. This table shows that the 50-year lifetime unregulated emissions presented in the *EIAR* of 14,933,067 tonnes (298,661 tonnes as an annual average) reduces to 3,838,753 tonnes or 76,775 tonnes as an annual average when the commitments set out in the original *Energy Policy Compliance Report* are taken into account, being a reduction of c.**74%**.

Table 6-3. Direct Operational (Unregulated) GHG Emissions with Mitigation

Case	Basis of Case	50-year Lifetime Direct Emissions (tonnes GHG)	Annual Average Direct Emissions (tonnes GHG)
Worst Case condition (As reported in Table 16.7 *EIAR*)	No inclusion of any of the above Factors	14,933,067	298,661
Base Case (i.e. taking into account Factors 1 and 2 above)	Phased Construction Load Ramp up of each data hall Operational demand at 80%	5,754,883	115,098
Proposal as per Planning Application (i.e. taking into account all of Factors 1 to 5 above)	Partial natural gas with: - 20% hydrogen mix - 30% renewables (CPPAs and onsite PV) - Biomethane - 100% hydrogen from 2039	3,838,753	76,775

As has been referenced in **Section 6** of this updated Energy Policy Compliance Report, since the submission of the planning application the design team have, in response to the KCC RFI and in recognition of the concerns expressed in RFI item 1, brought forward additional design and energy enhancements to further reduce the energy requirements and emissions arising including:

> **Factor 6:** Additional use of Renewable Energy – It is now proposed that from the outset a minimum of 50% of energy requirements will be met by renewable energy procured through CPPAs (increased from 30% as set out in the application for planning permission); and
>
> **Factor 7:** Use of CCGTs (see Section 3.3 above) – It is now proposed that the gas turbines required to provide up to 50% of energy demand shall be CCGT rather than, as previously proposed, OCGT. This shall improve the efficiency of the electricity generated on site from circa 30.8% to near 45% and significantly reduce the volume of gas required to serve the data centres.

The application of each of these factors gives a projection of the likely unregulated energy emissions that will in fact arise from the Project once these enhancements are taken into account, as shown in Table 6-4 below.

The actual projected unregulated energy emissions from the Likely Emissions Scenario will be circa **85% lower** than the worst-case scenario referenced in the *EIAR*. Projected likely annual average emissions from the data centre will be 43,715 tonnes, compared to the worst case 298,661 tonnes presented in the *EIAR*.

Table 6-4. Direct GHG Emissions with Mitigation, Amended Gas Turbines and Increased Renewable Energy.

Case	Basis of Case	50-year Lifetime Direct Emissions (tonnes GHG)	Annual Average Direct Emissions (tonnes GHG)
Worst Case condition (As reported in Table 16.7 *EIAR*)	No inclusion of any of the above Factors	14,933,067	298,661
Base Case (i.e. taking into account Factors 1 and 2 above)	Phased Construction Load Ramp up of each data hall Operational demand at 80%	5,754,883	115,098
Proposal as per Planning Application (i.e. taking into account all of Factors 1 to 5 above)	Partial natural gas with: - 20% hydrogen mix - 30% renewables (CPPAs and onsite PV) - Biomethane - 100% hydrogen from 2039	3,838,753	76,775
Likely Emissions Scenario (i.e. taking into account all of Factors 1 to 7 above)	Partial natural gas with: - 20% hydrogen mix - Biomethane - 100% hydrogen from 2039 - 50% renewables (CPPAs) 45% turbines as CCGT types	**2,185,760**	**43,715**

Indirect emissions from embodied carbon in servers

Embodied carbon refers to the total greenhouse gas emissions associated with the production and transportation of materials and equipment. In this project the highest embodied carbon as presented in Table 16.7 of the *EIAR* relates to the embodied carbon in the servers that will be employed in the project.

As discussed above, the emissions associated with server fit out that are presented in Table 16.7 of the *EIAR* represent a highly conservative worst-case estimate whereby the highest possible embodied carbon values per server are employed along with the highest possible frequency of server exchange (i.e. servers being replaced every four years) have been assumed. However, this assessment set out in the *EIAR* did not take account of the obligations placed on the tenants of the Data Centres by the Carbon Neutral Data Centre Pact, which will lead to a significant reduction in the likely embodied carbon arising from the manufacture of servers.

To estimate what in fact will be the likely embodied carbon associated with the production of servers, to be included in the Likely Emissions Scenario, a sensitivity analysis has been undertaken where a more typical embodied carbon server has been selected, along with a more mid-range frequency of server exchange, to reflect

how tenants will in fact be required to fit out and operate the data centre buildings. This analysis is presented in Table 6-5 below alongside the highly conservative worst-case emissions presented in Chapter 16 of the *EIAR*.

This demonstrates that when alternative servers to those considered in the *EIAR* are used, and measures are undertaken to extend the lifetime of servers through maintenance regimes and reuse, associated emissions are circa **62%** lower than the value quoted in the *EIAR* across an assumed 50-year lifetime of the Project, being a reduction from 13,177,597 tCO_2e to 4,959,046 tCO_2e.

Reduction in the likely Lifespan of the Project

The above analysis sets out a realistic assessment of the likely carbon emissions associated with the proposed development over a 50 year lifespan, which was the lifespan assumed in the *EIAR* based on the standard timeframe for carbon life cycle assessment, and demonstrate that the overall net emissions of the project over that period have been reduced by **74%** compared to the figures set out in the *EIAR*.

However, as mentioned above, the 50-year lifespan assumed in the *EIAR* is not a realistic assumption for a development of this nature, and in fact the operational lifespan of the proposed development will be significantly less than 50 years. On review of other consented data centres in Ireland, the typical operational lifetime of such operations is up to 20 years. Therefore, the total lifetime emissions of the project has been further re-assessed on the basis of a 20-year lifespan.

Tabel 6-5 below shows a comparison of the total lifetime emissions in the *EIAR* Worst Case Scenario based on a 50-year total lifespan, and what those worst-case lifetime emissions would be if assessed based on a realistic 20-year lifespan.

Table 6-5: Comparison of a 50-year lifespan assumed in the EIAR against a realistic 20 year lifespan in the EIAR Worst Case Scenario

Source		EIAR 50-Year Lifespan (tCO_2e)	20-Year Lifespan (tCO_2e)	Change
Direct (Applicant Controlled Elements)				
Construction	Embodied carbon in construction materials	211,936	211,936	No change
Operation	Regulated energy use (i.e. space heating and cooling, hot water, ventilation, and lighting)	88,351	35,340	-60%
	Unregulated energy use (i.e. data hall demand)	14,933,067	5,973,227	-60%
	Battery energy storage systems	235,889	94,356	-60%
Total Direct		**15,469,243**	**6,341,859**	-59%
Indirect	Embodied carbon in servers	13,177,597	5,271,039	-60%
Total Lifetime		**28,646,840**	**11,585,898**	**-60%**

This table shows that when calculated over a realistic 20-year timeframe, the lifetime emissions even in the *EIAR* Worst Case Scenario reduce from c. 28.5 million tCO_2e to circa 11.6 million tCO_2e, illustrating that the data presented in Chapter 16 of the *EIAR* is based on a significantly over-estimated timeframe and is therefore not a realistic estimate of the likely lifetime emissions of the proposed development.

Further, Table 6-6 below shows a comparison of the total lifetime emissions in the Likely Emissions Scenario based on a 50-year total lifespan, and what those lifetime emissions would be if assessed based on a realistic 20-year lifespan.

Table 6-6: Comparison of a Likely Emissions Scenario 50 year lifespan against a realistic 20 year lifespan in the Likely Emissions Scenario

Source		50-Year Lifespan (tCO_2e)	20-Year Lifespan (tCO_2e)	Change
Direct (Applicant Controlled Elements)				
Construction	Embodied carbon in construction materials	211,936	179,093	-15%
Operation	Regulated energy use (i.e. space heating and cooling, hot water, ventilation, and lighting)	88,351	10,308	-88%
	Unregulated energy use (i.e. data hall demand)	14,933,067	2,185,760	-85%
	Battery energy storage systems	235,889	38,529	-84%
Total Direct		**15,469,243**	**2,413,689**	-84%
Indirect	Embodied carbon in servers	13,177,597	2,125,305	-84%
Total Lifetime		**28,646,840**	**4,538,994**	**-84%**

This table demonstrates that, when compared against a realistic 20-year lifespan for the development, the total lifetime emissions in the Likely Emissions Scenario are further reduced to 4.5 million tonnes.

This analysis of lifetime emissions results in an overall reduction in lifetime emissions from the figure of **28,646,840** tCO_2e set out in the *EIAR*, to **4,538,994** tCO_2e, being a reduction of **84%**.

Comparison against Relevant Sectoral Emissions Ceilings

RFI Item No. 1 also refers to the contextualization of the Project relative to the Sectoral Emissions Ceiling for the Commercial Built Environment Sector. In that regard, CAP25 notes that this Commercial Built Environment sector includes the residential, public and commercial sectors, with emissions relating to space and water heating of such buildings as noted in the inventories compiled by the EPA[2].

In responding to this aspect of the RFI, a review of the appropriate Sectoral Emissions Ceiling for use on this Project has been undertaken based on the nature of the energy demand for the Project, an evaluation of the national policy base, and consideration of evaluation criteria used on other data centre projects (in particular those consented in County Kildare), to ensure consistency for the planning authority and to ensure that the emissions of the Project are compared to the correct Sectoral Emissions Ceiling.

Following this review, the climate experts have determined that the Commercial Building Environment sector was not in fact the correct sector against which to compare the carbon emissions arising from the energy demand for the data centres. Rather, the Electricity Sectoral Emission Ceiling is the appropriate policy comparator for a number of reasons, namely:

- This sector accounts for emissions from fuels combusted in electricity generation. The use of a set of on-site gas turbines to generate electricity for use on site designates the site as a large/medium combustion plant, indicating that this Project falls within the Electricity Sector, rather than the Commercial Built Environment Sector (for projects in the Commercial Built Environment sector, electricity and/or gas is imported for space/water heating);
- The use of the Electricity Sectoral Emission Ceiling as a policy comparator in other consented data centre developments. For example, the Kildare Innovation Campus which was granted permission by Kildare County Council on the 7th September 2023 (KCC Ref: 2360047, ABP Ref: 318151) employed the Electricity Sectoral Emission Ceiling in the evaluation of impacts. Therefore the use of this sectoral ceiling in the assessment of this project also facilitates consistency in assessment and decision making as between different applications for planning permission; and
- In addressing the potential climate impact of data centres in the Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy 20223, the impact is addressed in the context of the Electricity Sectoral Emission Ceiling, illustrating the key importance of data centres with respect to this sector and its emissions ceilings.

The analysis presented in the *Addendum to the EIAR* Chapter 16 Climate Change submitted as part of the response to the KCC RFI uses the Electricity Sectoral Emission Ceiling, where appropriate, as the relevant policy comparator for the determination of climate impact. Therefore, the comparison set out in Chapter 16 of the *EIAR*, and referred to in RFI item 1, against the sectoral emissions ceiling for the

[2] Source: Commercial and public services | Environmental Protection Agency and https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/residential/#

[3] Source: https://enterprise.gov.ie/en/publications/government-statement-on-role-of-data-centres-in-enterprise-strategy.html

Commercial Built Environment sector has been superseded and should be disregarded.

In July 2022, the government approved the sectoral emissions ceilings for the first two carbon budget periods (2021-2025 and 2026-2030)[4] and the Electricity Sectoral Emission Ceiling are as follows:

- 2021-2025: 40 MtCO2eq
- 2026-2030: 20 MtCO2eq

Table 6-7 below compares the direct operational emissions of the project (from Table 6-3) with the Electricity Sectoral Emission Ceiling 2026-2030, and the results indicate that these emissions equate to **1.78%** of the Sectoral Emission Ceiling.

KCC noted in RFI Item 1 that the worst-case emissions reported in the *EIAR* represented c. 49.35% of the Sectoral Emissions Ceiling for the Commercial Built Environment Sector to 2030. Clearly, the Likely Emissions Scenario discussed above and presented in the Addendum to Chapter 16 represents a very significant reduction in total emissions, which is now compared against the correct sectoral emissions ceiling. In this regard the 49.35% of the Sectoral Emissions Ceiling that rightly raised a concern for KCC is now more appropriately reported at **1.78%** of the appropriate Sectoral Emissions Ceiling, which is not considered significant.

It is also noted that the analysis presented in Chapter 16 that raised the concerns of KCC was that the 49.35% of the Sectoral Emissions Ceiling included both the direct and indirect emissions presented in Chapter 16. While it is appropriate to determine the significance of the direct emissions from energy use (as these emissions are generated in Ireland), it was not appropriate to compare the indirect emissions from embodied carbon in servers relative to the Sectoral Emissions Ceilings.

That is because these servers are manufactured outside the State, predominately in North America or Asia, and the embodied emissions associated with materials and manufacture of such servers are realised and reported nationally, where required, in these jurisdictions. None of the servers will be manufactured in Ireland and, as such, while indirect emissions associated with the Project must be reported in compliance with Article 3 of the EIA Directive (2014/52/EU), it is not appropriate and would not be correct to compare those indicted emissions against Ireland's national Sectoral Emissions Ceilings.

Embodied carbon emissions from the manufacturer of servers will not impact on the State's carbon budgets or on any of the national sectoral emissions ceilings, and the inclusion of these emissions in the comparison presented in Chapter 16 was not correct. These emissions will be slight adverse as reported (see section 16.6 Climate Change Chapter of the *Addendum to the EIAR*), but cannot be included in the comparative analysis presented in Table 6-7 below.

[4] Source: https://assets.gov.ie/234926/2ebb2431-d558-4a54-a15c-605817c37b2f.pdf

Table 6-7. Impact relative to the Electricity Generation Sectoral Emissions Ceiling
Source: RPS/HDR

Source		Emissions (tCO_2e)
Operation	Regulated energy use (i.e. space heating and cooling, hot water, ventilation, and lighting)	10,308
	Unregulated energy use (i.e. data hall demand)	2,185,760
	Battery energy storage systems	38,529
Total Direct Emissions from Energy Use		**2,413,689**
Total Direct Emissions (Annual Average over 20 years)		**355,086**
Electricity Sectoral Emission Ceiling 2026-2030		**20,000,000**
% of Sectoral Emissions Ceiling		**1.78**

Further detail on Herbata Ltd's response to this RFI item is provided in the enclosed *Addendum to the EIAR* Climate Change Chapter prepared by RPS.

Conclusion

Having regard to all of the above, and all other submitted and enclosed detail as referenced above, the concerns raised in Item No. 1 of the KCC RFI have been fully addressed in this report and the RFI Response.

As set out in Table 6-3 above for the EIAR Worst Case Scenario, the direct unregulated emissions from the operational phase will reduced by over **85%**, to under **15%** of the value presented in Chapter 16 of the EIAR. This reduction is achieved through:

- Phasing of build up to full operation and full operation being 80% of the design IT capacity
- Renewable Energy Sources including:
  - 38% of all turbines as CCGT types to provide 50% of the total energy demand of the data centres;
  - 20% hydrogen mix from outset and 100% hydrogen from 2039;
  - 50% renewables (CPPAs); and
  - Biomethane.

In addition, by applying a realistic 20-year lifetime for the Project, the Likely Emissions Scenario estimated for the project is **4.5 million tonnes** which is **84%** lower than the total lifetime emissions presented in the EIAR.

A review of the appropriate Sectoral Emissions Ceiling for use on this Project has been undertaken based on the nature of the energy demand for the Project, an evaluation of the national policy base and consideration of evaluation criteria used on other data centre projects (in particular those consented in County Kildare) to ensure consistency for the planning authority and the Electricity Sectoral Emission Ceiling has been identified as the appropriate policy comparator.

Therefore, the analysis presented in the Climate Change Chapter of the *Addendum to the EIAR* uses the Electricity Sectoral Emission Ceiling, where appropriate, as the

relevant policy comparator for the determination of climate impact and the results indicate that these emissions equate to **1.78%** of the Sectoral Emission Ceiling which is not considered significant. The proposed development fully accords with national, regional and local policy.

Further, it is also clear from what is set out above in this report and also in (i) the Response to the Request for Further Information prepared by RPS, (ii) the addendum to Chapter 16 (Climate Change) of the EIAR prepared by RPS, and (iii) the Energy Strategy Report prepared by BOS Energy, all of which have been submitted as part of the response to the KCC RFI, that a comprehensive response to Items No. 2 and 3 of the KCC RFI has also been prepared, which fully addresses any concerns raised relative to those two items by KCC.

Appendix A

GHG Emissions Prediction, and Pathway to Net Zero Study

Herbata Data Centre Campus

GHG Emissions Prediction, and Pathway to Net Zero Study

17th May 2024 Rev 0

1. Introduction

Herbata Ltd. are proposing to develop a data centre campus to the west of Naas, with six data centre buildings each with an IT capacity of 30MW. The development is in support of Ireland's digital economy and commerce, however Herbata are acutely aware of the need to keep Greenhouse Gas (GHG) Emissions to a minimum and to show how and when they will achieve Net Zero Carbon ("NZC") in order to complement the digital economy alongside decarbonisation.

The following slides demonstrate the opportunities available for Herbata to reduce GHG emissions and achieve NZC well before 2050, addressed in the following sections:

2. **Potential Renewable Energy** – this explains how renewable energy sources for electricity and gas are expected to develop in Ireland through to 2050, including key production targets for biomethane and green hydrogen production, based on Government and Gas Network publications at the time of writing (further details contained in Section 4)

3. **Data Centre Campus Consumption Ramp-up** – the campus is planned to be constructed in three phases, with each building gradually loaded up with IT equipment. An assessment has been made on the likely ramping-up of IT load from 2027 to end of 2035

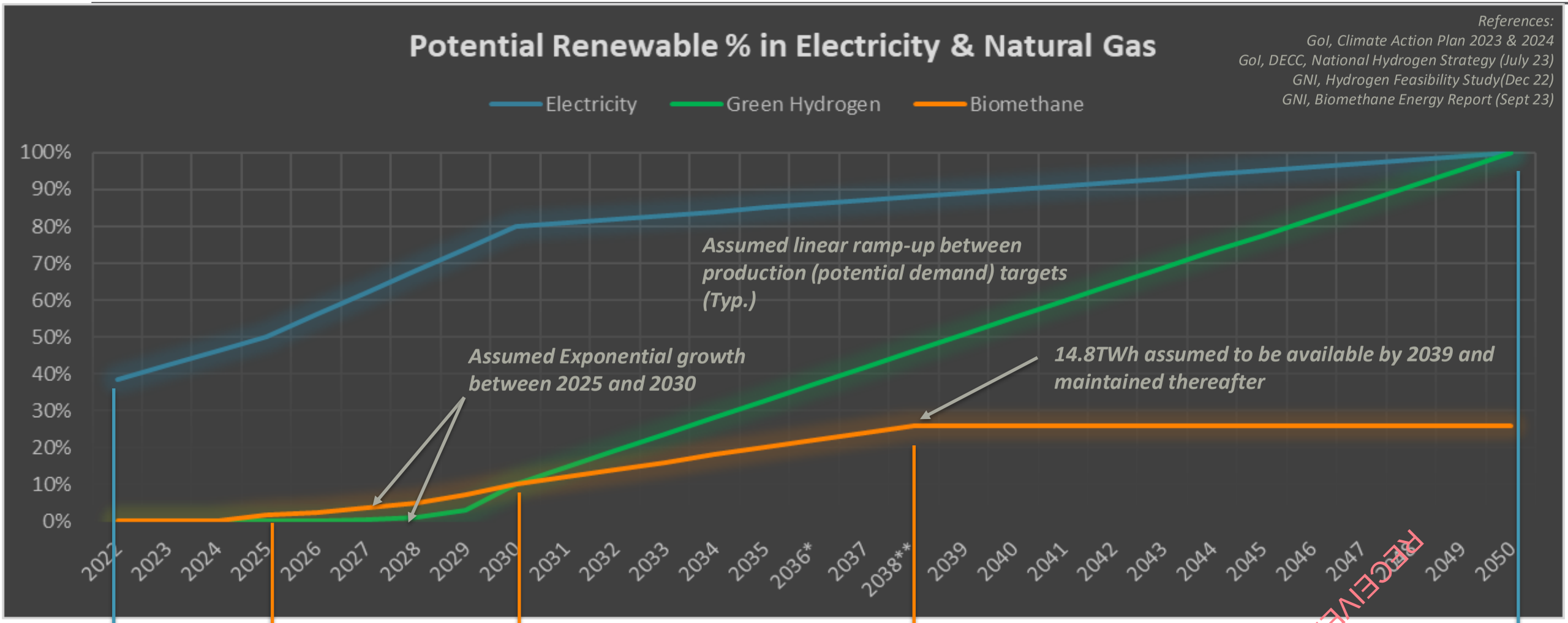
4. **Fuel Blend Scenarios Explanation** – Explanation of Scenarios that are considered and reported on in the following sections

5. **Fuel Blending Scenarios** - comparison of the Base Case, Scenario 1, and Scenario 2 in tabular format

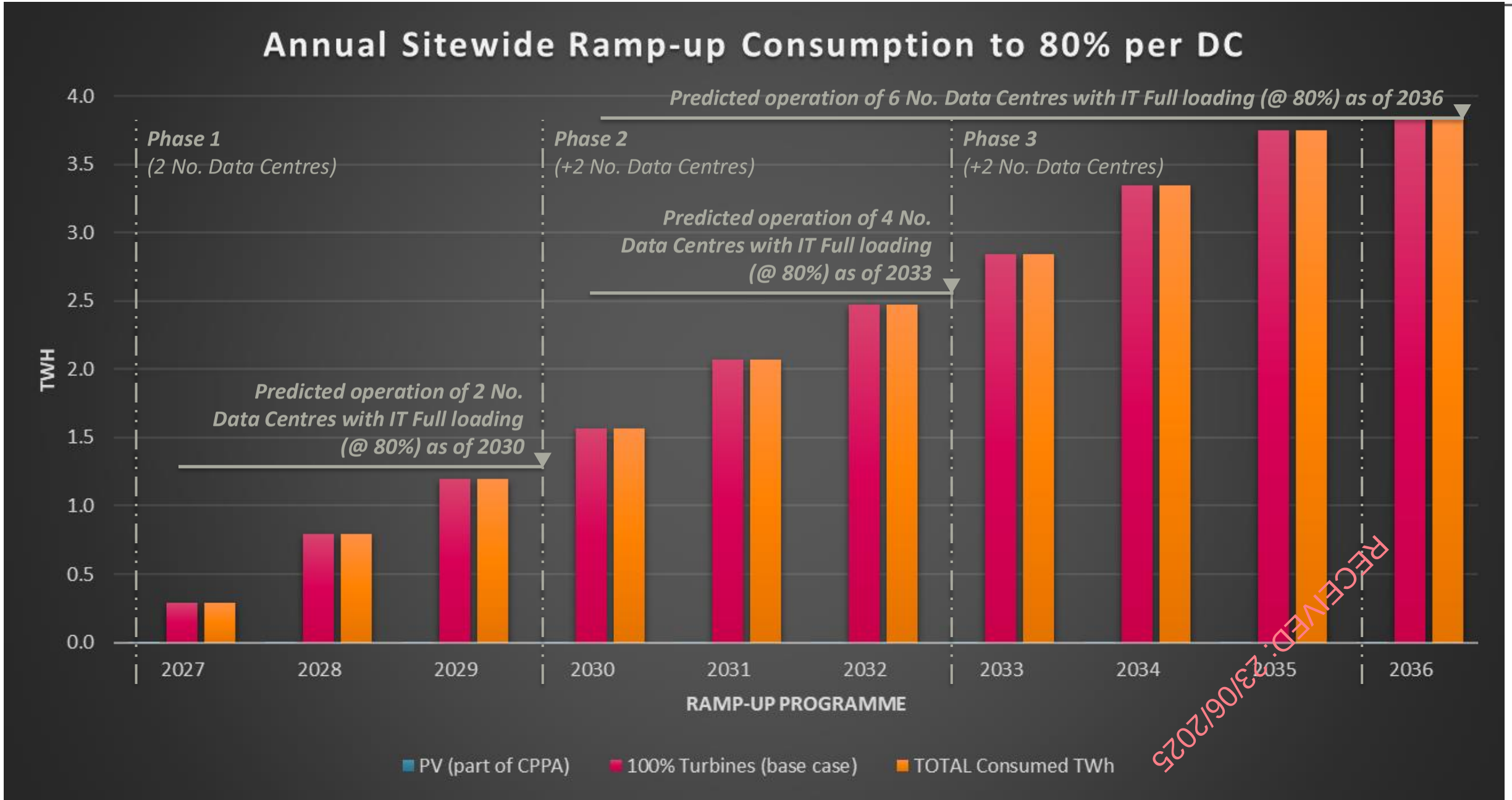
6. **GHG CO_2 Emissions** – comparison of the Base Case, Scenario 1 and Scenario 2 in graphical representation

7. **GHG Emissions Conclusion** – this summarises the output of this study

2. Potential Renewable Energy



3. Data Centre Campus Consumption Ramp-up



4. Fuel Blend Scenarios Explanation

Using collated, interpolated, and extrapolated information from Government of Ireland, Department of the Environment, Climate and Communications (DECC) and Gas Networks Ireland (GNI) as well as other key bodies such as Eirgrid and SEAI, it has been possible to develop various energy blend scenarios. To get to a NZC position, it is essential that ultimately all energy sources are provided by zero carbon / renewable sources. The main three low-and-zero carbon sources considered for this project are as follows:

1. **Electricity generated off-site** from solar and wind farms, connected through the grid to the site via commercial power purchase agreements (CPPAs)

2. **Biomethane** either injected directly on site into the gas supply or via a wider area arrangement with certificates

3. **Green Hydrogen** either mixed into the general gas network or locally injected as it becomes available

All of the above sources are being developed currently, and all have forecasted production rates through to 2050. There has to be some concern about the rate at which these fuel source developments occur as well as what proportion of the production can be assumed for this project. The more ambitious forecasts considered have therefore not been used and a more conservative approach adopted to develop three main scenarios, these are described in more detail on the following slide, and summarised below:

1. **Base Case** – this is the 'business-as-usual' approach, until green hydrogen switchover in 2039, with all energy being sourced from current natural gas pipelines and used in the on-site turbines to produce all electricity demands

2. **Scenario 1** – As Base Scenario, albeit with 30% (minus on-site PV) of the electrical energy sourced from grid connected CPPAs

3. **Scenario 2** – As Scenario 1, with biomethane and hydrogen added on a gradual uplift, then linear to maximum anticipated production

5. Fuel Blend Scenarios – Base Case, Scenarios 1 & 2

Year	Sitewide Demand & Energy Usage				
	Direct - Peak Gas Load (MW)	Indirect - Peak Electricity Load (MW)	Direct - Gas Usage (GWh/yr)	Indirect - Electricity Usage (GWh/yr)	
2027	29.0	3.7	254	32	Phase 1
2028	79.9	10.4	701	91	
2029	120.6	15.8	1,058	138	
2030	157.8	20.7	1,383	181	Phase 2
2031	208.7	27.4	1,830	240	
2032	249.4	32.8	2,187	287	
2033	286.6	37.7	2,512	330	Phase 3
2034	337.5	44.4	2,959	389	
2035	378.2	49.8	3,315	436	
2036	386.4	50.9	3,387	447	Sitewide IT load @ 80%
2037	386.4	50.9	3,387	447	
2038	386.4	50.9	3,387	447	
2039	386.4	50.9	3,387	447	
2040	386.4	50.9	3,387	447	
2041	386.4	50.9	3,387	447	
2042	386.4	50.9	3,387	447	
2043	386.4	50.9	3,387	447	
2044	386.4	50.9	3,387	447	
2045	386.4	50.9	3,387	447	
2046	386.4	50.9	3,387	447	
2047	386.4	50.9	3,387	447	
2048	386.4	50.9	3,387	447	
2049	386.4	50.9	3,387	447	
2050	386.4	50.9	3,387	447	

Scenarios of GHG Emissions predictions:

Base Case = 100% natural gas from 2027 to 2038, 100% green hydrogen from 2039 to 2050, no electricity grid connection throughout.

Scenario 1 = 100% natural gas from 2027 to 2038, 100% green hydrogen from 2039 to 2050, with 30% (minus on-site PV) electricity grid connection & CPPA throughout.

Scenario 2 = Blended natural gas with up to 20% green hydrogen and biomethane ramp-up from 2027 to 2038, 100% green hydrogen from 2039 to 2050, with 30% (minus on-site PV) electricity grid connection & CPPA throughout.

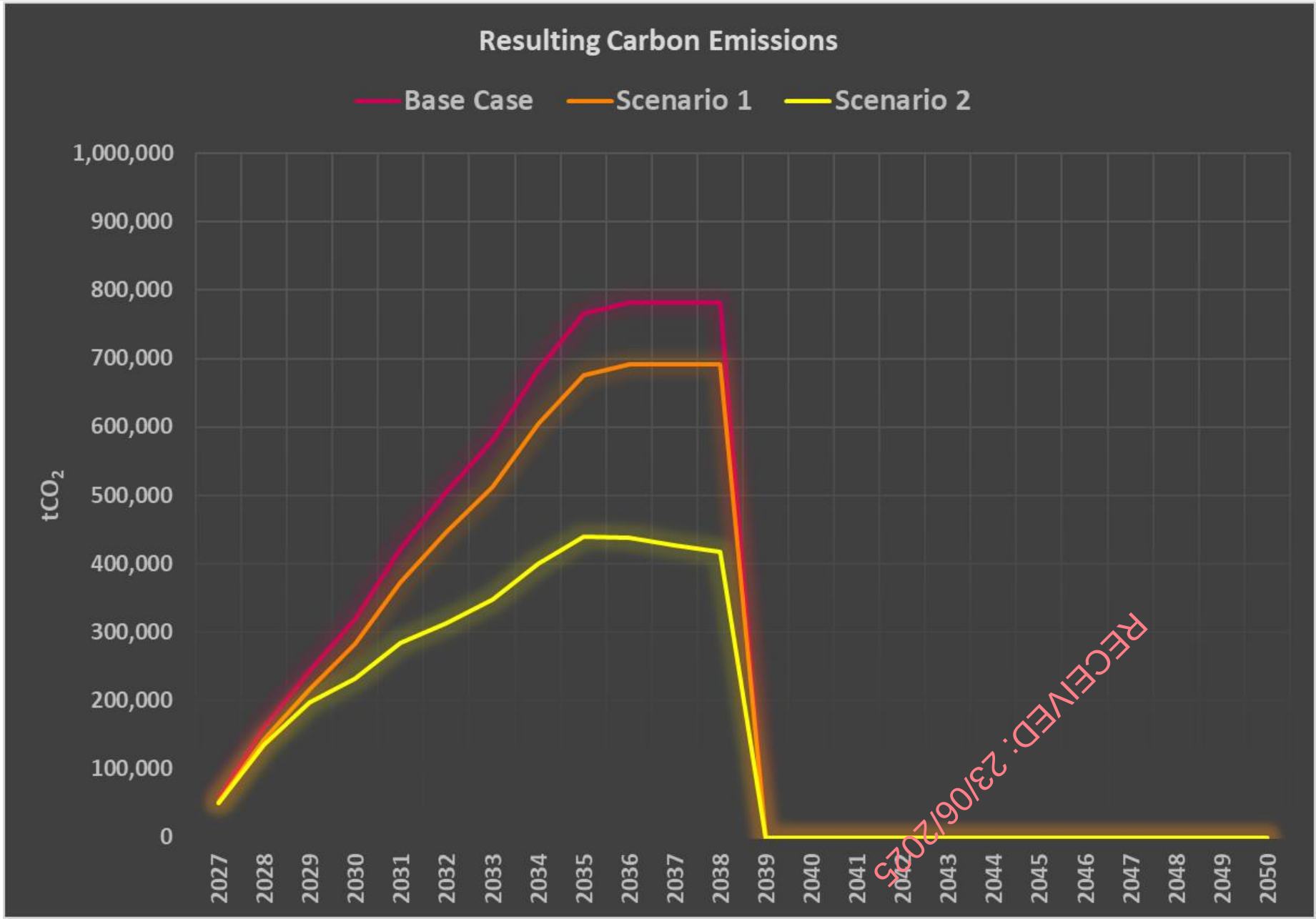
Year	Direct GHG Emissions (tCO_2/yr)			Indirect GHG Emissions (tCO_2/yr)	
	Base Case	Scenario 1	Scenario 2	Non-CPPA Scenario's 1 to 4	CPPA Scenario's 1 to 4
2,027	58,415	51,815	50,285	6,649	0
2028	161,557	142,938	136,183	15,795	0
2029	243,928	215,711	197,436	19,449	0
2030	319,051	282,079	231,832	19,602	0
2031	422,193	373,203	284,349	24,676	0
2032	504,564	445,975	313,058	27,958	0
2033	579,686	512,344	347,979	30,349	0
2034	682,829	603,467	400,768	33,662	0
2035	765,200	676,240	438,899	35,375	0
2036	781,888	690,794	437,928	33,809	0
2037	781,888	690,794	427,510	31,394	0
2038	781,888	690,794	417,092	28,979	0
2039	0	0	0	26,564	0
2040	0	0	0	24,149	0
2041	0	0	0	21,734	0
2042	0	0	0	19,319	0
2043	0	0	0	16,904	0
2044	0	0	0	14,490	0
2045	0	0	0	12,075	0
2046	0	0	0	9,660	0
2047	0	0	0	7,245	0
2048	0	0	0	4,830	0
2049	0	0	0	2,415	0
2050	0	0	0	0	0
Total	6,083,088	5,376,153	3,683,318	467,083	0
% Saving		11.6%	39.4%		

6. GHG CO_2 Emissions

Base Case = 100% natural gas from 2027 to 2038, 100% green hydrogen from 2039 to 2050, no electricity grid connection throughout.

Scenario 1 = 100% natural gas from 2027 to 2038, 100% green hydrogen from 2039 to 2050, with 30% (minus on-site PV) electricity grid connection & CPPA throughout.

Scenario 2 = Blended natural gas with up to 20% green hydrogen and biomethane ramp-up from 2027 to 2038, 100% green hydrogen from 2039 to 2050, with 30% (minus on-site PV) electricity grid connection & CPPA throughout.



7. GHG Emissions Conclusion

Three different energy mix scenarios have been considered for the Herbata Data Centre Campus, proposed to be constructed on a phased basis from 2027 through to 2036. The NZC pathway study results shown in Sections 5 & 6 above are summarised as follows:

1. **Base Scenario** – worst case predicted GHG emissions using natural gas only

2. **Scenario 1** – the total emissions are predicted to reduce by **11.6%** compared to the Base Case

3. **Scenario 2** - the total emissions are predicted to reduce by **39.4%** compared to the Base Case

Scenarios 1 & 2 predict being NZC in 2039 subject to successful rollout of the 100% green hydrogen national network.

The scenarios developed have been based on current available information and predicted production of renewable energy. It is possible that these scenarios will be bettered as production methods and development of these renewable energy sources comes to market over the next 5 to 10 years.

Appendix B

Presentation Slides to Kildare County Council – 21st January 2025

HERBATA DATA CENTRE

KILDARE COUNTY COUNCIL FILE NUMBER: 2460787

Response to Further Information Request

21/01/25

rpsgroup.com

MAKING COMPLEX EASY

A TETRA TECH COMPANY

Attendees:

Ian Howard	Herbata Project Manager
Paul Chadwick	RPS Environmental & Sustainability
Robert Thorogood	HDR Project Design Engineer
Paul Scriven	HDR Project Design Engineer
Kieran Kennedy	RPS Planning
Michael Higgins	RPS Planning

Agenda

Further Information Request – Item 1

Total Emissions

Further Information Request – Item 3

Use of Biomethane

Total GHG presented in the EIAR (Chapter 16)

Phase	Detail	Lifetime Emissions over 50 years (tonnes GHG)	Lifetime Emissions over 20 years (tonnes GHG)
Direct Emissions – Construction Phase	Embodied Carbon in construction materials	211,936	211,936
Direct Emissions – Operation Phase	Regulated Energy Use - space heating and cooling, hot water, ventilation, and lighting	88,351	35,340
	Unregulated Energy Use - data hall demand	14,933,067	5,973,227
	Battery Energy Storage Systems	235,889	94,356
Total Direct Emissions		**15,469,243**	**6,314,859**
Indirect Emissions	Embodied carbon in servers	13,177,597	5,271,038

Direct GHG Operation Phase – WORST CASE

Detail	Emissions (tonnes GHG)
Regulated Energy Use - space heating and cooling, hot water, ventilation, and lighting	88,351
Unregulated Energy Use - data hall demand	14,933,067
Battery Energy Storage Systems	235,889
Lifetime	**15,257,307**
Per annum	**305,146**
Benchmarking against Consented Data Centres (Annual Average)	
Kildare Innovation Campus (4 x Data Centre Buildings + 2 'Deep Tech' Buildings) (KCC Ref: 2360047, ABP Ref: 318151).	441,621
Toreen Data Centre (6 x Data Centre Buildings) (ABP Ref: 314474)	657,000
Clonee Data Centre (4 x Data Centre Buildings) (ABP Ref: 307546)	330,497
Cruisreath Road Data Centre (3 x Data Centre Buildings) (Ref: FW22A/0308)	202,139
Profile Park Data Centre (2 x Data Centre Buildings) (SDCC Ref: SD21A/0241)	2,024,421 (Elec/Gas) 109,470 (Elec)

Direct Operational Emissions relative to Carbon Budgets and Emission Ceilings – Worst Case

Time Period	2021-2025	2026-2030	2031-2035
Project Direct Operational GHG Impacts per annum (tCO_2e)	305,146		
Carbon Budget (tCO_2e)	295,000,000	200,000,000	151,000,000
Development emissions (5 years) as percentage of Ireland Carbon Budget per annum	**0.52%**	**0.76%**	**1.01%**
Sectoral emission ceiling – Electricity (tCO_2e)	40,000,000	20,000,000	-
Development emissions (5 years) as percentage of Sectoral Emission Ceiling per annum	**3.81%**	**7.63%**	-

Indirect Impacts for Tenant Server Choices

Server Type	Power rating (at 100% load)	No. units required	Assumed lifetime (years)	Replacement Rate over 50 Years	GWP ($kgCO_2e$ per unit)	50 Year Lifetime embodied carbon (tCO_2e)
1U	244.2	737,101	4	13	1,375	**13,177,597**
			6	9		9,122,952
			8	7		7,095,629
	449.8	400,178	4	13	1,770	9,209,656
			6	9		6,375,916
			8	7		**4,959,046**

Context for Indirect Emissions

- Estimated Worst Case carbon impact of the embodied carbon in server manufacture included for compliance with the EIA Directive as ‘indirect’ effects.
- Servers will not be manufactured in Ireland – typically North America or Asia Pacific.
- Case law* – these indirect effects are not to be considered by planning authorities as they are ‘*remote, elusive, contingent, speculative and incapable of measurement*’.
- **As manufacture of servers is outside the State this will not have a direct impact on the National Carbon Budgets or Sectoral Emissions Ceilings.**
- **These indirect impacts do not conflict in any way with national, regional and local land use or climate policy.**

* Justice Holland in Coyne v An Bord Pleanála (Record No. 2021/780, 2021/781 JR, July 2023)

Total GHG – Factors to be considered

- Phasing of the development, bringing on of 2 buildings per phase (from 2027 to 2035)
- Load ramp up for each building – server deployment takes time (2 x 30MW DCs over 3 years)
- Maximum IT actual loading – typically 80% of design
- Deployment of plant and equipment will be phased (3 phases from 2027 to 2035)
- 30% end of year CPPAs prediction purchased upfront per year
- Proportion of gas used will be mixed with hydrogen and biomethane

GHG – Reducing Data Hall Unregulated Energy Use

Case	Basis of Case	Identified	Emissions (tonnes GHG)
Worst Case condition	No factoring	EIAR (Chapter 16)	14,933,067
Base Case	Natural gas based on factors (ref. to previous slide)	Energy Policy Compliance Report – App. 1	5,754,883
Scenario 1	30% renewables (CPPAs) then100% hydrogen from 2039	Energy Policy Compliance Report – App. 1	5,051,913
Scenario 2	30% renewables + 20% hydrogen + biomethane then 100% hydrogen from 2039	Energy Policy Compliance Report – App. 1	**3,838,753**

LIKELY REAL GHG Emissions

Phase	Detail	Emissions (tonnes GHG)
Direct Emissions – Construction Phase	Embodied Carbon in construction materials	211,936
Direct Emissions – Operation Phase	Regulated Energy Use - space heating and cooling, hot water, ventilation, and lighting	88,351
	Unregulated Energy Use - data hall demand	3,838,753
	Battery Energy Storage Systems	235,889
Total Direct Emissions		**4,374,929**

Direct Operational Emissions relative to Carbon Budgets and Emission Ceilings – Scenario 2

Time Period	2021-2025	2026-2030	2031-2035
Scenario 2 Direct Operational GHG Impacts, averaged per annum (tCO_2e) over 50 years:	87,499		
Carbon Budget (tCO_2e)	295,000,000	200,000,000	151,000,000
Development emissions (5 years) as percentage of Ireland Carbon Budget per annum	0.15%	0.22%	0.29%
Sectoral emission ceiling – Electricity (tCO_2e)	40,000,000	20,000,000	-
Development emissions (5 years) as percentage of Sectoral Emission Ceiling per annum	1.09%	2.19%	-

GHG – Response to Further Information Request (FIR)

Case	Basis of Case	Identified	Emissions (tonnes GHG)
Worst Case condition	No factoring	EIAR	14,933,067
Base Case	Natural gas only	Energy Policy Compliance Report – App. 1	5,754,883
Scenario 1	30% renewables (CPPAs) then100% hydrogen from 2039	Energy Policy Compliance Report – App. 1	5,051,913
Scenario 2	30% renewables + 20% hydrogen + biomethane then 100% hydrogen from 2039	Energy Policy Compliance Report – App. 1	**3,838,753**
Response to 'FIR' (Item 1)	38% of on-site generated energy using CCGTs, 50% from PV & CPPAs + up to 20% Hydrogen & Biomethane ramp-up. Switching to 100% green hydrogen from 2039 onwards	Proposed Response	**2,185,760**

FURTHER REDUCTIONS – Impact on GHG Emissions

Phase	Detail	Emissions (tonnes GHG)
Direct Emissions – Construction Phase	Embodied Carbon in construction materials	211,936
Direct Emissions – Operation Phase	Regulated Energy Use - space heating and cooling, hot water, ventilation, and lighting	88,351
	Unregulated Energy Use - data hall demand	2,185,760
	Battery Energy Storage Systems	235,889
Total Direct Emissions		**2,721,936**

Direct Operational Emissions relative to Carbon Budgets and Emission Ceilings – Response to FIR

Time Period	2021-2025	2026-2030	2031-2035
Response to FIR Direct Operational GHG Impacts, averaged per annum (tCO_2e) over 50 years:	54,439		
Carbon Budget (tCO_2e)	295,000,000	200,000,000	151,000,000
Development emissions (5 years) as percentage of Ireland Carbon Budget per annum	0.09%	0.14%	0.18%
Sectoral emission ceiling – Electricity (tCO_2e)	40,000,000	20,000,000	-
Development emissions (5 years) as percentage of Sectoral Emission Ceiling per annum	0.68%	1.36%	-

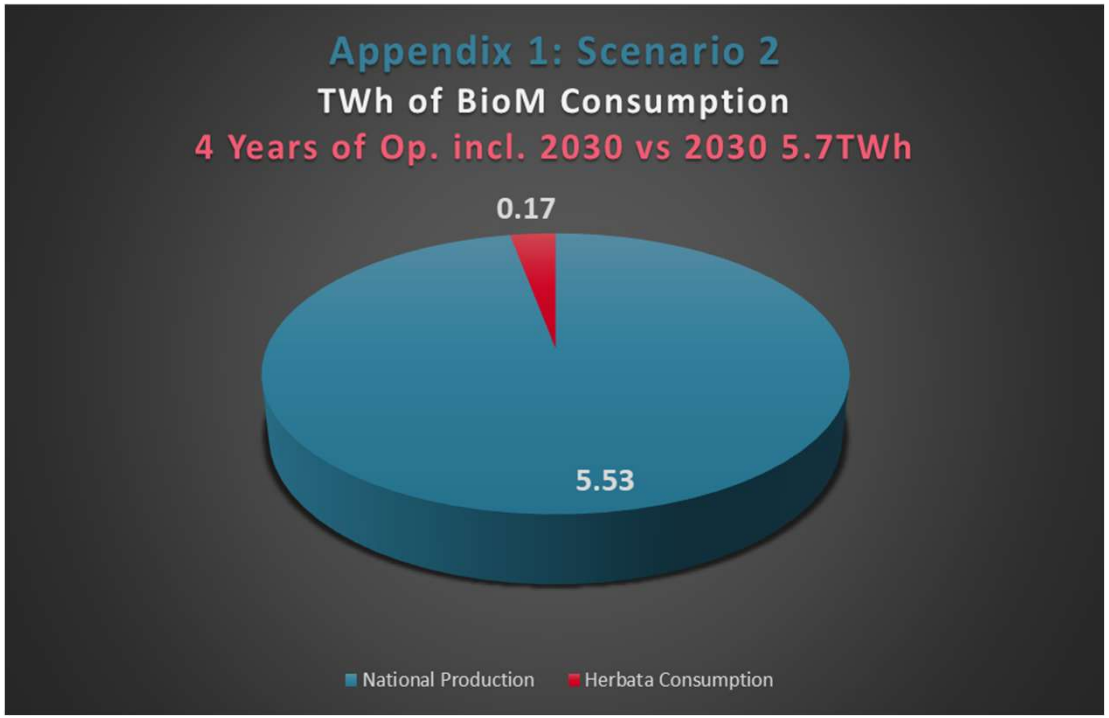
Conclusions

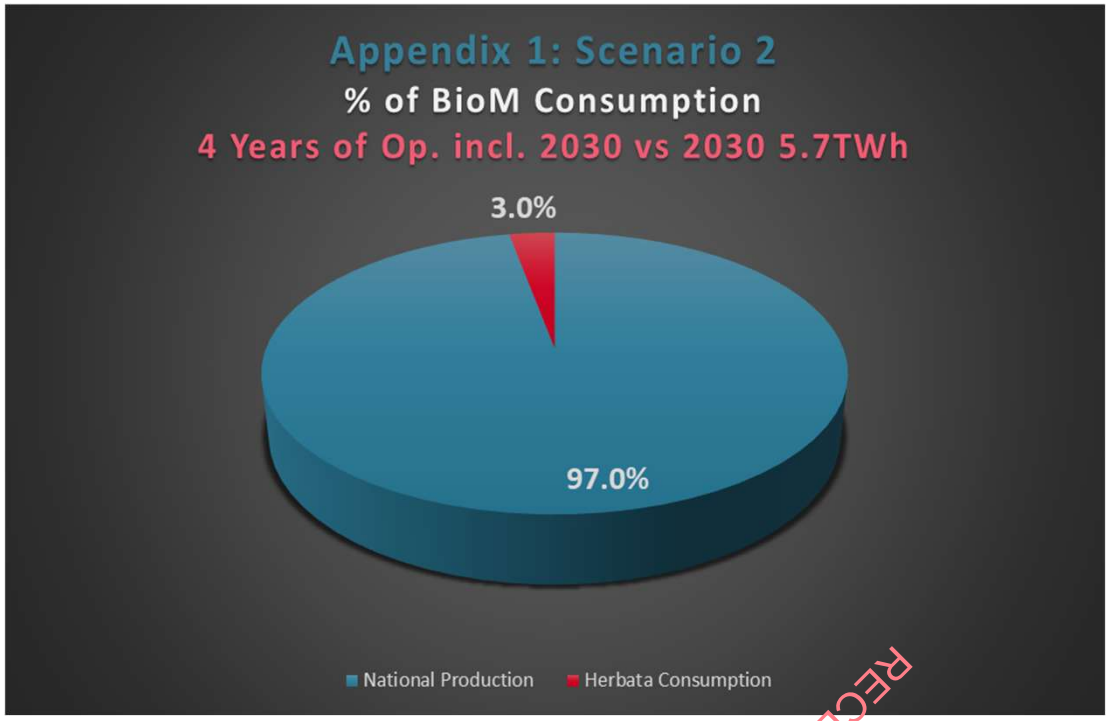
- Stated GHG Emissions were provided to identify an absolute worst-case scenario
- Included in the GHG Emissions were likely indirect amounts for servers and IT equipment, which is suggested should not be included in the assessment
- Herbata's planning submission also included more realistic scenarios and means to significantly reduce the direct GHG emission to **~30% of the EIAR values (Scenario 2 providing ~70% saving)**
- In response to the FI points raised, Herbata intend to further reduce the GHG emissions using higher efficiency turbines supplement by more off-site renewable energy. The result would be GHG emissions that are **~20% of the original EIAR values (providing ~80% saving)**.

Further Information Request – Item 3

Use of Biomethane

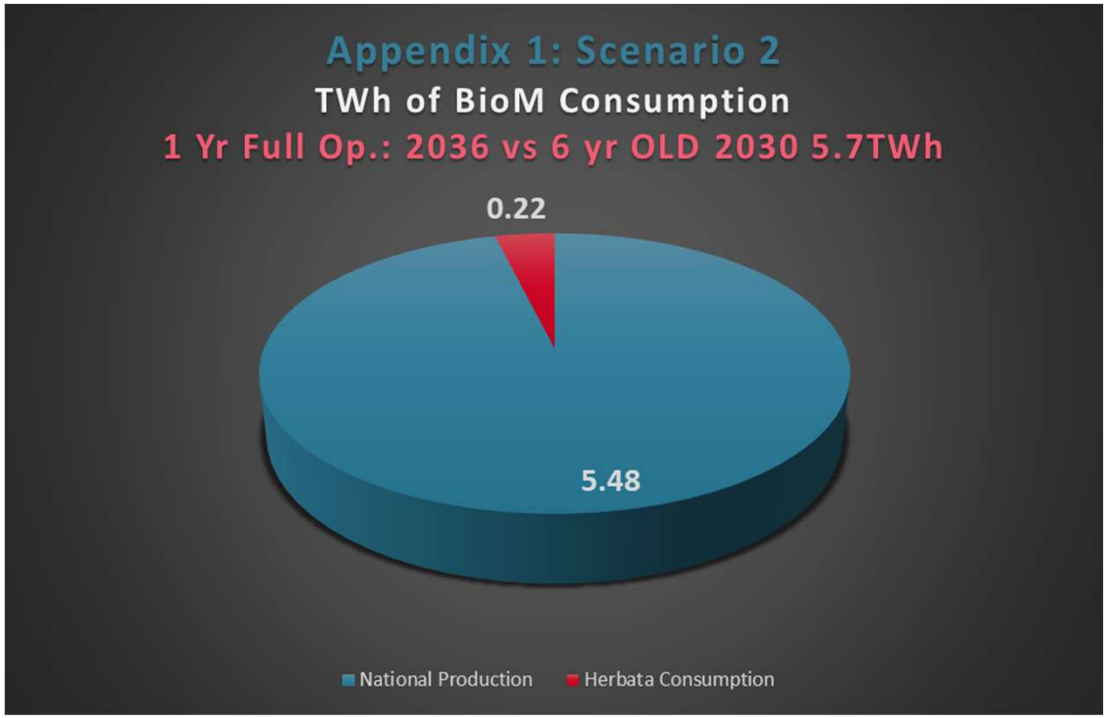
Context of Biomethane – EIAR (Chapter 16)

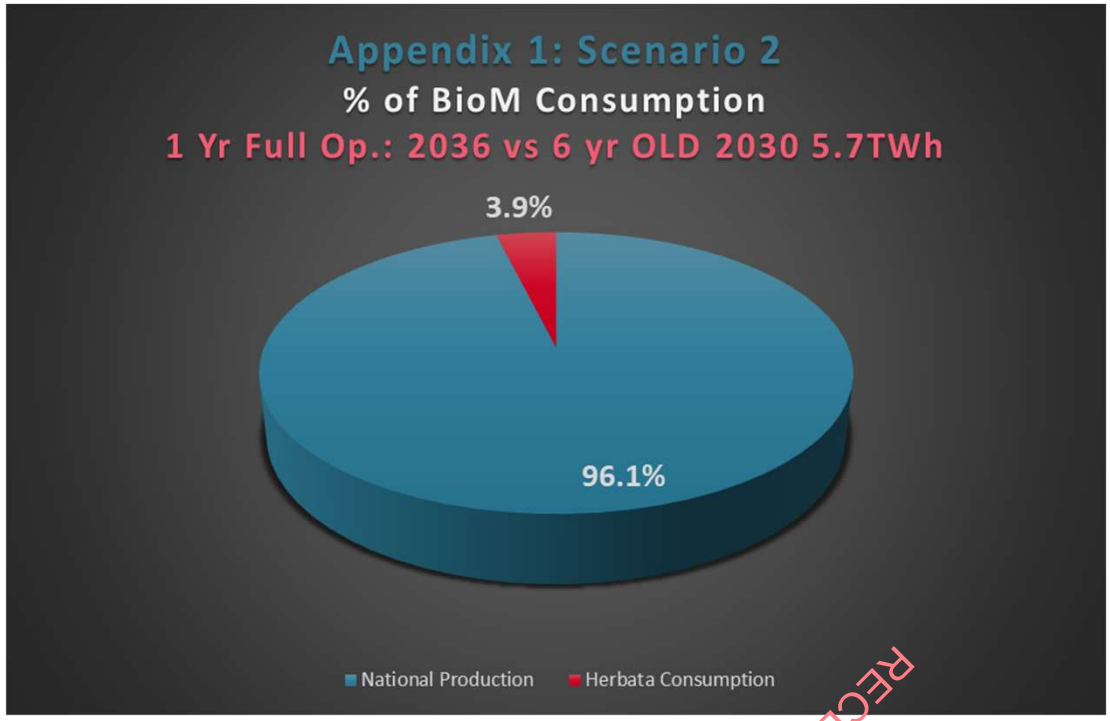




Excludes: Biomethane (BioM) Carbon Capture during production process

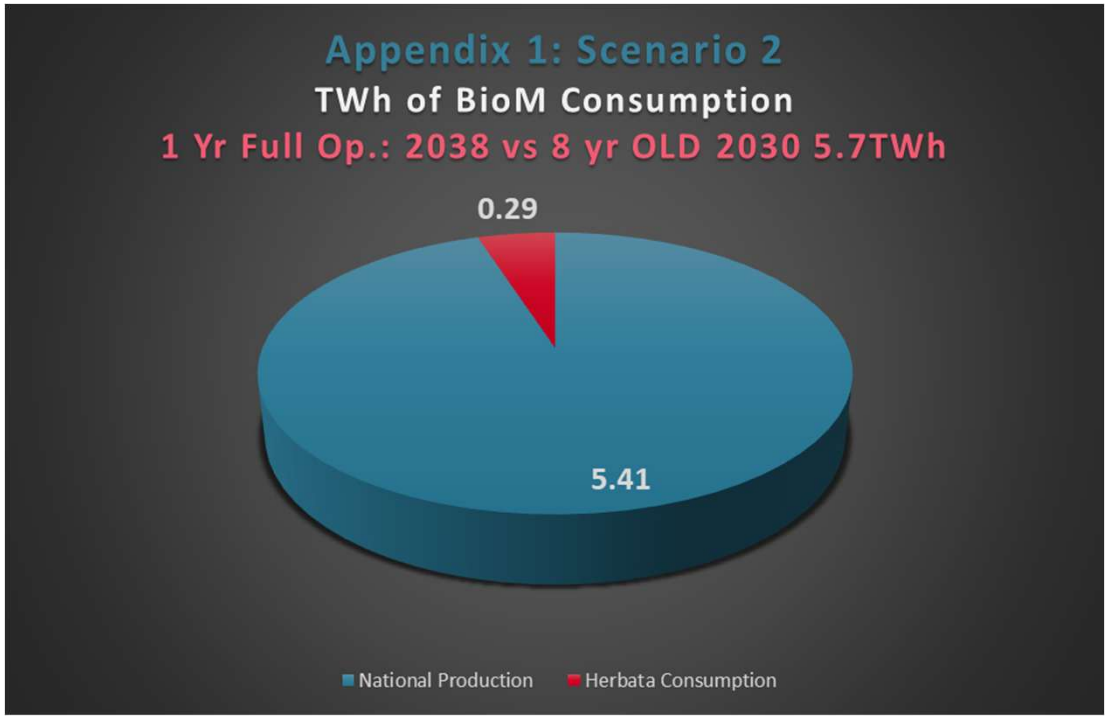
Context of Biomethane – EIAR (Chapter 16)

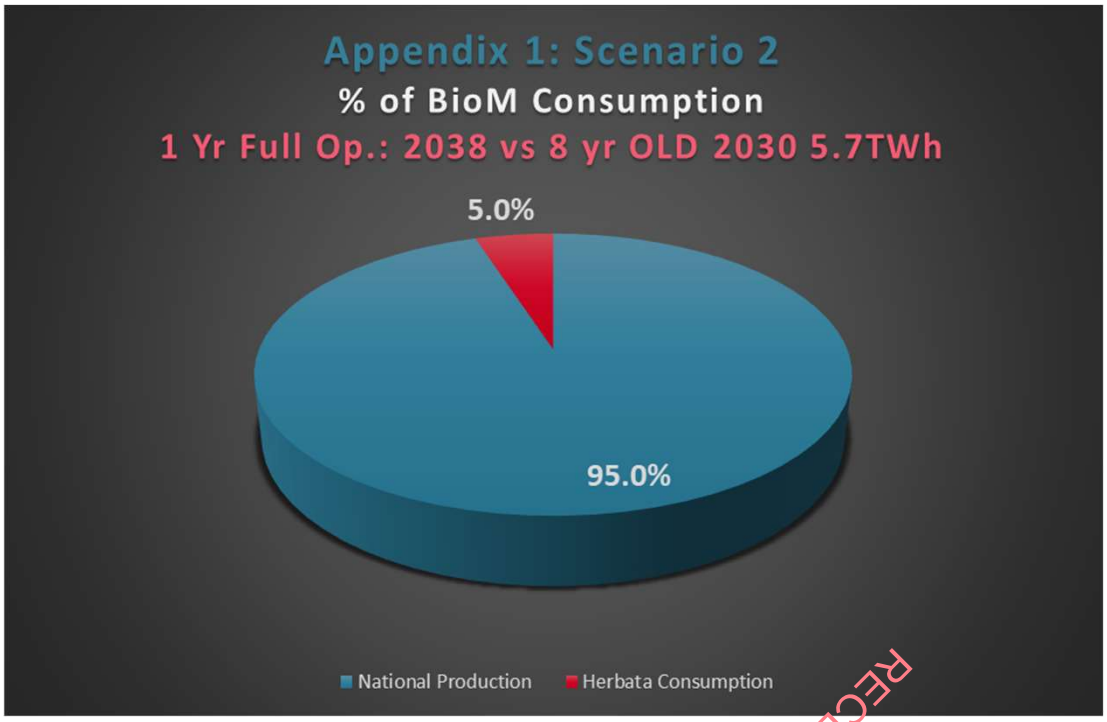




Based on National Production Potential of 14.8TWh / annum being achieved by 2050
Excludes: Biomethane (BioM) Carbon Capture during the production process

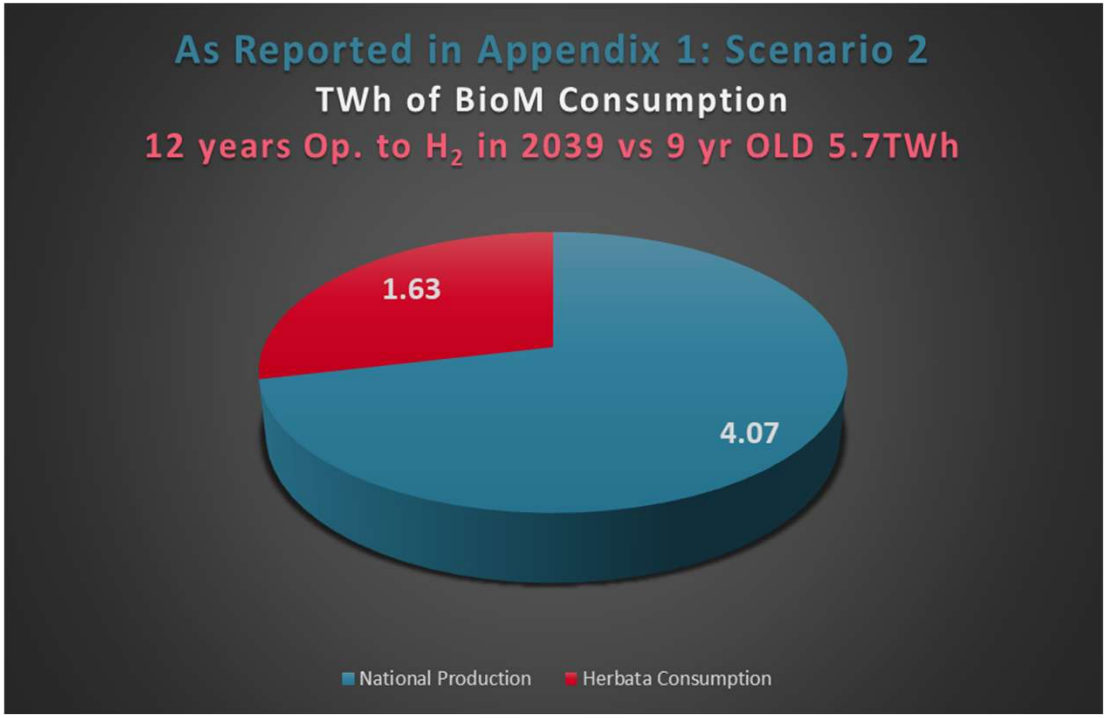
Context of Biomethane – EIAR (Chapter 16)

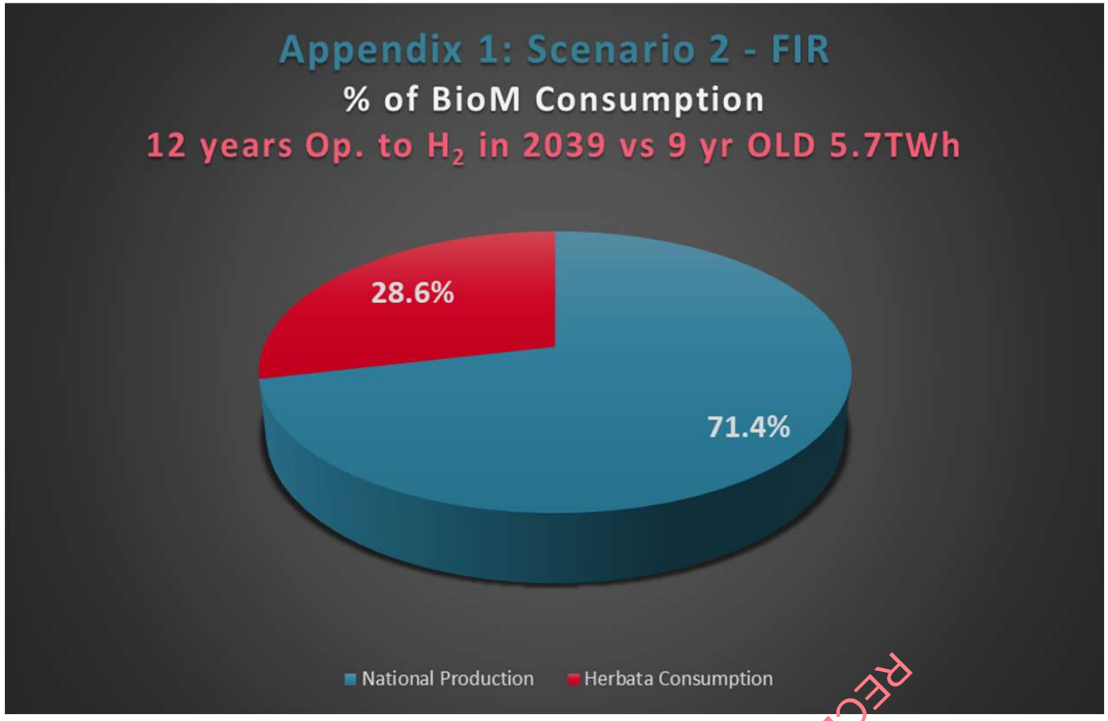




Based on National Production Potential of 14.8TWh / annum being achieved by 2050
Excludes: Biomethane (BioM) Carbon Capture during the production process

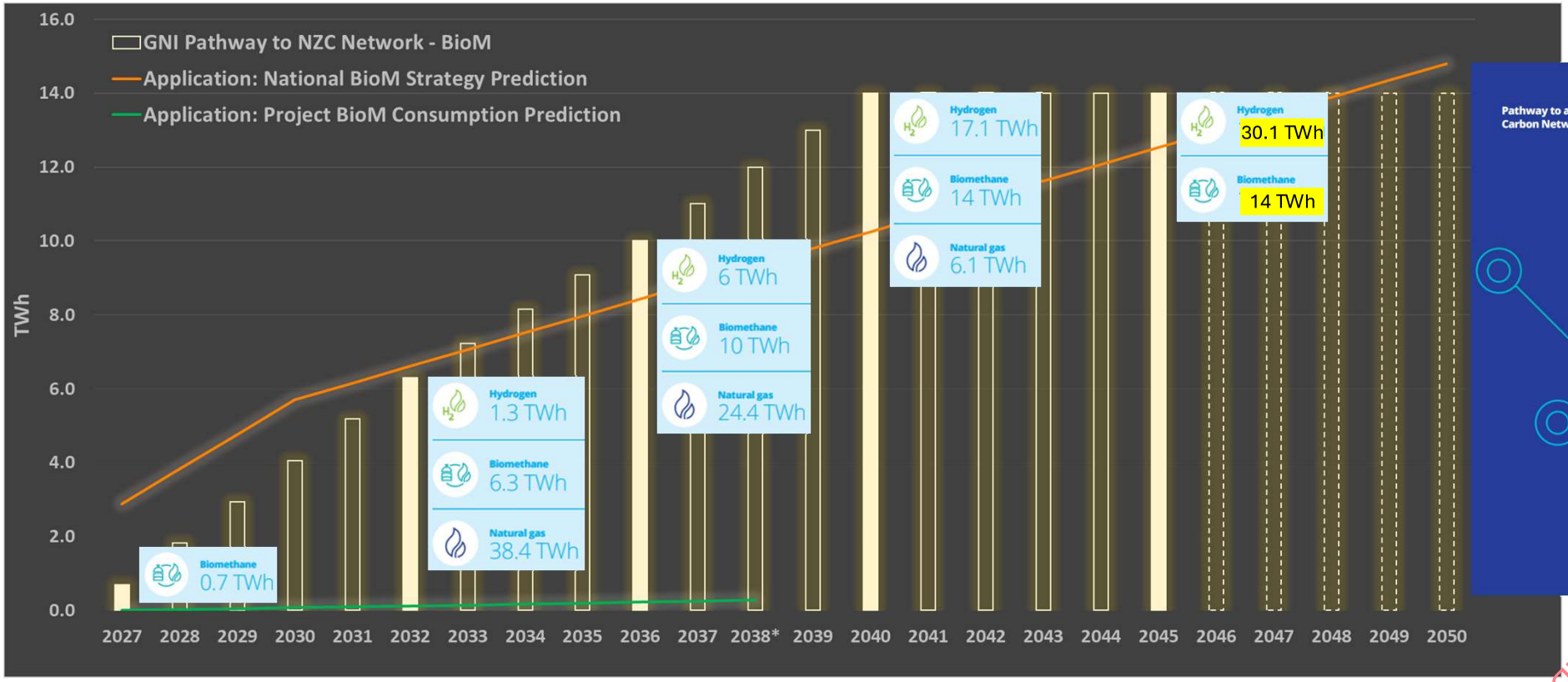
Context of Biomethane – EIAR (Chapter 16)

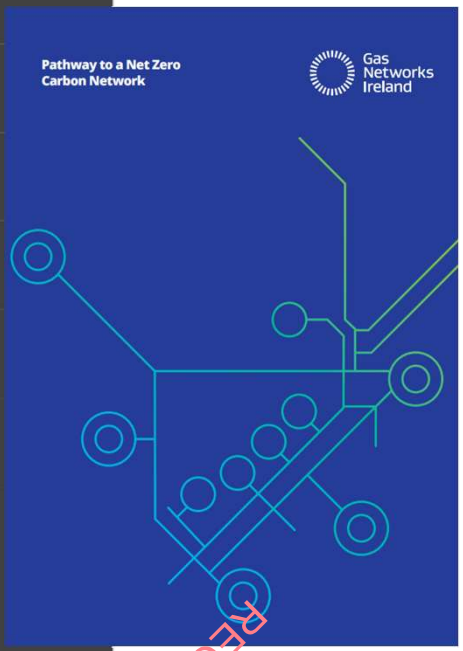




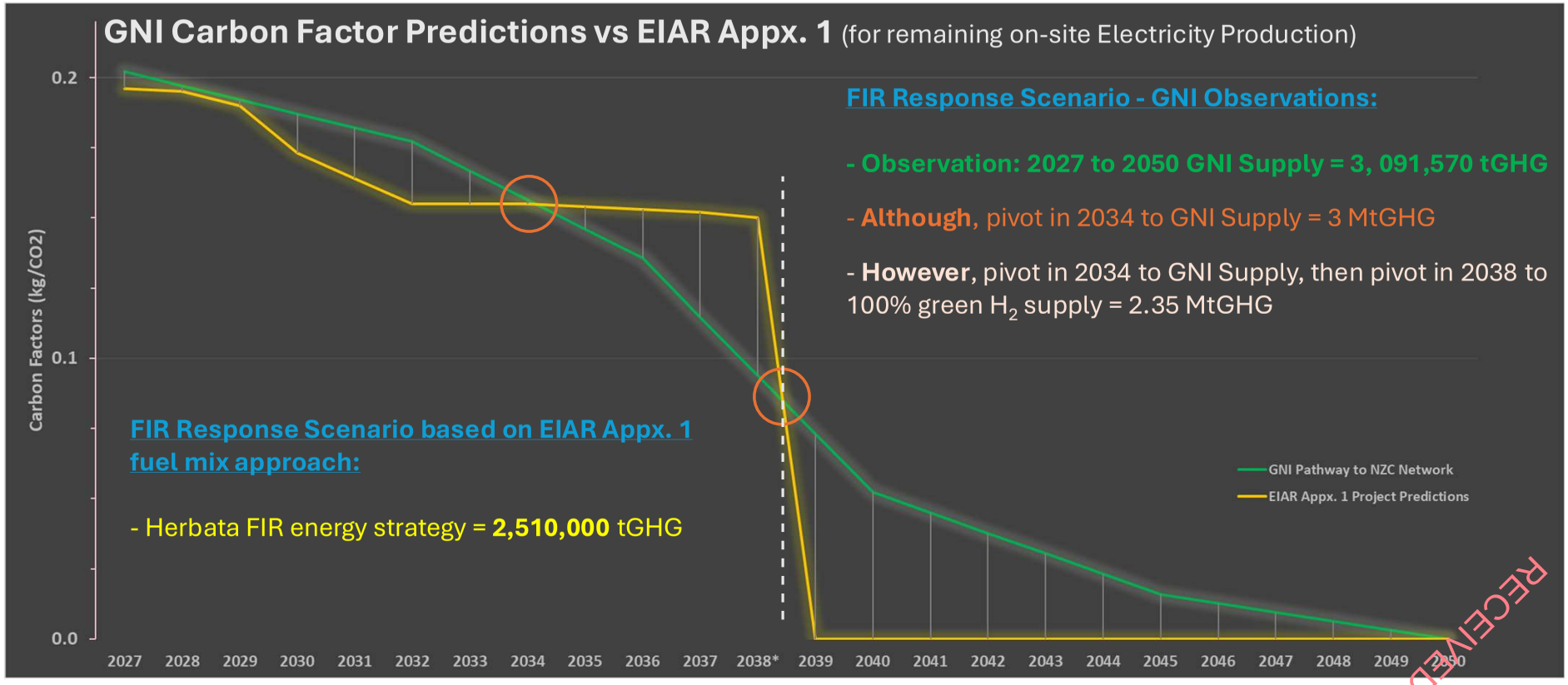
FIR Scenario includes the reported 1.63 TWh: which predicted likely additional on-site savings from Biomethane to be 95,377 tGHG vs EIAR Appx. 1 Scenario 2

Context of Biomethane – EIAR (Chapter 16)





Context of Biomethane – EIAR (Chapter 16)



Excludes: Biomethane (BioM) Carbon Capture during the production process

REDUCTIONS SUMMARY – Impact on GHG Emissions

DESCRIPTION		EIAR (Chapter 16)	EIAR Appx. 1 Scenario 2	FIR Scenario (Application Approach)	FIR Scenario (GNI 2027-2050)
Phase	**Detail**	**Emissions (tonnes GHG)**	**Emissions (tonnes GHG)**	**Emissions (tonnes GHG)**	**Emissions (tonnes GHG)**
Direct Emissions – Construction Phase	Embodied Carbon in construction materials	211,936	211,936	211,936	211,936
Direct Emissions – Operation Phase	Regulated Energy Use - space heating and cooling, hot water, ventilation, and lighting	88,351	88,351	88,351	88,351
	Unregulated Energy Use - data hall demand	14,933,067	3,838,753	2,185,760	2,767,329
	Battery Energy Storage Systems	235,889	235,889	235,889	235,889
Total Direct Emissions		**15,469,243**	**4,374,929**	**2,721,936**	**3,303,505**

Direct Operational Emissions relative to Carbon Budgets and Emission Ceilings – Response to FIR

DESCRIPTION	EIAR (Chapter 16)			EIAR Appx. 1 Scenario 2			FIR Scenario (Application Approach)			FIR Scenario (GNI NZ Pathway)		
Time Period	2021-2025	2026-2030	2031-2035	2021-2025	2026-2030	2031-2035	2021-2025	2026-2030	2031-2035	2021-2025	2026-2030	2031-2035
Response:	305,146			87,499			54,439			66,070		
Carbon Budget (tCO_2e)	295 Mt	200 Mt	151 Mt	295 Mt	200 Mt	151 Mt	295 Mt	200 Mt	151 Mt	295 Mt	200 Mt	151 Mt
Development emissions (5 years) as percentage of Ireland Carbon Budget per annum	0.52%	0.76%	1.01%	0.15%	0.22%	0.29%	0.09%	0.14%	0.18%	0.11%	0.17%	0.22%
Sectoral emission ceiling – Electricity (tCO_2e)	40 Mt	20 Mt	-	40 Mt	20 Mt	-	40 Mt	20 Mt	-	40 Mt	20 Mt	-
Development emissions (5 years) as percentage of Sectoral Emission Ceiling per annum	3.81%	7.63%	-	1.09%	2.19%	-	0.68%	1.36%	-	0.83%	1.65%	-

Summary

- GHG Emissions outlined in the EIAR were provided to identify an absolute worst-case scenario and the scenarios set out in the submitted *Energy Policy Compliance Report* provide a more realistic and relevant projection of emissions.

- In response to the RFI, Herbata intend to further reduce the GHG emissions using higher efficiency turbines supplemented by more off-site renewable energy. This will be fully detailed in the FI Response.

- The result would be GHG emissions that are c. 20% of the original EIAR values (providing up to 80% saving).

APPENDICES

Direct GHG Construction Phase

- EIAR Table 16.2: Construction-Phase Embodied Carbon.
- Royal Institution of Chartered Surveyors Professional Information, UK Methodology to calculate embodied carbon of materials (2012).

- **Benchmarks – Profile Park Data Centre: 209,804 tonnes**

Item	Embodied Carbon (tCO_2e)
Applicant Controlled Elements	
Data centre buildings	109,464
Admin workshop and water treatment plant building	757
Site security hut	39
District heating building	186
Solar PV	7,757
Gas Turbines	5,568
BESS	53,539
Substation	1,314
Construction transport movements	33,312
Sub-total	211,936

Direct Construction Emissions relative to Carbon Budgets and Emission Ceilings

Time Period	2021-2025	2026-2030	2031-2035
Project Direct Construction GHG Impacts (tCO_2e)	211,936		
Carbon Budget (tCO_2e)	295,000,000	200,000,000	151,000,000
Development emissions as percentage of Ireland Carbon Budget	**0.07%**	**0.11%**	**0.14%**
Sectoral Emission Ceiling – Built Environment (tCO_2e)	7,000,000	5,000,000	-
Development emissions as percentage of Sectoral Emission Ceiling	**3.03%**	**4.24%**	-

Benchmarks

Name/Planning Reference	Description	Averaged Operational GHG (tonnes per annum)
Kildare Innovation Campus (ABP 318151)	6 x Data Centre Buildings	441,621
Toreen Data Centre (ABP 314474)	6 x Data Centre Buildings	657,000
Cruisreath Road Data Centre (ABP 318180)	3 x Data Centres	202,139
Clonee Data Centre (ABP 307546)	4 x Data Centres	330,497
Profile Park Data Centre	2 x Data Centres	105,335 (Scenario 2) 2,024,425 (Scenario 1)
Herbata Data Centre	**6 x Data Centre Buildings**	**305,146**

Benchmarking – Recent Consented Cases of Similar Scale

Name/Planning Reference	Status	Description	Construction GHG (tonnes)	Operation GHG (tonnes per annum)	Indirect GHG (tonnes)
Kildare Innovation Campus (ABP 318151)	KCC granted permission in January 24 (2360047). Under appeal with ABP	4 x Data Centre Buildings + 2 'Deep Tech'	Not quantified	441,621	Not quantified
Toreen Data Centre (ABP 314474)	Granted by ABP (April 2024)	6 x Data Centre Buildings	Not quantified	657,000	Not quantified
Cruisreath Road Data Centre (ABP 318180)	FCC granted permission in Sep 23 (FW22A/0308). Under third party appeal with ABP.	3 x Data Centres	Not quantified	202,139	Not quantified
Clonee Data Centre (ABP 307546)	MCC granted permission in (RA191593) Granted by ABP (July 2021)	4 x Data Centres	Not quantified	330,497	Not quantified
Profile Park Data Centre	SDCC granted permission in May 22 (SD21A/0241)	2 x Data Centres	209,804	105,335 (Scenario 2) 2,024,425 (Scenario 1)	Not quantified

Carbon Budgets and Emissions Ceilings

Phase	Carbon Budget (tCO_2e)
2021-2025	295,000,000
2026-2030	200,000,000
2031-2035	151,000,000

Sector	Sectoral Emission Ceilings for each 5-year carbon budget period (tCO_2e)	
	2021-2025	2026-2030
Electricity	40,000,000	20,000,000
Built Environment - Commercial	7,000,000	5,000,000
Industry	30,000,000	24,000,000

Further Information Request – Item 1

Policy RE P12 of the Kildare County Development Plan 2023-2029 seeks to ensure that economic and enterprise related development is provided in a manner which facilitates a reduction in greenhouse gas emissions and accelerates the transition towards a sustainable, low carbon and circular economy. Furthermore, Policy RE P11 and Policy EC P18 seeks to support the accommodation of Data Centres at appropriate locations in line with the objectives of the National Planning Framework and the principles for Sustainable Data Centre Development of the Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy (July 2022) subject to appropriate Transport, Energy and Environmental Assessments and all relevant planning conditions.

The Data Centre development as proposed would result in the emission of 28.6 million tCO2e (tonnes of carbon dioxide equivalent) during its lifetime which represents c. 49.35% of the Sectoral Emissions Ceiling for the entire Commercial Built Environment Sector to 2030. This level of emission is considered to be excessive for one development and would have wider implications for the sector to remain within its emission ceiling, with a consequent negative impact on climate change. The proposed development, as proposed, would run counter to the provisions of National Policy as set out in Ireland's Integrated National Energy and Climate Plan 2021-2030 and in the Government Statement on the Role of Data Centres in Irelands Enterprise Strategy 2022, both of which require decarbonisation through emissions reduction/removal and design. The development would therefore be contrary to Policy REP12, RE P11 and EC P18 of the Kildare County Development Plan 2023-2029, would set an undesirable precedent for similar developments of this nature and would be contrary to the proper planning and sustainable development of the area.

The Applicant is requested to comment."

Further Information Request – Item 3

"Natural gas is a fossil fuel. The energy supply to serve the proposed development, as proposed, is largely fossil fuel driven. Notwithstanding the national target of decarbonising gas supply by 2050 and to produce 5.7TWh of biomethane by 2030, it is considered that the volume of biomethane required to serve the fully operational proposal would be c.50% of the national target which is considered to be unsustainable. The proposed gas fueled electricity generation will allow the proposed data centre to be an independent Operator, outside of the National Grid and, to this end, it is an example of an "islanded" Data Centre, not connected to the grid and powered mainly by on site fossil fuel generation. Such developments as identified in the Government Statement on the Role of Data Centres in Irelands Enterprise Strategy 2022, run counter to emissions reduction objectives and would not serve the wider efficiency and decarbonisation of our energy system and could result in the security of supply risk being transferred from electricity to gas supply, which would be a significant challenge given Ireland's reliance on gas importation.

In this regard, having regard to the lack of significant on site renewable energy to power the development, the reliance on gas powered turbines to provide energy to the development and the lack of detailed evidence for Corporate Power Purchase Agreements, the proposed "islanded" Data Centre would be contrary to the provisions of Policy RE P11 and EC P 18 of the Kildare County Development Plan 2023-2029 which support the accommodation of Data Centres in line with, inter alia, the Government Statement on the Role of Data Centres in Irelands Enterprise Strategy 2022, would set a precedent for similar proposals of this nature and would therefore be contrary to the proper planning and sustainable development of the area.

The Applicant is requested to comment."

Further Information Request

- **Policy RE P12** seeks to ensure that economic and enterprise related development is provided in a manner which facilitates a reduction in greenhouse gas emissions and accelerates the transition towards a sustainable, low carbon and circular economy.

RE P12
Ensure that economic and enterprise related development is provided in a manner which facilitates a reduction in greenhouse gas emissions and accelerates the transition towards a sustainable, low carbon and circular economy. The following measures shall be supported:

- **An increase in employment densities within walkable distances of communities and on public transport routes.**
- **Promotion of walking and cycling and use of public transport through increased permeability and mobility management measures within and outside employment areas.**
- **The sourcing of power from district heating and renewables including wind and solar.**

Additional native tree planting and landscaping on existing and proposed enterprise zones and development sites to aid with carbon sequestration, contributing to the green infrastructure network of the County and promoting quality placemaking.

Further Information Request

- **Policy RE P11** and **Policy EC P18** seek to support the accommodation of Data Centres at appropriate locations in line with the objectives of the National Planning Framework and the principles for Sustainable Data Centre Development of the Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy (July 2022) subject to appropriate Transport, Energy and Environmental Assessments and all relevant planning conditions.

RE P11/EC P18
Support the accommodation of Data Centres at appropriate locations in line with the objectives of the National Planning Framework and the principles for Sustainable Data Centre Development of the Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy (July 2022) subject to appropriate Transport, Energy and Environmental Assessments and all relevant planning conditions. The location of data centres shall be situated where they will not have a potential likely significant effect on a European Site. Such developments shall be subject to an AA Screening Report, and where applicable, Stage 2 AA. They shall have regard for any hydrological connection shared with a European Site and shall account for any potential likely significant effects and provide mitigation and monitoring where appropriate.

Principles

- The Government has a preference for data centre developments associated with strong economic activity and employment.
- The Government has a preference for data centre developments that make efficient use of our electricity grid, using available capacity and alleviating constraints.
- The Government has a preference for data centre developments that can demonstrate the additionality of their renewable energy use in Ireland.
- The Government has a preference for data centre developments in locations where there is the potential to co-locate a renewable generation facility or advanced storage with the data centre, supported by a CPPA, private wire or other arrangement.
- The Government has a preference for data centres developments that can demonstrate a clear pathway to decarbonise and ultimately provide net zero data services.
- The Government has a preference for data centre developments that provide opportunities for community engagement and assist SMEs, both at the construction phase and throughout the data centre lifecycle.

Carbon Budgets, Sectorial Ceilings and Sector Considerations

1. Ireland's Carbon Budgets & Sectorial Ceilings

Table 3.1 – Ireland's Carbon Budgets

CAP 24

Carbon Budget Period	$MtCO_2eq.$	Average Annual reduction
2021 – 2025	295	4.8%
2026 – 2030	200	8.3%
2031 – 2035 *(provisional)*	151	3.5%

[11] Metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential.

Table 3.2 – Sectoral Emission Ceilings

(Figures for $MtCO_2eq.$ for 2018, 2025 and 2030 have been rounded. This may lead to some discrepancies)

	2018 Baseline ($MtCO_2eq.$)[13]	Sectoral Emission Ceilings for each 5-year carbon budget period ($MtCO_2eq.$)	
Sector	**2018**	**2021-2025***	**2026-2030***
Electricity	10	40	20
Transport	12	54	37
Built Environment - Residential	7	29	23
Built Environment - Commercial	2	7	5
Industry	7	30	24
Agriculture	23	106	96
Other (F-Gases, Waste & Petroleum refining)	2	9	8
LULUCF	5	Reflecting the continued volatility for LULUCF baseline emissions to 2030 and beyond, CAP24 puts in place ambitious activity targets for the sector reflecting an EU-type approach (see chapter 12)	
TOTAL	68		
Annual unallocated Emission Savings in 2030	-	-	5.25[14]
Unallocated Savings 2026-2030[15]			26

2. Ireland's Carbon Budgets - Electricity Sector

5.6.1 Focus on economy-wide energy efficiency and demand management

Ireland aims to achieve a reduction in final energy consumption against anticipated 2030 levels, in line with the EU Energy Efficiency Directive (EED). CAP24 outlines specific 2030 energy efficiency and demand management targets spanning the buildings, industry, and transportation sectors which work towards meeting the EU EED. Examples of additional actions in energy efficiency and demand management could include:

- **Increasing retrofit and heat pump uptake beyond CAP24 plans** with focus on social and public buildings;
- **Further modal shifts,** particularly in freight towards rail, above and beyond that already factored into, and accounted for in, the transport emissions reduction pathway as outlined in Chapter 15;
- **Managing energy demand in the commercial sector**, with a potential focus on data centre power demand.

52

Contributing to 100% of Key Targets

Electricity Sector:

Sectoral Emission Ceilings

- Carbon Budget 1 (2021-2025): 40 $MtCO_2eq.$
- Carbon Budget 2 (2026-2030): 20 $MtCO_2eq.$

Trends in the Sector

In 2022, renewable generation accounted for 38.6% of electricity, an increase from 35% in 2021. Electricity emissions decreased by 2% in 2022 which is attributable to

Key Targets

National Target	2025	2030
Renewable Electricity Share	50%	80%
Onshore Wind	6 GW	9 GW
Solar	Up to 5 GW	8 GW
Offshore Wind	-	At least 5 GW
New Flexible Gas Plant	-	At least 2 GW
Demand Side Flexibility	15-20%	20-30%

152

2. Ireland's Carbon Budgets – Electricity Sector

Electricity's

- 1 - Non-utility, PV (new non-utility solar: 2025 & 2030)
- 2 - CPPAs (renewable electricity: 2025, 2030 & 2035)

Contributing to 100% of Abatement Targets

- 3 - Electricity Generation (minimise surplus grid generation: 2025 & 2030)
- 4 - Battery Storage (required long-term storage: 2025, 2030 & 2035)
- 5 – Blended Fuel (flexible gas-fired generation: 2030 & 2035)
- 6 – 100% Hydrogen 2038 (zero emission gas-fired generation: 2030 & 2035)
- 7 – Enabling 'Demand Side flexibility' (2025, 2030 & 2035)
- 8 - Energy Management System

Demand Management	Demand side flexibility 15-20% Zero carbon demand growth		Demand side flexibility 20-30% Zero carbon demand growth		Demand side flexibility 30% Zero carbon demand growth
Total Estimated Abatement Potential		**2.21**		**7.18**	

Table 12.5 – Key Metrics to Deliver Abatement in Electricity[80]

Theme	2025 KPI	2025 abatement (vs. 2018) $MtCO_2eq.$	2030 KPI	2030 abatement (vs. 2018) $MtCO_2$ eq.	2031-2035 measures
Accelerate Renewable Energy Generation[81]	50% renewable electricity share of demand 6 GW onshore wind capacity Up to 5 GW solar PV capacity, including at least 1 GW of new non-utility solar	2. 21	80% renewable electricity share of demand 9 GW onshore wind capacity At least 5 GW offshore wind capacity 8 GW solar PV capacity, including 2.5 GW of new non-utility solar	7.18	Decarbonisation roadmap for a net-zero power system Green hydrogen production via 2 GW offshore wind

[80] For CAP24 new modelling was undertaken to underpin the Electricity chapter, the current abatement figures are based on the latest modelling

[81] The abatement figures here represent the total figure for all three themes

			Green hydrogen production from renewable electricity surplus generation		
Accelerate Flexibility	Maximum level of renewables at any one time on the grid: 85% Dispatch down (excluding surplus generation) of renewables below 7% Minimise surplus generation Required long term storage (4 hour plus) in place	See above abatement figure	Maximum level of renewables at any one time on the grid: 95-100% Dispatch down (excluding surplus generation) of renewables below 7% Minimise surplus generation Required additional long-term storage (4 hour plus) in place At least 2 GW of new flexible gas-fired generation Zero-emission gas-fired generation from biomethane and hydrogen commencing by 2030	See above abatement figure	Required additional long duration storage technologies in place Increased zero emission gas-fired generation to enable a net zero power system

3. Ireland's Carbon Budgets – Industry Sector

Can only Contribute to 33% of Key Targets

Industrial Sector:

Sectoral Emission Ceilings

- Carbon Budget 1 (2021-2025): 30 $MtCO_2eq.$
- Carbon Budget 2 (2026-2030): 24 $MtCO_2eq.$

Key Targets

Target	2025	2030
Carbon-neutral heating in industry	50-55% share of carbon neutral heating	70-75% share of carbon neutral heating
Decrease embodied carbon in construction materials	Decrease by 10% embodied carbon for materials produced and used in Ireland	Decrease by at least 30% embodied carbon for materials produced and used in Ireland
Reduce fossil fuel demand through energy efficiency measures in industry	Reduce by 7%	Reduce by 10%

- Expand and enhance supports from the Sustainable Energy Authority of Ireland, IDA Ireland, and Enterprise Ireland with a focus on achieving energy demand reduction, electrification, and biomass adoption in industry
- Electrification of new and current manufacturing processes displacing the use of fossil fuels where possible and as soon as possible
- Low and net zero carbon product substitution for construction materials and a reduction in the clinker content for cement where practical
- Utilisation of biomass, and low and zero emission gas as key fuels for decarbonisation, noting that these are limited resources, and priority will be given to its use in areas where alternative methods of decarbonisation (e.g., electrification) are not commercially or technically viable
- Continue to develop policies for hydrogen to support its deployment, predominantly for the third carbon budget period and beyond
- Start to develop carbon capture, utilisation and storage policies to support its deployment, predominantly for the third carbon budget period and beyond.

3. Ireland's Carbon Budgets – Industry Sector

Industry's

✓ 1 – Non-utility PV (reduction in fossil fuel use: 2025, 2030 & 2035)
✓ 2 - CPPAs (reduction in fossil fuel use: 2025, 2030 & 2035)
✓ 3 - Hydrogen & Biomethane (reduction in fossil fuel use: 2025, 2030 & 2035)

✗ - Site-wide Heating <1% of total fuel demand (non-Data Halls) (50-80% share of heating in total fuel demand: 2025, 2030 & 2035)
- Cooling Bi-product: Waste Heat Recovery offered for future connection to 3rd party Heat Network – end user 'Sector' unknown

✓ 4 – Decrease Embodied Carbon, where practical (2025, 2030 & 2035)

✗ - Manufacturing Electricity

✗ - No Industrial Heating

Can only Contribute to ~33% of Abatement Targets

Table 13.5 – Key Metrics to Deliver Abatement in Industry

Theme	2025 KPI	2025 abatement (vs 2018) $MtCO_2eq.$	2030 KPI	2030 abatement (vs 2018) $MtCO_2eq.$	2031-2035 measures
Overarching Transition Measurement	Reduction in fossil fuel use in industry sector from 64% of final consumption (2018) to 45%	Abatement set out in KPIs below	Reduction in fossil fuel use in industry sector to 50% of final consumption	Abatement set out in KPIs below	Further reductions in fossil fuel use in industry sector
Carbon Neutral Heating	50-55% share of carbon neutral heating in total fuel demand[87]	0.6	70-75% share of carbon neutral heating in total fuel demand	1.2[88]	70-80% share of carbon neutral heating in total fuel demand
Construction Materials	Decrease embodied carbon in construction materials produced and used in Ireland by 10% through product substitution	0.4[89]	Decrease embodied carbon in construction materials produced and used in Ireland by at least 30% through product substitution for construction materials and reduction of clinker content in cement	1.0	Implementation of CCUS framework product substitution for construction materials and reduction of clinker content in cement
Energy Efficiency	Reduce industry fossil fuel demand through energy efficient measures in manufacturing process by 7%	0.2	Reduce industry fossil fuel demand through energy efficient measures in manufacturing process by 10%	0.2	Further reductions in industry energy demand
Increasing Use of Zero Emission gas	At least 1 TWh consumption of zero emission gas for industrial heating[90]	0.2	At least 2.1 TWh consumption of zero emission gas for industrial heating and aligned with the Heat Policy Statement	0.4	Further consumption of zero emission gas for industrial heating in line with national biomethane and hydrogen strategy ambitions
Total Estimated Abatement Potential		**1.4**		**2.8**	

4. Ireland's Carbon Budgets – Built-Env. Sector

Can only contribute 1% site-wide to 89% of Abatement Targets

Built Environment Sector:

Sectoral Emission Ceilings

- Residential: 29 $MtCO_2e$. for 2021-2025, and 23 $MtCO_2e$. for 2026-2030
- Commercial/Public: 7 $MtCO_2e$. for 2021-2025, and 5 $MtCO_2e$. for 2026-2030

Key Targets

- All new dwellings designed and constructed to Nearly Zero Energy Building standard by 2025, and Zero Emission Building standard by 2030
- Equivalent of 120,000 dwellings retrofitted to BER B2 or cost optimal equivalent by 2025, and 500,000 dwellings by 2030
- Up to 0.8 TWh of district heating installed capacity across both the residential and commercial building stock by 2025, and up to 2.7 TWh by 2030
- 170,000 new dwellings using heat pumps by 2025, and 280,000 by 2030
- 45,000 existing dwellings using heat pumps by 2025, and 400,000 by 2030
- Up to 0.6 TWh of heating provided by biomethane by 2025, and up to 1.1 TWh by 2030
- Delivery of savings of 0.735 $KtCO_2e$. in public and commercial buildings

- **Non-Residential (Commercial) Sector = 18.8% of Built Env. Emissions Ceilings**

- **IT Data Halls make up 99% of site-wide fuel demand**

Therefore, Commercial (Admin + Ancillary Buildings) make up only 1%

- **Heating of the No fossil-fuel heating requirement (PV + CPPAs) <1%**

- **Can indirectly Contribute to 0.8TWh District Heating via Waste Heat Recovery connection (proposed)**

- **Insignificant Built Environment Commercial Sector alignment and impact**

4. Ireland's Carbon Budgets – Built-Env. Sector

Built Env.'s

✓ 1 – Non-Data Halls only, <1% of energy demand (2025, 2030 & 2035)

✗ - Data Halls = 24/7 cooling so enhanced fabric performance increases cooling energy consumption – relaxation of fabric applies to Data Halls.

✓

✗ 2 – Non-Data Halls only will be zero carbon via PV + CPPAs (2025, 2030 & 2035)

✗ - No requirement for District Heating to be supplied to site.

✗ - Support commercial buildings to deliver savings - Waste Heat Recovery offered for future connection to 3rd party Heat Network – end user 'Sector' unknown.

- WHR bi-product of H_2 & BioM fuel supply – not relevant to H_2 supply only

Can only contribute 1% site-wide to 89% of Abatement Targets

Table 14.6 – Key Metrics to Deliver Abatement in the Commercial/Public Sector

Theme	2025 KPI	2025 abatement (vs 2018) $MtCO_2eq.$	2030 KPI	2030 abatement (vs 2018) $MtCO_2$ eq.	2031-2035 measures
Standards and Regulations	All new buildings designed and constructed to NZEB standard and using renewable energy sources	N/A[107]	All new buildings designed and constructed to ZEB standard	N/A	Minimum energy performance standards for all commercial and public buildings
Decarbonisation of Public and Commercial Heating	Up to 0.1 TWh of district heating	0.03	Up to 0.2 TWh of district heating	0.04	Continued expansion to ensure heating is supplied by district heating networks
	Support public and commercial buildings to deliver savings of 375 $kCO_2e.$	0.4	Support public and commercial buildings to deliver savings of 735 $kCO_2e.$	0.7	Increased number of buildings with installed heat pumps connected to district heating, in line with levels of deployment activity during 2026-2030
	Up to 0.2 TWh of heating provided by renewable gases to be delivered through agriculture-based supply chains	0.04	Up to 0.4 TWh of heating provided by renewable gases to be delivered through agriculture-based supply chains	0.1	Focus on ensuring alignment of use of renewable gases
Total Estimated Abatement Potential		**0.47**		**0.84**	

Appendix C

Gas Networks Ireland – Vision 2050 Document

Gas Networks Ireland

Vision 2050

A Net Zero Carbon Gas Network for Ireland

ERVIA

The solution to Ireland's energy and climate challenge will require the successful deployment of many technologies. Electrification, natural gas (with Carbon Capture and Storage (CCS)), renewable gas and renewable electricity sources will all play significant roles in the energy system in 2050.

Ireland's gas network is a valuable national asset which will play a major role in achieving a clean energy future in a least cost, safe and secure manner.

This document outlines how our vision can be achieved.

Gases and gas technologies to deliver Ireland's net zero carbon network by 2050:

Natural Gas
It emits 40% less CO_2 than coal and 22% less CO_2 than oil.

Renewable Gas
It is net zero carbon, extremely versatile and fully compatible with the existing gas network infrastructure.

Compressed Natural Gas (CNG) and Bio-CNG
Compressed Natural Gas (CNG) is natural gas used in transport. Bio-CNG is compressed renewable gas used in transport.

Carbon Capture and Storage (CCS)
Captures the emissions from natural gas power plants and large industry preventing emissions entering the atmosphere – the **'abated'** natural gas is net zero carbon.

Hydrogen
Produces zero CO_2 emissions when combusted and can be blended with natural gas or used in its pure form.

Power to Gas (P2G)
Uses renewable electricity to split water into hydrogen and oxygen.

Foreword

Climate change is one of our greatest and most urgent global challenges. This challenge is man-made and the implications of not solving it are catastrophic. Global warming is having far reaching and profound impacts on communities, human health and the world's climate. Major economies are falling short of climate change targets and Ireland is no exception.

Ireland is experiencing significant population growth with projections forecasting a population of 6.7 million in 2051 in the Republic of Ireland[1]. Ireland's economy is growing and is out-performing many other European economies. The growth in our population and economic activity will create even higher energy demands.

Heat and transport account for 80% of Ireland's energy use while electricity accounts for the remaining 20%[2]. While the country has made huge strides in creating renewable electricity, this remains a relatively small part of Ireland's overall required energy mix. We urgently need to come up with solutions to address the remaining energy requirements and to ensure we are all more efficient in our use of energy.

Ireland's Climate Action Plan (CAP) sets out an ambitious trajectory to address climate disruption over the coming years[3]. The CAP also sets out clear governance arrangements which will significantly enhance accountability and purpose in implementing the proposals. Gas Networks Ireland and Ervia welcome the strength of the ambition and the associated governance set out in the CAP. We recognise that Ireland must significantly increase its commitments to tacking climate disruption, and we are delighted to share our vision for the significant role that the gas network can play in supporting Ireland's climate commitments. We welcome the CAP as a living document which will be updated annually. As we achieve progress toward our vision we will periodically refresh this document to chart our progress and potential, and to share critical developments in new and emerging clean gas technologies. The gas network plays a critical role in Ireland's economy today, delivering 30% of the country's primary energy needs; serving homes, businesses and electricity generation. In 2017 over half of all electricity produced in Ireland was generated using natural gas[4].

Our vision is for the gas network to evolve to become net zero carbon by 2050 and to support emissions reductions across every sector of the Irish economy at the lowest cost possible. We will realise this vision by meeting half the projected 2050 gas demand with net zero carbon and zero carbon gases and by using Carbon Capture and Storage (CCS) to abate the emissions from the remaining natural gas. Gas Networks Ireland has already begun to invest in new technologies to facilitate renewable gas injection into the gas network, and to supply Compressed Natural Gas (CNG) from the gas network as a fuel source for commercial vehicles. Ervia is also assessing the feasibility of CCS and hydrogen solutions as part of a wider long-term ambition to pursue net zero carbon and zero carbon solutions.

Our vision for the existing gas network is exciting and ambitious. We are committed to working with government and policy makers across all sectors, to ensure we maximise the contribution this asset owned by the people of Ireland can make to help reduce emissions at least cost. We must all take responsibility and act to address climate change in order to preserve and protect Ireland for future generations.

Cathal Marley

Interim CEO,
Ervia

Denis O'Sullivan

Managing Director,
Gas Networks Ireland

Key drivers to deliver Ireland's net zero carbon gas network:

Renewable gas (Biomethane)

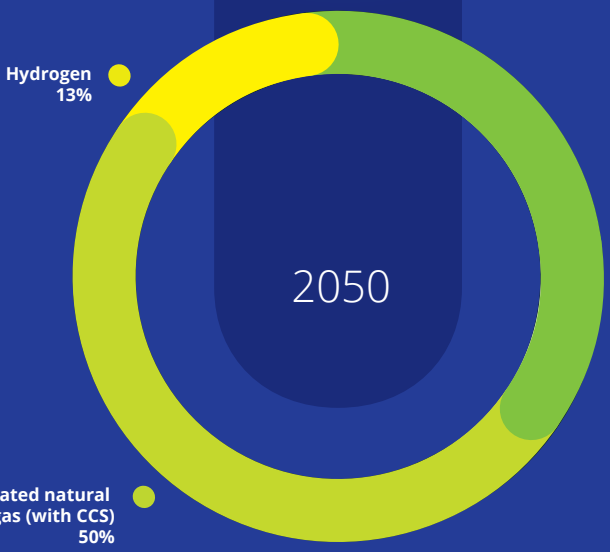
Abated natural gas (with CCS)

Hydrogen

The gas network will provide a sustainable, secure and cost-effective decarbonisation pathway

A net zero carbon gas network will deliver at least 18.7Mt/ annum CO_2 emissions savings by 2050 (31% of Ireland's overall current emissions).

- **Electricity 8.2Mt**
- **Industry 2.7Mt**
- **Heat 2.6Mt**
- **Transport 2.8Mt**
- **Agriculture 2.4Mt**



1. Introduction and Key Messages

The Challenge and Opportunity

Urgent action is required to reduce Ireland's emissions

Climate change is one of the greatest global challenges facing this generation and it is widely recognised that "rapid, far reaching, and unprecedented changes" are required to limit harmful greenhouse gas (GHG) emissions to avoid a global climate disaster[5]. In recognition of the urgent and far reaching action required, the European Commission has set out its vision to achieve net zero emissions by 2050[6]. Ireland has committed to radically decarbonising its energy system by 2050, however the country is not on course to achieve its short or long-term climate ambitions.

The transition to a low carbon economy presents significant challenges for Ireland. Energy demand is forecast to increase, driven by a rising population and a growing economy. Agriculture is a key sector of the Irish economy and it is the largest source of Ireland's emissions. The agri-food sector is forecast to continue to grow and decarbonising it is very difficult. The heating and transport sectors are also challenging to decarbonise.

Ireland's Climate Action Plan (CAP) is a welcome development which sets out clear targets for emissions savings per sector to 2030 along with clear governance and accountability. It highlights the need for, and benefits of, early action: "The earlier we act, the less dramatic and costly it will ultimately be for Ireland. Acting now reduces our long-term transition costs, and brings additional benefits such as better air quality and reduced fuel poverty"[3]. Ireland's gas network can play a vital role in delivering early and sustained action.

Networked gas is a key component of Ireland's energy mix

Ireland's gas network is among the most modern gas networks in Europe and it provides a safe, secure and reliable energy supply. The gas network plays an important role in Ireland's economy, delivering 30% of the country's primary energy needs serving homes, businesses and electricity generation[4]. In 2017 over half of total electricity produced was generated using natural gas[3]. In total there are over 700,000 gas customers in Ireland, including 30,000 businesses. Ireland's national gas network infrastructure, which is valued at €2.6 billion, is 14,390km long and connects towns and villages in 21 counties across the country.

The gas network also provides essential back-up and flexibility for the electricity grid when wind levels drop, an increasingly important feature as intermittent renewable electricity generation continues to grow. The large energy storage capacity of the gas network means it can deliver heat to homes and businesses and can still provide fuel for electricity generation when there is no wind.

Ireland's gas network can deliver early and significant emissions savings

Natural gas provides a cleaner alternative to coal, peat and oil today. Replacing these fuels with natural gas in electricity generation and heating will ensure early action and provide immediate emissions reductions. Similarly converting Ireland's Heavy Goods Vehicles (HGVs) from diesel to Compressed Natural Gas (CNG) can yield near-term emissions reductions in the transport sector.

Ireland's gas network can evolve for even greater, sustainable emissions savings

By transporting renewable gas (biomethane) in the network now, and by developing technologies such as hydrogen and CCS, we will play a critical role in transforming Ireland's energy economy. A total emissions saving of at least 18.7Mt CO_2 per annum can be achieved by using gas and the gas network to decarbonise every sector of the economy. Based on total emissions of 61Mt CO_2[7], this represents a reduction of 31% of Ireland's total emissions, or the equivalent of 58% of the emissions from transport, electricity generation and the built environment. This analysis draws on collaborative research between Gas Networks Ireland and MaREI, the Science Foundation Ireland (SFI) Research Centre for Energy, Climate and Marine.

Our Vision

A net zero carbon gas network

Our vision is for Ireland's gas network to be net zero carbon by 2050.

This ambition will be achieved by progressing two core aims, each contributing approximately half of the emissions savings required to completely decarbonise the network.

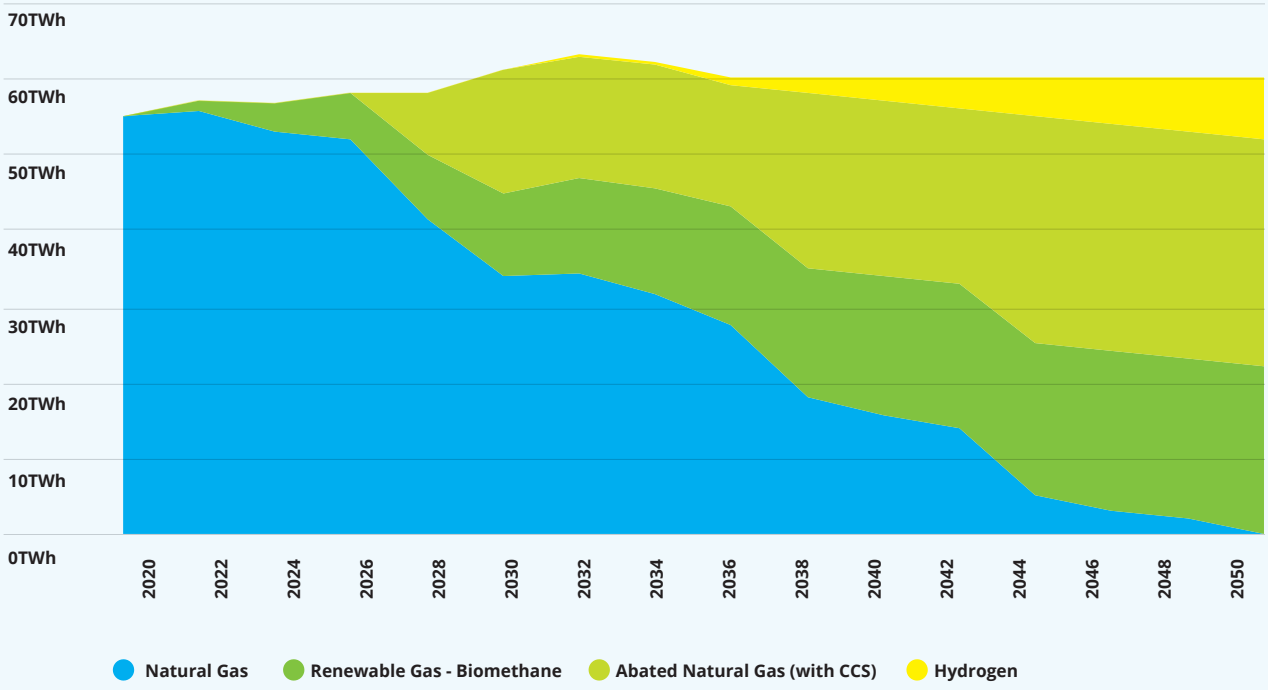
Injecting 50% net zero carbon and zero carbon gases into the network to displace half of the natural gas required to meet consumer demand. Renewable gas will be injected into the gas network now, and over time, hydrogen will also be added. Gas Networks Ireland is targeting 11TWh/annum renewable gas in the network by 2030 (20% of current demand). The volume of renewable gas and hydrogen in the gas network will increase over time to 50% by 2050. The evolution of technology between now and 2050 will determine the ultimate split between renewable gas and hydrogen in the network in 2050. A variety of scenarios may arise over this timeframe which may result in more or less hydrogen or renewable gas, but with the combination of these gases still meeting 50% of gas demand.

'Abating' the 50% natural gas still required to meet overall demand. CCS technologies will increasingly capture and store the CO_2 emissions from natural gas used for power generation and large industry.

By 2050 the combination of renewable gas, hydrogen and natural gas in combination with CCS will deliver net zero carbon gas for home heating, transport, industry and electricity generation.

Our vision for Ireland's gas network is aligned with other European gas networks of which six have committed to net zero carbon by 2050.

Figure 1: Our vision for a net zero carbon gas network by 2050



Benefits of a Net Zero Carbon Gas Network

Transitioning to a clean energy economy will be challenging as a balance between sustainability, security and affordability must be achieved. Using existing energy assets and capabilities will achieve these aims earlier, offering the potential to achieve a smoother and more sustainable transition.

Immediate emissions savings

These will be achieved by moving to replace peat, coal and oil with natural gas in electricity generation, heating and transport. Making early progress ensures savings accumulate and grow year after year as we move toward 2030 and 2050. Longer-term, as the gas network evolves to become net zero carbon, **a total emissions saving of at least 18.7Mt CO_2 annually will be achieved economy wide**.

Least cost and least disruptive transformation

Supplying renewable gas through the gas network is the least cost and least disruptive way to decarbonise home heating for those on or near the gas network. An analysis carried out by KPMG has demonstrated that the cost of **decarbonising heating for the one million homes on or close to the gas network is three times more expensive via electrification** compared with renewable gas[8]. Poyry have concluded that achieving a decarbonised energy sector in 2050 will be significantly cheaper by including natural gas with CCS, renewable gas and hydrogen[9]. The European Commission has reported that it will **cost the EU an additional €1.2 trillion to reach its CO_2 reduction target for the power sector** without CCS[10].

Energy security and flexibility

The large storage capability of the gas network is unique and cannot be economically provided by other energy sources. The **flexibility and energy storage capacity of the gas network ensures that heat is always available**, and high levels of renewable energy can be reliably accommodated on Ireland's electricity grid. Gas together with CCS will ensure that existing and new gas power plants can be securely accommodated to provide flexible, secure and cost effective electricity generation.

Other benefits

CNG provides an **immediate pathway to decarbonisation of HGVs and bus transport** and even greater benefits as renewable gas displaces natural gas. The use of gas in transport also significantly improves air quality compared to diesel, reducing serious health effects associated with poor air quality. The EU requires Member States to achieve 3.5% advanced biofuels in transport by 2030, and renewable gas from grass (Bio-CNG) offers a commercially viable advanced biofuel which is cheaper than other advanced biofuels. CNG and Bio-CNG are particularly important options for heavy duty transport such as HGVs and buses where viable options to decarbonise are limited.[11]

Delivering renewable gas, primarily from grass, agricultural wastes and other sustainable feedstocks, will provide clean energy while also helping to reduce agricultural emissions through better land and agricultural waste management. A renewable gas industry will help **stimulate the rural economy by introducing an additional income stream to farms** and developing new, skilled and sustainable jobs in rural areas.

The availability of competitive renewable and net zero carbon gas supplies will enable businesses who favour gas, or require it for high temperature processes, to locate or remain in Ireland.

Maximising the use of existing state energy infrastructure will deliver a least cost approach to achieve a clean energy future, ensuring energy affordability and a just and fair transition for all energy consumers.

In total there are over 700,000 gas customers in Ireland, including 30,000 businesses. Ireland's national gas network infrastructure, which is valued at €2.6 billion, is 14,390km long and connects towns and villages in 21 counties across the country.

Realising Our Vision

Supports are required to unlock this opportunity for Ireland

Supportive policy and regulations will be critical

Energy investments are typically sizeable and long-term and consequently are ideally made under conditions of relative certainty, typically in response to encouraging policy signals from Government. Gas network connection and network utilisation can be enabled or disabled by policy. Energy policy should support the potential for networked gases with a net zero carbon gas network as a key component of Ireland's clean energy future.

Investment support will also be critical

Emerging and new clean energy technologies in Ireland will require support to become economically mature and self-sustaining. Similar to other clean energy technologies, a variety of measures will be required to enable the gas network and networked gases to maximise their contribution towards meeting the decarbonisation challenge.

Supporting renewable gas – the inclusion of renewable gas in an appropriate support scheme is critical to kick-start the development of renewable gas projects in Ireland.

A detailed policy roadmap will be required to set out the measures required from demand side to supply side to successfully develop Ireland's renewable gas industry. Gas Networks Ireland would welcome the development of a detailed policy roadmap in support of renewable gas and would work in partnership with industry stakeholders, researchers and relevant Government Departments to develop this.

Revising building regulations – Part L of the building regulations currently excludes renewable gas as a renewable energy technology despite the capability of gas boilers to operate on both renewable gas and natural gas. To create a level playing field for renewable gas, Part L should be amended to include appliances that are fuelled by a gas blend inclusive of a renewable gas element, and for the renewable element within the blend to be calculated toward the minimum renewable energy contribution[12]. Similarly, the option to select renewable gas is not on the default settings for Building Energy Rating (BER) Certification for the domestic sector. All other technologies are listed in the default settings and renewable gas should be recognised on the same basis.

Committing to transition Ireland's HGVs from diesel – the Accelerated Capital Allowance (ACA scheme) for gas vehicles and refuelling equipment and the excise duty treatment for CNG should be retained beyond their expiry in December 2021 and 2024 respectively, and until such time as the HGV population is 30% gas powered.

Integrating energy systems planning - The gas network and electricity grid are complementary and co-dependent. 'Sector coupling' between gas and electricity has been recognised at European policy level as key to supporting decarbonisation efforts. Coupled policy and regulations are required for electricity and gas to achieve an integrated systems approach. Energy planning should adopt a technology neutral approach with the focus on achieving required decarbonisation at least cost and least disruption.

Supporting CCS development in Ireland – Gas fired power plants in combination with CCS could introduce a new product in the Irish electricity market. This combination could provide zero emission electricity that is dispatchable on-demand. Ireland already has Combined Cycle Gas Turbine (CCGT) plants and Open Cycle Gas Turbine (OCGT) plants, and more are likely to be built over the coming 15 years. To ensure this energy option is developed, CCS should therefore be recognised and incentivised in a similar way to other technologies which provide the same benefits.

Facilitating hydrogen trials – Gas Networks Ireland will introduce hydrogen into the network in the longer-term but only following extensive testing and safety case development. Investment in these activities will be required through the 2020's to enable the development of appropriate standards and codes. Shareholder and Regulator support will be required to introduce safe but pragmatic regulations and incentives that will facilitate the introduction of new gases onto the network.

A Clean Energy Future for Ireland

Ireland's gas network provides a major opportunity to achieve significant and enduring emissions savings, sooner rather than later, across every sector of the economy, in a least cost and least disruptive manner; while retaining energy sector security and flexibility.

Ervia and Gas Networks Ireland are committed to developing the gas network so that this opportunity can be realised. Policy and other supports will be required to achieve our vision and as we work towards it, we will partner with key energy stakeholders, industry bodies, researchers and communities to ensure a least cost and fair transformation to a clean energy economy.

Realising a net zero carbon gas network will help to ensure that Ireland plays its part in the global effort to tackle climate change, becoming a sustainable clean energy economy now and for future generations.

Components of Our Vision

Natural Gas is the earth's cleanest fossil fuel. It emits 40% less CO_2 than coal and 22% less CO_2 than oil[3]. It also produces negligible levels of nitrogen dioxide (NOx) and sulphur dioxide (SOx) compared to oil or coal. Switching from these higher carbon fuels to natural gas can deliver immediate emissions benefits. The existing gas network is already capable of taking on significant new energy demands.

Compressed Natural Gas (CNG) is natural gas stored under high pressure. Replacing diesel in HGVs and buses with CNG would deliver immediate emissions reductions, air quality improvement (by eliminating particulate matter) and noise reduction. CNG is particularly well suited to deliver the high power and distance requirements of heavy-duty transport such as HGVs, buses and ships. Bio-CNG is renewable gas stored under high pressure. It can be used as a renewable transport fuel in the same way as CNG but delivers even greater emissions savings. We are already investing in CNG refuelling solutions for HGVs and buses. In 2018 the first public CNG refuelling station at Dublin Port became operational as part of our ambition to develop, in partnership with others, a 170-station CNG refuelling network.

Renewable Gas is biomethane (purified biogas) produced from existing waste streams and a variety of sustainable biomass sources, including grass, animal waste, crop residues and food waste. It is net zero carbon, extremely versatile and fully compatible with existing gas network infrastructure. It is identical in standard to natural gas and can be used for all the same applications, using the same machinery (boilers, appliances). It can be blended with, or can act as a substitute for, natural gas. Gas Networks Ireland is targeting 11TWh/annum renewable gas in the network by 2030 (20% of current demand). We are already active in facilitating the emergence and uptake of this new energy source via the existing gas network. A network of renewable gas injection points is under development with the first commissioned in 2019. We are working with Teagasc, MaREI and other key stakeholders to develop plans for a renewable gas industry for Ireland in partnership with farmers and communities. We are developing certification for renewable gas for Ireland (Green Gas Certificates) to assure the origin and sustainability of renewable gas sources which will stimulate the use of renewable gas by industry and other sectors.

Hydrogen produces zero CO_2 emissions when combusted. Much like natural gas, hydrogen can be used for heating, transport, and power generation. Currently most hydrogen is produced by separating it out from methane. This involves separating out the hydrogen in natural gas through a process called Steam Methane Reforming (SMR). This process produces CO_2 emissions which can be stored via CCS. Hydrogen may also be produced by an entirely carbon free process called electrolysis, this can use renewable electricity to split water into hydrogen and oxygen. The process is commonly referred to as Power to Gas (P2G). Electrolyser technology is developing rapidly, becoming larger scale and lower cost. Given the scale of the ambition for increased renewable energy generation for Ireland, this approach offers significant potential.

Gas Networks Ireland participates in a number of Irish and European gas forums and research initiatives, which are assessing how hydrogen could be transported using existing gas networks. We are also closely monitoring developments in the UK where hydrogen use in the gas network is being trialled by Northern Gas Networks.

Carbon Capture and Storage (CCS) involves capturing CO_2 from large point sources, such as power plants, and transporting it by pipeline or shipping, and securely storing it underground in depleted gas fields, thus preventing the CO_2 from entering the atmosphere (CO_2 "abatement"). Abated Natural Gas is natural gas supplied in conjunction with CCS to provide the benefits of natural gas without the emissions. Together with Ervia, we are already examining the feasibility of CCS solutions for Ireland with CO_2 being stored off-shore of Ireland or with CO_2 being exported (piped or transported by tanker to foreign storage facilities).

2. Ireland's Decarbonisation Challenge

Ireland is not on course to meet its EU 2020 Greenhouse Gas (GHG) emissions and renewable energy targets. Heating and transport emissions targets are proving particularly challenging. Emissions and renewable energy targets will increase in 2030 and 2050. Ireland will also have to manage the impact of a rising population, a growing economy leading to increased energy demand, and a growing agriculture sector. Natural gas will play an immediate role in reducing emissions in the residential, transport, electricity generation, and industrial and commercial sectors by replacing more CO_2 intensive fossil fuels such as oil, coal and peat. There are significant further opportunities for the gas network to support the achievement of targets in electricity generation, heat and transport.

Ireland's Current Position

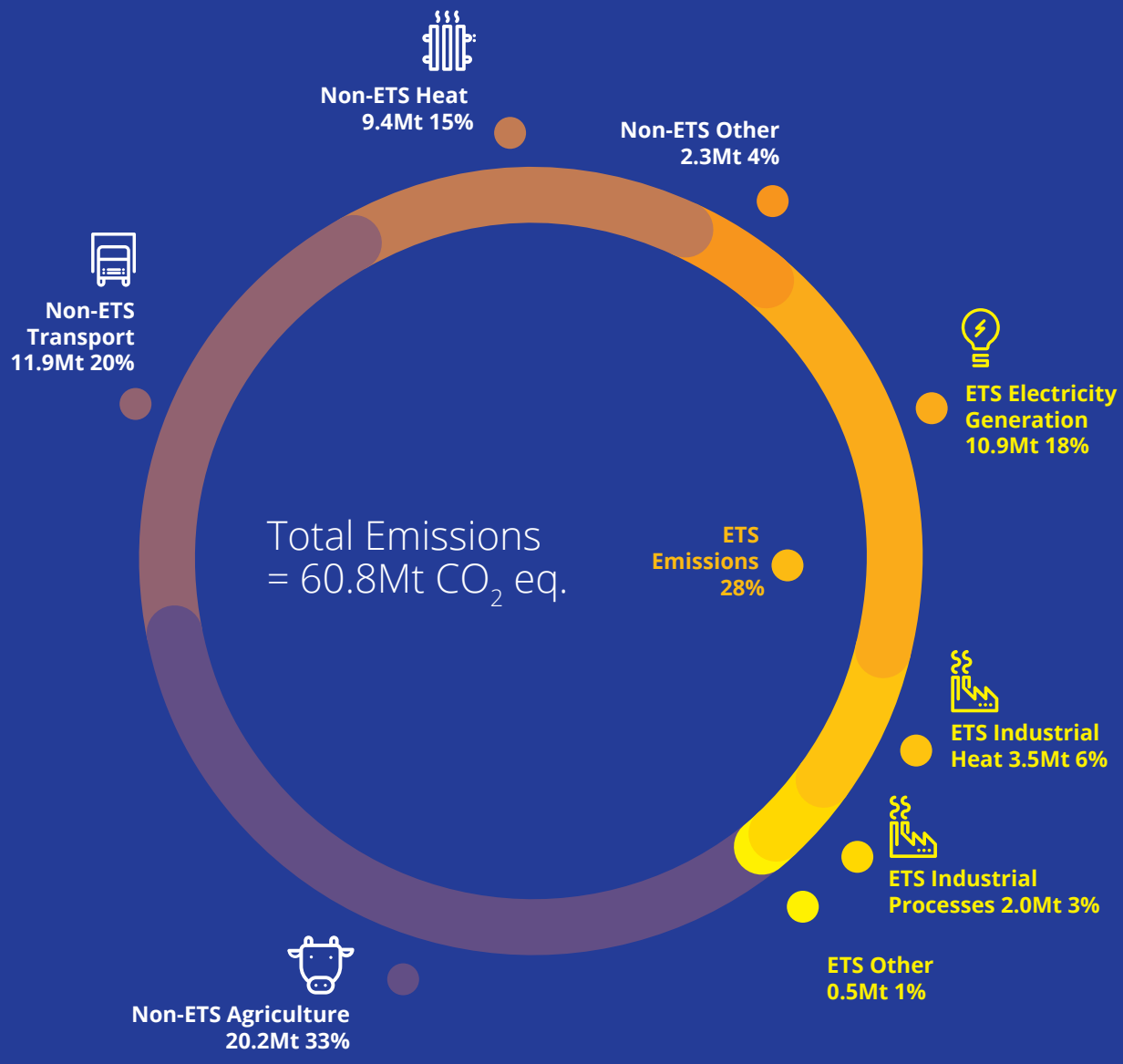
Emissions reductions are not on course to meet EU targets

Ireland must achieve mandatory national emissions reductions in the EU Non-Emissions Trading Scheme (Non-ETS) sector which includes agriculture, transport, residential and commercial sectors. Large emitters in the power generation, industrial and aviation sectors must achieve targets in the EU Emissions Trading Scheme (ETS) sector.

Ireland's emissions profile is set out in Figure 2. This shows that agriculture is the biggest source of overall emissions, currently at 33%, followed by transport at 20% and electricity generation at 18%. The nature of its agriculture-based economy means Ireland has the highest portion of overall emissions from agriculture against an EU average of circa 10%[13]. Decarbonising the agriculture sector is challenging, particularly as agri-food output is forecast to increase.

Ireland is not projected to meet its EU 2020 emissions targets and is not on the right path to meet longer-term EU and national targets. Non-ETS emissions are projected to be only 0-1% below 2005 levels by 2020 compared to a 20% reduction target[14]. Ireland's CAP is a welcome development which sets out clear targets for emissions savings per sector to 2030 along with clear governance and accountability.

Figure 2: Ireland's GHG Emissions 2017 (based on EPA 2017 Inventory)[7]



ETS = Emissions Trading Sector
Non-ETS = Non Emissions Trading Sector

Emissions targets will increase for 2030

EU targets will increase by 2030 and will rise further in line with the EU's ambition to achieve climate neutrality (net zero emissions) by 2050. Failure to achieve these targets will result in substantial fines levied on EU/Irish taxpayers.

The EU has set out more challenging emissions targets for 2030 as follows:

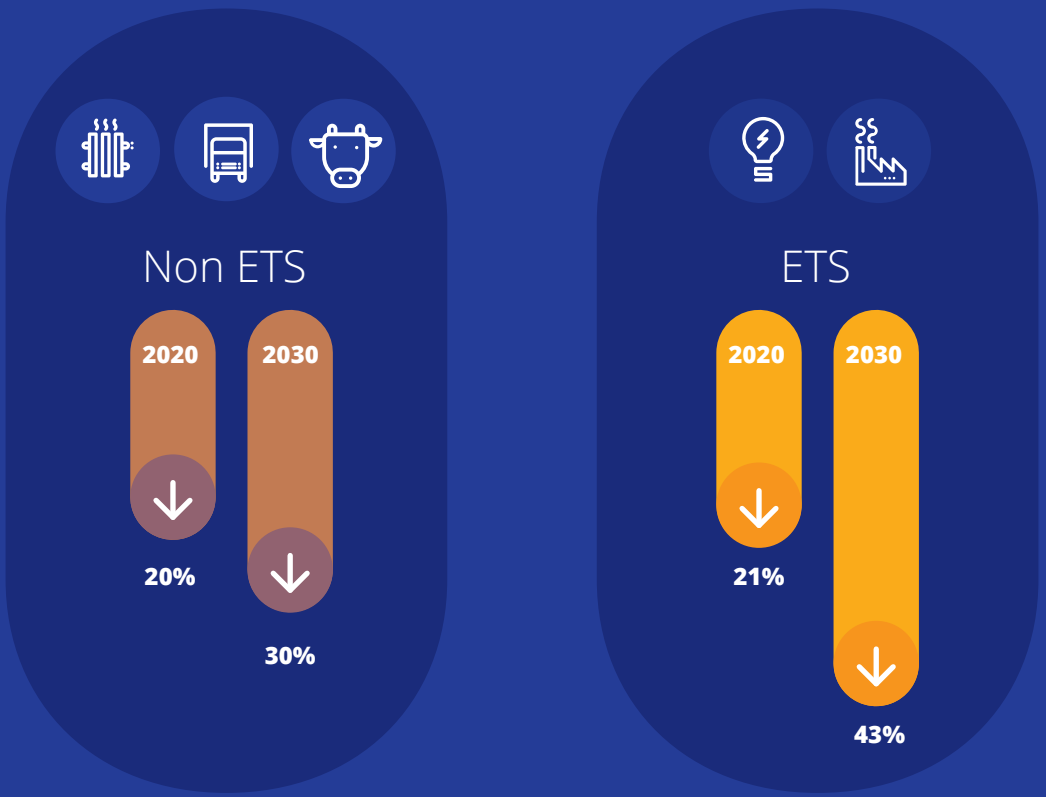
- Non-ETS sector[15] – 30% emissions reduction by 2030 compared to 2005 levels
- ETS sector[14] – 43% emissions reduction by 2030 compared to 2005 levels

The Non-ETS sector target is a mandatory national target and compliance is achieved by staying within allocated carbon budgets. Ireland's next carbon budget will be for the period 2021–2030. Emissions savings achieved early and maintained over the period can be accumulated toward the 2030 target. Early action is therefore important to ensuring the best possible chance of achieving Ireland's targets.

At a national level, Ireland's Climate Action and Low Carbon Development Act 2015 requires "an aggregate reduction of at least 80% CO_2 emissions (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and in parallel, an approach to carbon neutrality in the agriculture and land-use sector"[14].

To achieve this target, Ireland must reduce emissions across the electricity generation, built environment and transport sectors from 31.8Mt CO_2 today to 5Mt CO_2 in 2050[15]. Emissions from transport alone are double this target which highlights the scale of the challenge. Over this time, it is estimated that Ireland's population may reach 6.7 million (an increase of almost 2 million) which will further escalate the emissions challenge[1]. Ireland's ambition to reduce emissions will likely increase even further in line with the European Commission's vision to achieve climate neutrality by 2050.

Figure 3: EU Non-ETS and ETS Emissions Reduction Targets



Ireland's Renewable Energy Challenge

Renewable energy is growing significantly in the electricity sector but Ireland is not on course to meet overall EU targets

In 2017, Ireland met 10% of energy use from renewable energy[14]. Significant progress has been made in increasing renewable energy in electricity generation, however Ireland looks set to miss its EU 2020 overall target of 16% energy use from renewables (Renewable Energy Share – 'RES'). This 16% target is made up of individual targets for electricity, heat and transport as set out in Figure 4. In 2017, renewable energy accounted for 30% of electricity generation, 7% of heat, and 7% of transport[14].

Renewable energy targets will increase for 2030 and heat and transport must play an increasing role

The EU has made it clear that more demanding targets will be implemented in the decades ahead. European agreement has been reached for an even more challenging target of 32% RES for the EU for 2030, with a clause for an upwards revision by 2023[17]. This target will be split across electricity generation, heat and transport.

Electricity generation is the area which has seen most success to date. Electricity however only accounts for 20% of overall energy use in Ireland, meaning the 30% renewable electricity share in 2017 equates to just 6% of overall energy use from renewable sources[2]. Ireland has made significant progress towards its 40% target for electricity generation from renewable sources given the successful investment in onshore wind generation. The government has also set out an ambition to generate 70% of electricity from renewable sources (which will include offshore wind and solar) by 2030[18]. However, even at Ireland's target of 70% renewable electricity, only 14% of overall energy use would come from renewables, against a target of 32% in 2030[2] (assuming electricity remains at circa 20% of overall energy use). Heat and transport account for 80% of energy use, and Ireland must also achieve a much higher share of renewable energy in these sectors in order to meet its 2030 targets.

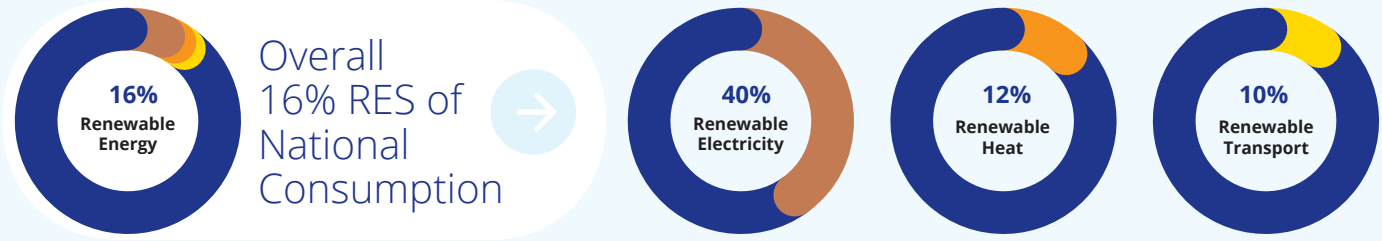
Meeting Ireland's Emissions and Renewables Challenges

Natural gas is a cleaner alternative to coal, peat, and oil, and replacing these fuels with natural gas in electricity generation, heating and transport will provide immediate emissions reductions. As the gas network evolves to become a net zero carbon network by introducing renewable gas, hydrogen and CCS, continued progress will be made toward Ireland's long-term climate goals.

Renewable gas in heat and transport offers a vital opportunity for Ireland to increase its overall renewable energy share while also contributing to Ireland's mandatory non-ETS emissions targets. Emissions reductions from renewable electricity do not count toward Ireland's mandatory EU emissions targets as they are counted toward ETS sector targets. Renewable electricity and renewable gas therefore can play complementary roles in reaching both emissions and renewable energy targets.

Ireland's CAP is a welcome development which sets out a significant ambition for the increased deployment of renewable energy in the country's overall energy mix. If all the targets in the CAP are met, it is estimated that approximately 30% of Ireland's energy requirements will be met by renewable sources by 2030. The current CAP does not reflect Gas Networks Ireland's target for 11TWh/annum renewable gas in the network by 2030 (20% of current demand). This represents approximately 10% of Ireland's projected energy use in 2030 and its implementation would increase Ireland's renewable energy usage to 40% by 2030.

Figure 4: Ireland's 2020 Renewable Energy Targets[16]



3. Unlocking a Clean Energy Future Using the Gas Network

Ireland's existing gas network is a critical €2.6 billion asset owned by the people of Ireland. The gas network underpins Irish economic growth and competitiveness, and this valuable national asset can be used to transform the country's energy economy. The gas network will provide a sustainable, secure and cost-effective decarbonisation pathway for Ireland in partnership with renewable electricity.

Meeting Ireland's targets and transitioning to a clean energy future will require a variety of low carbon and renewable energy options to be explored and integrated across every sector of society. Early action is essential for Ireland to have the best possible chance of achieving its climate goals. By waiting for future technology solutions and behaviour change, Ireland risks being left with too much to deliver too late, and ultimately missing its targets.

To have the best chance of achieving its targets, Ireland must consider how it can use its existing electricity and gas networks to make progress sooner rather than later. Both systems can play a complementary role in a clean energy future. Using the existing gas network will ensure that immediate progress can be achieved in a manner which balances sustainability with affordability and energy security.

Sustainable:

Gas (in all its forms – natural, renewable, abated, hydrogen) is an essential part of Ireland's pathway to 2050 and beyond. The gas network will deliver immediate emissions reductions, and over time the network will evolve to become net zero carbon, in the same way that the electricity grid is progressively decarbonising.

The gas network plays a crucial role in the Irish economy today, providing heat to homes, businesses and industry and providing the fuel for over half of Ireland's electricity generation. The demand for gas to provide heat and fuel is growing, driven by an expanding population and continued economic growth. Gas demand is expected to grow significantly between now and 2030[19], and both natural gas and renewable gas will be part of the Irish energy mix beyond 2050[20,21].

The gas network provides a way to achieve immediate progress on emissions. Natural gas is a cleaner alternative to coal, peat and oil and replacing these fuels with natural gas in electricity generation, heating and transport will ensure early action and provide immediate emissions reductions. As the gas network evolves to become a net zero carbon network by introducing renewable gas, hydrogen and CCS, continued progress will be made toward Ireland's long-term climate goals.

The nature of Ireland's agricultural economy also means that the country is uniquely positioned to develop a renewable gas industry which will provide a productive use of agricultural wastes, reduce agricultural emissions, and contribute to meeting Ireland's renewable energy targets.

Secure:

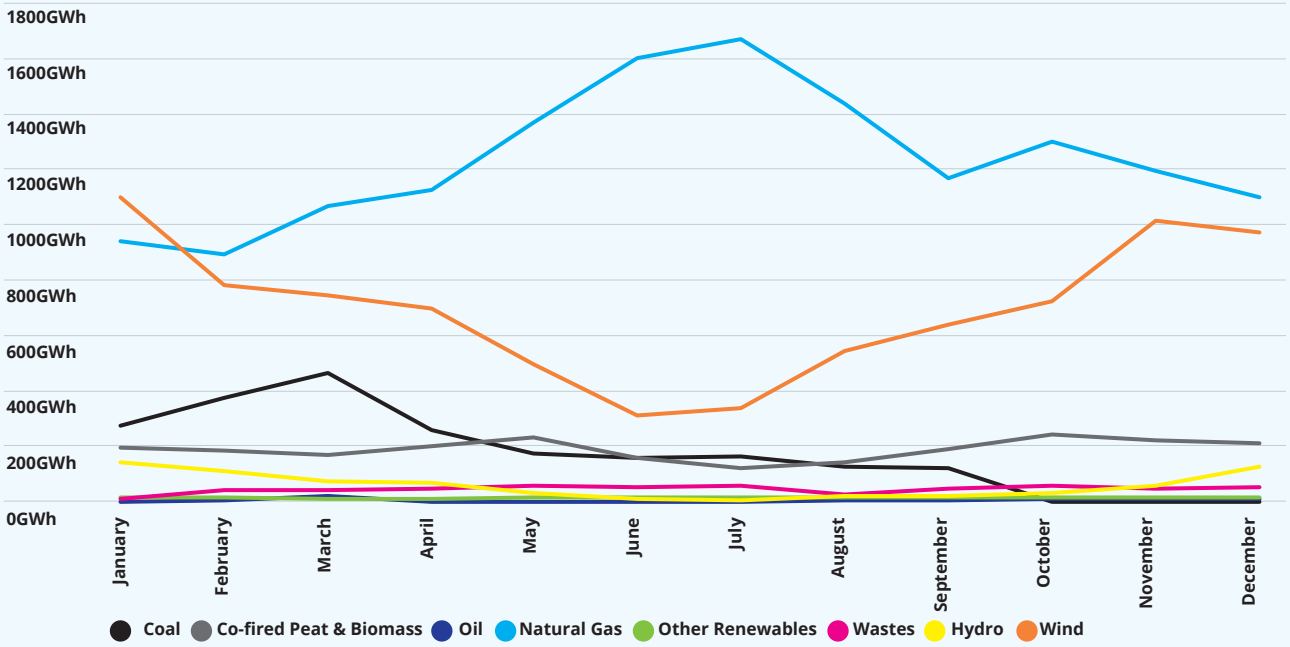
The unique large storage capacity and flexibility of the gas network provides low cost energy storage, enhances security of supply and enables high levels of renewable energy such as wind on the electricity grid.

The large energy delivery and storage capability of the gas network plays a significant role in Ireland's energy system. In 2017, the gas network transported over double the energy transported by the electricity grid[22,23]. The gas network is a vital part of Ireland's energy system providing 30% of Ireland's total primary energy needs and the fuel required for more than half of all electricity generation[4]. The gas network has also consistently proven its resilience through extreme weather events, with no loss of gas supply to households, businesses or the power generation sector.

Ireland has significantly increased its renewable electricity share to 30% in 2017[14]. This is a very positive development, and Ireland has set an ambition to reach 70% renewable electricity by 2030[18]. The gas network enables high levels of renewable energy by providing quick ramp up and flexibility when there is very low wind. The large storage capacity of the network can be used to flexibly meet short-term energy demand fluctuations and high seasonal winter peaks. This was evidenced in summer 2018, when up to 90% of electricity was generated using natural gas due to very low winds[24] (Figure 5). The flexibility and large storage capability of the gas network is unique and cannot be economically provided by other energy sources.

The gas network will continue to provide a safe and secure energy supply to the Irish economy. It will also continue to provide the flexibility to support high and increasing levels of intermittent (not always available) wind and solar energy on the electricity grid, ensuring that the stability of the grid is maintained. Renewable gas and hydrogen will play significant roles in the future gas supply, which will provide indigenous, renewable, and diverse gas sources, enhancing security of supply. Imports of renewable gas or hydrogen could also supplement indigenous production in the future, providing a further option to diversify the gas supply.

Figure 5: Electricity Generation Mix 2018 (SEAI)[25]



Cost effective:

Gas and the gas network will provide a least cost pathway to decarbonise home heating and power generation (with CCS), and will provide cost effective solutions for other sectors supporting a competitive economy and ensuring energy affordability.

MaREI has carried out an analysis of Ireland's energy system which has shown that electrification, natural gas with CCS, renewable gas and hydrogen will all play significant roles in 2050[20]. Poyry have similarly concluded that achieving a decarbonised energy sector in 2050 will be significantly cheaper by including natural gas with CCS, renewable gas and hydrogen[9]. The European Commission's analysis on a carbon neutral Europe by 2050 also indicates significant roles for bioenergy/renewable gas, CCS and hydrogen in the future energy mix.[26]

Using the existing gas network to transport renewable gas is the least cost and least disruptive way to decarbonise home heating. An analysis carried out by KPMG has demonstrated that the cost of decarbonising heating for the one million homes on or close to the gas network is three times more expensive via electrification compared with renewable gas[8]. Economic levels of energy efficiency (i.e. insulation) should underpin every solution, however, placing a high cost burden on households will not deliver the rapid change required. Using the gas network to transport renewable gas is a practical way to decarbonise home heating which avoids 'carbon lock in' as the consumer does not have to make an active choice to invest and adopt new technology. This means that progress can be achieved sooner rather than later and en masse. Emissions savings achieved early can be accumulated year on year toward meeting Ireland's targets.

Ireland's CAP estimates that the Marginal Abatement Cost (MAC) associated with agricultural renewable gas (agricultural biomethane) is €377 per tCO_2eq (MAC is the cost of reducing emissions measured per unit). Analysis by KPMG has demonstrated that the MAC in respect of renewable gas from agricultural sources is estimated to be €128 to €207 per tCO_2eq. The CAP estimate is therefore approximately 82% to 195% higher than KPMG's estimates. Renewable gas can be produced from a wide variety of sources and using a wide range of technologies. As a result, the MAC varies accordingly. The analysis contained in the CAP assumes a single cost estimate using worst case assumptions, the costly use of seaweed as a feedstock. Gas Networks Ireland's target to reach 20% renewable gas in the network in 2030 is based on agricultural waste and grass, a significantly cheaper source. The gas network also requires significantly less investment to facilitate renewable gas injection in comparison with the electricity grid reinforcement costs required for high levels of electrification. The total system costs should be evaluated when comparing technologies to ensure the lowest overall cost to the Irish citizen.[27]

Natural gas and the gas network will also continue to play a key role in keeping electricity generation costs down, particularly as the level of intermittent (not always available i.e. wind and solar) renewables increases. The gas network provides large energy storage today at a much lower cost than battery storage. Combining CCS with the large storage and flexibility characteristics of the gas network will be key to a cost effective transformation. The International Energy Agency (IEA) has stated that without CCS, the transformation of the power sector will be at least $3.5 trillion (USD) more expensive[28]. The European Commission has similarly reported that it will cost the EU an additional €1.2 trillion to reach its CO_2 reduction target for the power sector without CCS[10].

The gas network will also provide cost effective solutions to reduce emissions in heavy transport. CNG (and Bio-CNG) provides an attractive solution for HGVs and bus fleet owners to displace diesel, resulting in reduced emissions and operating costs, and enhanced air quality for Ireland.

The gas network will continue to provide cost effective solutions for industry. Natural gas is a vital input and heat source for many multi-national industrial customers with high temperature heat requirements. The availability of secure and cost competitive natural gas, and increasingly renewable gas, is a key requirement for many of these companies in choosing to locate or expand in Ireland.

Maximising the use of the existing gas network will facilitate a cost-effective transformation, avoiding significant new capital investment, and ensuring a fair and just energy transition for all citizens, especially those most vulnerable to energy poverty.

Ireland's Future Energy System and Complementarity:

Electricity and gas can play complementary roles to decarbonise Ireland's energy system in a least cost manner while ensuring energy security.

'Sector coupling' between gas and electricity has been recognised at European policy level as key to supporting decarbonisation efforts. This means that gas and electricity infrastructure should be planned and operated in an integrated manner. Combining the virtues of the electricity and gas systems can deliver early emissions savings, allow more renewables, lower costs to consumers, enhance energy storage and increase system resilience. European gas system operators are actively working on sector coupling initiatives with electricity system operators.

Ireland's electricity and gas networks already play complementary roles. Gas produces substantial amounts of Ireland's electricity and can ramp up and down depending on the level of intermittent renewable energy (i.e. wind) available to the electricity grid. Gas and electricity also meet customer energy needs for heat and power in a complementary way. EU studies have shown that electricity use may reach up to 40% of total final energy consumption by 2050[29]. Net zero carbon gas networks will therefore play an important complementary role for Europe and for Ireland. Recognising this, six European gas networks have already committed to net zero carbon by 2050. As Ireland seeks to deliver on its climate ambitions, integrated planning and operation of the electricity grid and gas network will ensure emissions savings are achieved in a secure and affordable manner. This approach will deliver a fair transition for all energy users.

In electricity, increasing levels of renewable energy will be required to meet Ireland's targets and decarbonise the electricity sector. The gas network will continue to provide large energy storage and flexibility for the electricity grid particularly as the level of intermittent renewables increases. This will optimise the use of Ireland's existing state assets and avoid significant and unnecessary electricity grid reinforcement costs.

The use of CCS will also extend the use of gas fired electricity generation plants with the benefit of reducing the overall cost of the energy transition for the state, and ultimately for the energy consumer.

In heating, it will be less costly and less disruptive to decarbonise heating for those consumers already connected to and within reach of the network by using the existing gas network than by electrification. The CAP sets out a significant ambition for electrification of heat in the existing residential sector by 2030. It also calls for a target to be set for renewable gas use for 2030. Both electrification and renewable gas will play key roles in decarbonising the existing residential heating sector. Renewable gas can be used in existing gas boilers today and its use will ensure redundancy, security and affordability in our path to 2030. Existing boilers are also understood to be compatible with small percentage blends of hydrogen.

The CAP signals an effective ban on the installation of gas boilers from 2025 in all new dwellings through the introduction of new regulatory standards for home heating systems. As the gas network evolves to become net zero carbon, transporting renewable gas and hydrogen, it will offer a viable alternative clean heat source for new dwellings which can be delivered through renewable heating systems such as renewable gas and hydrogen boilers.

District heating could also potentially offer another viable option as a heat source for new dwellings.

In transport, electric vehicles provide a suitable solution for cars and light vehicles while CNG and Bio-CNG provide a suitable solution for heavy-duty transport including HGVs, buses and ships.

4. A Net Zero Carbon Gas Network by 2050

Gas technologies available today will deliver immediate emissions savings for Ireland and will provide a pathway for future clean technologies to be adopted. Longer-term, emerging technologies will become cost competitive and suitable for adoption. Gas and the gas network will deliver significant emissions savings for Ireland as the gas network progressively decarbonises and becomes net zero carbon. A net zero carbon gas network will complement the role of renewable electricity and ensure Ireland delivers on its climate goals in a practical and cost-effective manner.

Our Vision

Our vision is for Ireland's gas network to be net zero carbon by 2050 (Figure 6).

In 2050, net zero carbon gas will be available for use in home heating, transport, industry and electricity generation. This ambition will be achieved by progressing two core aims, each contributing approximately half of the emissions savings required to completely decarbonise the network.

Injecting 50% net zero carbon and zero carbon gases into the network to displace half of the natural gas required to meet consumer demand. Renewable gas will be injected into the network now, and over time, hydrogen will also be added. Gas Networks Ireland is targeting 11TWh/annum renewable gas in the network by 2030 (20% of current demand). The volume of renewable gas and hydrogen in the gas network will increase to 50% by 2050. The evolution of technology between now and 2050 will determine the ultimate split between renewable gas and hydrogen in the network in 2050. A variety of scenarios may arise over this timeframe which may result in more or less hydrogen or renewable gas, but with the combination of these gases still meeting 50% of gas demand.

'Abating' the 50% natural gas still required to meet overall demand. Abated natural gas is natural gas used in conjunction with CCS to capture and store the CO_2 emissions from power generation and large industry.

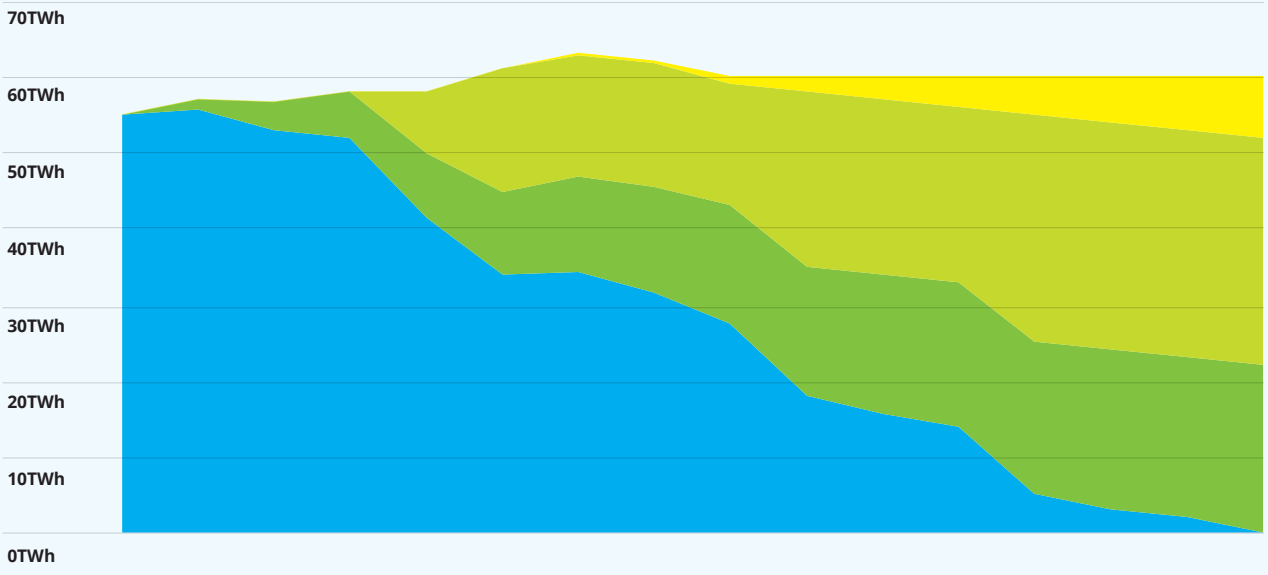
Our vision for Ireland's gas network is aligned with other European gas networks of which six have committed to net zero carbon by 2050.

Our vision for the short to medium-term is based on currently available and mature technologies (natural gas, CNG in transport, and renewable gas) which will deliver immediate emissions savings for Ireland. Making early progress ensures savings accumulate and grow year after year as we move toward 2050. Our vision for the longer-term is underpinned by technologies which are already being piloted and adopted in other parts of the world (CCS and hydrogen). Our vision is also underpinned by collaborative research between Gas Networks Ireland and MaREI on renewable gas, power to gas and the future of gas.

Our vision is for half of Ireland's heating sector to decarbonise seamlessly and 'en masse' as the gas delivered to customers via their existing gas connections is increasingly decarbonised. Electrification will also play an important role in the energy system as we progress toward 2050, with electrification offering a way to decarbonise existing 'one-off' and rural housing that is not located within practical reach of the existing gas network.

Our vision is that CNG (and Bio-CNG from renewable gas) will play an important role in decarbonising the heavy-duty transport sector including HGVs and buses, while electrification will play a key role in decarbonising the passenger car fleet.

Figure 6: Our vision for a net zero carbon gas network by 2050



Gas constitution percentage %	2020	2022	2024	2026	2028	2030	2032	2034	2036	2038	2040	2042	2044	2046	2048	2050
Natural Gas	100	97	94	90	72	56	54	51	46	30	26	23	8	5	3	0
Renewable Gas (Biomethane)	0	3	6	10	15	18	20	23	26	28	31	32	33	35	35	37
Abated Natural Gas (with CCS)	0	0	0	0	14	26	25	26	27	38	38	38	50	50	50	50
Hydrogen	0	0	0	0	0	0	0	1	2	3	5	7	8	10	12	13

Our vision also accommodates Ireland's electricity sector continuing to evolve to include two-way energy flows (where customers deliver energy back to the grid), higher demand, and greater demand volatility. The electricity grid will need to meet these complex requirements with an increasingly high level of intermittent renewable energy. The gas network will play a complementary and important role in supporting high levels of intermittent renewable energy on the grid and in providing flexibility to ramp up and down to meet the evolving needs of the electricity grid.

Our Vision Components

The gases and technologies which underpin our vision are as follows:

Renewable gas

Renewable gas is a clean, sustainable and net zero carbon fuel for heat, electricity and transport. It works in the same way as natural gas, coming into homes and businesses through the existing gas infrastructure. Ireland is uniquely positioned to benefit from renewable gas. Not only will renewable gas reduce energy related emissions, it will also help to reduce those from the hard to tackle agriculture sector, the biggest source of Ireland's emissions.

Ireland has the highest potential for renewable gas production per capita within the EU, with a potential of 13TWh/annum forecast by 2030[30]. Gas Networks Ireland is targeting 11TWh/annum renewable gas production by 2030 (20% of current demand). Various studies indicate that Ireland has the potential to sustainably produce over 42TWh/annum renewable gas[31]. We forecast that 22TWh/annum could be produced in Ireland by 2050.

Renewable gas is produced from a wide variety of sources including existing waste streams and a variety of sustainable biomass sources, including grass, animal waste, crop residue and food waste. Renewable gas can be produced through a variety of techniques, including the most widely used process 'anaerobic digestion'. This is where microorganisms break down the waste and biomass sources in the absence of air, producing gas. Anaerobic digestion is a well-established mature technology with over 17,000 plants in operation across Europe including Ireland and Northern Ireland[32].

The re-cast EU Renewable Energy Directive (RED II) comes into legal effect from 2021 and its sets out the minimum compliance requirements for all renewable energy fuels. Key among these requirements for liquid, gaseous, and solid fuels is the sustainability criteria. RED II sets out a list of fuel and feedstock types that can be classified as sustainable and also sets out carbon intensity thresholds. In addition, RED II recognises certain improvements in agriculture production which should be encouraged and assigns bonus carbon rating measures to assist in stimulating these. Ireland will use a life cycle assessment calculation formula to determine compliance with the sustainability criteria set out in the Directive. Gas Networks Ireland has partnered on an industry project to develop a robust calculation methodology and independent certification scheme for Ireland. Ireland's Green Gas Certification (GGC) scheme will ensure a reliable method of tracing and verifying renewable gas origin and will ensure the sustainability criteria set out under RED II are met.

In order to achieve our 2030 ambition, a network of 340 anaerobic digestion plants will be required. These plants will deliver renewable gas to the gas network either by direct connection or through a network of transmission connected Central Grid Injection (CGI) points. The first CGI facility is planned for Mitchelstown in Co. Cork and will enable the output of 590GWh/annum renewable gas, which is enough for 56,000 homes, avoiding over 170,000 tonnes of CO_2 per annum.

Gas Networks Ireland's role will be as facilitator of the roll-out of renewable gas. We will be an advocate for change and we will put in place the network to transport the renewable gas. A partnership of Government, investors, local producers and large energy users will ultimately ensure the successful delivery of this vital new indigenous resource.

CCS and abated natural gas

CCS is a technology which captures up to 100% of the CO_2 from electricity generation and large industrial emitters and transports it by pipeline or shipping and securely stores it underground in depleted gas fields ensuring that it is not emitted into the atmosphere[33]. The nearly depleted Kinsale gas field, off the coast of Cork, offers a potentially ideal storage facility for CO_2 and this is being investigated by Ervia and Gas Networks Ireland. Developing CCS in Ireland would allow us to continue to enjoy the benefits of natural gas and support the penetration of increasing levels of renewable energy in electricity generation, while largely eliminating the CO_2 emissions. Natural gas used in conjunction with CCS in this way is known as 'Abated Natural Gas'.

CCS will become available from the late 2020s and will ramp up in phases as gas fired power plants (or large industry) adopt this technology, enabling emissions to be abated. CCS also provides the option to export CO_2 to other jurisdictions outside Ireland.

CCS is not a new technology; 18 large-scale facilities are operating successfully around the world and further facilities are planned across Europe, the US and Canada[34].

A CCS project in Ireland could capture CO_2 from a number of gas-fired power plants enabling the provision low-carbon electricity. It would also provide a pathway for CO_2 intensive heavy industry to decarbonise. Ireland needs essential products like cement and aluminium to build homes and grow our economy. These industrial processes produce CO_2 which can only be removed using CCS.

Hydrogen

Hydrogen produces zero CO_2 when combusted and has the potential to play an increasing role in Ireland's decarbonisation strategy. Much like natural gas, hydrogen can be used for heating, transport, industry and power generation. Hydrogen can be mixed with natural gas or renewable gas in small percentages to form a blended gas or it can also be used on its own (100% hydrogen). Gas Networks Ireland and Ervia are investigating the potential for hydrogen production and transportation using the gas network. Ireland's gas network has the potential to transport large volumes of hydrogen. The low-pressure distribution network has polyethylene pipework which is understood to be compatible with 100% hydrogen. Work is also underway to evaluate the compatibility of the high-pressure steel transmission pipelines with hydrogen.

Currently hydrogen is primarily produced by separating it out from methane. This involves separating out the hydrogen in natural gas through a process called 'steam methane reforming' (SMR). This process produces CO_2 emissions which can be stored via CCS. Hydrogen may also be produced by an entirely carbon free process called 'electrolysis'. This process uses renewable electricity to split water into hydrogen and oxygen. Producing hydrogen in this way is known as 'power to gas' (P2G). Electrolyser technology is developing rapidly, becoming larger scale and lower cost. Given the scale of the ambition for increased renewable energy generation for Ireland, this approach offers significant potential. Hydrogen from P2G can complement electrification by acting as a source of energy storage for intermittent renewable energy generation which would otherwise be wasted.

The production of hydrogen will give rise to the need for additional gas storage capacity. As Ireland's geology precludes some of the preferred methods of storing hydrogen at scale currently in use internationally, Gas Networks Ireland is focussing on assessing developments in man-made storage methods. One such approach is to use hydrogen rich liquids such as ammonia. Ammonia, which is a combination of nitrogen and hydrogen can be produced when there is a surplus of hydrogen. Hydrogen is then separated out as required. Ammonia can also be shipped internationally potentially forming part of a future international trade in hydrogen.

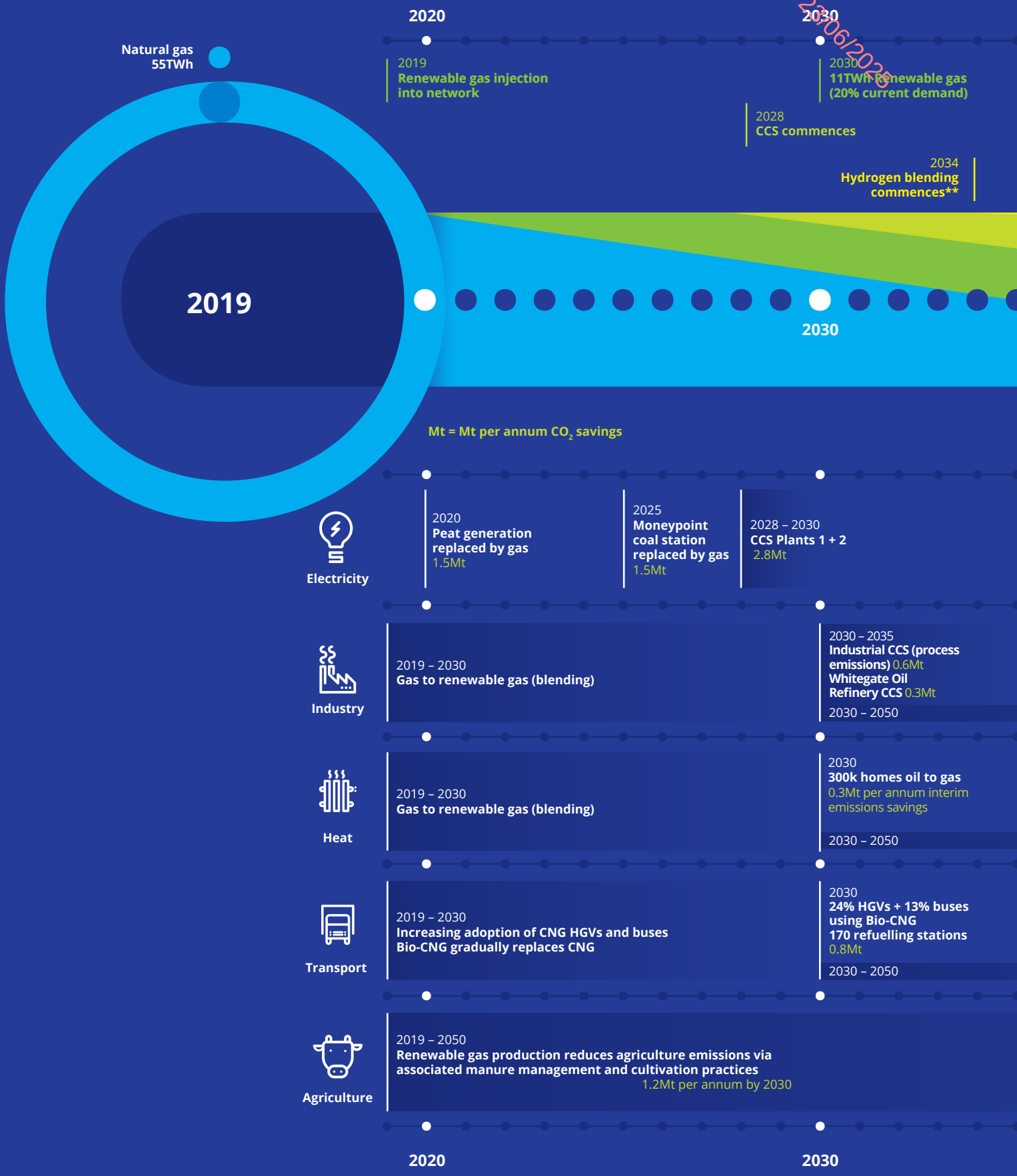
Gas Networks Ireland participates in a number of European gas forums, which are assessing how hydrogen could be transported using existing gas networks. In Ireland, Gas Networks Ireland and Ervia are actively collaborating with a variety of hydrogen research initiatives and bodies including GENCOMM (GENerating Energy Secure COMMunities through Smart Renewable Hydrogen), Hydrogen Mobility Ireland and Hydrogen Ireland Association. Hydrogen has the potential to provide Ireland with a highly versatile energy source which can be used in gas network injection, electricity generation, heat, transport and industry. Its storage capability also provides a potential additional source of energy security for the country. Gas Networks Ireland and Ervia have collaborated with peer semi-state companies to investigate hydrogen production and associated costs for Ireland.

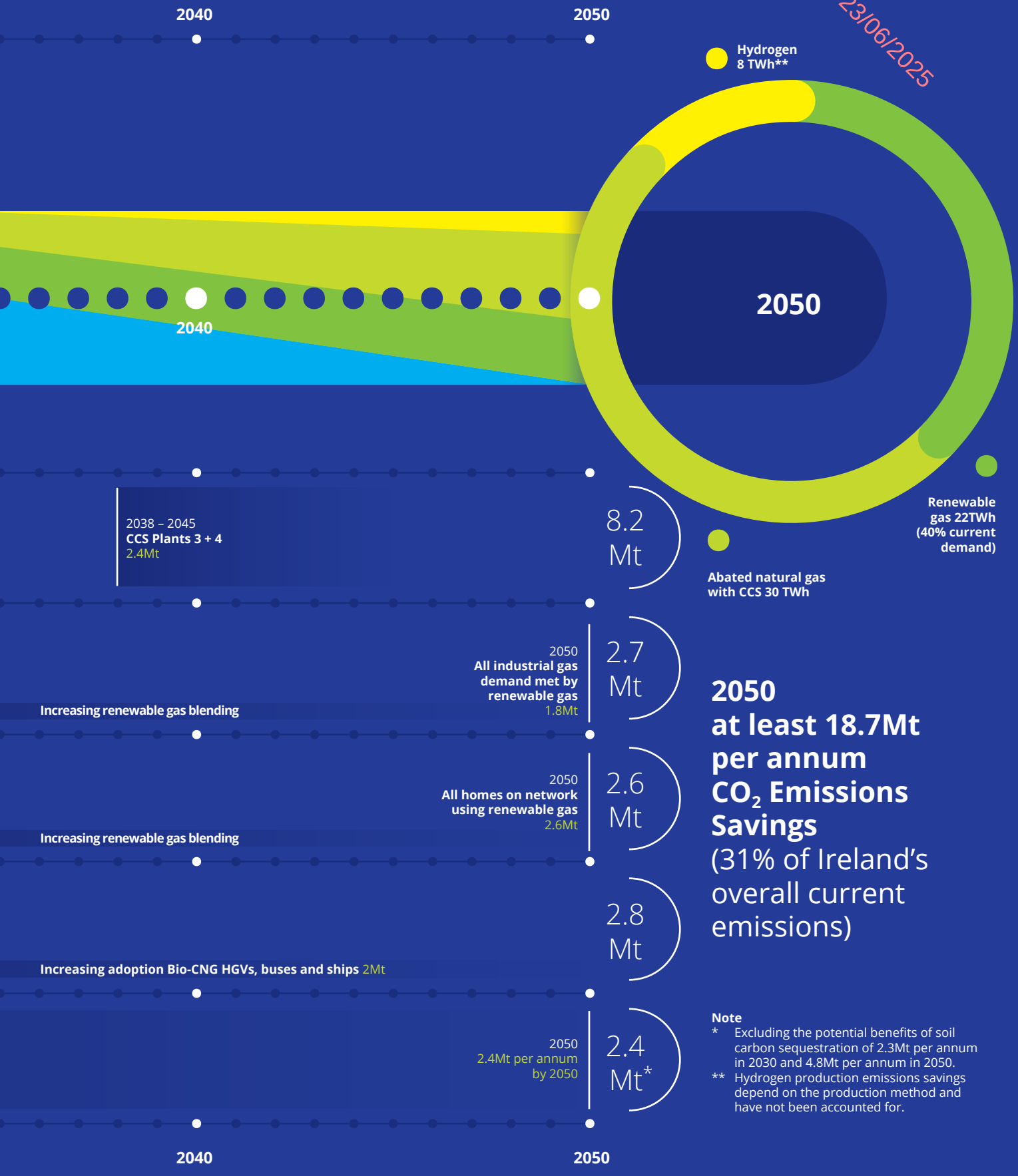
Hydrogen is being piloted and evaluated for use in heating and transport in many countries worldwide. In the UK, the Northern Gas Networks H21 North of England project is examining the feasibility, from both a technical and economic viewpoint, of converting the existing natural gas network to 100% hydrogen. We are closely monitoring developments in the UK.

Imports and exports

Emerging global markets in traded renewable gases will mean that import of renewable gas and hydrogen is likely to be available from 2030 onwards. Similarly, it is expected that CO_2 export to foreign storage facilities (e.g. Norway, UK) by ship or by pipeline will be available in the 2030s. These facilities could supplement, or substitute for, indigenous facilities if required in the future.

Our Vision Roadmap





2050
at least 18.7Mt per annum CO_2 Emissions Savings
(31% of Ireland's overall current emissions)

Note
* Excluding the potential benefits of soil carbon sequestration of 2.3Mt per annum in 2030 and 4.8Mt per annum in 2050.
** Hydrogen production emissions savings depend on the production method and have not been accounted for.

A Net Zero Carbon Gas Network by 2050

Our vision for a net zero carbon gas network in 2050 will be achieved in stages. As the gas network evolves and transports increasing volumes of net zero carbon and zero carbon gases, increasing emissions savings directly related to networked gas will be achieved. Figure 7, shows how the emissions profile of the gas network itself will evolve over time to become net zero carbon by 2050.

Our vision for a net zero carbon gas network will directly deliver significant emissions savings for Ireland as outlined in Figure 7, but it will also deliver wider emissions savings. A total emissions saving of at least 18.7Mt CO_2 per annum can be achieved by using gas and the gas network to decarbonise every sector of the economy. Based on total current emissions of 61Mt CO_2[7], this represents a reduction of 31% of Ireland's total emissions, or the equivalent of 58% of the emissions from transport, electricity generation and the built environment (against a target of 80% by 2050). Figure 8, outlines the economy wide decarbonisation potential of the gas network to 2050.

One of the key benefits of decarbonising the gas network is that it will not only help to achieve Ireland's ultimate renewable energy and decarbonisation targets in 2050, but in making early and continuous progress it will significantly contribute to meeting Ireland's interim milestone targets.

Figure 7: Gas network emissions reduction pathway

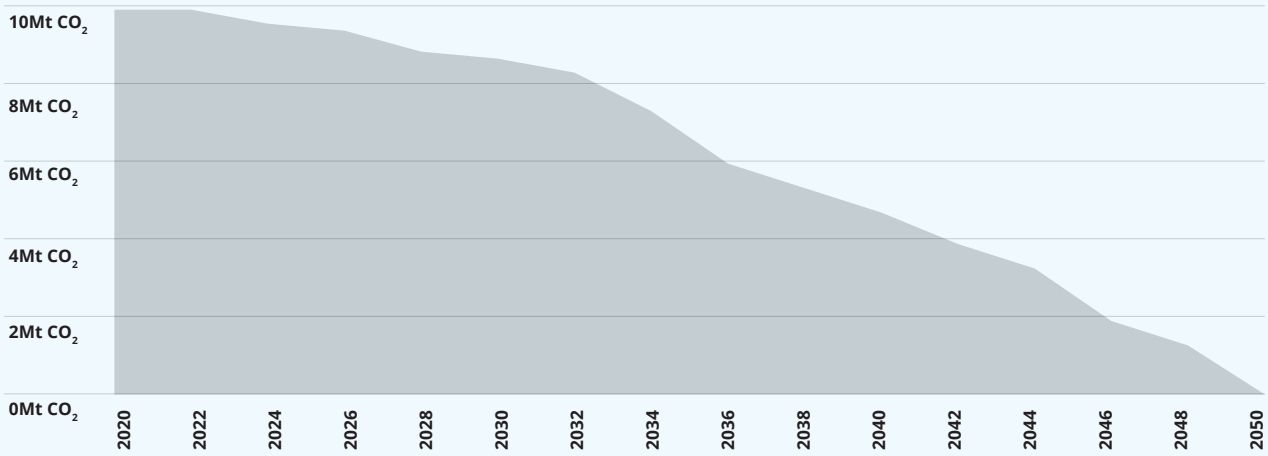
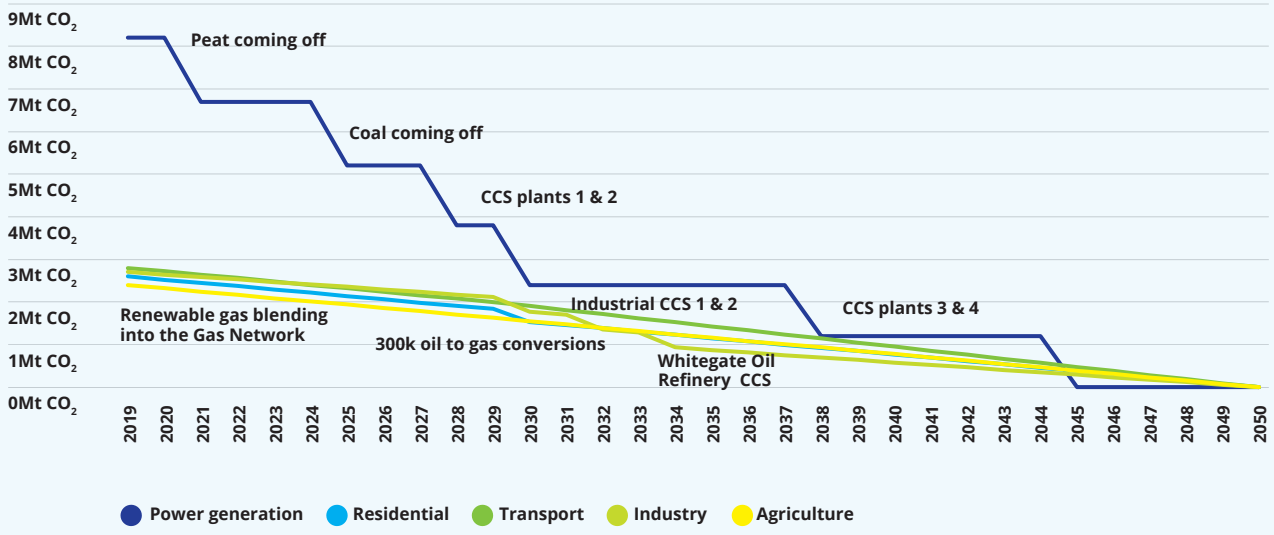


Figure 8: Economy wide decarbonisation potential



Our Vision in Summary

Our vision is for the gas network to evolve to become net zero carbon by 2050.

Natural gas and renewable gas in the network, together with CNG and Bio-CNG in transport, will deliver immediate emissions savings for Ireland. In the longer-term, hydrogen and CCS will play a significant role in achieving a net zero carbon gas network.

Our vision for the gas network will deliver decarbonisation sooner rather than later, and it will enable significant society wide emissions savings of at least 18.7Mt CO_2 /annum by 2050. Our vision for 2050 is one in which the gas network plays a key role in a decarbonised energy system, delivering net zero carbon gas and continuing to provide the critical large energy storage and flexibility which it provides today.

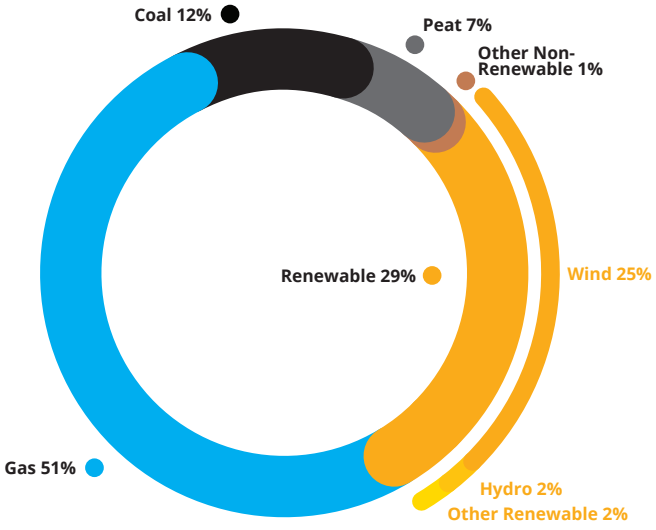
Using the gas network, a reduction of at least 8.2Mt CO_2/annum in electricity generation can be achieved by 2050.

5. Decarbonising Electricity

Electricity generation represents 18% (10.9Mt CO_2) of Ireland's emissions[7]. For Ireland to meet its long-term decarbonisation targets, low carbon electricity generation must be achieved. The carbon intensity of Ireland's electricity generation sector has fallen significantly over the last ten years; as the share of renewable energy in the generation mix has continued to increase, and as natural gas has replaced coal and oil. The responsive, flexible generation provided by natural gas will play an increasingly important role in supporting the volatility of intermittent renewable energy sources. Using the gas network, a reduction of at least 8.2Mt CO_2/annum can be achieved by 2050. Combining renewable gas with CCS offers the prospect of net negative emissions for Ireland and could be used to offset emissions in other sectors.

Ireland has set out an ambition to meet 70% of electricity generation from renewable energy[18]. Technologies such as wind and solar are 'intermittent' energy sources which means they are not always available to match demand and can drop off very quickly. As the share of intermittent renewables increases, the challenge of maintaining electricity grid stability and matching supply and demand grows. The responsive, flexible generation provided by natural gas plays an important role in supporting the volatility of intermittent renewables. In 2017, natural gas fuelled 51% of electricity generation requirements[22] (Figure 9).

Figure 9: Ireland's electricity generation fuel mix in 2017[22]



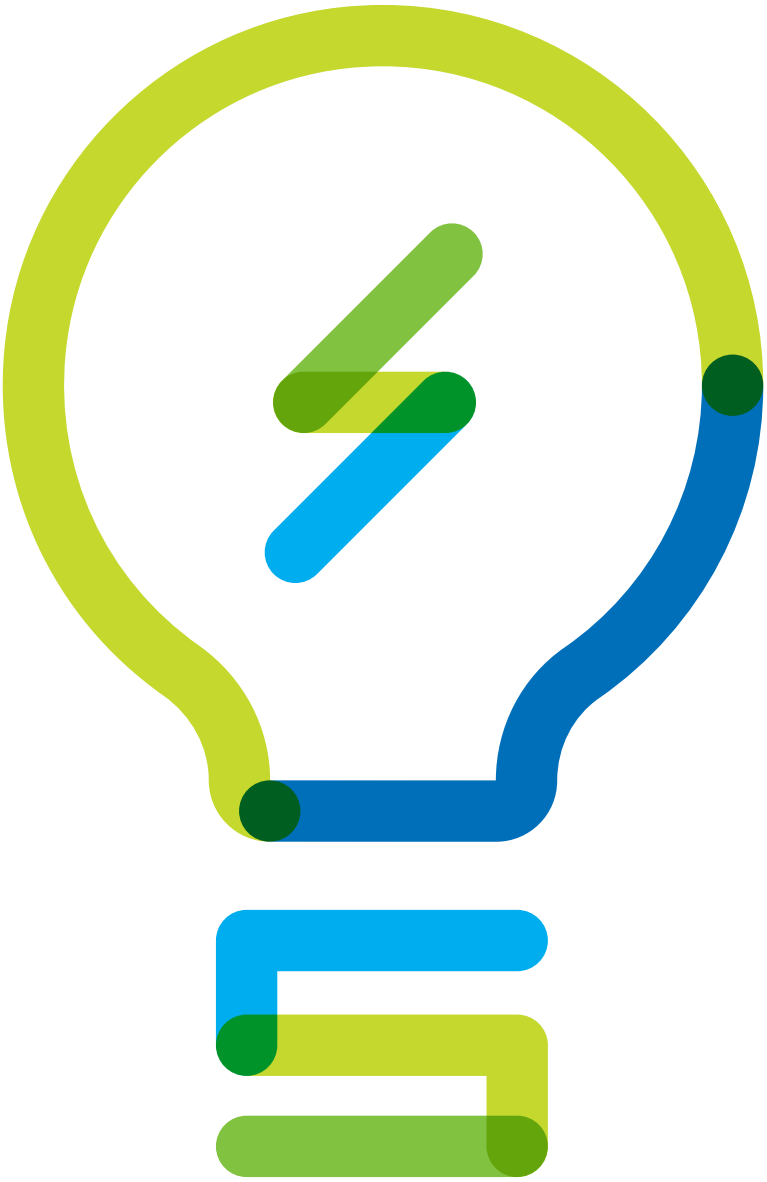
The CAP recognises the challenge Ireland will face in moving to higher penetrations of renewable electricity given its intermittent and often unpredictable nature and references the need for a range of technology solutions including interconnection, storage and dispatchable capacity such as gas plants. The electricity and gas systems are highly interdependent, and an integrated systems approach to both electricity and gas can deliver smart solutions and synergies for Ireland.

Why gas and the gas network provides a smart solution

Natural gas fired generation provides flexibility and stability to the electricity grid, allowing a high level of intermittent renewable electricity.

Ireland's electricity system has been designed to operate within very tight tolerances. If these tolerances are not met, the grid may become unstable with the risk of power outages[35]. Natural gas fired power generation provides flexibility and electricity grid stability, which complements the high level of intermittent renewable generation on the system.

The gas network provides critical inter-seasonal flexibility through its capability to supply large volumes of energy. This means that even on the coldest winter days with low wind availability, the gas network can ramp-up to provide gas for peak electricity generation, while also meeting peak heating demand.



Similarly, wind generation can be very low during summer periods. Natural gas demand for power generation hit an all-time high in June and July of 2018, with up to 90% of the country's electricity supply generated from natural gas, and an average of 70% over this period[24]. Even in winter, when demand is greatest, intermittent renewables such as wind and solar will fluctuate and there is no guarantee of the levels of electricity they will deliver.

As the penetration of intermittent renewables increases, the role of natural gas fired generation in providing system stability and security will become even more critical. No other power generation technology that is available on demand (dispatchable) provides the flexibility of gas.

The gas network provides large scale and cost-effective energy storage for Ireland

The gas network possesses significant energy storage capabilities, playing an important role in Ireland's energy security. In 2017 the gas network transported over 56,000GWh of energy, almost double that conveyed by the electricity grid at approx. 28,000GWh[22,23]. With the increasing use of intermittent renewable electricity generation, the need for back up capacity will continue to grow. Battery technology continues to improve and while it can play an important role, batteries can only store "a fraction of the energy that the gas system provides today at a far lower cost than even the lowest cost electricity storage"[36].

In 2017, approximately 4% of wind generation in Ireland was curtailed[37]. The level of curtailed wind and other renewables will increase as their penetration on the grid increases. P2G can harness this curtailed electricity and convert it to hydrogen or methane, which can be stored and injected into the gas network. Batteries are a suitable option for short-term peak storage, but they are more expensive per unit of energy stored versus P2G (by up to a factor of 1,000)[38].

High efficiency gas power plants can provide significantly cleaner electricity than coal and peat

Natural gas provides significant emissions savings over peat and coal fired generation. Replacing peat and coal with natural gas, would result in a saving of at least 3Mt CO_2/annum. Renewable gas could also be used in electricity generation in gas fired power plants (if sufficient volumes were available in future). This would have the effect of maintaining the critical flexibility and stability that gas generation provides, while progressively lowering CO_2 emissions and increasing renewable generation. Combining renewable gas with CCS in gas fired power plants offers the prospect of net negative emissions for Ireland. Negative emissions through CCS is one of the only ways to take emissions out of the atmosphere and could offset emissions in other sectors.

CCS is a proven technology which can be used together with natural gas to provide clean, dispatchable electricity

CCS can capture up to 100% of the CO_2 from the exhaust stream of existing gas power plants in Ireland[33]. This means the benefits of gas fired power generation such as flexibility and stability can be retained while eliminating CO_2 emissions. The use of CCS will also reduce the cost of reducing emissions for Ireland. The European Commission has reported that it will cost the EU an additional €1.2 trillion to reach its CO_2 reduction target for the power sector without CCS[10].

Progress in decarbonising electricity

Ervia and Gas Networks Ireland are investigating the potential for CCS at the nearly depleted Kinsale gas field off the coast of Co. Cork. This would provide the potential to capture the CO_2 from a number of gas fired power plants in the area, enabling them to provide low-carbon electricity.

Recommendations to decarbonise electricity

Convert Moneypoint to natural gas:

Moneypoint is Ireland's largest power plant. It is currently operating on coal, one of the heaviest carbon emitting fuels. Conversion to natural gas would deliver significant immediate emissions reductions of circa 1.5 Mt CO_2/annum. Ireland's CAP supports an end to the burning of coal in ESB's Moneypoint generation plant by 2025, and the replacement with low-carbon and renewable technologies.

Invest in developing CCS solutions for Ireland:

Investing in CCS solutions will ensure that the flexibility and security of gas fired power generation can be retained while eliminating CO_2 emissions. CCS will be key to a cost effective transformation for the power sector. Ireland's CAP sets out an action for the establishment of a steering group to examine and oversee the feasibility of CCS in Ireland.

Ensure coupled regulations for electricity and gas to deliver an integrated systems approach to decarbonisation:

'Sector coupling' between gas and electricity has been recognised at European policy level as key to supporting decarbonisation efforts. This means that the development of gas and electricity infrastructure should be planned in an integrated manner. A joint approach will optimise the delivery of energy to consumers and increase the capacity to store renewable energy efficiently and effectively. European gas system operators are actively working on sector coupling initiatives with electricity system operators.

Electricity and gas can play complementary roles in decarbonising Ireland's energy system. Policy development should be linked across these sectors to ensure an integrated systems approach which will deliver synergies for Ireland.

Investigate P2G solutions to store curtailed renewable energy generation:

P2G can harness curtailed electricity and convert it to hydrogen or methane, which can be stored and injected into the gas network. This could avoid wasting this clean energy resource and could provide a more cost-effective means of energy storage than batteries.

Using the gas network, a reduction of at least 2.7Mt CO_2/annum in industry can be achieved by 2050.

6. Decarbonising Industry

Large industrial ETS emissions accounts for 9% (5.5Mt CO_2) of Ireland's emissions[7]. Using the gas network, a reduction of at least 2.7Mt CO_2/annum can be achieved by 2050. The large Industrial and Commercial (I&C) companies in the ETS sector are required to reduce their emissions under the EU 'cap and trade' mechanism. Companies must either reach their targets or pay for credits by auction. These companies are expressing greater need for clean solutions as targets continue to reduce allowable emissions, and as investors continue to ramp up their demand for green credentials. Natural gas and renewable gas are particularly valued by companies to produce heat and energy solutions.

Why gas and the gas network provides a smart solution

The I&C sector is of vital economic importance for Ireland. Gas and the gas network can contribute to reducing emissions by working in partnership with industry.

Attract and retain industry and multi-national investment

Many industries require gas for high temperature processes. Industry has a limited number of technically feasible solutions for many high temperature processes. Multi-national and large I&C companies are increasingly seeking to procure renewable gas to meet their Corporate Social Responsibility (CSR) commitments to reduce their carbon footprint. Over 40 companies, including large manufacturing and agri-food companies in Ireland, have recently signed a carbon pledge to significantly reduce their emissions footprint between now and 2030.

Many I&C customers with thermal heat requirements are actively looking to natural gas and renewable gas as a means of decarbonising. A clear roadmap for the availability of renewable gas is thus becoming a key requirement for many of these companies in choosing to locate or expand in Ireland. In 2016, the Renewable Gas Forum of Ireland (RGFI), of which Gas Networks Ireland is a member, surveyed large manufacturing companies in Ireland about their thermal energy needs. The results highlighted that 75% of the companies surveyed have specific targets to reduce their carbon footprint. Natural gas and renewable gas are particularly valued by many of these companies, especially those in the pharmaceutical and food or beverage processing sectors. Renewable gas is emerging as an important factor in terms of securing ongoing and future investment in Ireland.

Provide industry with attractive renewable gas solutions available in other global locations

There is a growing demand for renewable gas and carbon abatement solutions amongst major I&C companies globally, with an increasing number of large brands committing to carbon neutrality. In the US, the world's largest cosmetics company, L'Oreal, has committed to becoming carbon neutral. As part of that ambition it has diversified its energy portfolio to include renewable gas, signing a 15-year power purchase agreement for 40% of the renewable gas produced from one renewable gas plant[39].

Green Gas Certificates (GGCs) are essential to supporting the growth of a renewable gas industry in Ireland. GGCs enable companies to verify renewable gas origin and sustainability credentials in order to claim use of a renewable energy source.

As CCS solutions become available for Ireland, CO_2 intensive heavy industries will have the option to avail of CCS to further reduce their carbon footprint, while benefiting from the continued use of natural gas to meet their operational requirements. Hydrogen may also offer a potential future solution for industry.

Provide cost effective gas CHP options for industry

Natural gas delivered by the network can be used for onsite energy generation, offering I&C customers substantial energy cost savings. This provides an attractive solution and Gas Networks Ireland has contracted with numerous I&C customers who wish to avail of onsite generation options. Data centres in particular have a large demand for electricity. There are approximately 46 data centres in operation in Ireland with substantial future growth predicted[19]. Gas Networks Ireland has developed a combined offering of natural gas, renewable gas and dark fibre (through Ervia's telecoms business Aurora Telecoms) for its data centre customers.

Progress in decarbonising industry

The EU Renewable Energy Directive Re-cast (RED II), provides for clear recognition of renewable gas and associated Guarantees of Origin for supply of renewable gas, via gas network systems. A key requirement that comes with this recognition is a robust GGC scheme and service.

Ireland's GGC scheme will allow end users to purchase renewable gas with confidence, as well as giving government and regulators the certainty that sales of renewable gas are transparent and accounted for. The scheme will be the first of its kind in Ireland.

Recommendations to decarbonise industry

Convert I&C businesses near the gas network from oil and coal to natural gas:

Replacing coal and oil with natural gas provides an immediate emissions reduction. These businesses will then continue to be decarbonised as the gas network ultimately becomes net zero carbon.

Green Gas Certification (GGC):

A reliable method of tracing and verifying renewable gas origin is vital to providing confidence to consumers that the gas delivered is renewable and can be counted against their emission reduction targets. Gas Networks Ireland, in partnership with other Irish and European agencies, is developing a GGC scheme for Ireland. The successful implementation of Ireland's GGC scheme will support the growth of a market for renewable gas in Ireland. This scheme also aligns with European goals to develop an EU wide Guarantee of Origin scheme.

Using the gas network, a reduction of at least 2.6Mt CO_2/annum in heat (non ETS) can be achieved by 2050.

7. Decarbonising Heat

Domestic heating accounts for 9% of Ireland's emissions or almost 6Mt CO_2 emissions[7]. Using the gas network, a reduction of at least 2.6Mt CO_2/annum can be achieved by 2050. The primary domestic heating sources in Ireland are oil and gas. Of the 2 million[40] residential dwellings in Ireland, there are currently over 700,000 (35%) connected to the gas network with a further 300,000 (15%) in urban areas located close to the network. The gas network provides a smart, cost effective means of immediately delivering significant emissions reductions in heat, with further improvements over time as renewable gas is introduced.

Why gas and the gas network provides a smart solution

Decarbonising the heating sector is challenging. However, the gas network provides a smart, cost effective pathway to deliver significant emissions reduction, while also increasing Ireland's renewable energy share.

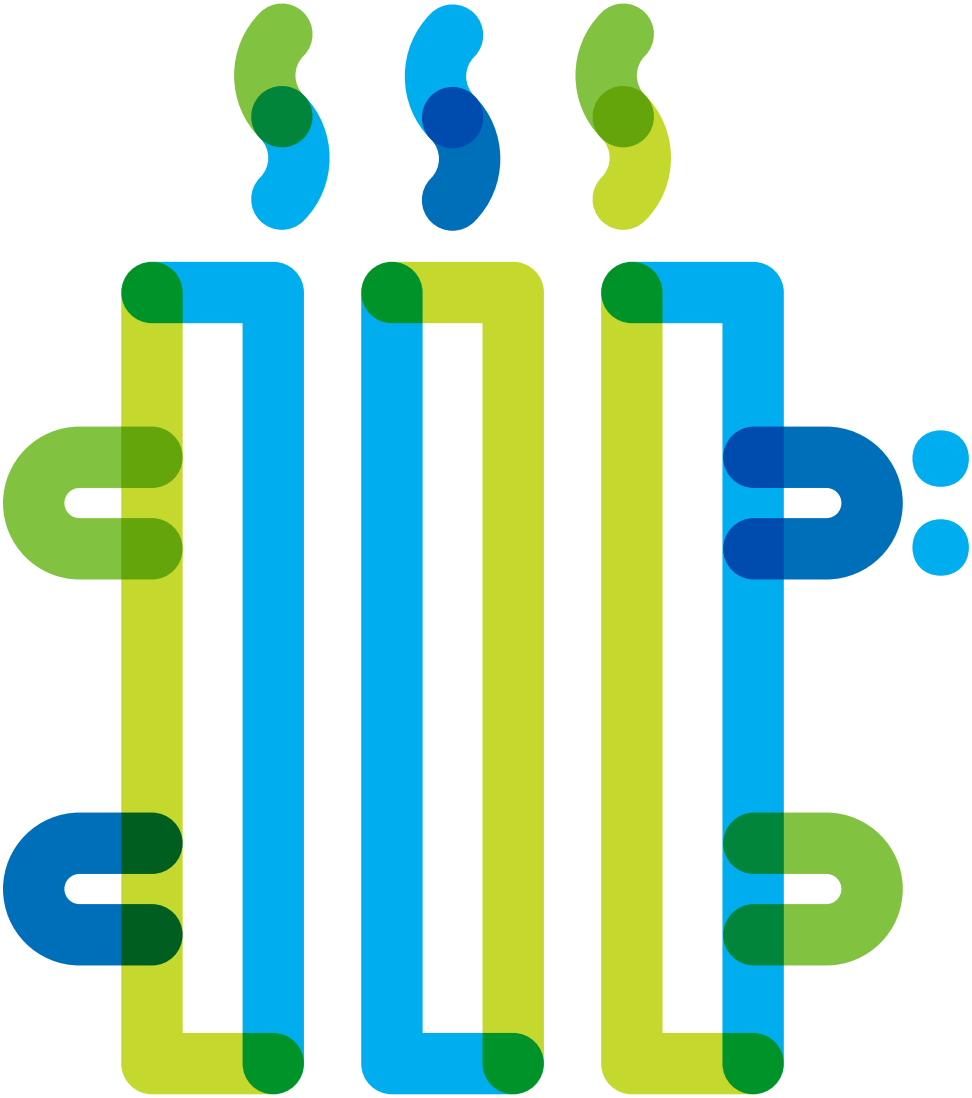
Least cost and least disruption to decarbonise home heating

Investment will be required to transform to a low carbon society. Using the existing gas network offers a practical and effective pathway to minimise the investment required. Economic levels of energy efficiency (i.e. insulation) must form a basis for any pathway. It will be less costly and less disruptive to decarbonise heating for those consumers already connected to and within reach of the network by using the existing gas network than by electrification. The CAP sets out a significant ambition for electrification of heat in the existing residential sector by 2030. It also calls for a target to be set for renewable gas use for 2030. Both electrification and renewable gas will play key roles in decarbonising the existing residential heating sector. Renewable gas can be used in existing gas boilers today, and its use will ensure redundancy, security and affordability in our path to 2030. Existing boilers are also understood to be compatible with small percentage blends of hydrogen.

The CAP signals an effective ban on the installation of gas boilers from 2025 in all new dwellings through the introduction of new regulatory standards for home heating systems. As the gas network evolves to become net zero carbon, transporting renewable gas and hydrogen, it will offer a viable alternative clean heat source for new dwellings which can be delivered through renewable heating systems such as renewable gas and hydrogen boilers.

By converting the 300,000 homes close to the gas network from oil heating to natural gas, the carbon intensity of heating these homes would reduce by 30%[19]. As renewable gas is injected into the network, the heating sector can be decarbonised at scale and without relying on customer behaviour change.

Analysis conducted by KPMG has shown that the cost of decarbonising heating for the one million homes on, or close to, the gas network is three times more expensive via electrification than by using renewable gas in the gas network[8]. Electric heat pumps are emerging as a favoured option for electrification of heat. The installation of heat pump technology requires significant adaptation of the heating system relative to gas. Optimal use of heat pump technology requires high levels of insulation which typically requires significant building fabric upgrades. The cost of deep retrofitting Ireland's existing housing stock would be in the region of €60bn - €80bn based on an average cost of €35,000 - €50,000 per house[41]. A similar study by Wales and West Utility in the UK finds the cost could be up to £60,000 per household[42]. Where heat pump solutions are considered suitable, hybrid heat pumps which combine high efficiency gas condensing boilers with air source heat pumps offer a more practical solution than heat pump only solutions. Hybrid heat pumps select the most efficient heating system depending on outdoor temperatures and require less disruptive changes for the homeowner compared with a heat pump only solution. The lower the disruption the greater the likelihood of widespread early adoption.



There is a very clear consensus amongst policy makers and climate experts globally that immediate action is required to avoid dangerous levels of global warming. Simply placing the burden of cost and disruption on the customer and relying on behaviour change will not deliver the transformational and immediate action required. By using the existing gas network to deliver renewable gas, there is a clear opportunity to achieve significant progress towards emissions targets in a practical, least cost, and least disruptive manner. By making it easier for consumers, we are likely to see greater uptake of low carbon solutions.

Renewable gas can be produced from a wide variety of sources and using a wide range of technologies. As a result, the MAC varies accordingly (MAC is the cost of reducing emissions measured per unit). Analysis by KPMG has demonstrated that the MAC in respect of renewable gas from agricultural sources is estimated to be €128 to €207 per tCO_2eq. The gas network also requires significantly less investment to facilitate renewable gas injection in comparison with the electricity grid reinforcement costs required for high levels of electrification. It is important that the total system cost is evaluated when comparing technologies to ensure the lowest overall cost to the Irish citizen.[27]

Maximise investment in the existing gas network infrastructure and avoid unnecessary investment

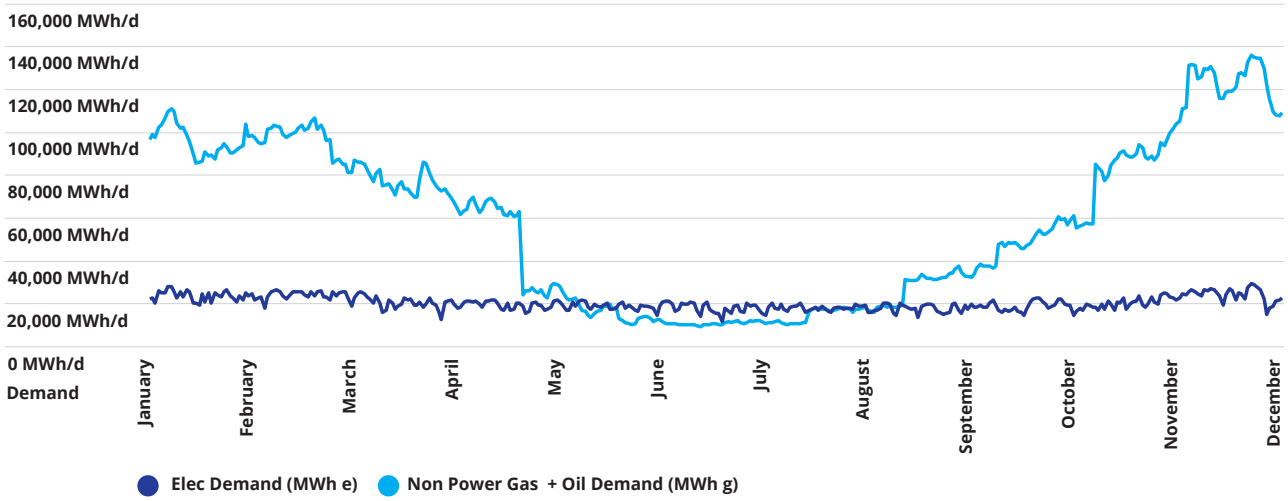
The gas network is built to accommodate 1 in 50 winter peak demand (i.e. a severe winter peak day that is statistically likely to occur once every 50 years). If this additional heating demand was to be met by electrification, it would place significant strain on the electricity system. Substantial reinforcement would be required to ensure that enough capacity would be available to meet peak heating and electricity demand occurring together. Building new infrastructure with the capability to meet an infrequent 1 in 50 heating event is inefficient when the gas network already delivers this capacity.

In 2010, Ireland experienced a severely cold winter, Figure 10 shows residential gas and oil demand versus residential electricity demand over the course of 2010. This shows that significant extra electricity infrastructure would be required at distribution level to meet the addition of heating demand. Utilising the existing gas network avoids the additional costs that would be required to reinforce the electricity network and avoids stranding the significant capital already invested in Ireland's gas network infrastructure.

Progress in decarbonising heat

Natural gas provides a significantly cleaner alternative to coal, oil and peat heating today and as renewable gas is introduced, the homes and businesses connected to the gas network will decarbonise. The first renewable gas injection facility in Cush, Co. Kildare was commissioned in 2019. The network entry facility for this project is designed to inject up to 108GWh/annum renewable gas, enough gas for 9,000 homes[19].

Figure 10: Electricity vs gas + oil heating demand profiles showing winter 2010 '1 in 50' peak demand (based on Eirgrid, Gas Networks Ireland, NORA data)



Recommendations for decarbonising heat

Convert homes near the gas network from oil and coal to gas:

Replacing coal and oil with natural gas provides an immediate emissions reduction. These homes will then continue to be decarbonised in a least cost and least disruptive manner as the gas network introduces renewable gas.

Ensure that there is a level playing field for all renewable energy technologies:

Part L of the building regulations does not provide a level playing field. It excludes renewable gas as a renewable energy technology because the appliance (gas boiler) can operate on both renewable gas and natural gas. Part L should allow the blending of fuels in appliances, subject to robust supporting verification such as the GGC scheme. A reasonable solution would allow appliances that are fuelled by a blend, and for the renewable element within the blend to be calculated toward the minimum renewable energy contribution[12]. Similarly, the option to select renewable gas is not on the default settings for Building Energy Rating (BER) Certification for the domestic sector. All other technologies are listed in the default settings and renewable gas should be recognised on the same basis.

Given the high level of uncertainty over the technologies which will deliver long-term decarbonisation for Ireland, it is important that all technologies are allowed to compete on an equal basis. Renewable gas is already well developed and available at competitive rates in other European countries and a renewable gas support scheme is vital to establishing the industry in Ireland. State support is required to cover the price gap between wholesale natural gas and the cost of producing renewable gas.

The Department of Communications, Climate Action and Environment (DCCAE) has implemented the Support Scheme for Renewable Heat (SSRH) for air, ground and water source heat pump technology. An appropriate support scheme for renewable gas is critical for the development of renewable gas projects in Ireland.

Ensure a technology neutral approach to future energy solution planning:

As technologies mature, more solutions will become viable and economic to adopt. All technologies must be allowed to compete for future adoption to ensure that viable solutions are not ruled out now. Gas and the gas network can deliver "rapid and far reaching" emissions reductions for Ireland now using currently available technologies, and in the longer-term using early stage technologies. Limiting the choice of pathways now, such as planning for an electrification only future, could have far reaching implications in terms of the long-term 'cost' to the country.

It has been demonstrated by KPMG that the cost of decarbonising heating for the one million homes on, or close to, the gas network is three times more expensive via electrification than by using renewable gas in the gas network[8]. Gas and the gas network therefore provide a cost effective and minimally disruptive way of decarbonising heat and must not be ruled out in favour of an electrification only future.

Using the gas network, a reduction of at least 2.8Mt CO_2/annum in transport can be achieved by 2050.

8. Decarbonising Transport

The transport sector is a large energy consumer and is the source of 20% of Ireland's emissions or almost 11.9Mt CO_2[7]. Using the gas network, a reduction of at least 2.8Mt CO_2/annum can be achieved by 2050. While HGVs and buses account for only 4% of vehicles on the road, they account for 30% of all emissions in the road transport sector[43]. CNG is a cleaner, affordable and proven alternative fuel to diesel or petrol. CNG as a fuel significantly reduces particulate matter emissions and, when renewable gas is introduced, it offers HGVs and buses a pathway to net zero carbon transport.

Emissions from the transport sector are a key contributor to air pollution in Ireland. High levels of particulate matter are a growing concern, with an estimated 1,100 premature deaths every year as a result of poor air quality[44].

Ireland's CAP sets out a number of welcome measures to support the decarbonisation of the transport sector including the development of a CNG fuelling network to support the uptake of CNG vehicles.

Why gas and the gas network provides a smart solution

CNG solutions for HGVs and buses can immediately reduce emissions from the transport sector and can provide a pathway for renewable gas use in these vehicles.

CNG provides an immediate lower carbon solution for HGVs which will improve air quality and health

CNG is a proven technology with over 26 million CNG vehicles in use worldwide[45]. The use of CNG in HGVs and buses can provide an immediate and significant emissions reduction, including harmful emissions such as particular matter, SO_x and NO_x, compared to diesel. The fine nature of particulate matter means it can get deep into the lungs and bloodstream causing harmful health effects[46]. The use of CNG will therefore significantly enhance Ireland's air quality and reduce serious illnesses.

CNG is an attractive solution for fleet owners, offering cheaper running costs

HGV and bus fleet owners are showing increased interest in CNG solutions as they recognise the dual benefit of reducing emissions while making significant cost savings. CNG can generate savings of up to 35% for fleet owners compared to diesel and offers comparable re-fuelling times[47]. The payback period for HGV trucks is in the region of 2-2.5 years which is a very attractive proposition for fleet owners[47].

CNG is a pathway for renewable gas transport (Bio-CNG) which can further eliminate emissions

Moving the HGV and bus sector to CNG will provide a pathway for the use of Bio-CNG, as an increasing level of renewable gas is transported by the gas network. In the UK, CNG Fuel's Leyland CNG filling station has been supplied with 100% renewable gas (Bio-CNG) since September 2016. Transitioning Dublin Bus and Bus Eireann fleets to CNG and Bio-CNG could deliver a substantial reduction in overall emissions and make a powerful statement of intent regarding Ireland's commitment to a low carbon economy.

Hydrogen may provide a future solution and CNG/ Bio-CNG provides a pathway

The application of hydrogen in the transport sector is being explored and trialled in the US, Japan, Europe and other global locations. CNG and Bio-CNG gas transport provide a pathway for hydrogen powered HGVs and buses in the future. Gas Networks Ireland and Ervia are actively collaborating with a variety of hydrogen research initiatives and bodies including GENCOMM, Hydrogen Mobility Ireland and Hydrogen Ireland Association to assess applications for hydrogen,including its use in transport.

Progress in decarbonising transport

Gas Networks Ireland plans to facilitate the development of a 170-station CNG fuelling network including 40 public access forecourts, on major routes, and/or close to urban centres. We are building partnerships with forecourt operators and haulage companies to make this possible. This ambition will help meet Ireland's requirements under the EU's Alternative Fuels Infrastructure Directive. Gas Networks Ireland is targeting the conversion of 24% of HGVs and 13% of buses to CNG or Bio-CNG by 2030.

Gas Networks Ireland is leading a project called the Causeway Study, which is funded by the Commission for Regulation of Utilities (CRU) and the Connecting Europe Facility (CEF) Transport Fund, under which it is intended to deliver 14 high capacity fast fill CNG stations and a single renewable gas network injection point. The fast fill stations provide quick, efficient and safe refuelling. The normal fill time for a CNG HGV is 3-5 minutes from empty which is comparable to diesel. The first public access station has been constructed at the Circle K Service Station in Dublin Port, one of the busiest HGV refuelling stations in the country. The station is currently operational and has capacity to refuel up to 70 HGVs per day.

In 2017 Gas Networks Ireland launched its CNG Vehicle Fund, making up to €20,000 available to businesses towards the purchase of a new CNG vehicle.

Recommendations for decarbonising transport

Maintain policies which support the transition of HGVs and buses from diesel to CNG/Bio-CNG:

The existing excise duty treatment should be maintained at the current level after expiry in December 2024. The Accelerated Capital Allowance scheme for gas vehicles and refuelling equipment should be maintained after expiry in December 2021. Both incentives should be retained until such time as the HGV population is 30% gas powered (circa 5,000 trucks).

Introduce further supports to stimulate the CNG/Bio-CNG market for HGVs and buses:

Technology Adoption: Transition the public transport fleet away from diesel to CNG/Bio-CNG

Planning Permission: Provide planning support for CNG re-fuelling stations. On strategic corridors, planning permission should require CNG refuelling in forecourt design

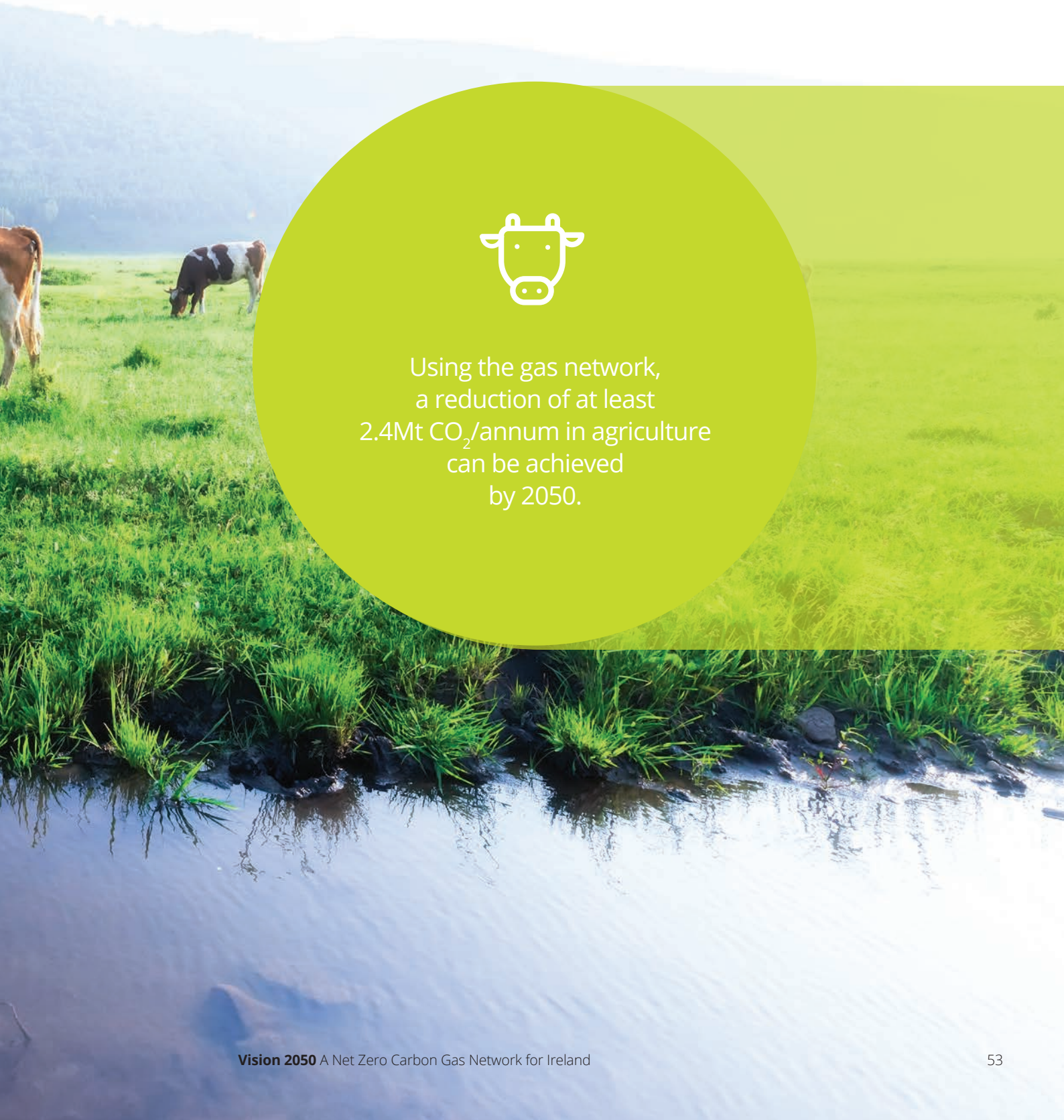
Toll Charges: Exempt gas-powered HGVs and buses from toll charges

Vehicle Purchase: Introduce a grant scheme or tax relief for trucks to accelerate uptake and support early adopters

Ireland must also advocate for European support for renewable gas in transport. By implementing the right supports, the European Union could boost Bio-CNG in transport and significantly reduce emissions from heavy duty transport, a challenging sector to decarbonise.

Green Gas Certification (GGC):

A reliable method of tracing and verifying renewable gas origin is vital to providing confidence to consumers that the gas delivered is renewable and can be counted against their emission reduction targets. Gas Networks Ireland, in partnership with other Irish and European agencies, is developing a GGC scheme for Ireland. The successful implementation of Ireland's GGC scheme will support the growth of a market for renewable gas in Ireland. This scheme also aligns with European goals to develop an EU wide Guarantee of Origin scheme.



Using the gas network, a reduction of at least 2.4Mt CO_2/annum in agriculture can be achieved by 2050.

9. Decarbonising Agriculture

At 33% (20Mt CO_2)[7], the agriculture sector is the biggest source of Ireland's emissions against an EU average of circa 10%[13]. Using the gas network, a reduction of at least 2.4Mt CO_2/annum can be achieved by 2050. Agriculture and the agri-food sector is of vital importance to Ireland and the Irish economy. Total agriculture sector employment in 2016 was 173,000 and output from the sector was valued at €6.92 billion[48]. Decarbonising agriculture is challenging, particularly as agri-food output is growing. Gas and the gas network can contribute to a reduction in agriculture emissions by supporting and enabling a renewable gas economy which captures methane and waste emissions. A renewable gas industry provides Ireland with a unique opportunity to stimulate the rural economy, enhance farm incomes and create jobs.

Why gas and the gas network provides a smart solution

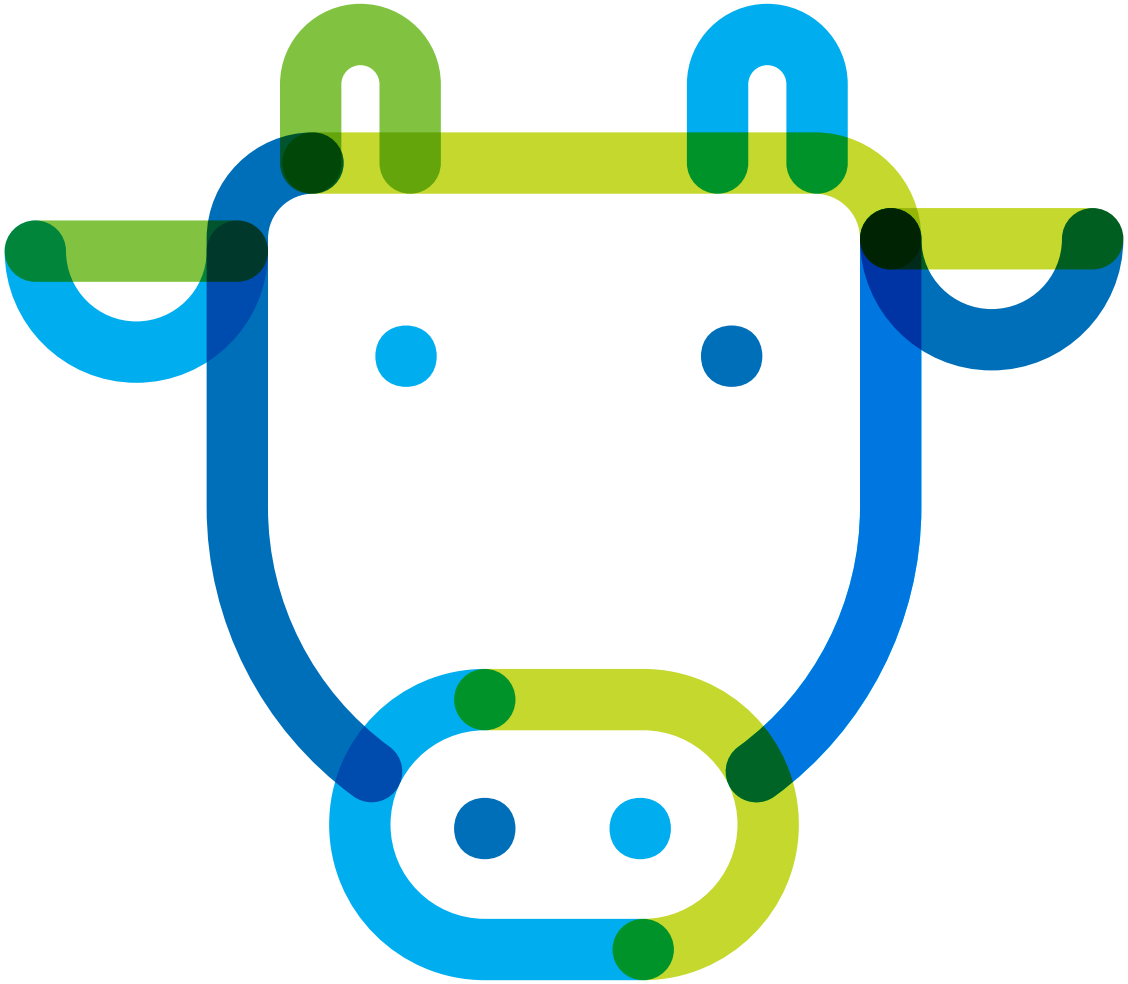
Ireland must find solutions to tackle agricultural emissions whilst meeting the needs of its agri economy. Developing a renewable gas industry can contribute to tackling agricultural emissions while supporting the development objectives of Government and the farming industry.

Gas and the gas network can contribute to emissions savings by supporting a renewable gas economy which would also boost farm incomes and stimulate rural Ireland. Ireland has the highest potential within the EU for renewable gas production per capita by 2030, at 13TWh/annum[30]. Gas Networks Ireland is targeting 11TWh/annum renewable gas production by 2030 (20% of current demand). This renewable gas will be produced through a process called 'anaerobic digestion', by which wastes and biomass (i.e. grass and slurry) are broken down by microorganisms in the absence of air. The process produces renewable gas and a by-product called 'digestate' or 'bio-fertiliser' which can be applied instead of chemical fertilisers. Even accounting for the energy and emissions in the production process and the emissions from combustion, the net output is at a minimum net zero carbon and can often be carbon negative (this means that renewable gas can have a net effect of removing CO_2 from the atmosphere).

Reduce CO_2 and potent methane emissions from agriculture

Methane is 28-36 times more harmful than CO_2 in terms of its global warming potential[49]. The use of fresh slurry in renewable gas production can reduce emissions from manure storage on farms, particularly potent methane emissions. The replacement of open slurry storage with anaerobic digestion can potentially deliver 17% methane emissions savings[50]. Slurry biogas systems are therefore very favourable as they can be carbon negative. The digestate produced as a by-product of the anaerobic digestion process can also be used as a bio-fertiliser, reducing emissions from energy intensive chemical fertiliser production.

Since the elimination of the milk quota system in 2015, the dairy industry has seen substantial growth and this is expected to continue with increased energy usage from the dairy sector. This poses a challenge for Ireland in terms of reducing agricultural and energy emissions. Renewable gas can provide a viable solution for the dairy industry to meet increasing energy demands in a sustainable and economic manner.



Contribute to a circular economy and improve waste management practices

The CAP expresses a need for Ireland to transform its approach to waste and apply circular economy principles.

Renewable gas can contribute to a circular economy. The anaerobic digestion of slurry and food waste produces renewable gas and contributes to significant emission reductions. Combining grass and other sustainable feedstocks with slurry increases the yields of renewable gas. Anaerobic digestion of food and agricultural wastes is the most environmentally friendly and economical means of processing such wastes in comparison with Ireland's current practices, including composting, landfill, exporting, land spreading and incineration. Applying the treated digestate or bio-fertiliser from agricultural anaerobic digestion as fertiliser is also more environmentally friendly as it reduces emissions and produces less odours than slurry spreading.

Increase farm incomes and stimulate the rural economy

The National Farm Survey 2017 found that 30% of farms were economically vulnerable, while another 27% were only viable due to the presence of another income source outside the farm[51]. It is estimated that approximately 33% of grassland in Ireland is making a financial loss for farmers[52]. Irish dairy farms are producing approximately 7.1 tonnes of grass dry matter per hectare (DM/ha), while more efficient farms produce 12-14 tonnes DM/ha[53]. The development of a renewable gas industry would provide farmers with an incentive to improve output and providing sustainable feedstocks such as grass or red clover would attract an additional source of income with no capital investment costs for farmers. Using the digestate or bio-fertiliser from anaerobic digestion could also reduce costs for farmers by reducing the need to purchase chemically manufactured fertilisers.

The development of an indigenous renewable gas industry and supply chain provides Ireland with a unique opportunity to stimulate the rural economy, enhance farm incomes, and create jobs. While Gas Networks Ireland will facilitate the development of infrastructure, local entrepreneurs, local communities and private sector investors will develop the production. The renewable gas industry has created over 35,000 jobs in Germany, 8,000 jobs in Italy and 11,000 jobs in the UK[54]. Our target of reaching 11TWh (20%) of indigenous renewable gas production will create an estimated 4,000 new direct jobs and secure a further 2,500 indirect jobs in rural communities. GDP contribution is estimated at over €2bn from the construction of biogas plants to 2050, and over €400m from the operation of the plants in 2050[55]. By displacing imported gas, Ireland also benefits from a positive balance of trade contribution of €25m/annum for every 1TWh.

Ireland has the grassland potential to develop a renewable gas industry sustainably while meeting livestock and food harvest requirements

Various studies have reported that Ireland can produce more than enough grass to meet the demands of both agriculture and a renewable gas industry[31,56]. It is estimated that circa 2.8 million tonnes of dry matter (produced from 11.1 million tonnes of grass silage) and 9.9 million tonnes of slurry will be required to produce the targeted 11TWh/annum (c.20% of Ireland's current gas demand)[53]. By improving grassland management and production practices, it is estimated that the average surplus grassland resource could be increased to 12.2 million tonnes DM/annum, even when allowing for food harvest 2020 targets[31]. This is more than sufficient to meet Gas Networks Ireland's renewable gas target for 2030.

Bio-fertiliser will be used to enhance grassland production. Under the EU RED II Directive (which is legally binding from 2021), use of bio-fertiliser is mandatory for any farmer supplying feedstock such as grass silage to anaerobic digesters. RED II compliance is ensured through independent auditing under the GGC scheme for Ireland. The emissions Life Cycle Assessment (LCA) must equate to the zero carbon requirements of the Directive or better. Chemical fertiliser can be used at the very beginning, when bio-fertiliser is not available, but this still forms part of the LCA calculation, and thus its use is limited to an application of lime or other limited applications, depending on soil deficiencies. In the case of a grass silage source, this would be confined to the first application of fertiliser on the first annual cut, but all subsequent cuts (cuts 2, 3, and 4) will have sufficient supply of bio-fertiliser, which must be used. All subsequent use of chemical fertiliser is prohibited, and in the longer-term, the increased availability of bio-fertiliser will displace chemical fertilisers across other farming operations.

RED II sets out a list of fuel and feedstock types that can be classified as sustainable and also sets out carbon intensity thresholds. In addition, RED II recognises certain improvements in agriculture production which should be encouraged and assigns bonus carbon rating measures to assist in stimulating these. Ireland will use an LCA calculation formula to determine compliance with the sustainability criteria set out in the Directive. Gas Networks Ireland have partnered on an industry project to develop a robust calculation methodology and independent certification scheme for Ireland. Ireland's GGC scheme will ensure a reliable method of tracing and verifying renewable gas origin and will ensure the sustainability criteria set out under RED II are met.

Progress in decarbonising agriculture

Gas Networks Ireland is working with Teagasc and other key stakeholders to develop plans for a renewable gas industry in partnership with farmers and rural communities.

Recommendations for decarbonising agriculture

Seek whole system carbon accounting for Ireland at European level:

RED II sets out strict carbon accounting criteria which will become tighter from 2026 onwards. The emissions reductions which can be counted from renewable gas are limited under the current calculation methods. RED II allows member states to seek further emissions reductions to be counted. For instance, there are additional savings which can be achieved from better land use management and the use of bio-fertiliser when renewable gas is produced from agricultural sources. At present these savings are not counted as part of emissions savings. As Ireland's renewable gas industry develops, these additional savings must be measured and demonstrated in order to benefit from whole system carbon accounting of renewable gas at European level.

Develop an industry standard for biofertiliser:

The development of a standard for digestate, as in the UK, is critical to ensuring the circular economy which Gas Networks Ireland envisages for the renewable gas industry in Ireland. This means that the by-product of the renewable gas production process can be used as a bio-fertiliser by farmers, further reducing the emissions impact of the life cycle renewable gas production process.

10. Supporting a Cleaner Energy Future

Policy and supports are required to unlock the significant decarbonisation potential of the gas network. Similar to other renewable technologies, policy, regulation and investment supports are needed to stimulate renewable gas production and develop CCS. A combination of technologies will be required to achieve Ireland's climate goals. A level playing field is necessary to ensure that all clean energy technologies can compete for future adoption, and to ensure that viable future solutions are not ruled out too early and regretted later. An integrated policy development approach for gas and electricity would deliver valuable synergies for Ireland and deliver a least cost and least disruptive transition for Irish citizens and businesses.

Making Early Progress

The decarbonisation agenda tends to focus on absolute transition, getting off fossil fuels and straight on to zero-carbon alternatives. But absolute transition to clean alternatives is not always readily available or immediately achievable. Waiting for absolute transition and a perfect future means the opportunity to bank immediate and cumulative emissions savings will be missed and Ireland will continue to miss its interim emissions targets. Making early progress ensures savings accumulate and grow year after year as we move toward 2050.

Waiting on technologies to mature, costs to decline, and consumer behaviours to change, risks leaving too much to deliver far too late.

The gas network can deliver "rapid and far reaching" emissions reductions for Ireland now using currently available technologies. In the longer-term, as the gas network evolves to become net zero carbon, it will deliver significant emissions savings across every sector of the economy. The gas network will provide a platform to achieve progress at scale by delivering net zero carbon gas to customers using their existing gas connection.

Policy measures required to achieve early progress

There are six key policy areas in which action is required to stimulate immediate progress toward Ireland's climate goals:

Timing **Immediate**

Develop coupled policy and regulations for electricity and gas to achieve an integrated systems approach

Electricity and gas can play complementary roles as part of a whole system solution to decarbonise Ireland's energy system. Policy development should be linked across these sectors to ensure an integrated systems approach, which will deliver synergies for Ireland. Sector coupling between gas and electricity has been recognised at European policy level as key to supporting decarbonisation efforts and European gas system operators are actively working on sector coupling initiatives with electricity system operators. This means that the development of gas and electricity infrastructure should be planned and operated in an integrated manner. A joint approach will optimise the delivery of energy to consumers and increase the capacity to store renewable energy efficiently and effectively.

Timing **Immediate**

Introduce policy measures to support the development of CCS facilities for Ireland

CCS is recognised globally by the IPCC, IEA, European Commission and others as critical to delivering a cost-effective transition for the electricity generation sector. There are a number of supports that would stimulate the development of CCS in Ireland.

An essential first step is fair and reasonable consideration of the CCS offering. CCS enables the combined benefits of both renewables and unabated gas fired power plants i.e. zero emission electricity that is dispatchable on-demand and provides inertia to the electricity grid. It should therefore be rewarded and recognised in a similar way to other technologies which provide the same benefits. Cost comparisons for CCGT and CCS against wind or solar should be based on the full system cost. A study by the UK Energy Research Centre suggests that the extra reserve and network costs are in the range of £15-£45/ MWh for high levels of wind and solar penetration[57].

Timing **Immediate**

Beyond affording fair comparison of the technology, securing acknowledgement in national policy of the critical role CCS can play in decarbonising Ireland's electricity and industry sectors is key. This would provide a necessary signal to potential investors. This must also be backed up with support at Government level for EU grant applications, which will form a further key funding element.

Timing **Mid 2020s**

Ultimately there is a need for clear economic signalling. The electricity market must recognise that operating gas power plants in combination with CCS effectively represents the introduction of a new product with all the combined benefits of both renewables and unabated gas power plants; this should be rewarded using the electricity Public Service Obligation (PSO).

Timing **Immediate**

Implement a support scheme for renewable gas

State support is required to cover the price gap between wholesale natural gas and the cost of producing renewable gas. DCCAE has implemented the SSRH for air, ground and water source heat pump technology. An appropriate support scheme for renewable gas is critical for the development of renewable gas projects in Ireland.

Timing **Immediate**

Revise Part L of the Building Regulations to create a level playing field for renewable gas

Part L of the building regulations does not currently provide a level playing field. It excludes renewable gas as a renewable energy technology because the appliance (gas boiler) can operate on both renewable gas and natural gas. Part L should allow the blending of fuels in appliances, subject to robust supporting verification, such as the GGC scheme. A reasonable solution would allow appliances that are fuelled by a blend, and for the renewable element within the blend to be calculated toward the minimum renewable energy contribution[12]. Similarly, the option to select renewable gas is not on the default settings for Building Energy Rating (BER) Certification for the domestic sector. All other technologies are listed in the default settings and renewable gas should be recognised on the same basis.

Maintain and introduce policies which will support the transition of larger vehicles from diesel to CNG and Bio-CNG

In order to support the transition of larger vehicles away from diesel and towards CNG, and ultimately Bio-CNG, the following policy supports should be considered:

Timing **2021**

Accelerated Capital Allowance (ACA): Maintain the ACA scheme for gas vehicles and refuelling equipment after expiry in December 2021 until such time as the HGV population is 30% gas powered (circa 5,000 trucks)

Timing **2024**

Excise duty: Maintain the excise duty treatment for CNG at the current level (due to expire in December 2024) until such time as the HGV population is 30% gas powered (circa 5,000 trucks)

Introducing the following policy measures would further support the adoption of CNG / Bio-CNG:

Timing **Immediate**

Toll charges: Exempt gas-powered HGVs from toll charges for main routes

Timing **Immediate**

Vehicle purchase: Introduce a vehicle grant scheme or tax relief of €15,000 - €20,000 per truck to accelerate uptake and support early adopters

Timing **Immediate**

Develop a detailed policy roadmap for renewable gas

A detailed policy roadmap will be required to set out the measures required from demand to supply side to successfully develop Ireland's renewable gas industry. Gas Networks Ireland would welcome the development of a detailed policy roadmap in support of renewable gas and would work in partnership with industry stakeholders, researchers and relevant Government Departments to develop this.

Supporting early progress

There are six key initiatives which will deliver immediate progress toward Ireland's climate goals:

Timing **Early to Mid 2020s**

Convert coal and peat power plants to gas

Moneypoint is Ireland's largest power plant. It is currently operating on coal, one of the heaviest emitting fuels. Conversion of Ireland's coal and peat power plants to natural gas would deliver immediate emissions reductions of at least 3Mt CO_2 per annum, and longer-term adoption of CCS would almost eliminate emissions.

Timing **Immediate**

Implement a robust Green Gas Certification (GGC) scheme

Gas Networks Ireland, in partnership with other Irish and European agencies, is developing a GGC scheme for Ireland. This will ensure that renewable gas origin can be verified and traced so that it can be counted against emissions reduction targets. Support for the implementation of Ireland's GGC scheme will be required to stimulate the growth of a market for renewable gas in Ireland across heat and transport.

Timing **Immediate**

Convert 300,000 homes and businesses near the gas network from oil and coal to gas

Extending the gas network to the 300,000 homes and businesses close to the network offers a practical way to achieve immediate emissions reductions by displacing oil and coal. These homes will then continue to be decarbonised in a least cost and least disruptive manner as the gas network decarbonises and ultimately becomes net zero carbon. The gas network already has the capacity to meet this extra heating demand. Extending the network to regional towns will also enable inward investment in these regions as many industrial companies require natural gas and increasingly renewable gas solutions.

Timing **Immediate**

Convert HGV and bus transport sector from diesel to CNG initially and ultimately to Bio-CNG

The following initiatives would stimulate the adoption of CNG / Bio-CNG and provide immediate emissions reductions in the transport sector. This would significantly improve air quality for Ireland by almost eliminating particulate matter emissions from converted vehicles:

Technology adoption: Transition the public transport fleet away from diesel to CNG/Bio-CNG

Planning permission: Provide planning support for CNG re-fuelling stations i.e. specify a planning requirement for CNG refuelling facilities for forecourts located on strategic corridors

Ireland must also advocate for European support for renewable gas in transport. By implementing the right supports, the European Union could boost Bio-CNG in transport and significantly reduce emissions from heavy-duty transport; a challenging sector to decarbonise.

Timing **Immediate**

Develop a standard for biofertiliser

The development of a standard for digestate is critical to ensuring the circular economy which Gas Networks Ireland envisages for the renewable gas industry in Ireland. This means that the by-product of the renewable gas production process can be used as a biofertiliser by farmers, further reducing the emissions impact of the life cycle renewable gas production process.

Timing **Immediate**

Support the development of renewable gas network injection facilities

The addition of renewable gas to the network requires the development of CGI facilities at strategic locations throughout the country. Gas Networks Ireland has planned a network of transmission connected facilities. The first renewable gas injection facility in Cush, Co. Kildare was commissioned in early 2019. This is a very welcome development which will support renewable gas in Ireland's gas network. Continued support for the development of renewable gas infrastructure will be required to grow an industry of scale which will deliver significant emissions savings.

Keeping Options Open and Supporting Emerging Technologies

There are five key initiatives which will help ensure a successful long-term trajectory towards Ireland's climate goals and which will keep options open:

Timing **Immediate**

Ensure technology neutral energy planning

As technologies mature, more solutions will become viable and economic to adopt. All technologies must be allowed to compete for future adoption to ensure that viable solutions are not ruled out now and regretted later. Technologies must be evaluated not only on their emissions reduction potential but also on their relative affordability, adoptability, security, and potential to support the needs of Ireland's future energy system. Limiting the choice of pathways now, such as planning for an electrification only future, could have far reaching implications in terms of the long-term 'cost' to the country.

Timing **Early to mid 2020s**

Investigate CCS and hydrogen demonstration in Ireland

The UK and other European countries have made significant investments in investigating and demonstrating future gas technologies at scale, for example the H21 North of England Project. The H21 project is examining the feasibility, from both a technical and economic viewpoint, of converting the existing natural gas network to 100% hydrogen. Similarly, large scale CCS facilities are already operating successfully in other global locations with further facilities planned across Europe, the US and Canada. Investing in R&D and pilot projects to demonstrate future renewable gas technologies at scale is vital to ensuring that Ireland is positioned to adopt suitable emerging clean technologies at pace with Europe.

Timing **Early to Mid 2020s**

Support for P2G technology

P2G, using renewable electricity to produce carbon free hydrogen, is increasingly seen as a key decarbonisation pathway for electricity through sector coupling. Hydrogen can complement electrification by providing the large-scale energy storage necessary to overcome intermittency and make use of excess renewable energy generation. Commercial and academic organisations in Ireland are becoming active in the area of hydrogen and need policy makers to create conditions that provide for the trialling and potential commercialisation of hydrogen and P2G technologies.

Timing **Late 2020s**

Upgrade Ireland's natural gas power stations to use CCS technology

Installing CCS will allow for further reductions in emissions from natural gas fired power stations. This would maintain the flexibility and security of gas fired power generation while largely eliminating the CO_2 emissions.

Timing **Immediate**

Promote education and engagement regarding renewable and net zero carbon gas technologies

Rolling out promotion and educational programmes on clean energy technologies such as renewable gas, hydrogen and CCS is important to ensuring that communities and the general public are engaged. Given the currently low level of anaerobic digestion facilities in Ireland, the general public may have concerns over the adoption of the technology. Promotion and educational programmes relating to new clean energy technologies will help to ensure their successful adoption. These solutions should be progressed in collaboration with industry stakeholders, researchers and communities.

11. Conclusion

Ireland has committed to radical decarbonisation of its energy system by 2050. The gas network will deliver immediate emissions savings, increasing year on year, by transporting an evolving mix of gases in combination with CCS. The gas network will be net zero carbon by 2050, delivering economy wide emissions savings of at least 18.7Mt CO_2/annum, equivalent to 31% of Ireland's total current emissions. The gas network will deliver these savings in a least cost and least disruptive manner, while sustaining the security and resilience of Ireland's energy system.

Ireland's gas network provides a safe, secure and reliable energy supply. The gas network delivers 30% of the country's primary energy needs and transports twice as much energy as the electricity network to serve homes, businesses and electricity generation[4]. In 2017 over half of total electricity generated was powered by natural gas[4], and much higher proportions at times of peak demand or in the absence of intermittent renewables. The flexibility and energy storage capacity of the gas network ensures that heat is always available, and high levels of renewable energy can be accommodated on Ireland's electricity grid. The gas network will continue to play this critical role for Ireland, and it will also deliver a clean energy future in a least cost, safe, and secure manner. By transporting natural gas and renewable gas in our network now, and by developing future technologies such as hydrogen and CCS, we will play a critical role in transforming Ireland's energy economy.

Progress toward a net zero carbon gas network is already underway:

Natural gas will continue to be a significant component of the gas mix transported by the network between now and 2050. CCS will provide a means to remove or 'abate' the CO_2 emissions from large point emitters such as electricity generation plants and large industry. CCS technology is already available and used across the world. Together with Ervia, we are examining the potential for CCS solutions for Ireland at the depleted Kinsale gas field. Ireland could also avail of CCS solutions in other countries.

Investment in CNG refuelling solutions for HGVs and buses is underway. In 2018 the first public CNG refuelling station was completed at Dublin Port as part of our ambition to develop, in partnership with others, a 170-station CNG refuelling network. Replacing diesel with CNG will deliver immediate emissions reductions for Ireland and will significantly enhance air quality. As the network decarbonises, Bio-CNG will be available, further reducing transport emissions.

The development of a network of renewable gas injection points is underway. This now enables low carbon and net zero carbon gases to be transported by the gas network, serving homes, businesses and electricity generation. Gas Networks Ireland is also actively developing a GGC scheme. This scheme will certify the origin and sustainability of renewable gas, providing sustainability assurance to gas consumers, stimulating the use of renewable gas by industry and other sectors. Work is ongoing with Teagasc, farmers, their representative bodies and rural communities to develop plans for a renewable gas industry which will stimulate the rural economy, create jobs and enhance farm incomes. Renewable gas will play a significant role in delivering a net zero carbon gas network, not only delivering substantial emissions reductions, but also contributing to meeting Ireland's renewable energy targets in heat and transport. It is our ambition that 11TWh of gas demand (20% of current demand) will be met by renewable gas by 2030, and 22TWh (40% of current demand) by 2050, enhancing energy security through a new indigenous renewable energy source.

We are examining hydrogen solutions for Ireland, including the potential to blend hydrogen into the network. Ireland's gas network once carried 'town gas' which included a significant portion of hydrogen. Hydrogen has the potential to again play an important role in the future energy system.

The gas network has begun to decarbonise and will continue to deliver increasing emissions savings as the network evolves to ultimately become net zero carbon by 2050. The gas network will help meet Ireland's decarbonisation milestones in a least cost and least disruptive manner, while sustaining the security and resilience of Ireland's energy system. Achieving this will require that the role of the gas network in maintaining whole energy system stability in Ireland is recognised and that equitable supports are made available for net zero carbon gases (i.e. renewable gas) and CCS.

Gas Networks Ireland is committed to a clean energy future for Ireland. A whole energy system approach will deliver Ireland's climate ambitions in the most practical and least cost manner. To achieve this, we will partner with key energy stakeholders, industry bodies, research institutes and communities to ensure a least cost and fair transformation to a clean energy society. Our ambition to deliver a net zero carbon gas network will help to ensure that Ireland plays its part in the global effort to tackle climate change, supporting a clean energy society now and for generations to come.

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Abbreviations

Term	Definition
ACA	Accelerated Capital Allowance
AD	Anaerobic Digestion
Bio-CNG	Bio Compressed Natural Gas
CAP	Climate Action Plan
CCGT	Combined Cycle Gas Turbine
CCS	Carbon Capture & Storage
CEF	Connecting Europe Facility
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
CRU	Commission for Regulation of Utilities
CSR	Corporate Social Responsibility
DCCAE	Department of Communications, Climate Action and Environment
DM	Dry Matter
EPA	Environmental Protection Agency
ETS	Emission Trading Scheme
EU	European Union
GDP	Gross Domestic Product
GENCOMM	GENerating Energy Secure COMMunities through Smart Renewable Hydrogen
GGC	Green Gas Certificate
GHG	Greenhouse Gas
GWh	Giga Watt Hour
Ha	Hectare
HGV	Heavy Goods Vehicle
I&C	Industrial & Commercial
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Assessment
MAC	Marginal Abatement Cost
MaREI	Marine and Renewable Energy Research and Development Centre
Mt	Mega Tonne
MWh	Mega Watt Hour
Non–ETS	Non Emissions Trading Scheme
NOx	Nitrogen Oxides
OCGT	Open Cycle Gas Turbine
P2G	Power to Gas
PSO	Public Service Obligation
RED	Renewable Energy Directive
RED II	Renewable Energy Directive Re-cast
RGFI	Renewable Gas Forum of Ireland
RHI	Renewable Heat Incentive
SFI	Science Foundation Ireland
SMR	Steam Methane Reforming
SOx	Sulphur Oxides
SSRH	Support Scheme for Renewable Heat
tCO2eq	Tonnes of Carbon Dioxide Equivalent
TWh	Tera Watt Hour

RECEIVED: 23/06/2025