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Corrib and Inishkea West Emissions & the impact on Ireland's Grid Mix emissions intensity

Europa Oil and Gas, 19th April 2024

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Note that this study has used publicly available data from company reports and UK and Irish government bodies. All data sources and assumptions are recorded. The data used in this study has been taken on an as-is basis and no independent evaluation or checks have been undertaken and no responsibility is taken for any errors that may be contained within the datasets utilised.

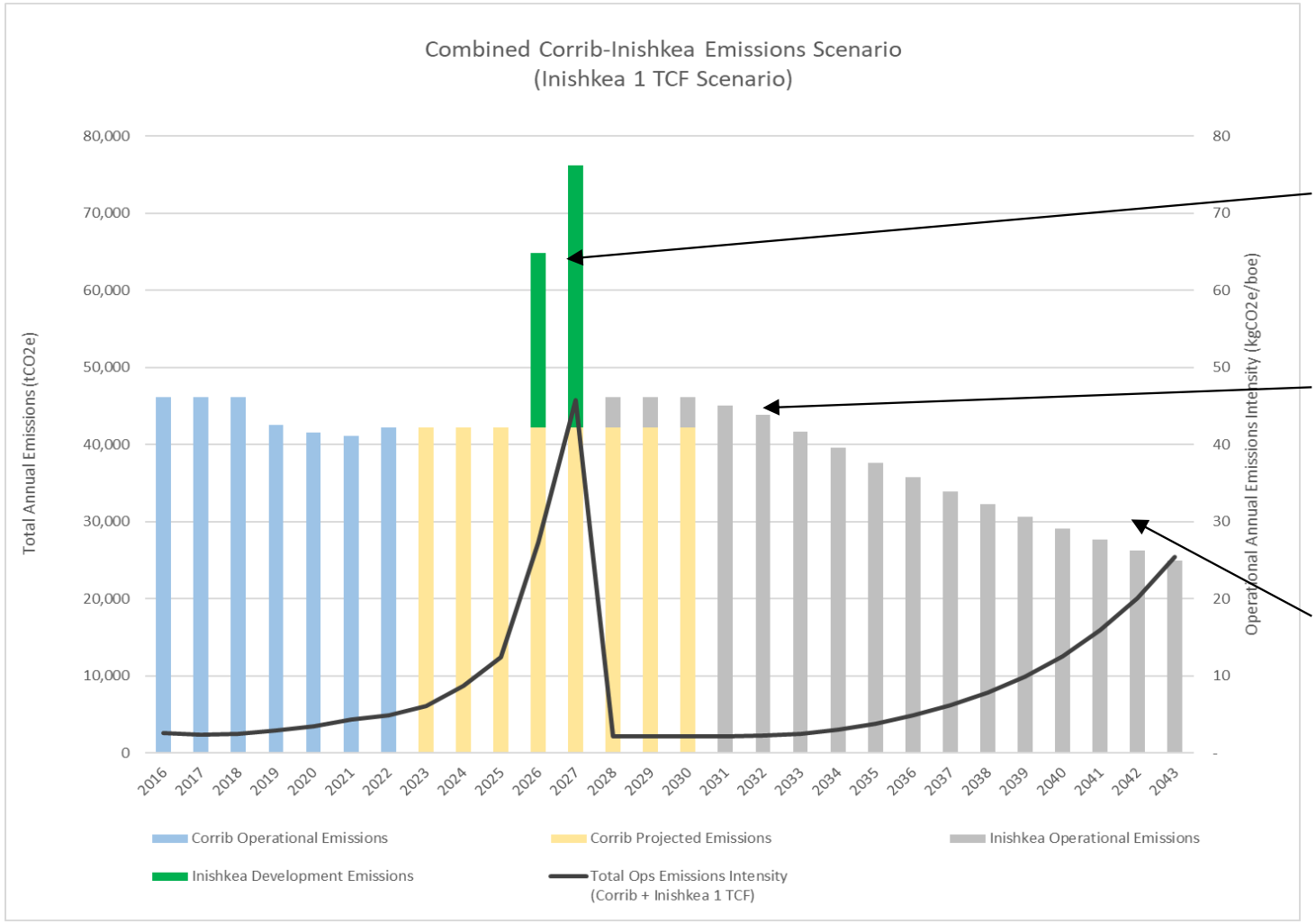
Executive Summary

Executive Summary – Corrib and Inishkea West Field

- Current 2023 annual operational emissions intensity calculated for Corrib Field is [1]: **6.1 kgCO_2e/boe**
- A small increase in emissions intensity is expected in 2024 due to a reduction in production while emissions at Bellanaboy Terminal remain stable.
- Annual operational emissions intensity is forecast to increase over time as production from Corrib Field declines
- **Average operational life-of-field** emissions intensities calculated for Corrib and Inishkea West Fields are:
  - Corrib only: **5.3 kgCO_2e/boe**
  - Corrib + Inishkea (1 TCF): **3.8 kgCO_2e/boe**
  - Incremental emissions Inishkea only (1 TCF): **2.8 kgCO_2e/boe**

Emissions Intensity quoted as kgCO_2e/boe for Corrib and Inishkea West Fields only – see notes for details

Corrib & Inishkea West Fields – Combined operational emissions



- **Total annual operational emissions from Corrib and Inishkea West**
- Spike in total emissions associated with Inishkea West development operations
- Inishkea West operational emissions initially assumed to be the **same as when Corrib was at/near peak production**
- **Emissions intensity** in fields **increases as production declines.**

Executive Summary – Gas Imports

- The weighted average carbon intensity of all UK gas (domestic and imported) in 2022 is [2,3]: **32 $kgCO_2$/boe**
- In 2022 the UK produced 40.7% of gas domestically with an average carbon intensity of [2,3]: **21 $kgCO_2$/boe**
- In 2022, 44.9% of imported gas to the UK was LNG (all countries) with a weighted average carbon intensity of [2,3]: **78 $kgCO_2$/boe**
- Average carbon intensity of imported gas from UK to Ireland in 2022 is calculated to be [2,3]: **36 $kgCO_2$/boe**
- This includes an estimated **4 $kgCO_2$/boe** resulting from compression and transport of the gas from the UK to Ireland [4].
- Based on this data and assumptions detailed in this study, as of 2023 gas produced at Corrib Field is:
  - **~80% lower in emissions intensity** compared to the **gas imported to Ireland from the UK** [5]
  - **~90% lower in emissions intensity** compared to **LNG imported from the US into the UK** [5]
  - *However, it is important to note that these intensity values are comparing different metrics (CO_2e vs CO_2), and are therefore not directly comparable (refer to note [3]).*

Carbon Intensity quoted as $kgCO_2$/boe for UK gas (domestic, imports & exports) – see notes for details

Summary table – Average **carbon** intensity of UK gas

Source of UK Gas	2022 Total UK Gas Imports (MMboe)	Average CARBON Intensity ($kgCO_2$/boe)	Source of Carbon Intensity Values
UK domestic production	249.2	21	NSTA benchmarking study (2023)
Pipeline imports (Europe)	200.3	8	NSTA benchmarking study (2023)
LNG imports (Worldwide)	163.5	78	NSTA benchmarking study (2023)
TOTAL	**613**	**32**	**Weighted average of all sources**
Compression & Transport emissions during export from UK to Ireland		4	NSTA Emissions Monitoring Report (2023)
TOTAL Carbon Intensity of Gas Exported from UK to Ireland		**36 $kgCO_2$/boe**	**Weighted average of all sources including export**

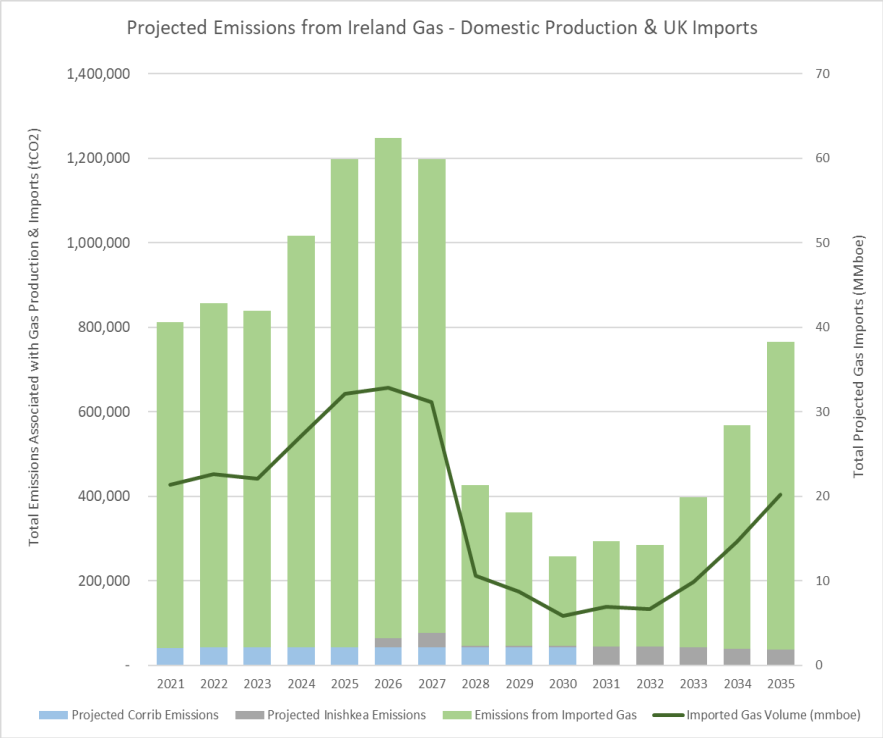
Sources: NSTA Emissions Benchmarking Study published in 2023: https://www.nstauthority.co.uk/the-move-to-net-zero/net-zero-benchmarking-and-analysis/natural-gas-carbon-footprint-analysis/#gas_footprint; NSTA Emissions Monitoring Report, published in 2023: https://www.nstauthority.co.uk/news-publications/emissions-monitoring-report-2023/; Digest of UK Energy Statistics (DUKES): natural gas - GOV.UK (www.gov.uk) (https://www.gov.uk/government/statistics/natural-gas-chapter-4-digest-of-united-kingdom-energy-statistics-dukes)

Executive Summary – Corrib & Inishkea West Emissions Comparison to Imported Gas

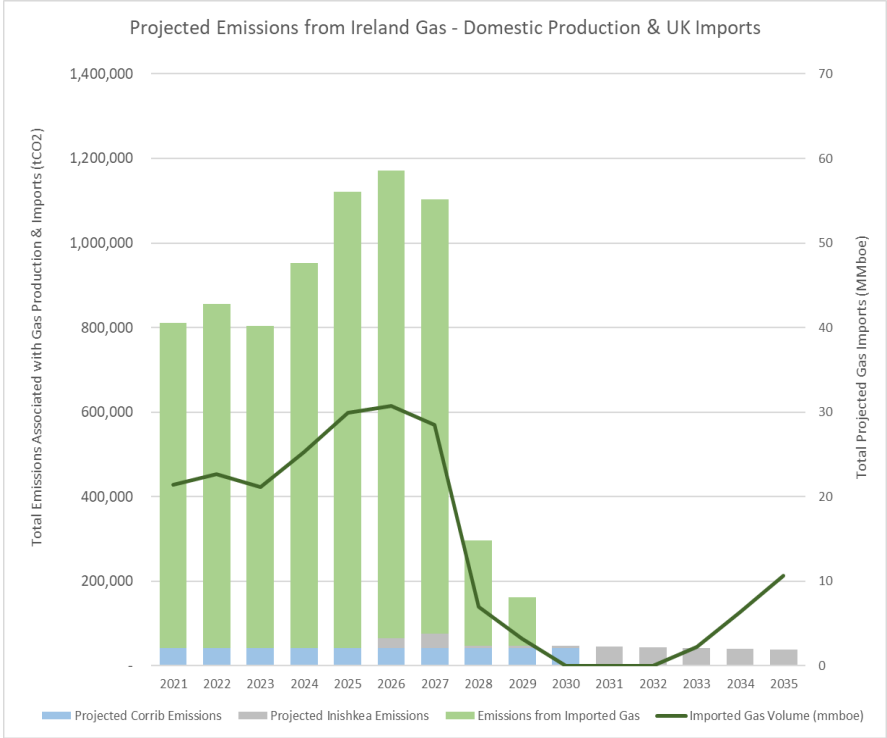
- As Corrib production declines, **imported gas volumes from UK have increased to meet demand**.
- In 2022, Corrib accounted for **28% of Ireland's gas supply**, but just **5% of total emissions** associated with gas demand [6,7].
- Corrib has a **lower forecasted emissions intensity** than imported gas up to and including 2027 (between 6 and 25 $kgCO_2e/boe$).
- If Inishkea West starts production, emissions intensity for Corrib and Inishkea West in the 1 TCF scenario is predicted to be **less than** the intensity of imported gas from UK.
- Projected production from Inishkea West has the **potential to almost eliminate the need for gas imports** from the UK in 2030 through to the end of 2032 and therefore **dramatically reduce associated emissions** (based on recent SEAI demand predictions) [8].
- Due to the higher carbon intensity of gas imported from UK (36 $kgCO_2/boe$), the **emissions impact of increasing gas imports is greater than increasing domestic production**.

Ireland Projected Gas Demand – Comparison to Corrib & Inishkea West

- **Projected emissions of domestic and imported gas** calculated from two demand scenarios published by SEAI.
- Projected production from Inishkea West will reduce, or potentially eliminate, the need for gas imports from the UK in (depending on actual demand), and therefore dramatically reduce associated emissions.
- Contribution by **Corrib & Inishkea West based on modelled scenarios** shown on previous slides (Inishkea West 1 TCF scenario) [7,10].



High_WEM – SEAI Current Actions Scenario



High_WAM_CAP23 – SEAI Ambitious Scenario

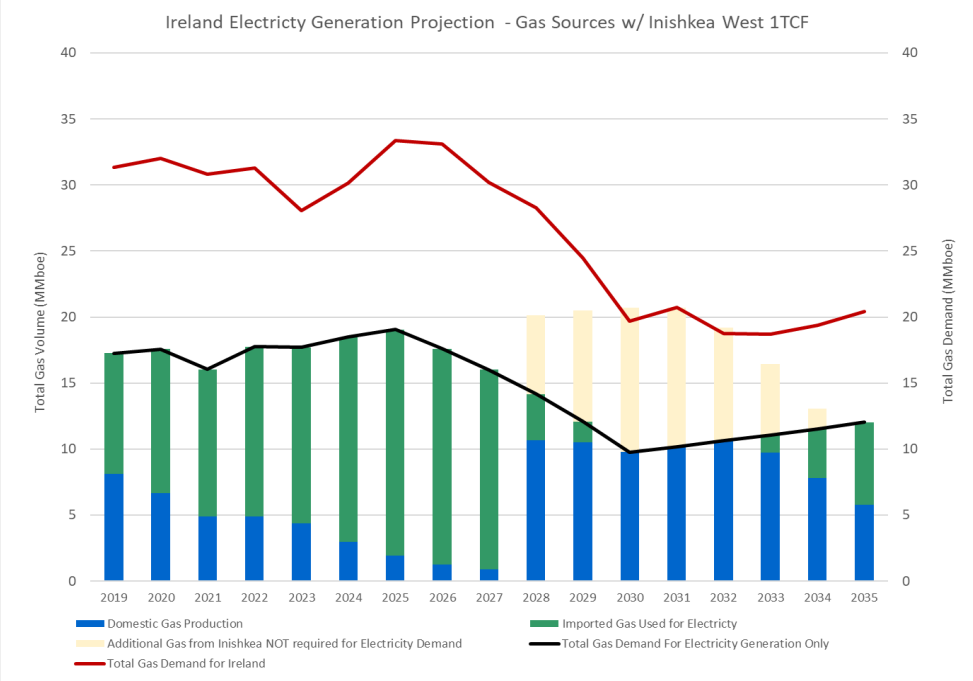
Executive Summary – Impact on the Grid Mix

- In Ireland in 2021, electricity accounted for **14.4% of Ireland's total greenhouse gas emissions**.
- The Irish Government's Climate Action plan has plans to increase the renewable energy proportion of the grid to **50% by 2025** and to **80% by 2030**.
- They also are aiming for **zero emission gas fired generation** from biomethane and hydrogen commencing by 2030.
- For the Inishkea West 1 TCF scenario, the overall reduction in emissions from electricity generation up to and including 2035 is estimated to be ca. **2.5 MtCO_2** (total absolute emissions difference between 2026-2035) [8].
  - Approximately equivalent to 6.5% of Ireland's total CO_2 emissions in 2021; or the annual emissions of ~325,000 Irish people (ca. 1/3 the population of Dublin); or the equivalent of taking ~206,000 mid-size petrol cars off the road over that period.
  - Emissions savings only occur from 2028 once Inishkea begins producing.
  - An emissions increase occurs between 2026 and 2027 due to Inishkea development emissions.

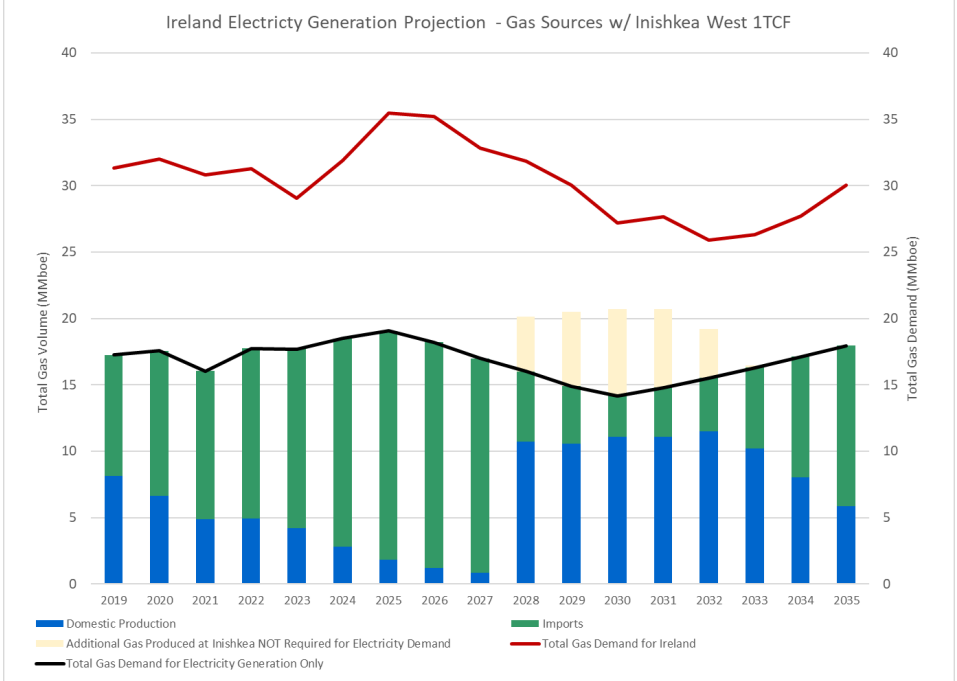
Ireland's Electricity Grid Mix – Projections to 2035

Assuming that in the future, Ireland's Grid uses the same proportions of domestically produced gas and imported gas as for the total gas demand, some imported gas is still assumed to be needed for electricity after Inishkea West comes online.

Additional gas from Inishkea West could partially or entirely satisfy the other demands for gas across the Irish economy, depending on the actual total demand for gas.



High_WAM_CAP23 – Ambitious Scenario



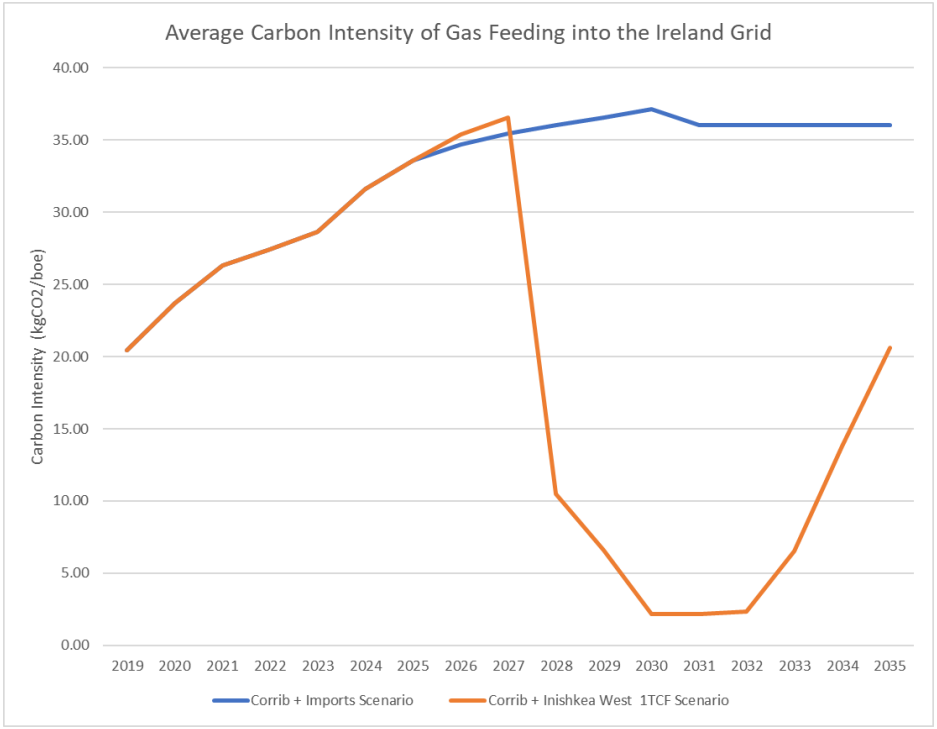
High_WEM – Current Actions Scenario

Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

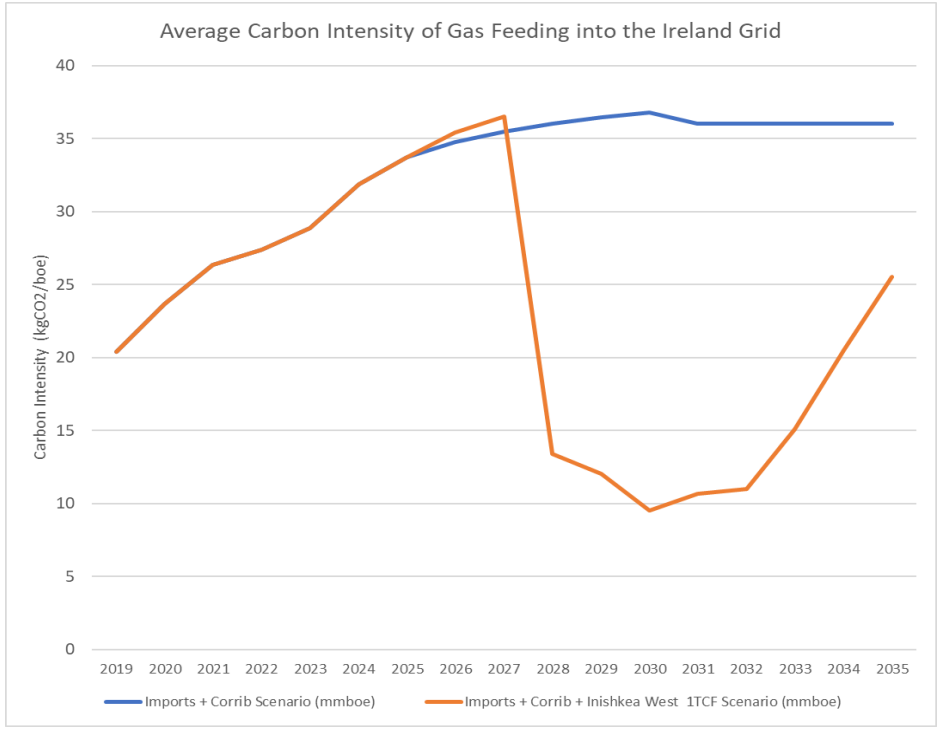
Ireland's Electricity Grid Mix – Projections to 2035

Slight **increase in emissions intensity in 2026 and 2027** in the Corrib + Inishkea West 1 TCF scenario due to development emissions associated with Inishkea West.

Sharp drop in average carbon intensity in 2028 as Inishkea West begins production and **replaces** more carbon intensive imports. Then carbon intensity will **rise again** as production from Inishkea West **declines**.



High_WAM_CAP23 Scenario - Ambitious



High_WEM – Current Actions Scenario

Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Assumptions & Notes on Data Used

Data Sources and Assumptions (1)

- **NSTA 2022 Gas Footprint study** is the primary source for carbon intensity data of imported gas to the UK. NSTA state this data is derived from the **Rystad Energy's Gas and LNG trade emission analysis dashboard** (July 2023)
  - Note that the authors of this current study on Corrib & Inishkea West Fields **do not have access to the Rystad source data to verify its quality and cannot provide assurance as to its quality**.
- NSTA state that all imported gas emissions values are **best estimates** given the lack of standardised monitoring, measurement and reporting of emissions across natural gas lifecycle stages and global sources, as well as uncertainties.
- **Emissions intensity** = Carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), expressed as carbon dioxide equivalent (CO_2e) per barrel of oil equivalent (boe) produced.
- **Carbon intensity** = Carbon dioxide (CO_2) emissions per barrel of oil equivalent (boe) produced.
- Operational emissions intensity represents annual Scope 1 and 2 emissions only during the production phase. Operational emissions exclude emissions associated with installation of infrastructure for the development.

Data Sources and Assumptions (2)

NOTES:

[1] Emissions intensity of Corrib Field based on **publicly available production data**.

[2] Carbon intensity of gas imported into Ireland is calculated using a **weighted average** based on 2022 UK gas import data from three sources: domestic production, pipeline imports and LNG imports.

- Data for gas imports to the UK from various countries have been sourced from the DUKES database, Tables 1.1, 4.1. and 4.5.
- There were several import countries in the DUKES 2022 data for which the NSTA did not provide a carbon intensity value for. The total of all of these sources accounted for less than 0.7% of imports and therefore the lack of a carbon intensity value for these countries was found not to impact the overall weighted average carbon intensity calculation of the imported gas.

- This study assumes no new LNG plants will be built in Ireland and no LNG imports will come into Ireland directly – all imports assumed to be from UK only.
- This study assumes that the gas exported to Ireland from the UK has the same composition as the overall UK gas mix in terms of domestic vs imports, and the countries from which imports are sourced.
- This study assumes that the gas used to produce electricity for Ireland's Grid has the same composition as the overall Irish gas mix of imported vs domestically produced gas.
- This study assumes that the carbon intensity of imported gas does not change in the future. However, it could be reasonably expected that emissions intensity of imported and domestic gas production will decrease over time given the importance being placed on implementation of emissions reduction actions.

Data Sources and Assumptions (3)

NOTES:

[3] Carbon intensity of domestic production and imported gas from various countries into the UK is taken directly from the **NSTA 2022 Gas Footprint** study:

- Data provided for 2022 are **carbon emissions intensity** values and therefore **only include CO_2 emissions** in their calculations.
- The previous NSTA 2019 Gas Footprint study provided **emissions intensity** data which include **all relevant Greenhouse Gases (GHGs) including CO_2 and methane (CH_4) reported as carbon equivalent (CO_2e) emissions values**.
- **Therefore, the data from the previous 2019 NSTA study and the most recent 2022 study are not directly comparable.**
- This also means that **comparing the emissions intensity of the Corrib Field (reported as CO_2e) to the 2022 NSTA derived carbon intensity (reported as CO_2 only) is not a direct like-for-like comparison**. Comparison of Corrib & Inishkea West emissions (which include CO_2, CH_4 and N_2O) to UK gas emissions (CO_2 only) therefore represent a conservative comparison.
- NSTA 2023 Emissions Monitoring Report indicates that the difference between CO_2 only and all GHGs is ca. **3-4 $kgCO_2e$/boe**.

[4] The most recent NSTA 2023 Emissions Monitoring Report indicates that emissions from onshore terminals (e.g. compression) accounts for **4.2 $kgCO_2$/boe**. This value has been used as the estimate for export of gas from the UK to Ireland.

[5] Corrib Field 2023 emissions intensity of **6.1 $kgCO_2e$/boe** compared to weighted average carbon intensity of imported gas from UK to Ireland of **36 $kgCO_2$/boe**. It is important to note that these intensity values are **not directly comparable** (refer to note [3] above).

Data Sources and Assumptions (4)

[6] Corrib production assumed to decline by 30% p.a. (based on trend from last 4 years of reported production).

[7] Total emissions from Corrib assumed to remain constant (based on trend from last 4 years of reported activity).

[8] This projection was run until 2035 but it is worth noting that the Irish Government's Climate Action Plan 2023 has a KPI for 2030 of 'Zero Emission gas fired generation from biomethane and hydrogen commencing by 2030'. Should this target be met, the emissions savings from using gas from Inishkea West to produce electricity would only be effective from 2028 to 2030:

- Energy demand scenario High_WAM_CAP23 was used because it matches the KPIs used for the electricity projections which were used to calculate future gas vs renewables mix in the Irish electricity grid.

[9] The Inishkea West 1 TCF scenario was chosen to use for the projected demand scenarios as production from Inishkea West will be throttled by the capacity of the Bellanboy terminal until 2030 and therefore there would be no difference between the Inishkea West 1 TCF and 3 TCF scenario.

[10] Assumes production start-up at Inishkea West is in 2028 (previous study assumed production start-up in 2027).

Source SEAI Demand Scenario Sources: https://www.seai.ie/data-and-insights/seai-statistics/energy-data/; Ireland's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Emissions Comparison – Scope of this study

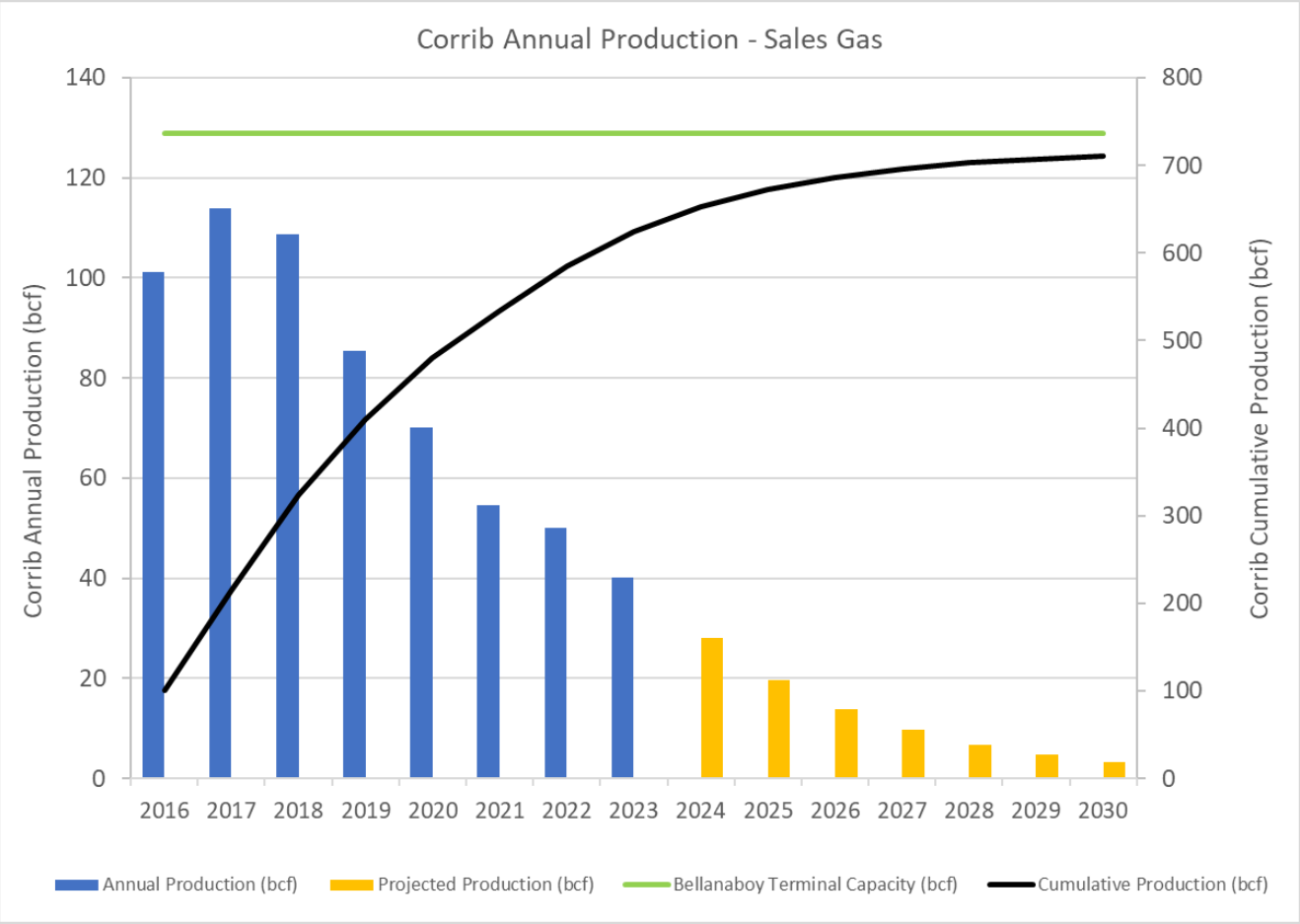
- This study represents an update to the previous 2023 study with a greater focus on the impact of domestic vs imported gas on Ireland's future emissions:
  - Updates include the most recent production and emissions data;
  - Comparison with local power grid and how gas from Inishkea West would change the local grid mix;
  - Emissions comparison of using Inishkea West gas to generate power using indigenous gas instead of importing gas from the UK;

Key Changes to 2023 Study

- **Inishkea West production and emissions** profiles remain **unchanged, but timing shifted back 1 year:**
  - Despite Inishkea West now being the preferred prospect, as these models are based on analogue data, updates are not recommended until more project-specific data is available when planning for the development progresses.
  - Timing of production starting shifted to 2028 (previously 2027), with drilling and development construction activities assumed to occur in 2026-2027 (previously 2025-2026).
- Where available, **2022 and 2023 data has been included** for the actual and forecast data used, and graphs and calculations have been updated. The SEAI forecasts have also been updated and extended to 2035 for this study.
- In the 2023 study, Corrib emissions were assumed to decrease at a rate of 5% per year based on the trend in reported emissions from 2019 – 2021.
  - However, in 2022 the Operator reported an increase in emissions.
  - Therefore, in this study, it has been **assumed that emissions will remain constant for Corrib** at the same level as 2022.

1. Emissions from Corrib & Inishkea West Fields

Corrib Field – Annual gas production

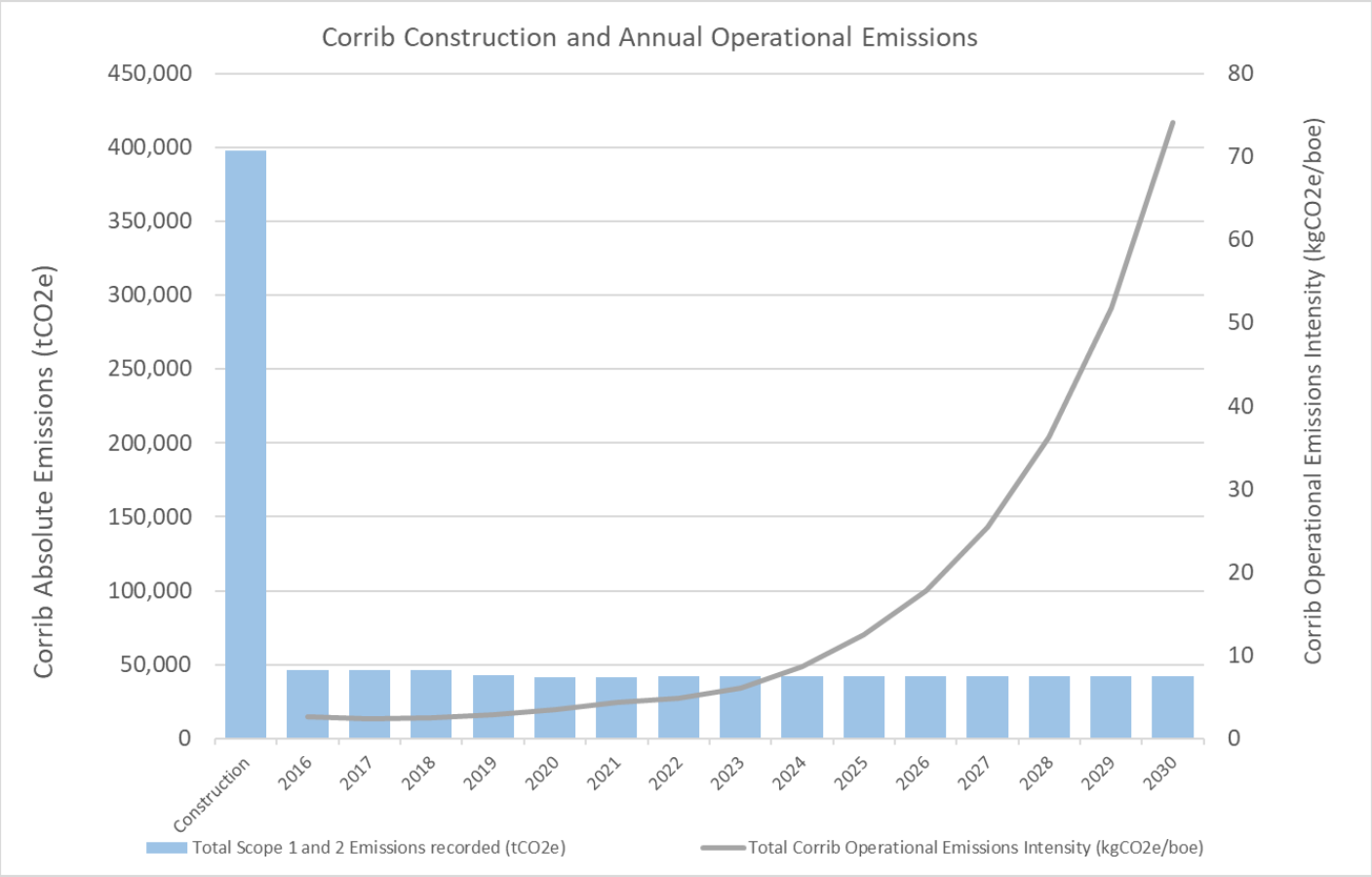


- **Annual production** (actual & projected) for **Corrib Field**
- **Bellanaboy** terminal processing **capacity is 353 MMscf/d** (128.8 bcf p.a.)
- Production for the field assumed to be **declining at 30% p.a.** based on data from 2017 – 2021.
- Corrib field currently assumed to **finish production in 2030.**

See Notes section below for more detail

2024 update: Production added for Corrib for 2023; Source of Corrib Field annual production – Sales Gas: https://www.gasnetworks.ie/corporate/gas-regulation/transparency-and-publicat/dashboard-reporting/entry-flows/physical-flows/ ;

Corrib Field – Construction & operational emissions

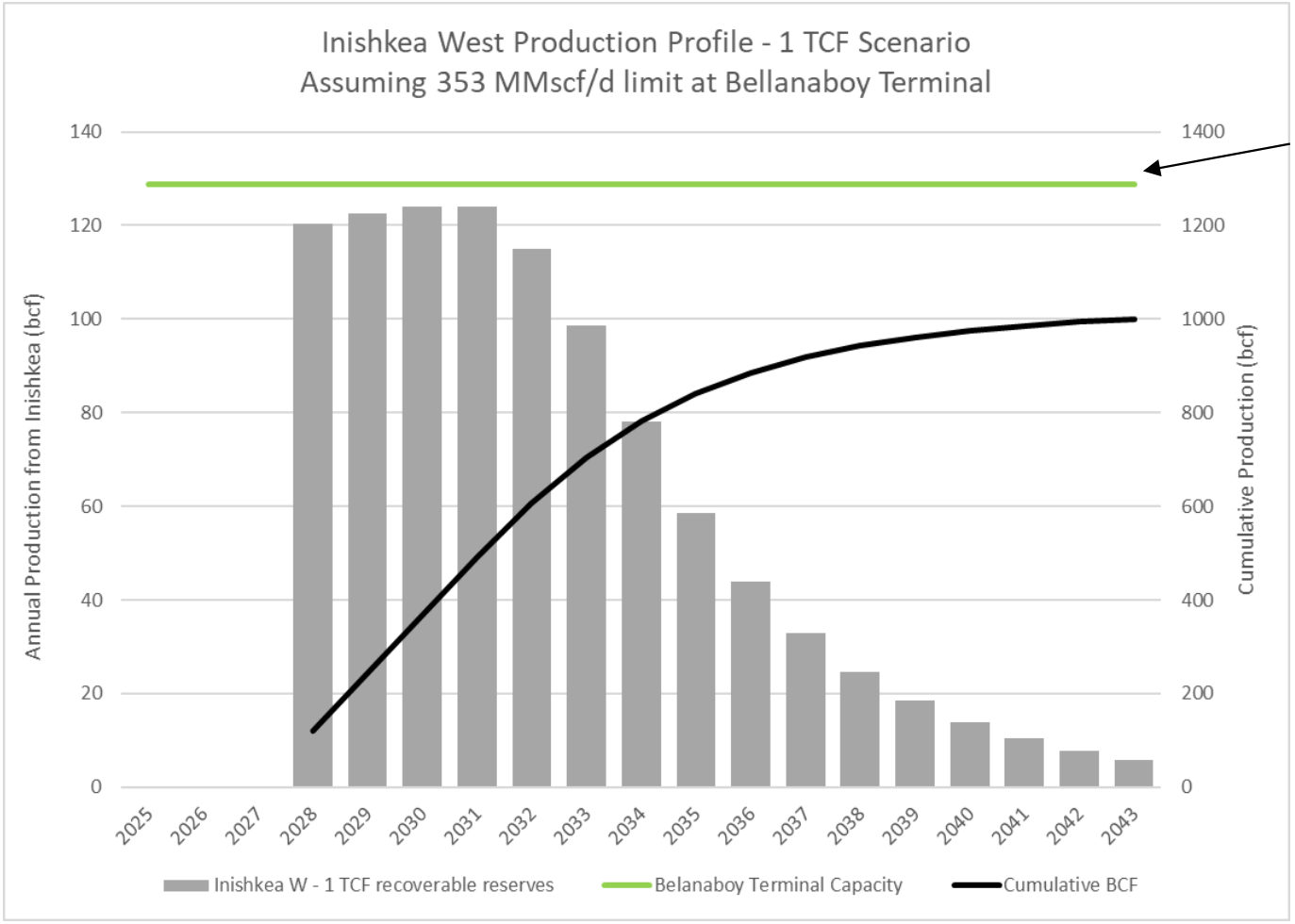


- Emissions for construction of Corrib and Bellanaboy facilities and pipelines estimated by Shell to be **397,448 tCO_2e** [b]
- Absolute operational emissions of Corrib includes emissions from Bellanaboy Terminal.
- Calculated operational emissions intensity for 2022 very low **4.9 CO_2e/boe** (reported by Vermillion).
- Emissions Intensity expected to rise rapidly as production decreases, but emissions remain relatively stable for running Bellanaboy facilities.

2024 update: Updated Corrib emissions for 2022, projected emissions changed to remain stable; Source of development and Bellanaboy construction and operating emissions: https://www.epa.ie/publications/licensing--permitting/climate-change/IE-GHG161-10426-4.pdf ; https://assets.gov.ie/85534/ebfd5cde-bc0d-498a-ba78-79bc50af959e.pdf

See Notes section below for more detail

Inishkea West – 1 TCF scenario modelled gas production

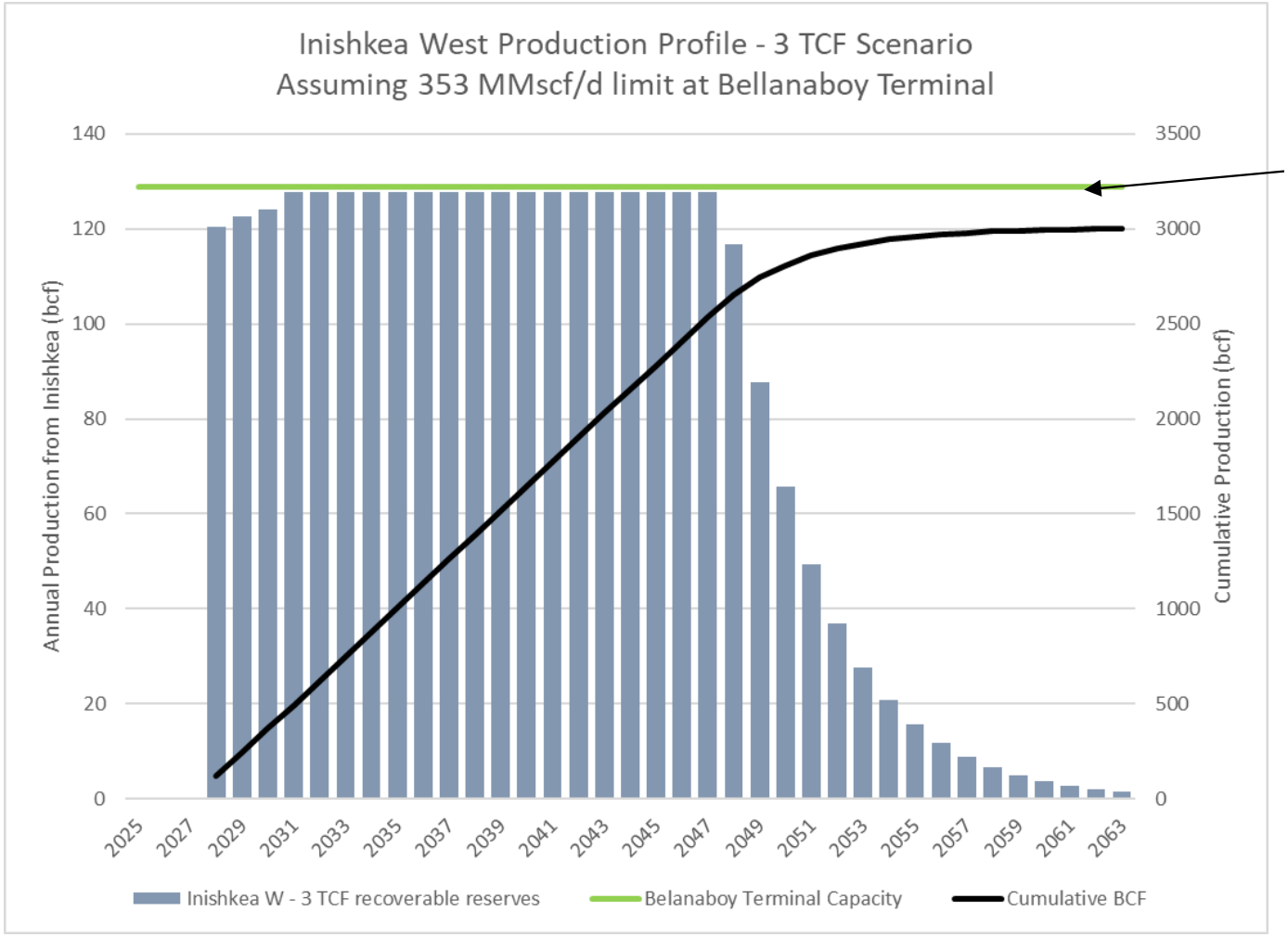


- Modelled **annual production for 1 TCF scenario**
- Accounts for **capacity of the Bellanaboy Terminal** of **353 MMscf/d** (128 bcf p.a.).
- Assumes
  - 3-year **overlap in production** with Corrib
  - **Short plateau** and **25% annual decline**
  - **15 year** field life
  - Total cumulative production **1 TCF**

See Notes section below for more detail

2024 update: Updated timing of Inishkea West to start production in 2028 (was previously 2027)

Inishkea West – 3 TCF Scenario modelled gas production

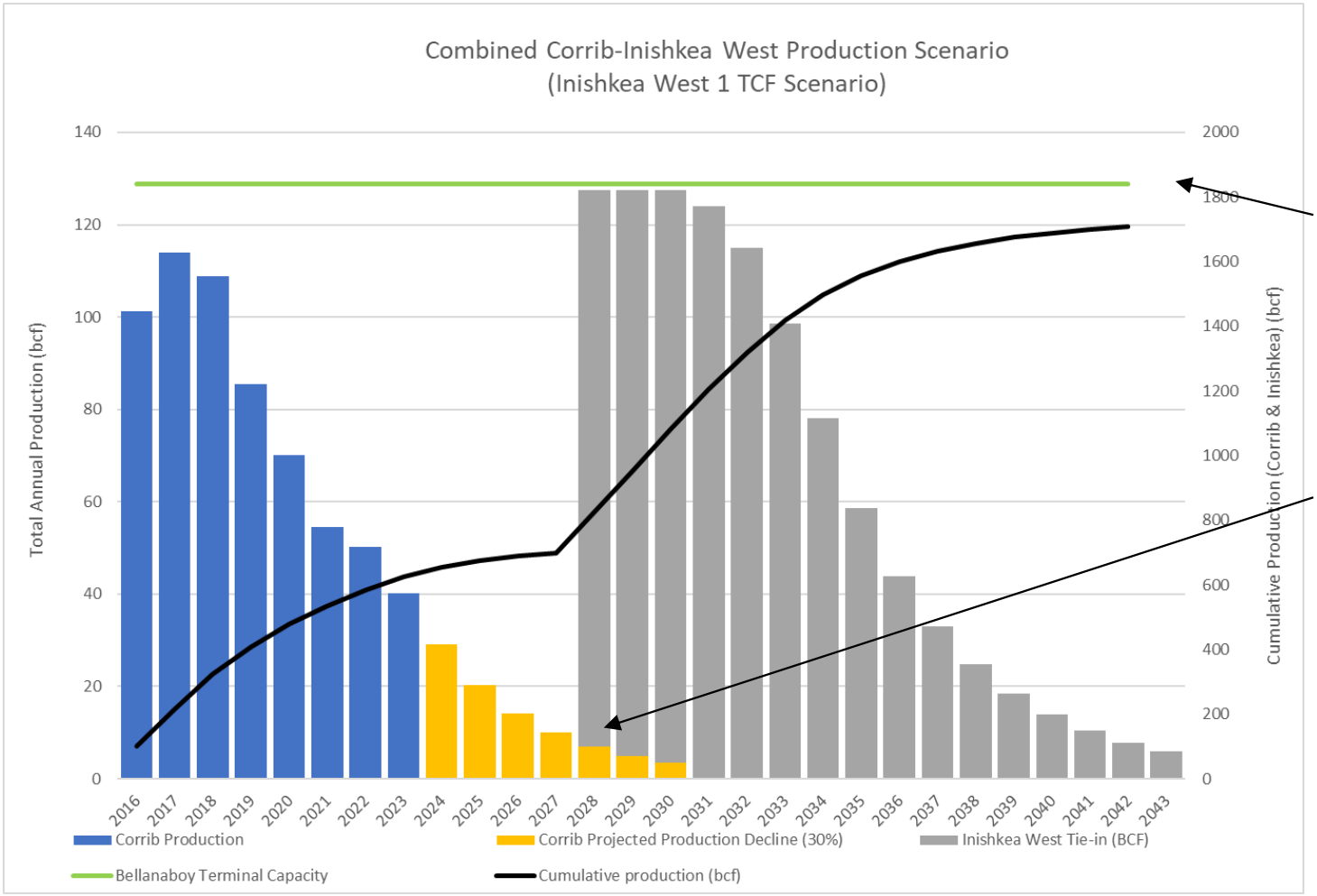


- Modelled **annual production for 3 TCF scenario.**
- Accounts for capacity of the Bellanaboy Terminal of **353 MMscf/d** – **no upgrading of facilities**.
- Assumes:
  - **25% annual decline**
  - **35 year** field life
  - Total cumulative production **3 TCF**
- **Upgrading** capacity at terminal in 3 TCF case **likely required**.

See Notes section below for more detail

2024 update: Updated timing of Inishkea West to start production in 2028 (was previously 2027)

Corrib & Inishkea West Fields – Combined scenario

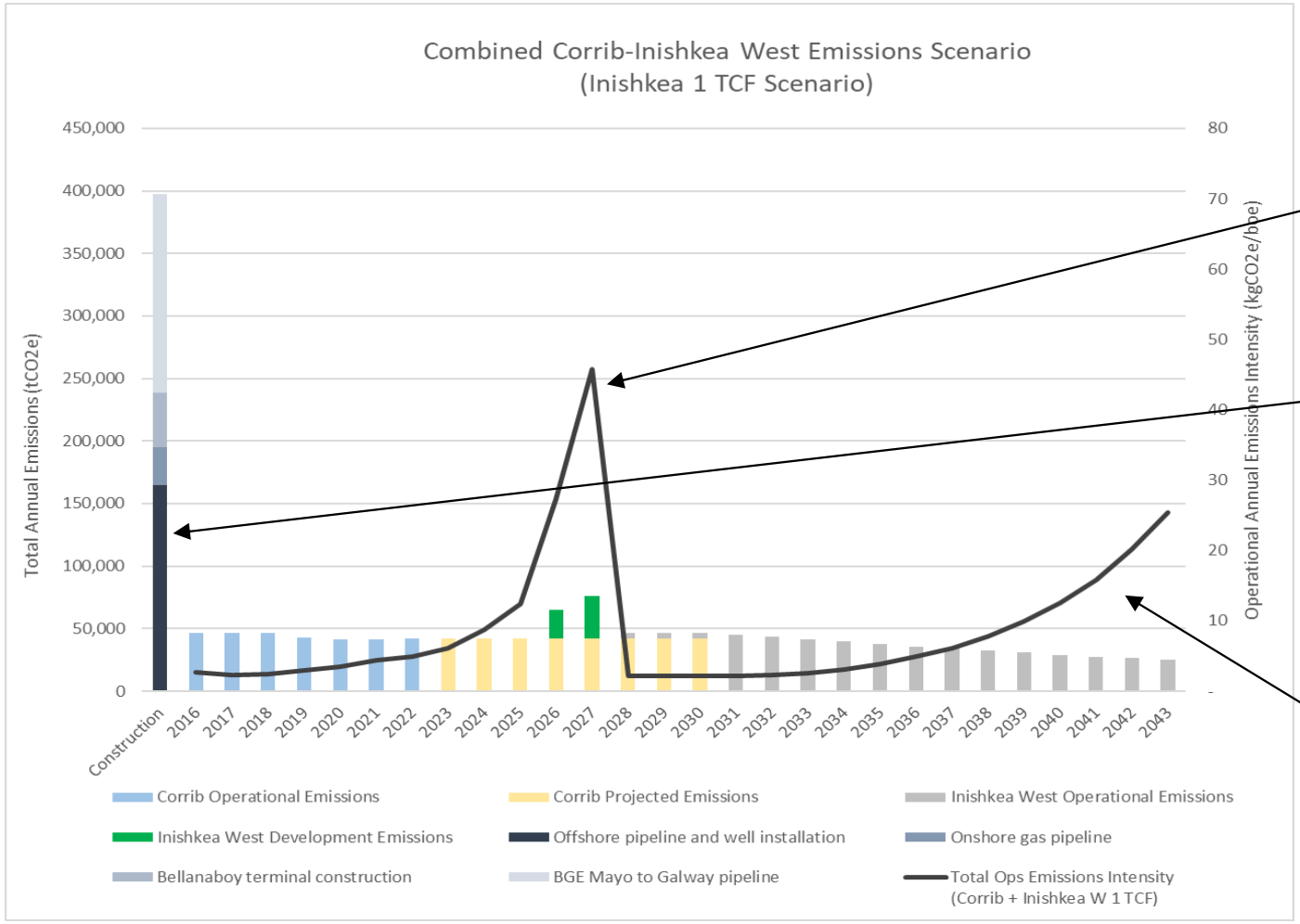


- **Combined production scenario** for Corrib and Inishkea West.
- **1 TCF scenario for Inishkea West**, taking into account capacity of the Bellanaboy Terminal – **no upgrading of facilities**.
- Model assumes some **overlap** in production between Corrib and Inishkea West.
- Based on assumptions and models from **previous slides**.

See Notes section below for more detail

2024 update: Actual production added for Corrib for 2023; Updated timing of Inishkea West to start production in 2028 (was previously 2027)

Corrib & Inishkea West – Combined construction & ops emissions

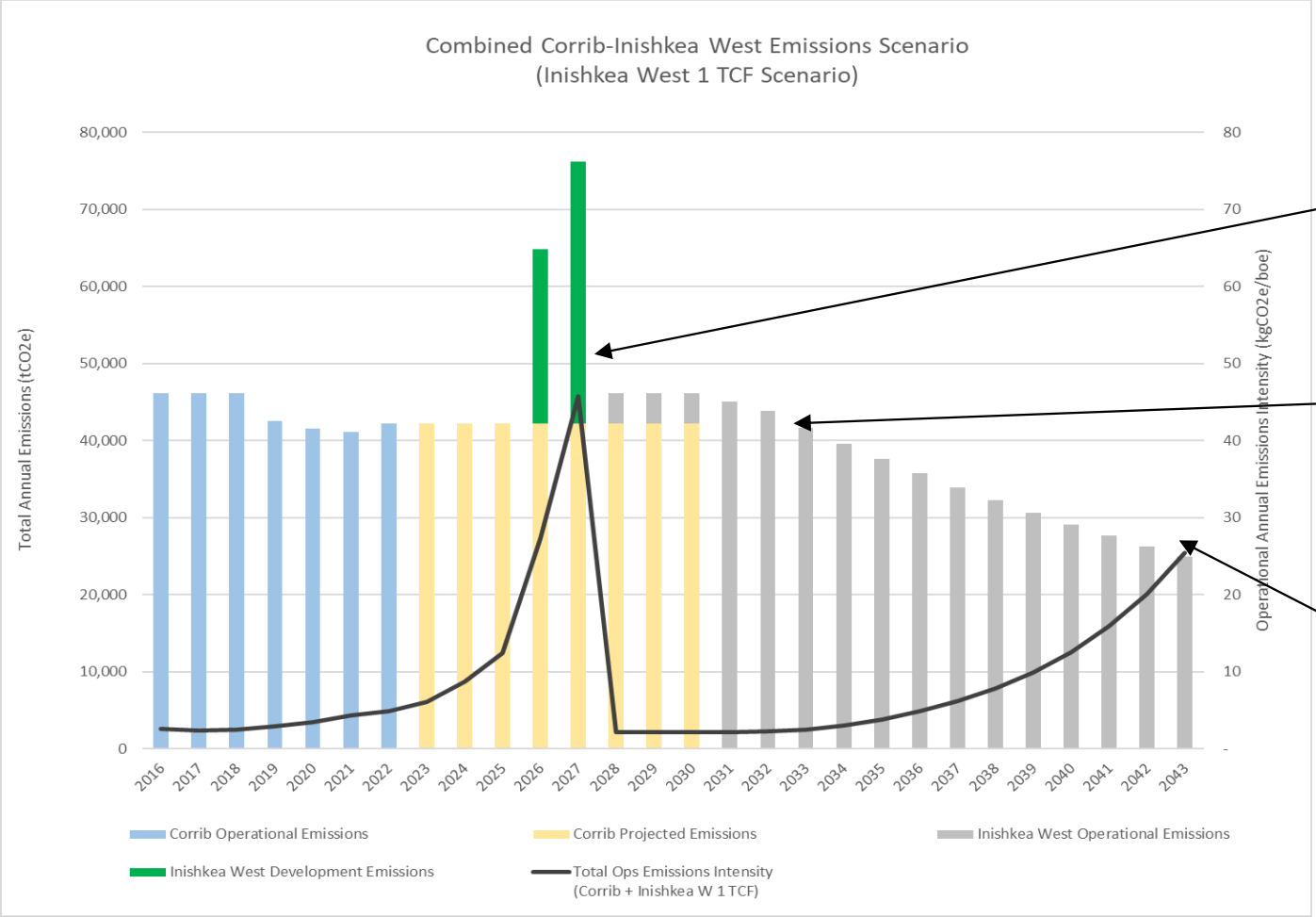


- **Total construction and annual operational emissions** from Corrib and Inishkea West.
- Spike in Corrib's emissions intensity as production declines to low levels before Inishkea West comes online.
- Emissions associated with **construction of Corrib facilities.**
- Inishkea West operational emissions initially assumed to be the **same as when Corrib was at/near peak production.**
- **Emissions intensity** in fields **increases as production declines.**

See Notes section below for more detail

2024 update: Updated Corrib actual emissions for 2022, projected Corrib emissions changed to remain stable; Updated timing of Inishkea West to start production in 2028 (was previously 2027)

Corrib & Inishkea West – Combined operational emissions

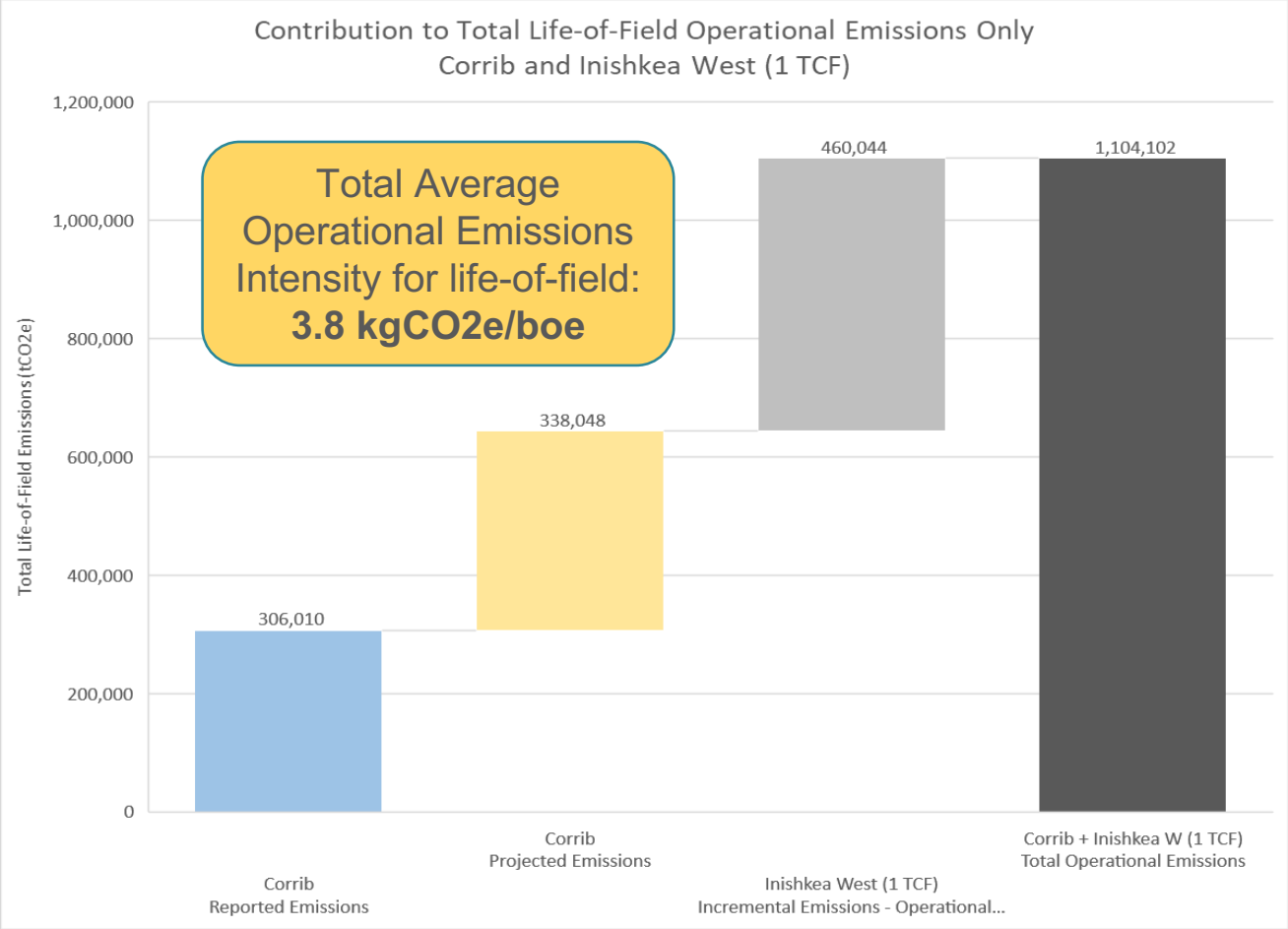


- **Total annual operational emissions from Corrib and Inishkea West.**
- Spike in emissions associated with Inishkea West development.
- Inishkea West operational emissions initially assumed to be the **same as when Corrib was at/near peak production.**
- **Emissions intensity** in fields **increases as production declines.**

2024 update: Updated Corrib actual emissions for 2022, projected Corrib emissions changed to remain stable; Updated timing of Inishkea West to start production in 2028 (was previously 2027)

See Notes section below for more detail

Corrib & Inishkea West – Life-of-Field operational emissions (Inishkea West 1 TCF)



- **Total <u>operational</u> emissions** from Corrib and Inishkea West over **full life of both fields.**
- Development and construction emissions <u>not included.</u>
- Emissions calculated based on **combined production scenario** for **Corrib and Inishkea West (1 TCF Scenario).**
- **Average Operational Life-of-Field Emissions Intensities:**
- <u>Corrib only:</u>

  5.3 kgCO_2e/boe
- <u>Corrib + Inishkea West (1 TCF):</u>

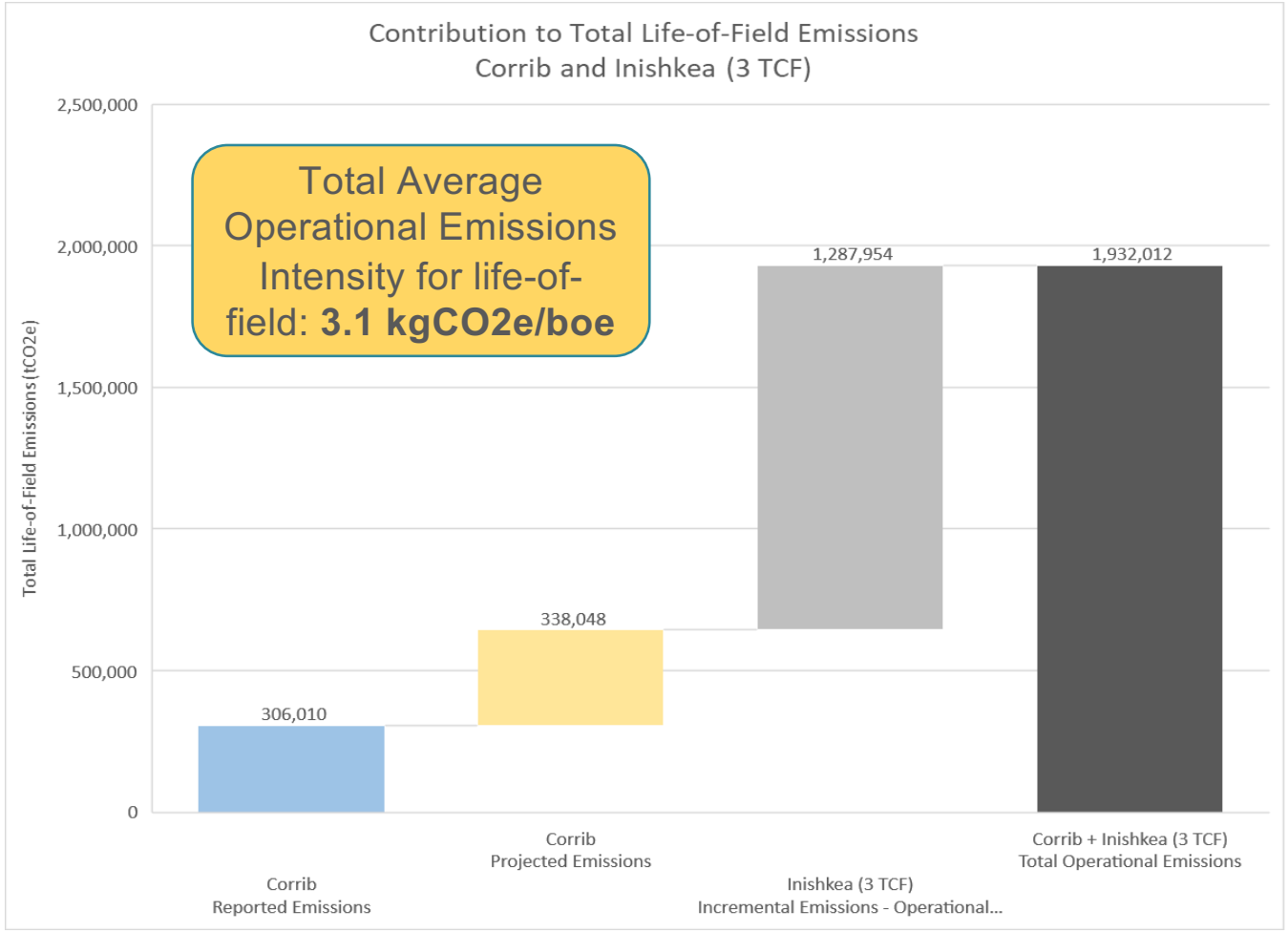
  3.8 kgCO_2e/boe
- <u>Inishkea West Incremental Emissions (1 TCF):</u>

  2.6 kgCO_2e/boe

See Notes section below for more detail

2024 update: Updated Corrib actual emissions for 2022, projected Corrib emissions changed to remain stable; Updated timing of Inishkea West to start production in 2028 (was previously 2027)

Corrib & Inishkea West – Life-of-Field operational emissions (Inishkea West 3 TCF)



- **Total operational emissions** from Corrib and Inishkea West over **full life of both fields.**
- Development and construction emissions not included.
- Emissions calculated based on **combined production scenario** for **Corrib and Inishkea West (3 TCF Scenario)**
- **Average Life-of-Field Emissions Intensities:**
- Corrib only:

  5.3 kgCO_2e/boe
- Corrib + Inishkea West (3 TCF):

  3.1 kgCO_2e/boe
- Inishkea West Incremental Emissions (3 TCF):

  2.6 kgCO_2e/boe

See Notes section below for more detail

Updated Corrib emissions for 2022, projected Corrib emissions changed to remain stable.

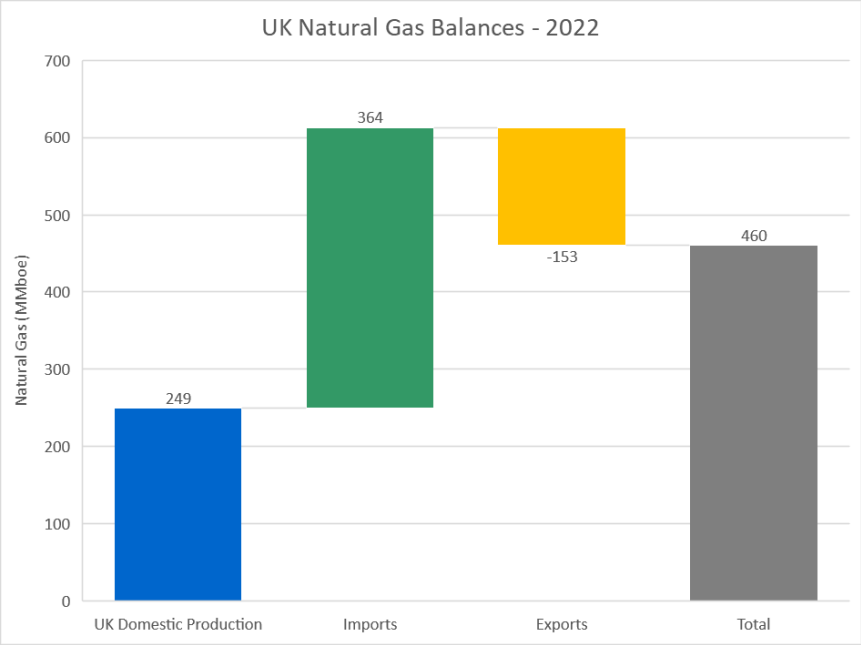
2. Emissions Intensity of UK Imported Gas

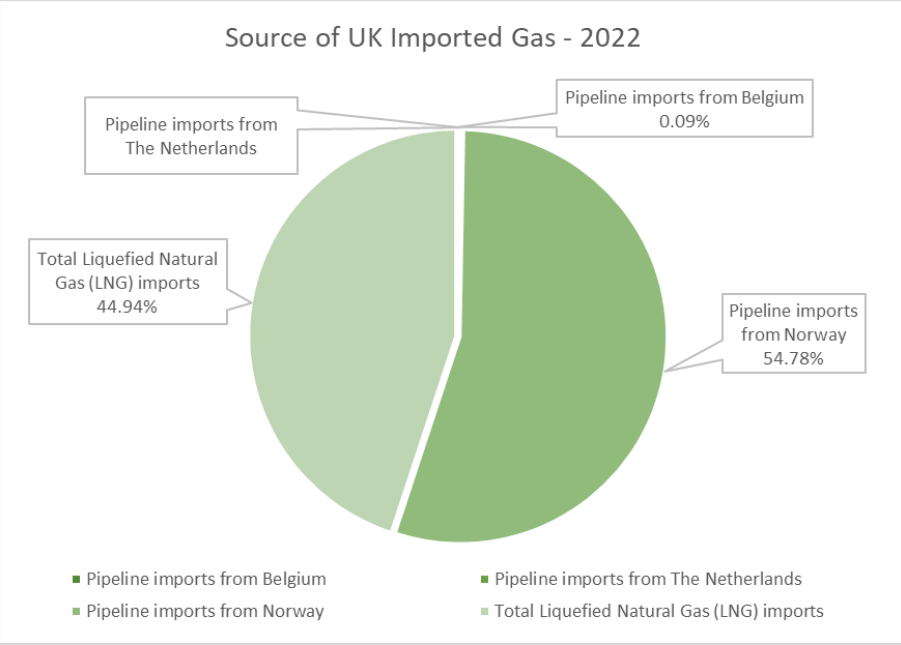
Important Note on **Carbon Intensity** for Imported Gas

- Carbon intensity of domestic production and imported gas from various countries into the UK is taken directly from the **NSTA 2022 Gas Footprint study** (published in 2023):
  - Data provided for 2022 are carbon emissions intensity values and therefore **only include CO_2 emissions** in their calculations.
  - The **previous** NSTA 2019 Gas Footprint study provided **emissions intensity** data which include all relevant Greenhouse Gases (GHGs) including CO_2 and methane (CH_4) reported as **carbon equivalent (CO_2e)** emissions values.
- **Therefore, the data from the previous 2019 NSTA study and the most recent 2022 study are not directly comparable.**
- **This also means that comparing the emissions intensity of the Corrib Field (reported as CO_2e) to the 2022 NSTA derived carbon intensity (reported as CO_2 only) is not a direct like-for-like comparison.**
- When showing comparisons between Corrib, Inishkea West and UK gas in this study, we have **reported all emissions in CO_2 only**. As Corrib and Inishkea West emissions are calculated as CO_2e, **this will provide a conservative comparison to the emissions from gas imports.**

Ireland imports gas from the UK which has a mixture of sources

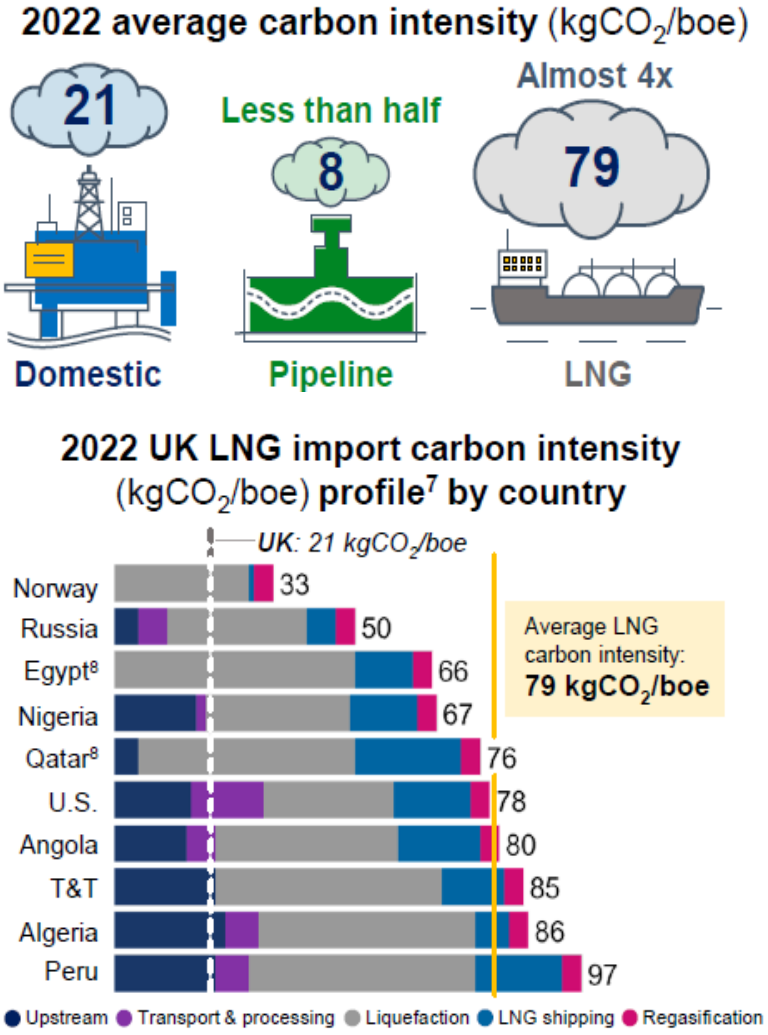
- All **gas imports** to Ireland come **from the UK**.
- The UK's gas supplies are a mixture of **domestic production and imports.**
- Main imports are via **pipeline** from western Europe and **LNG imports** from various countries around the world.
- Each source of gas has a **different emissions intensity** which should be averaged to determine the **emissions intensity of Ireland's imported gas**.





2024 update: Updated to include 2022 data. Source: https://www.gov.uk/government/statistics/natural-gas-chapter-4-digest-of-united-kingdom-energy-statistics-dukes

Carbon intensity of UK gas sources (NSTA, 2023)



- Main source of data for **carbon** intensity is the **NSTA Emissions Benchmarking Study** published in 2023.
- A **weighted average** was calculated based on total volume of gas imported in order to provide a more realistic estimate of **overall emissions intensity given the variety of sources**.
- Data reported for 2022 are **carbon emissions intensity** values and therefore **only include CO_2 emissions in their calculations.**

Source: NSTA 2023 study: https://www.nstauthority.co.uk/the-move-to-net-zero/net-zero-benchmarking-and-analysis/natural-gas-carbon-footprint-analysis/#gas_footprint

Summary table – Average **carbon** intensity of UK gas

Source of UK Gas	2022 Total UK Gas Imports (MMboe)	Average CARBON Intensity ($kgCO_2/boe$)	Source of Carbon Intensity Values
UK domestic production	249.2	21	NSTA benchmarking study (2023)
Pipeline imports (Europe)	200.3	8	NSTA benchmarking study (2023)
LNG imports (Worldwide)	163.5	78	NSTA benchmarking study (2023)
TOTAL	**613**	**32**	**Weighted average of all sources**

- The previous study in 2023 calculated a weighted average emissions intensity of **31 $kgCO_2e/boe$**.
- It should be remembered these values are **not directly comparable** (CO_2e vs CO_2 only).
- And the difference is due to a number of factors including NSTA changing from reporting CO_2e to CO_2 only in their most recent study, changes to the volumes of LNG imported from various countries, and changes to the reported emissions/carbon intensity of gas from certain countries.

See Notes section below for data sources

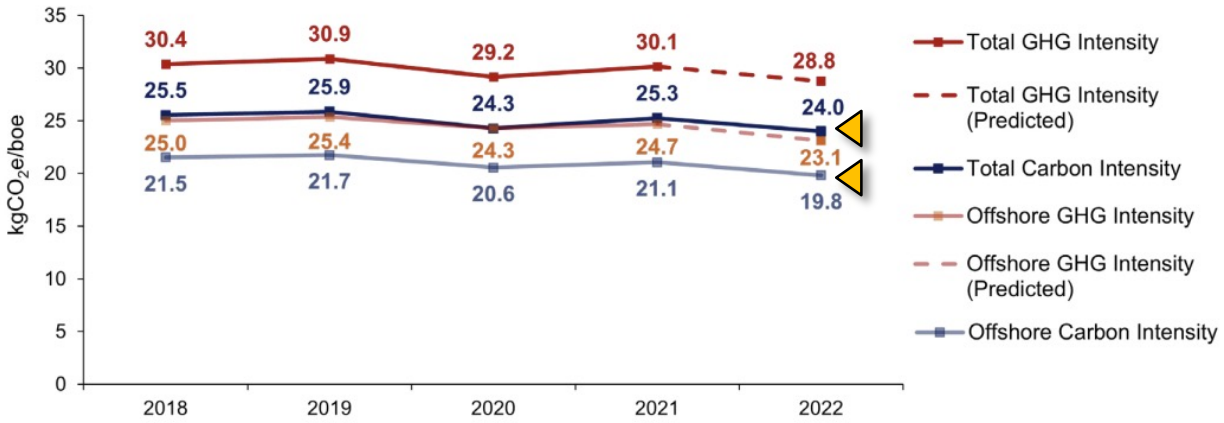
Average carbon intensity of imported gas into Ireland – Compression and transport

- Additionally, **compression** of the gas will be required when **exported from UK to Ireland**, which will require additional power and, hence additional emissions.
- The NSTA Emissions Monitoring report (published in 2023) predicts in 2022 **onshore terminals** had a **carbon** intensity of **4.2 $kgCO_2$/boe**.
- Therefore, it has been assumed that an **additional 4 $kgCO_2$/boe** is incurred when gas is **exported from UK to Ireland**.

Therefore, total average carbon intensity of UK gas imported into Ireland estimated: 36 $kgCO_2$/boe

Figure 26: Offshore and total (offshore plus terminals) industry carbon and GHG intensity, 2018–2022

(sources: NAEI, NSTA, EU ETS, UK ETS)



Note:
Onshore terminal carbon emissions are calculated as the difference between **Offshore Carbon Intensity** and **Total Carbon Intensity**

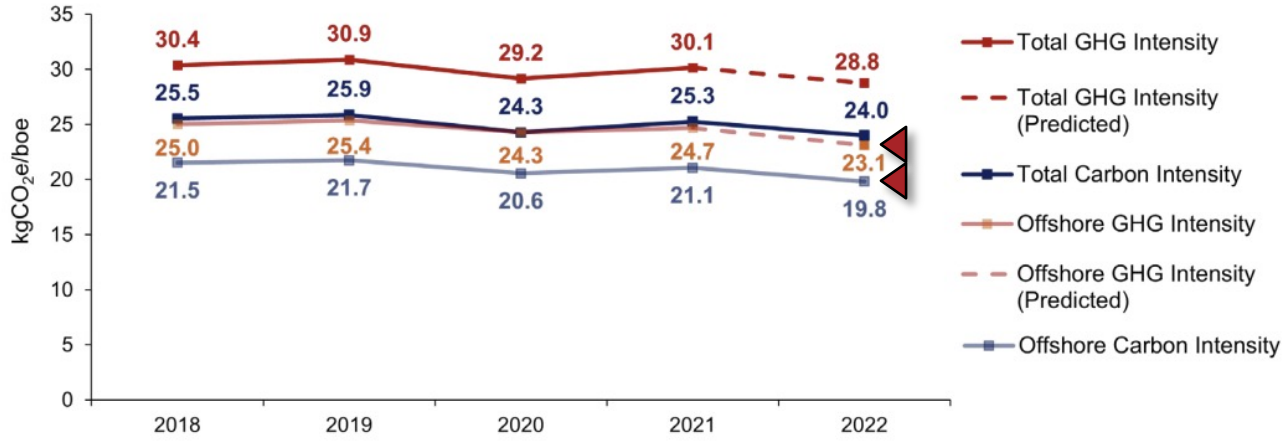
Source: https://www.nstauthority.co.uk/news-publications/emissions-monitoring-report-2023/

Difference between **carbon** & **emissions** intensity - Note

- The data is not available to provide a high-confidence **conversion** from **carbon** intensity only to **emissions** intensity (**CO_2 to CO_2e**).
- Analysis of UK domestic emissions reported by NSTA suggests the difference between CO_2 only and all GHGs in the North Sea is **3-4 $kgCO_2e$/boe**.
- However, countries with **higher venting emissions** and inclusion of **fugitive emissions** from LNG shipments are expected to account for **more** than 3-4 $kgCO_2e$/boe.
- Therefore, without more data, we have **not made an attempt to apply a conversion** to derive a CO_2e value.

Figure 26: Offshore and total (offshore plus terminals) industry carbon and GHG intensity, 2018–2022

(sources: NAEI, NSTA, EU ETS, UK ETS)

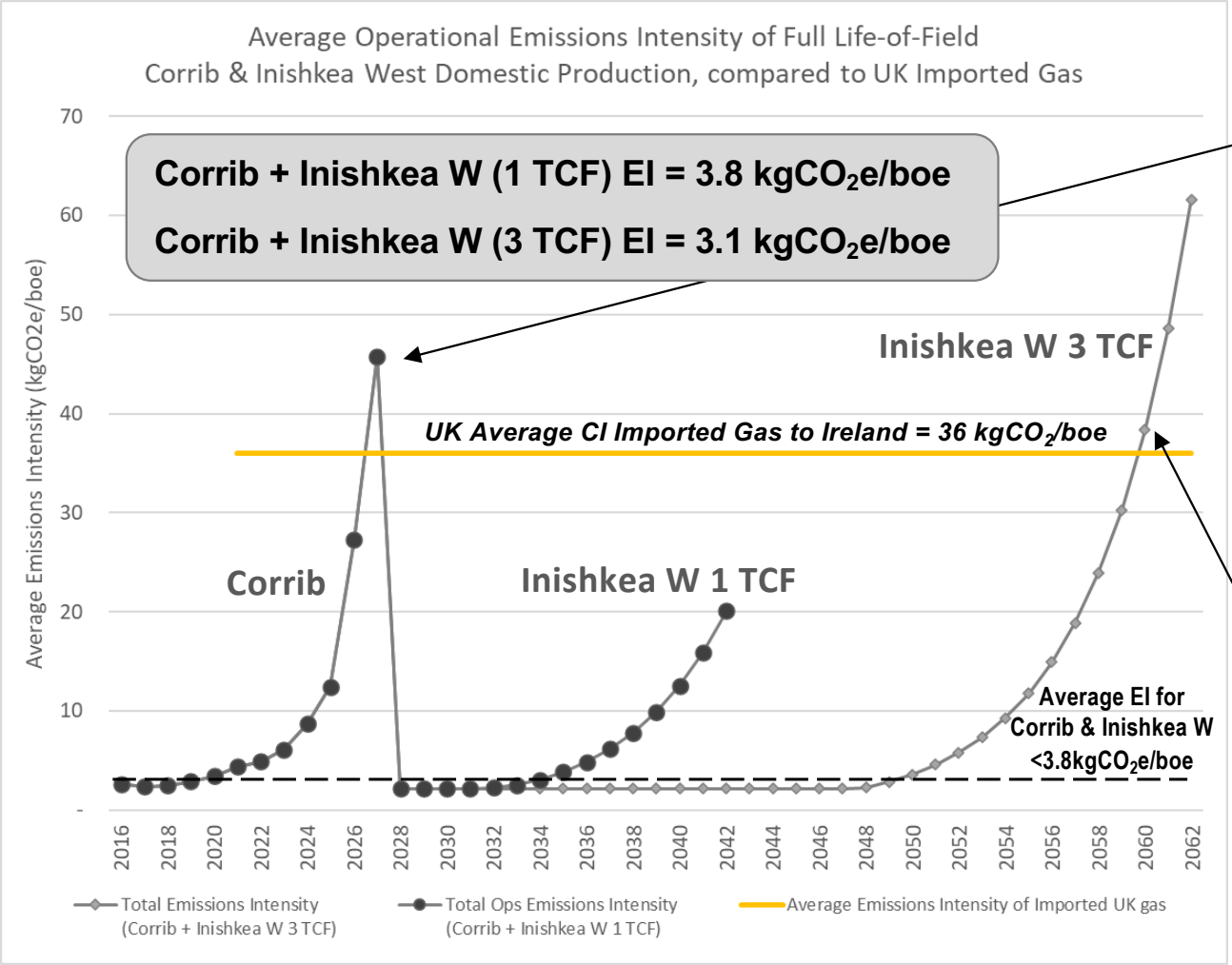


Note:
Difference between carbon & emissions intensity is calculated as the difference between **Offshore GHG Intensity** and **Offshore Carbon Intensity**

Source: https://www.nstauthority.co.uk/news-publications/emissions-monitoring-report-2023/

3. Corrib & Inishkea West Emissions Intensity Comparison to Imported Gas

Emissions intensity comparison of domestic & imported gas



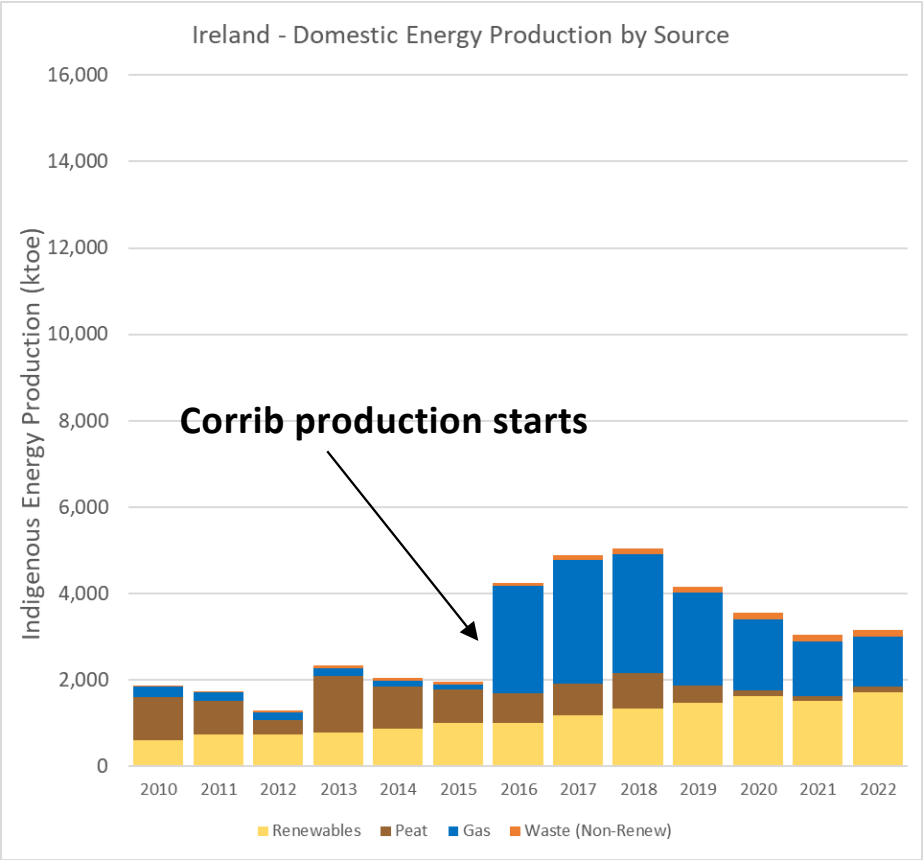
2024 update: Updated Corrib actual emissions for 2022, projected Corrib emissions changed to remain stable; Updated timing of Inishkea West to start production in 2028 (was previously 2027)

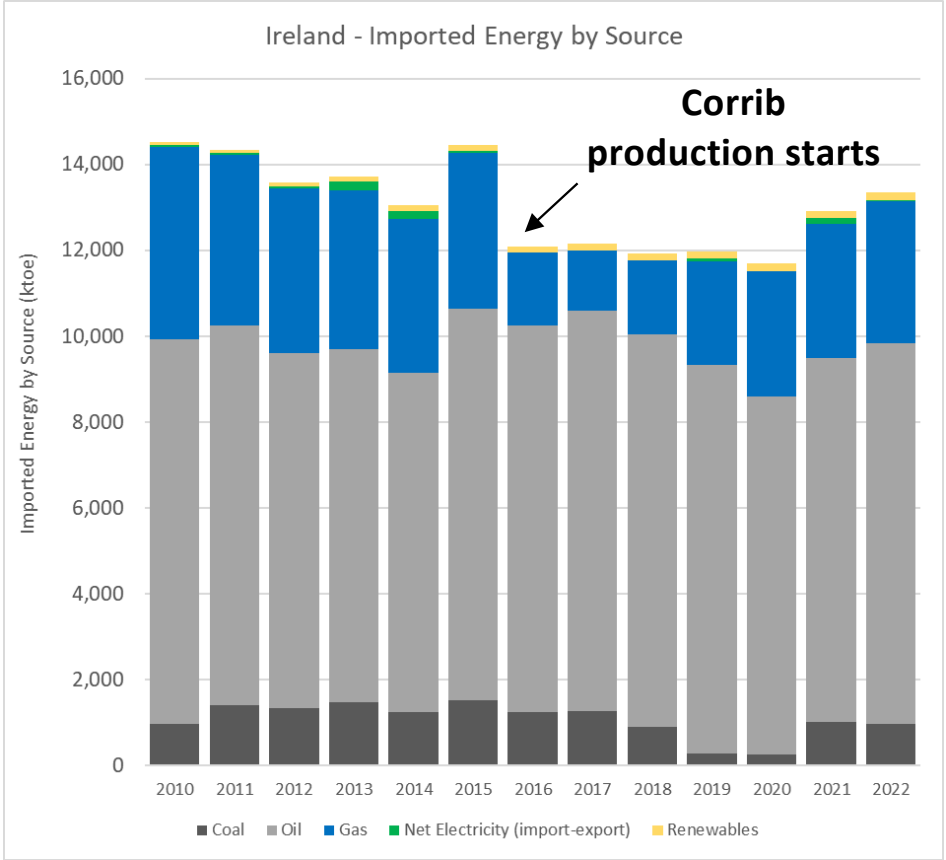
- Prior to Inishkea West coming online, estimated operational emissions for Corrib may be higher than the UK average emissions intensity for imported gas* at the end of the field's life.
- Once Inishkea West starts production, emissions intensity for **Corrib and Inishkea West in the 1 TCF scenario is predicted to be less than the intensity of imported gas from UK***.
- Late-life emissions intensity in **Corrib** and **Inishkea West 3 TCF scenario** will potentially **exceed the emissions intensity of UK imported gas** at the end of field life.

** Assumes **UK average emissions intensity remains unchanged** in the future.*

Ireland Domestic & Imported Energy – Historic trend

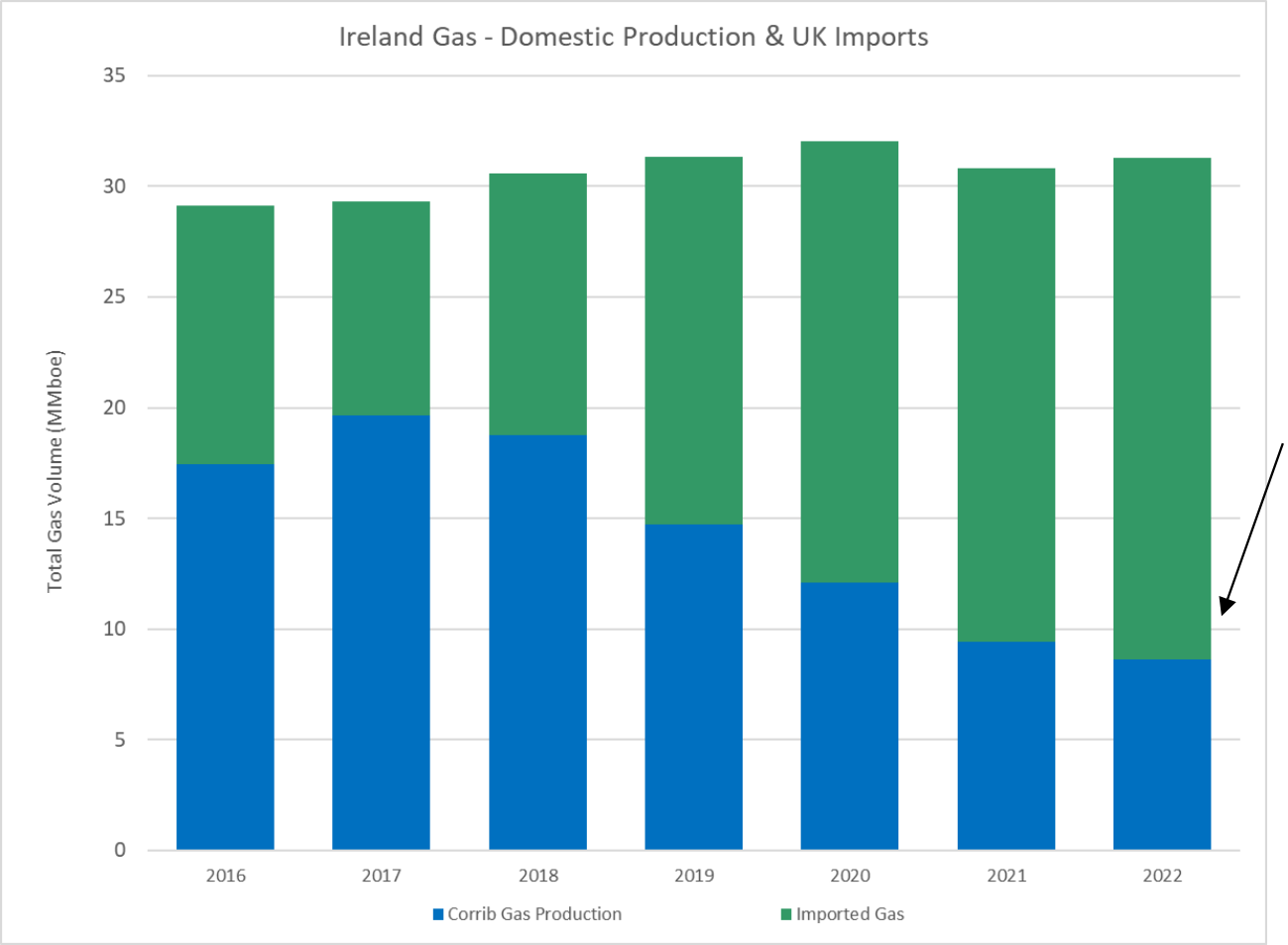
In 2022 Ireland **produced 1,165 ktoe** (~ 8 MMboe or 47.8 bcf) of gas
In 2022 Ireland **imported 3,306 ktoe** (~ 22.6 MMboe or 135.8 bcf) of gas





2024 update: Updated 2022 data; Source: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.seai.ie%2Fpublications%2FPrevious-Energy-Balances.xlsx&wdOrigin=BROWSELINK

Ireland Domestic & Imported Energy – Historic trend



Just focussing on gas:

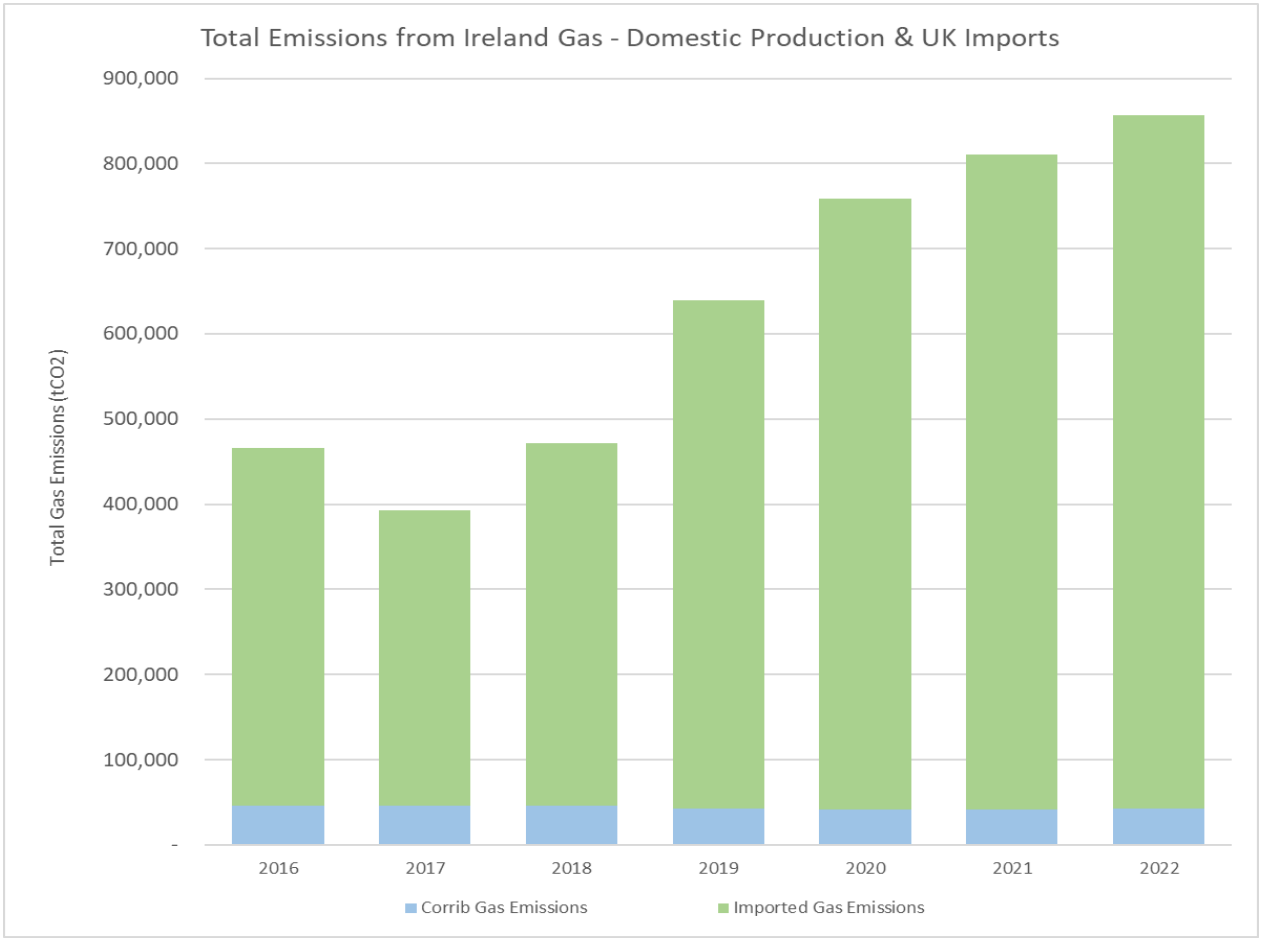
Total gas demand remained **fairly stable** between 2018 and 2022 at ca. 31 MMboe (~186 bcf) per year.

As **Corrib production declines**, **imported gas** volumes from UK have **increased** to meet demand.

In 2022 **Corrib contributed 28%** of Ireland's gas needs, compared to **61% in 2018** at the peak of production.

2024 update: Updated Corrib production from Gas Networks Ireland, source: https://www.gasnetworks.ie/corporate/gas-regulation/transparency-and-publicat/dashboard-reporting/entry-flows/physical-flows/ ; SEAI 2022 National Energy Balance https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.seai.ie%2Fpublications%2FPrevious-Energy-Balances.xlsx&wdOrigin=BROWSELINK

Emissions from Ireland Domestic & Imported Gas - 2022



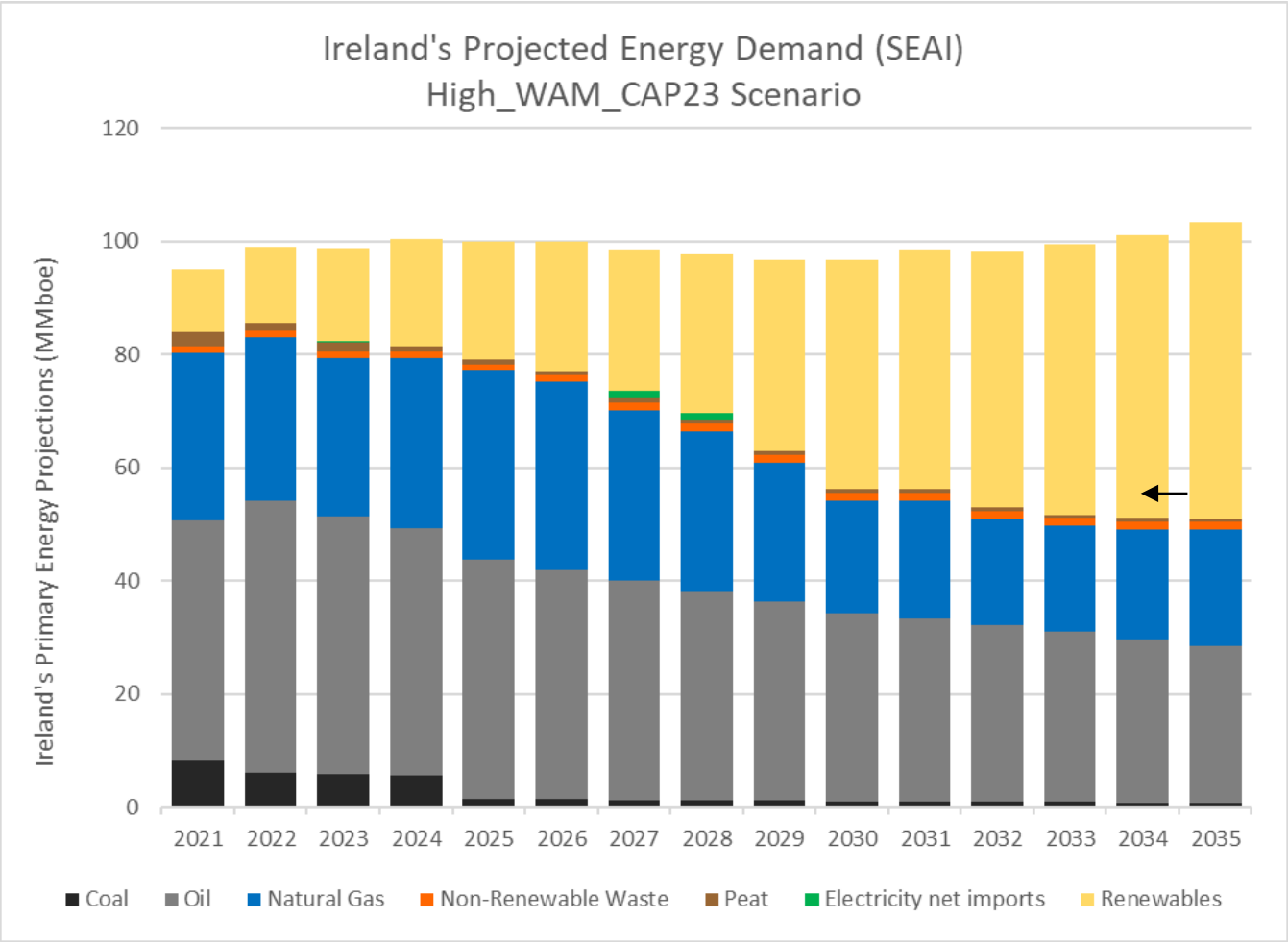
Due to the higher **carbon** intensity of gas imported from UK (**36 $kgCO_2/boe$**), the **emissions impact of increasing gas imports is greater than increasing domestic production**.

Corrib has a lower forecasted emissions intensity than imported gas up to and including 2027 (**between 6 and 25 $kgCO_2e/boe$**). However, after 2027, Corrib's emissions intensity will increase to between 36 and 74 $kgCO_2e/boe$.

In 2022, **Corrib accounted for 28% of Ireland's gas supply, but just 5% of total emissions associated with gas demand**

2024 update: Updated Corrib production from Gas Networks Ireland, source: https://www.gasnetworks.ie/corporate/gas-regulation/transparency-and-publicat/dashboard-reporting/entry-flows/physical-flows/

Projected Energy Demand for Ireland – Ambitious Scenario
All energy sources



Ambitious projected energy demand published by SEAI for period 2021 – 2035 (High_WAM_CAP2023).

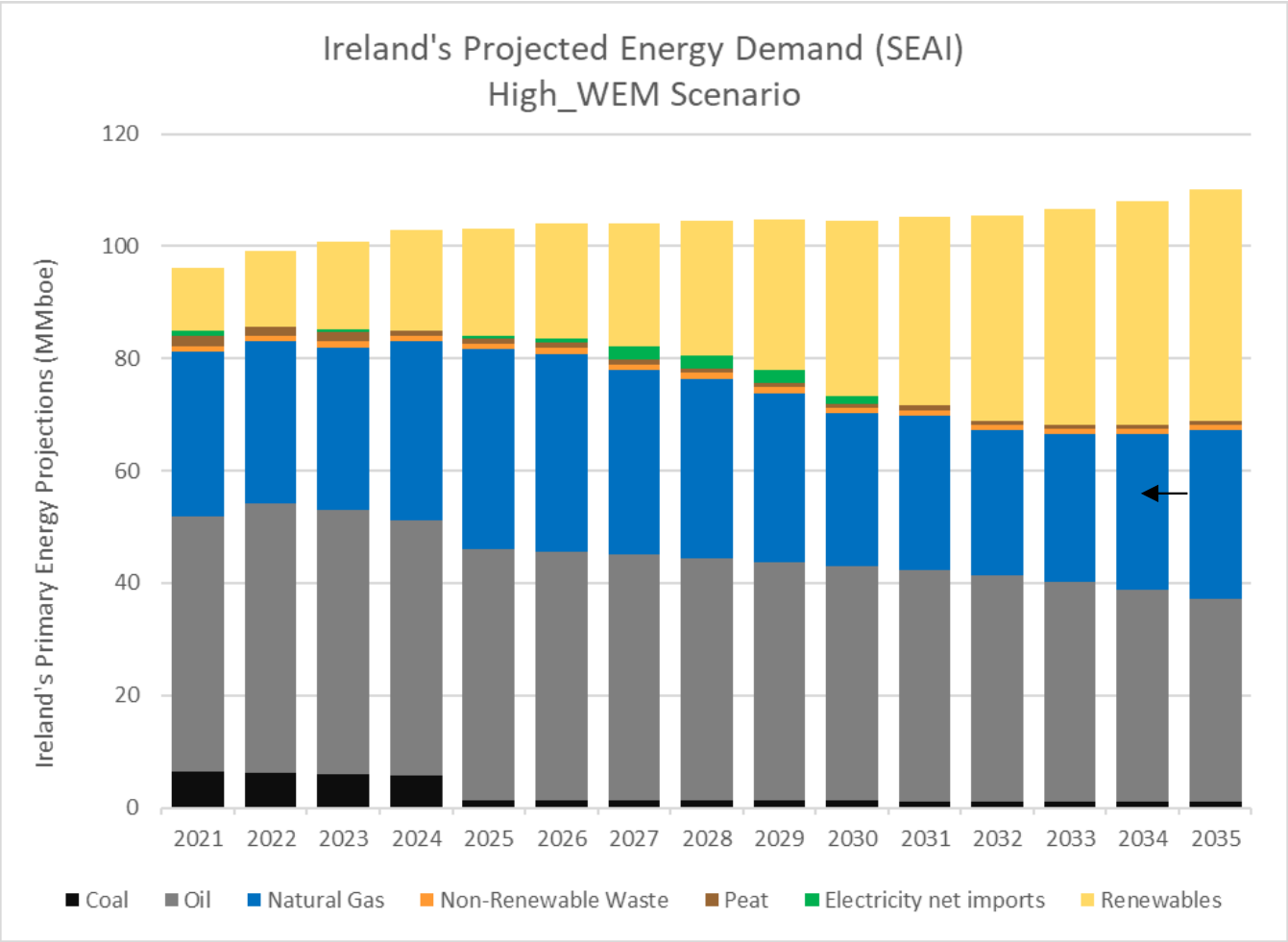
This has been updated since last year, with both a lower total energy demand through to 2030 and also a significant reduction in projected oil demand from 2025 (>10% reduction) and a reduction in gas demand from 2029 onwards compared to the 2021 projections.

Renewable energy also saw an increase in projected demand from 2025 onwards compared to previous projections.

Gas demand predicted to peak at ca. **33 MMboe** in approx. 2025/26 and then **decline to ~20 MMboe a year** through to 2035.

2024 update: Updated projections included from SEAI, source: https://www.seai.ie/data-and-insights/seai-statistics/energy-data/

Projected Energy Demand for Ireland – Current Actions
All energy sources



Current actions projected energy demand published by SEAI for period 2021 – 2030 (High_WEM).

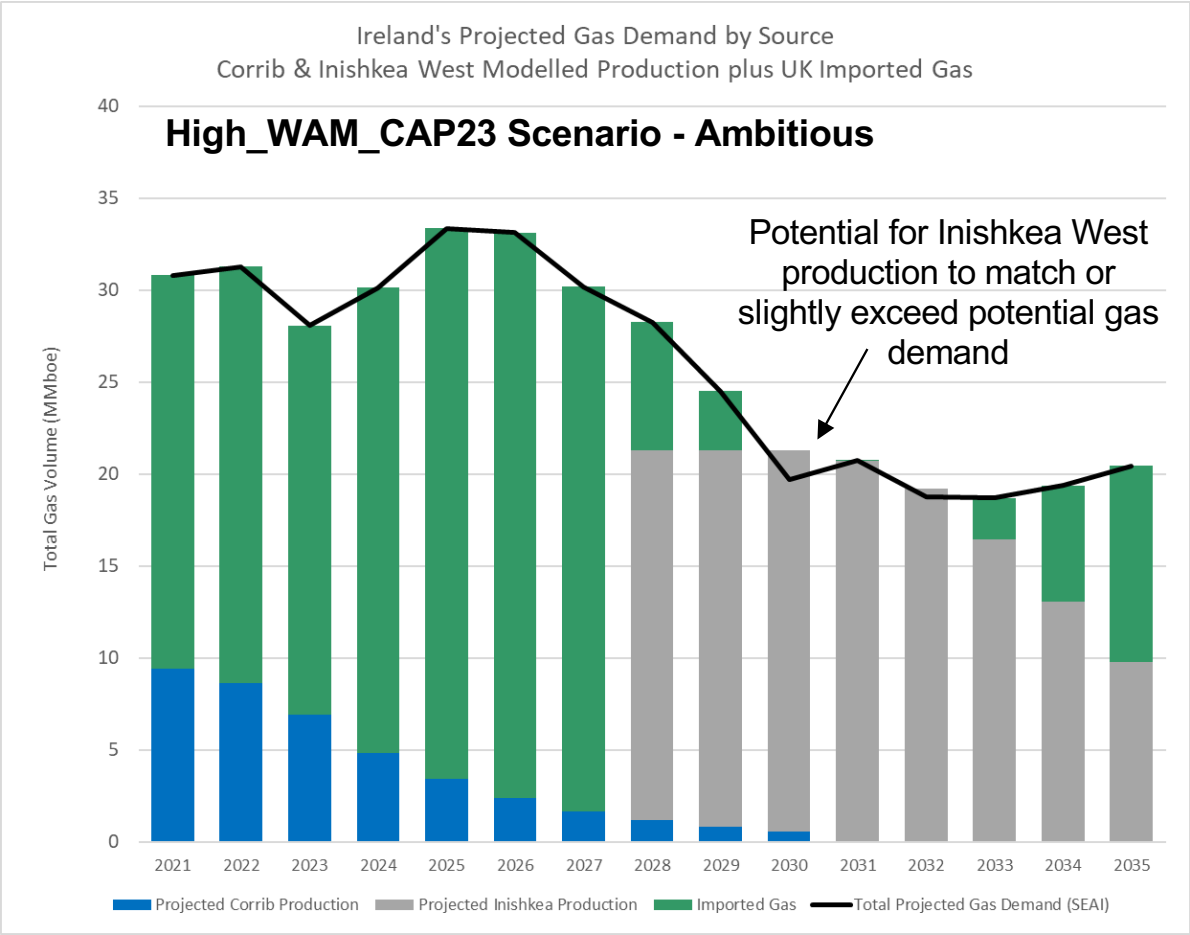
This has been updated since last year, with both a lower total energy demand through to 2030 and also a significant reduction in projected oil demand from 2025 (>10% reduction) and a reduction in gas demand from 2029 onwards compared to the 2021 projections.

Renewable energy also saw an increase in projected demand from 2025 onwards compared to previous projections.

Gas demand predicted to peak at ca. **35 MMboe** in approx. 2025/26 and then **decline slightly to ~26 MMboe in 2032** before **rising again to 30 MMboe** through to 2035.

2024 update: Updated projections included from SEAI, source: https://www.seai.ie/data-and-insights/seai-statistics/energy-data/

Ireland Projected Gas Demand – Comparison to Corrib & Inishkea West



Actual gas produced and imported for **2021 and 2022.**

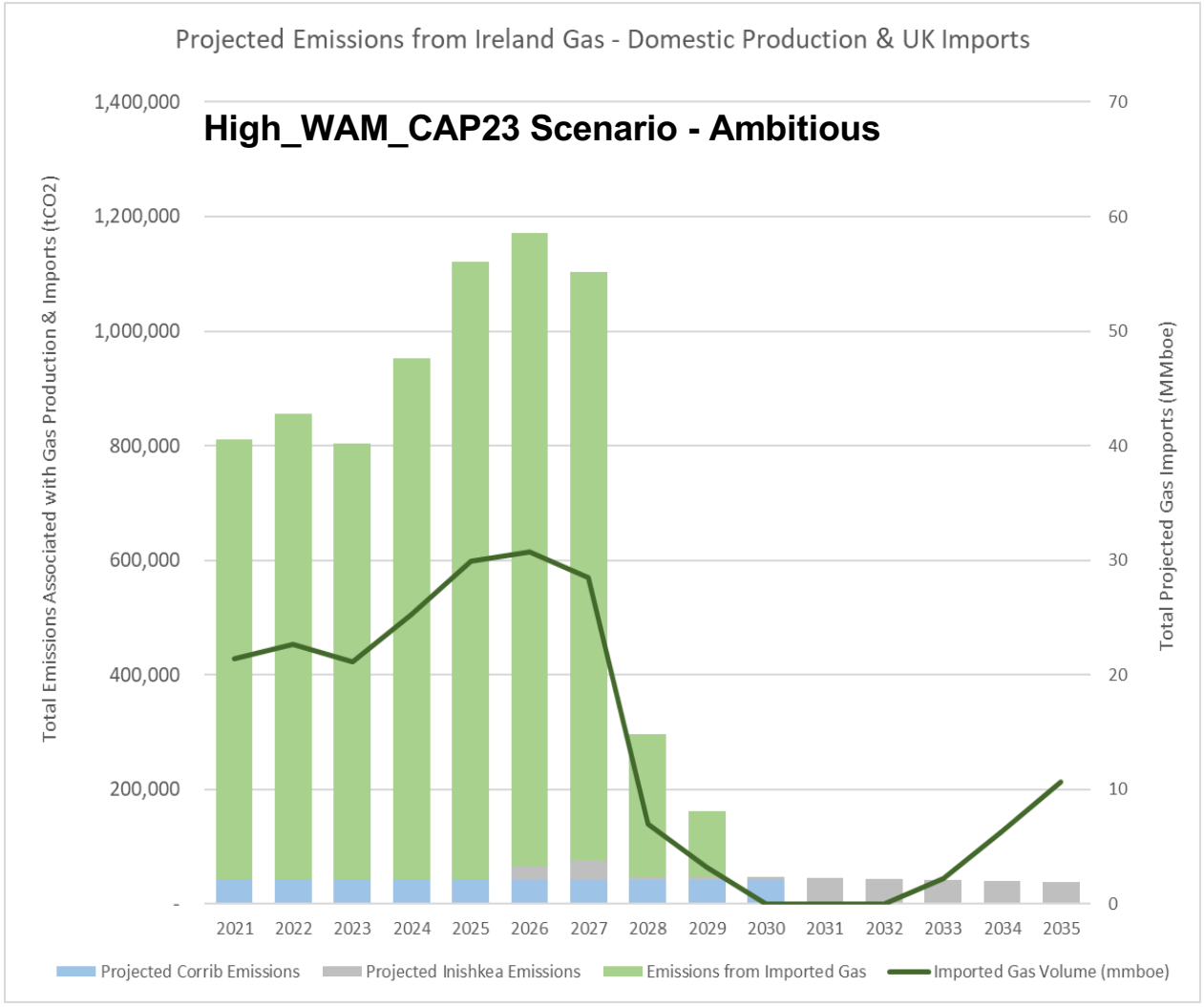
Ambitious projected energy demand published by SEAI for 2023 – 2035 (High_WAM_CAP23 Scenario).

Production from **Inishkea West could reduce Ireland's projected reliance on imported gas from >90%** in 2025-27 **to almost zero** in 2030-2032 as the projected gas demand has reduced due to an increase in planned renewable energy and reduction in overall expected demand.

Contribution by **Corrib & Inishkea West based on modelled scenarios** shown on previous slides (Inishkea West 1 TCF scenario).

2024 update: Updated projections included from SEAI, source: https://www.seai.ie/data-and-insights/seai-statistics/energy-data/ ; Updated Corrib production from Gas Networks Ireland, source: https://www.gasnetworks.ie/corporate/gas-regulation/transparency-and-publicat/dashboard-reporting/entry-flows/physical-flows/

Ireland Projected Emissions – Comparison to Corrib & Inishkea West



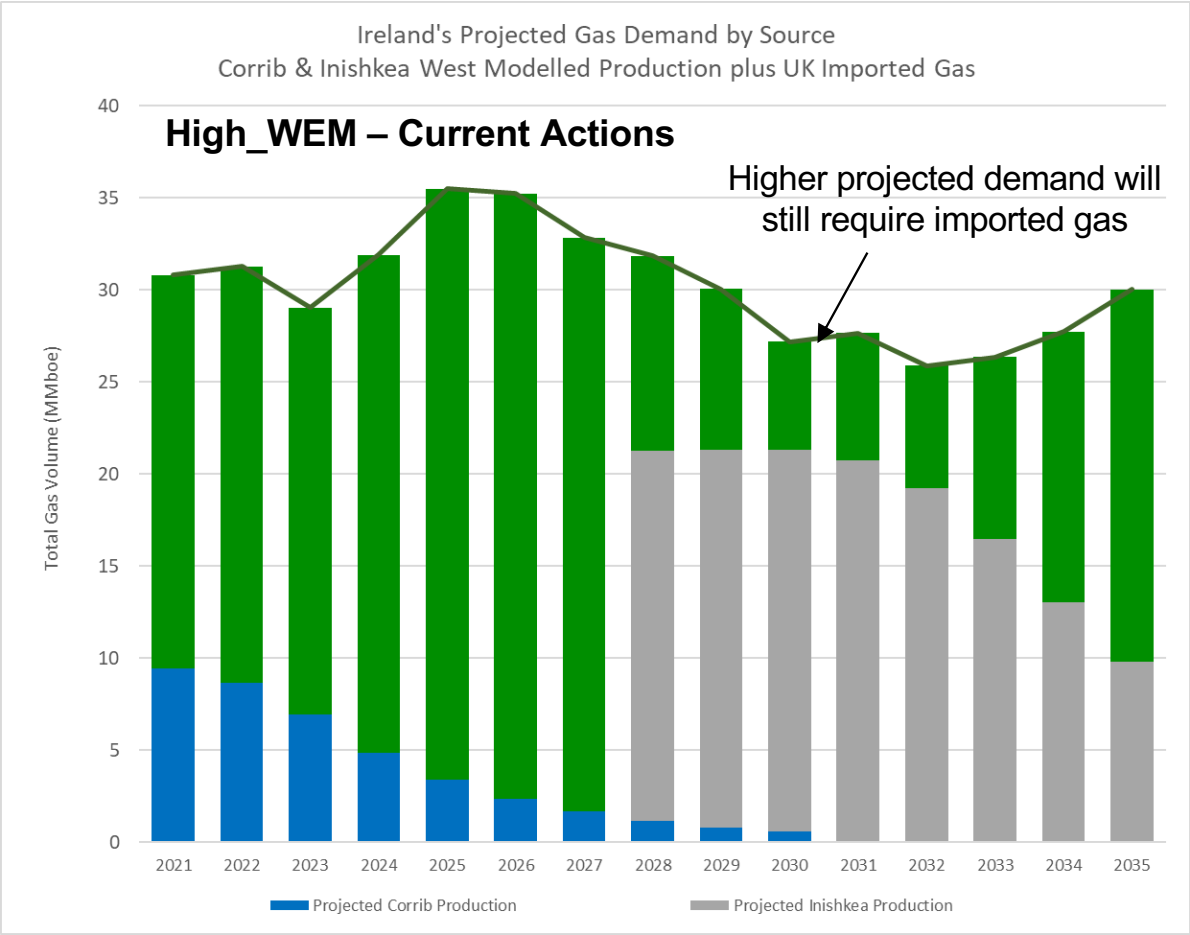
Projected emissions of domestic and imported gas calculated from demand data published by SEAI (Ambitious scenario High-WAM-CAP23).

Projected production from Inishkea West has the potential to eliminate the need for gas imports from the UK in 2030-32 and therefore dramatically reduce associated emissions.

Contribution by **Corrib & Inishkea West based on modelled scenarios** shown on previous slides (Inishkea W 1 TCF scenario).

2024 update: Updated Corrib emissions for 2022; Updated Corrib production for 2022 and 2023; Updated UK imported gas carbon intensity.

Ireland Projected Gas Demand – Comparison to Corrib & Inishkea West



Actual gas produced and imported for **2021 and 2022.**

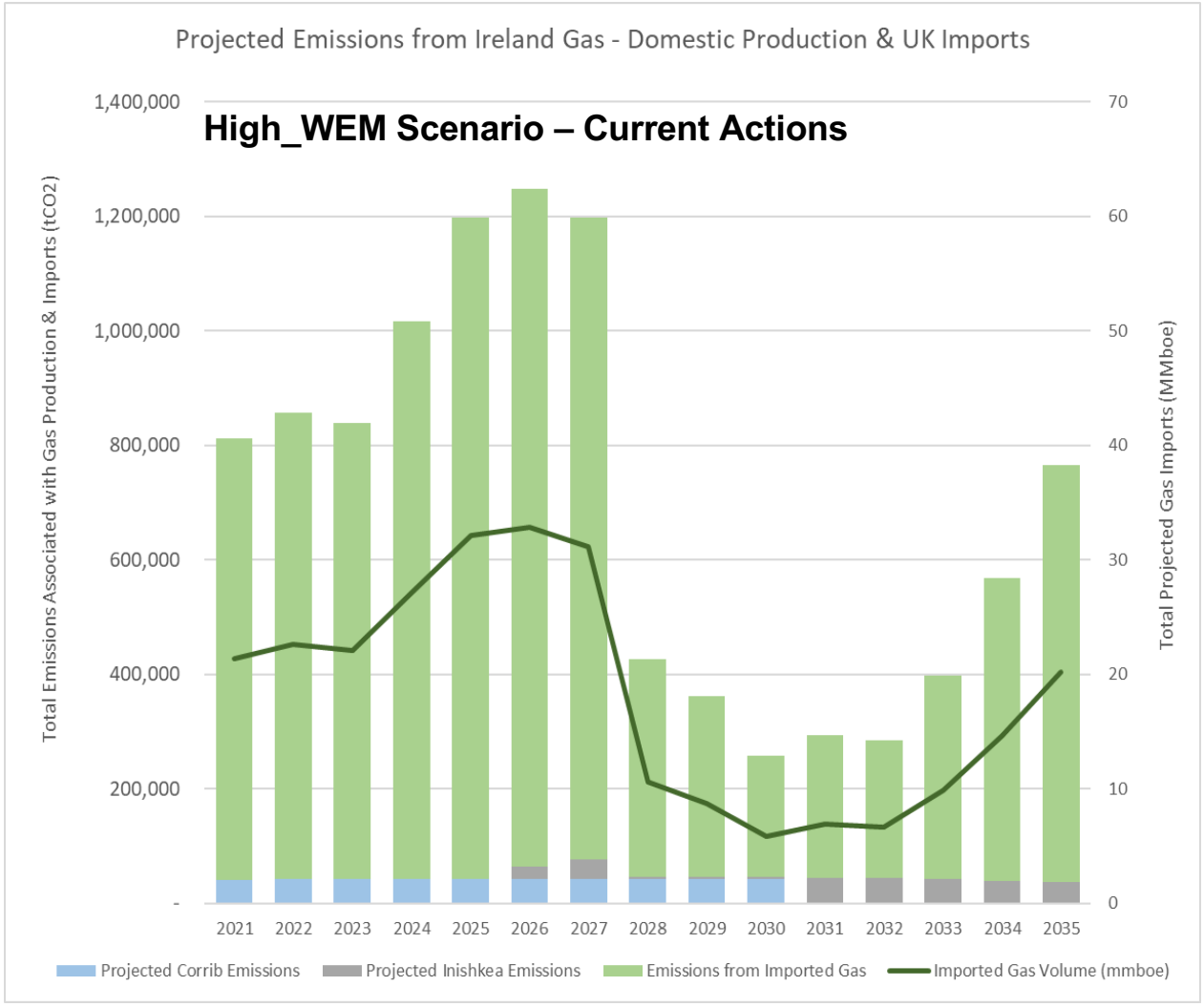
Projected energy demand based on current actions already in place predicts higher demand compared to the previous scenario (published by SEAI for 2023 – 2035, High_WEM Scenario).

In this scenario, production from **Inishkea West could reduce Ireland's projected reliance on imported gas from >90%** in 2025-27 **to ~25%** in 2030-2032.

Contribution by **Corrib & Inishkea West based on modelled scenarios** shown on previous slides (Inishkea West 1 TCF scenario).

2024 update: Updated projections included from SEAI, source: https://www.seai.ie/data-and-insights/seai-statistics/energy-data/ ; Updated Corrib production from Gas Networks Ireland, source: https://www.gasnetworks.ie/corporate/gas-regulation/transparency-and-publicat/dashboard-reporting/entry-flows/physical-flows/

Ireland Projected Emissions – Comparison to Corrib & Inishkea West



Projected emissions of domestic and imported gas calculated from demand data published by SEAI (Current actions scenario High-WEM).

Projected production from Inishkea West will reduce the volumes of gas imports from the UK and therefore dramatically reduce associated emissions.

Contribution by **Corrib & Inishkea West based on modelled scenarios** shown on previous slides (Inishkea W 1 TCF scenario).

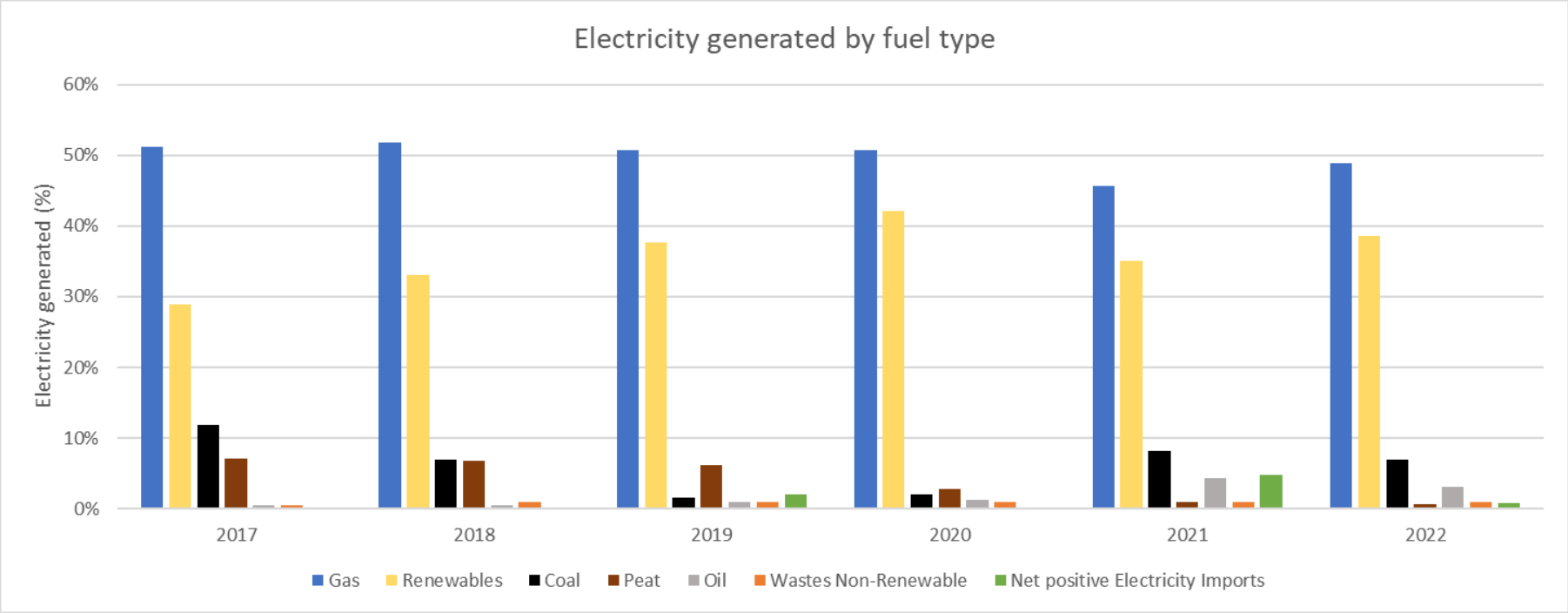
2024 update: Updated Corrib emissions for 2022; Updated Corrib production for 2022 and 2023; Updated UK imported gas carbon intensity.

4. Ireland’s Electricity Grid Mix

Ireland's Electricity Grid Mix – Historical Trend

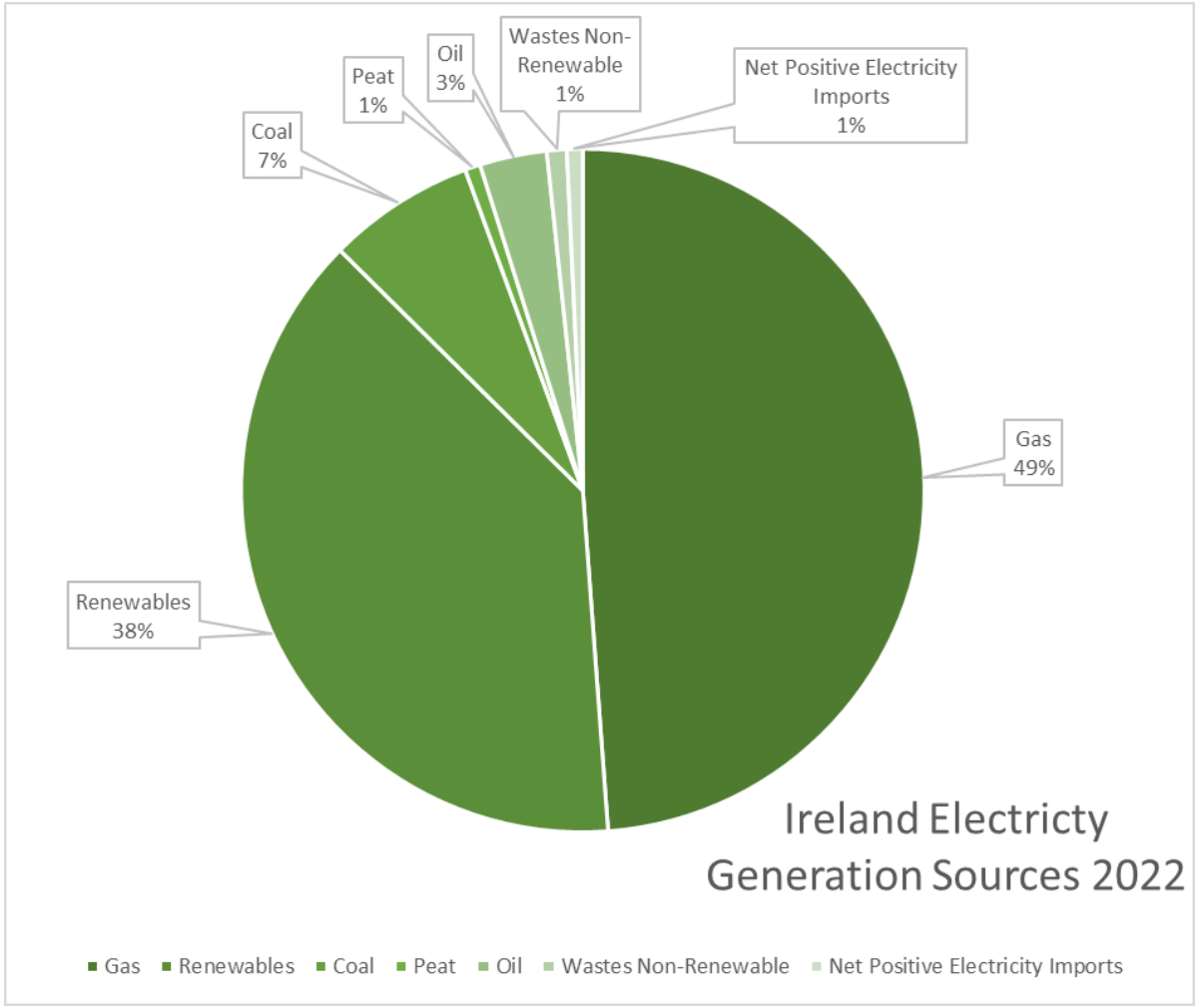
Ireland uses a **mix of fuel sources** for electricity generation including **Gas**, **Renewable Energy**, **Coal**, **Peat**, **Oil** and **Non-renewable wastes**.

Between 2017 and 2022, **Gas** and **Renewable Energy** generated on average **86% of the electricity** supplied to Ireland's Grid.



2024 update: 2017 - 2022 data taken from Electricity Data published online by SEAI: https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/electricity/

Ireland's Electricity Grid Mix – Historical Trend



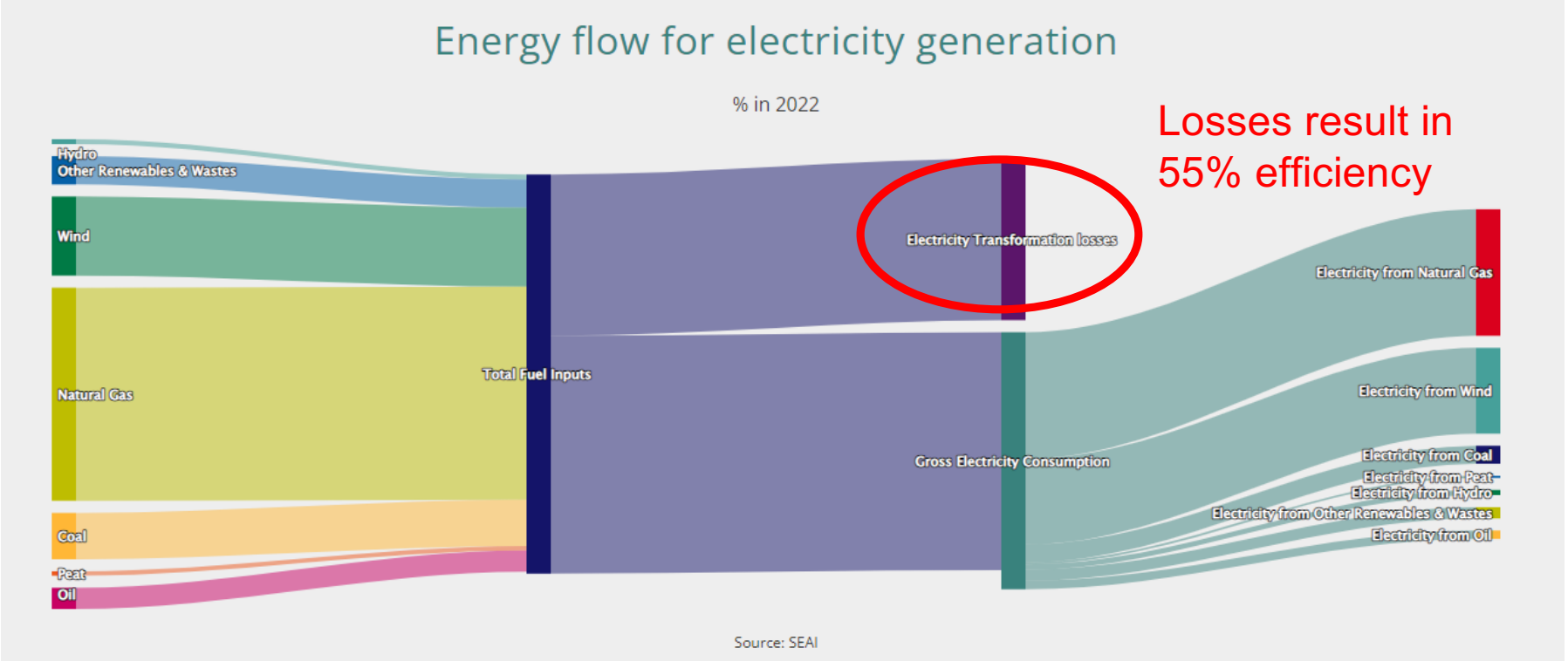
In **2022 Gas** and **Renewable Energy** generated **87% of Ireland's electricity needs**.

The **proportion of imported gas** that contributes to Ireland's electricity grid is **increasing** over time as **production at Corrib declines**.

2024 update: 2017 - 2022 data taken from Electricity Data published online by SEAI: https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/electricity/

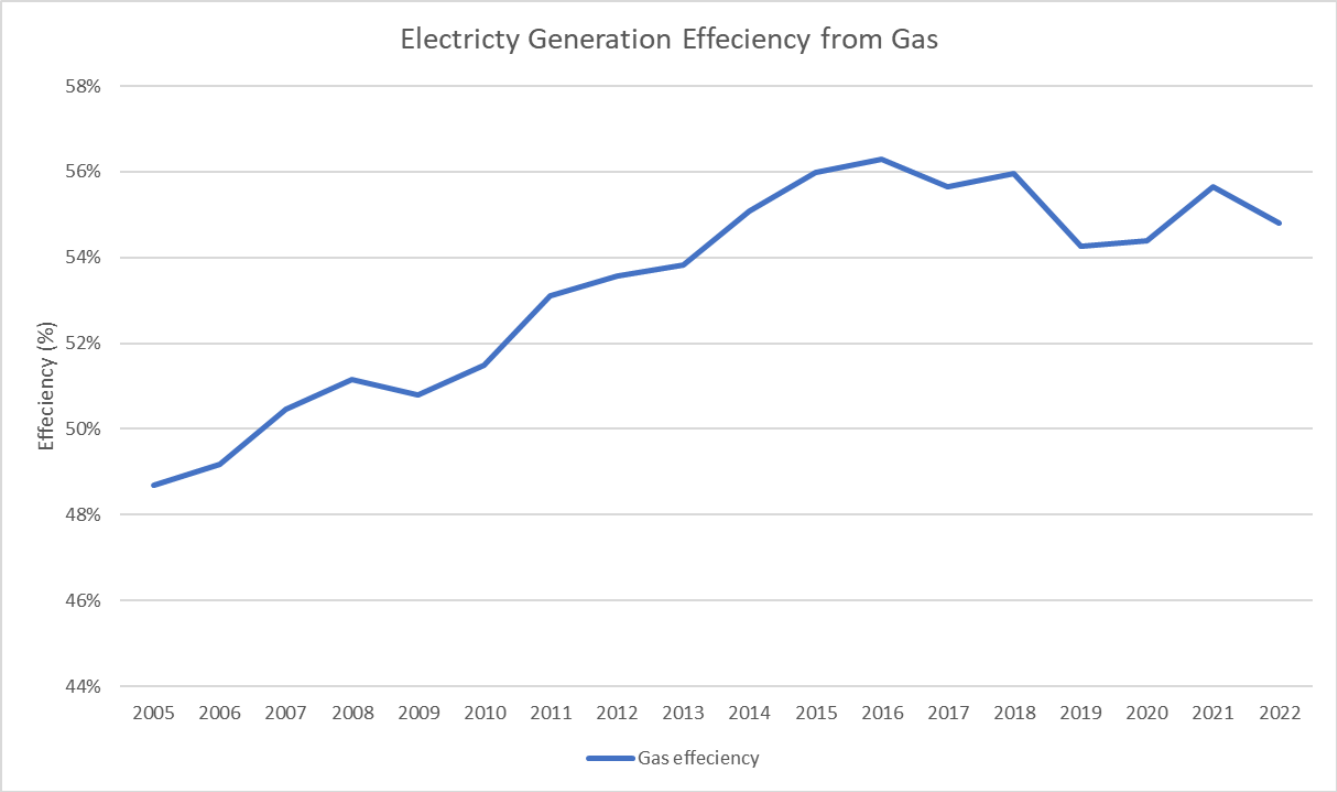
Ireland's Electricity Grid Mix – Generation Efficiency

- Depending on the type of fuel there can be a **sharp contrast** in the amount of primary input energy and the amount of energy produced as electricity.
- For electricity in 2022: 2,594 ktoe of gas was used as a **primary energy** input and 1,422 ktoe was generated from this gas as **electricity** (55% efficiency).



Source: SEAI Website https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/electricity/

Ireland's Electricity Grid Mix – Generation Efficiency



The graph on the left shows the calculated efficiency over time of using gas to produce electricity for the Irish Grid.

The Efficiency was calculated using the following formula:

$$\text{Efficiency} = \frac{\text{Gas input}}{\text{Electricity Output}}$$

Efficiency increased from 49% in 2005 to a peak of 57% in 2016.

In 2022, efficiency was 55%.

The efficiency average for the last 10 years has been 55%.

Ireland's Electricity Grid Mix – Projections to 2035

Two scenarios have been used to analyse the projected gas requirements for electricity generation in the future:

- **High-WAM-CAP23 projection model**
  - Most ambitious of the SEAI scenarios modelled.
  - Assumes all targets set out in the 2023 Climate Action Plan (CAP) for 2030 are broadly achieved.
  - **Assumes 50% of electricity from renewables by 2050, and 80% by 2030.**

- **High-WEM" projection model**
  - Reflects what would happen based only on the measures in place by the end of 2021, without any additional measures being implemented in later years.
  - 2021 Climate Action Plan is in scope, but this scenario does not assume that all targets set out in the CAP21 are met in all cases.
  - Projects level of achievement based on the actual measures in place at the end of 2021.
  - Does not take into account new policies and measures or increases in ambition set out in the 2023 Climate Action Plan (CAP23).
  - **Assumes 50% of electricity from renewables by 2050, and 70% by 2030.**

Source: https://www.seai.ie/data-and-insights/seai-statistics/energy-data/; Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Ireland's Electricity Grid Mix – Climate Action Plan 2023

- In the Irish Government's Climate Action Plan 2023 they outline their KPIs and aims for electricity generation:
  - **50%** of electricity coming from **renewable energy by 2025**
  - **80%** of electricity coming from **renewable energy by 2030**
  - A **42% reduction** in emissions by **2025** (6MtCO_2e) based upon a 2018 base year (10.1 MtCO_2e).
  - A rapid delivery of **flexible gas generation** is needed at scale and in a timeframe to **replace emissions from coal and oil generation** before the second carbon budget period (2026-2030).

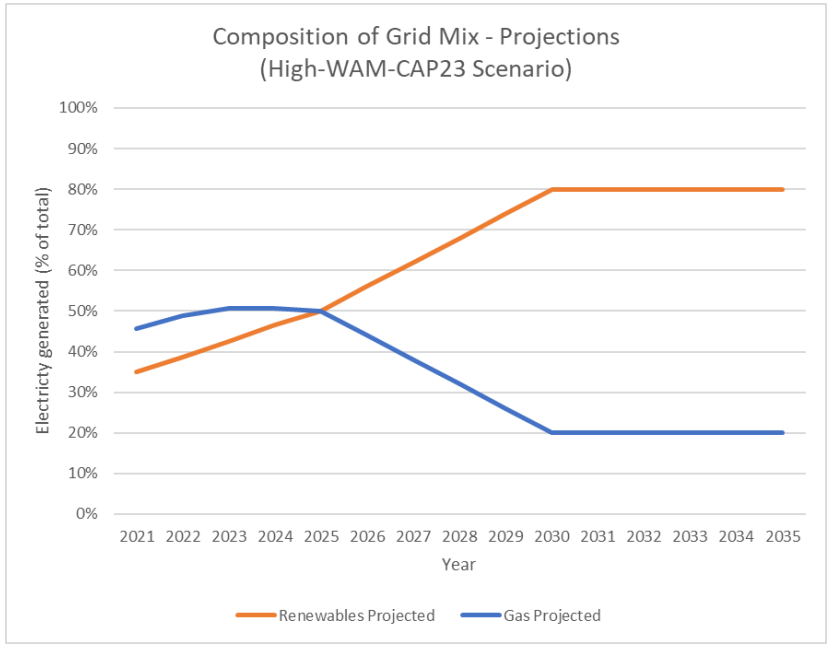
Key Targets

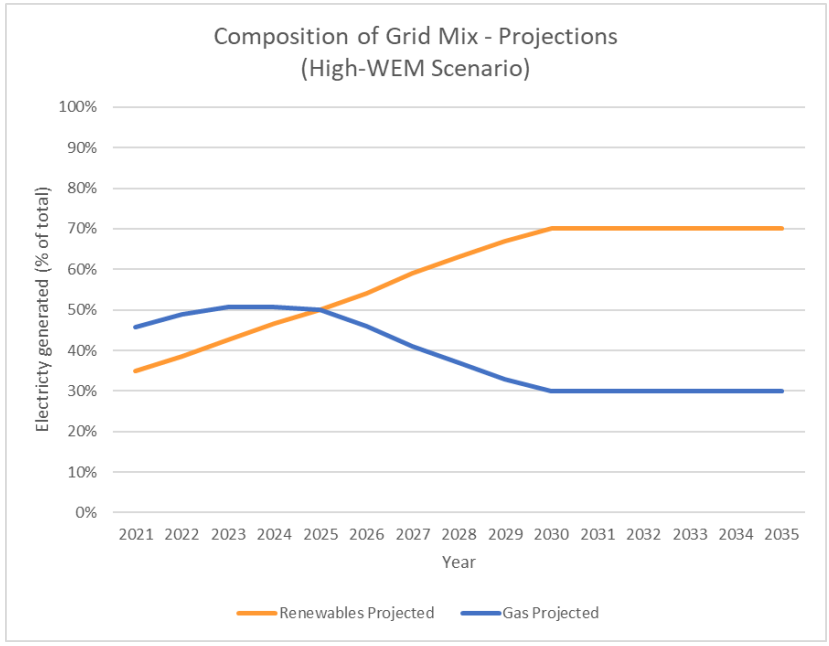
Target	2025	2030
Renewable Electricity Share	50%	80%
Onshore Wind	6 GW	9 GW
Solar	Up to 5 GW	8 GW
Offshore Wind	-	At least 5 GW
New Flexible Gas Plant	-	At least 2 GW
Demand Side Flexibility	15-20%	20-30%

Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Ireland's Electricity Grid Mix – Projections to 2035

- The graphs below suggest a **potential projection for the share of Gas and Renewable Energy** used for Ireland's electricity production.
- For the High-WAM-CAP23 model, the renewable energy trend **matches the KPIs from the Climate Action Plan**, 50% by 2025 and 80% by 2030, which is ambitious in its targets.
- The High-WEM model assumes **50% renewable energy by 2025 and 70% by 2030**, representing more modest achievements.
- The gas projection **assumes gas replacing more carbon intensive sources** such as Coal, Peat and Oil and that the efficiency of electricity generation from gas remains constant to 2035.

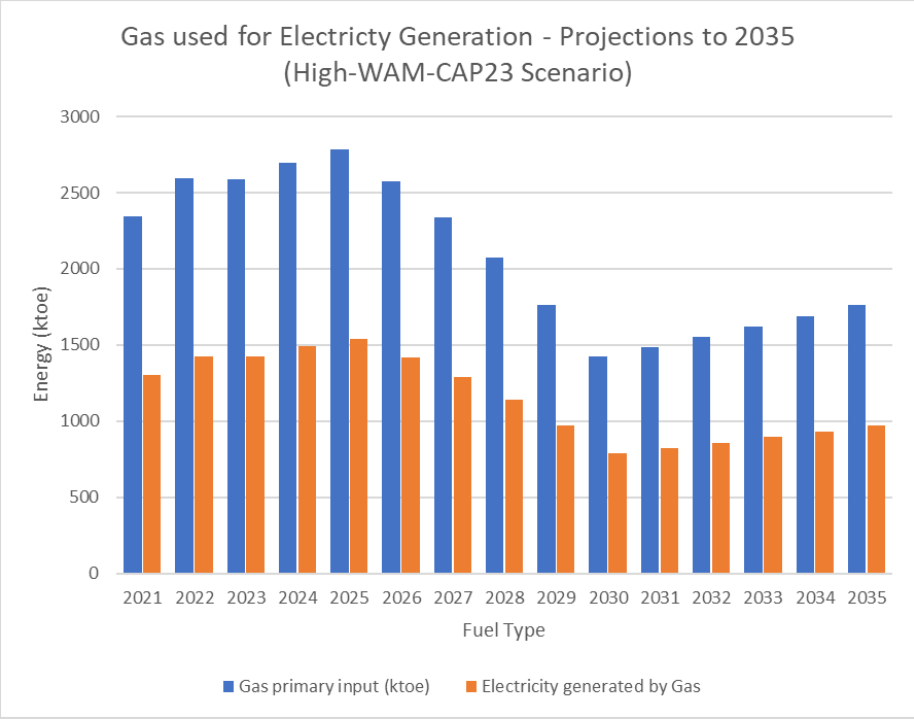


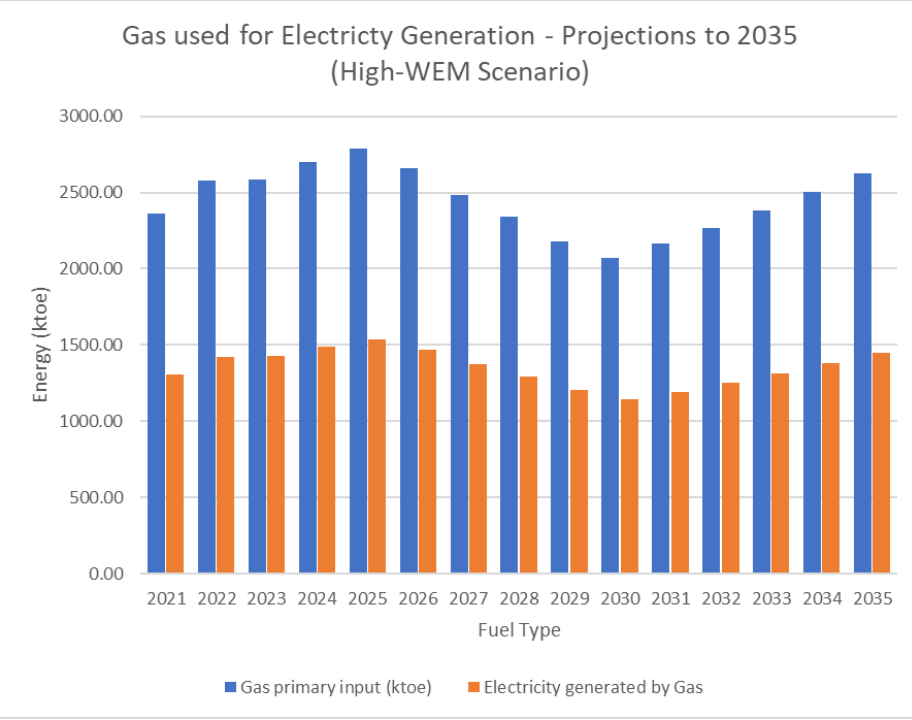


Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Ireland's Electricity Grid Mix – Projections to 2035

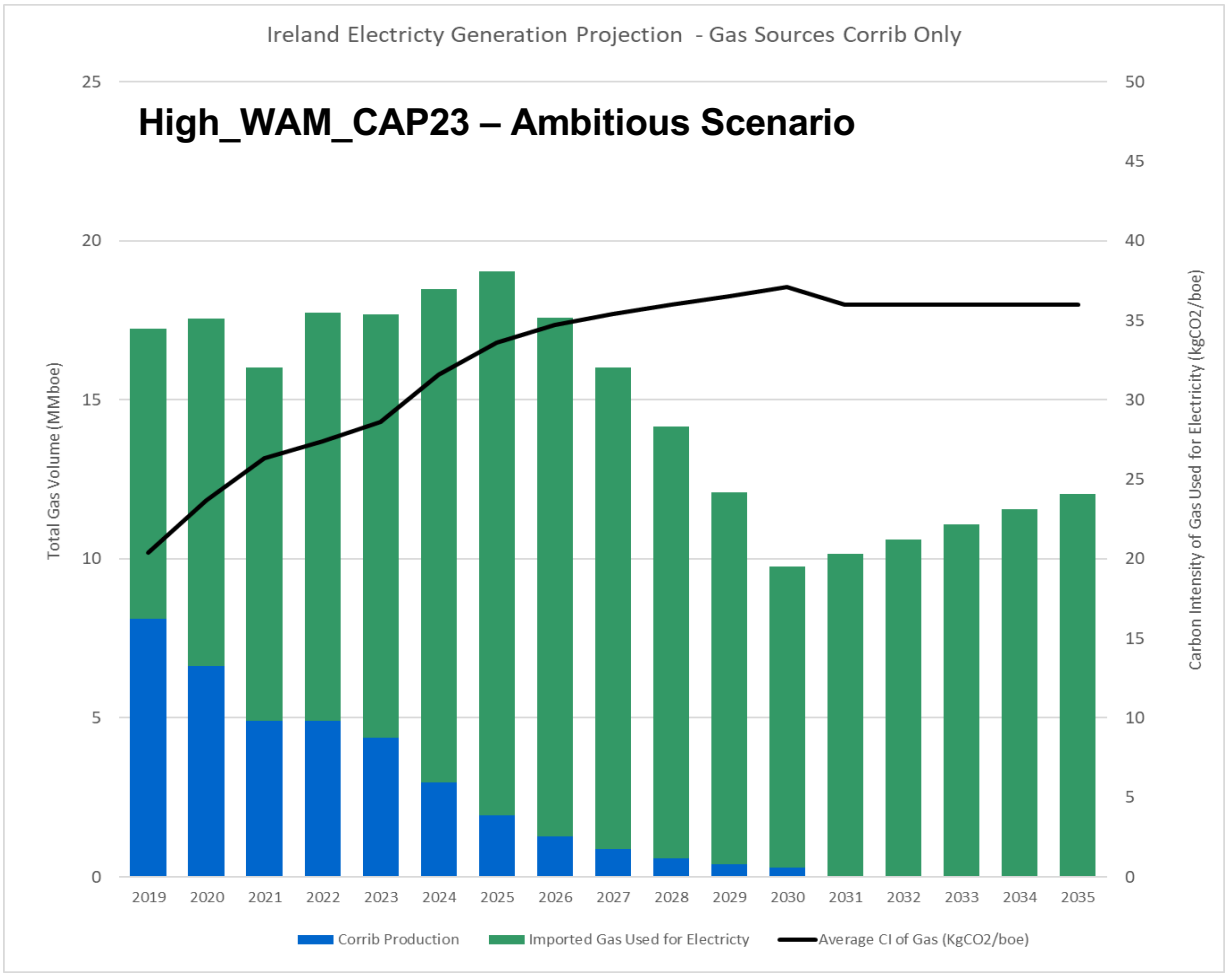
- The predictions below and in the following slides use the SEAI energy projections for the **expected electricity requirements** to 2035 based on two scenarios: (1) "High-WAM-CAP23" projection model; (2) High-WEM" projection model.
- Using an average **gas-to-electricity efficiency of 55%** and an assumption that **gas will comprise the remainder of any electricity generation not provided by renewables**, the following prediction was made.





2024 update: Updated projections included from SEAI, source: https://www.seai.ie/data-and-insights/seai-statistics/energy-data/

Ireland's Electricity Grid Mix – Projections to 2035



Assuming that in the future, Ireland's Grid uses the **same proportions** of domestically produced gas and imported gas and the 2023 Climate Action Plan **targets are met**:

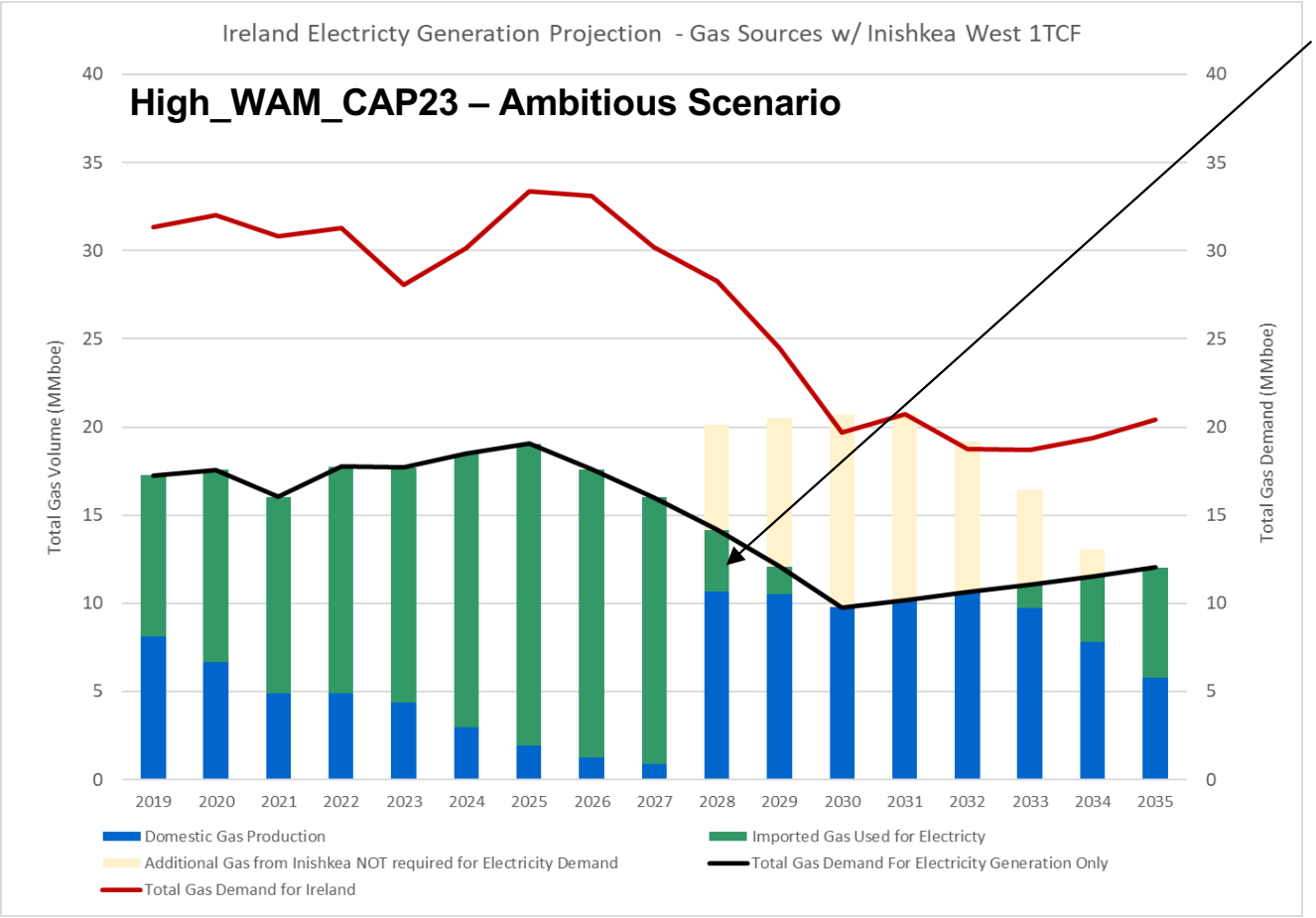
Corrib will account for **less than 10% of the gas used for electricity generation by 2025** due to declining production.

The **carbon intensity** of the gas used for electricity generation will increase year on year **from ca. 20 kgCO_2/boe in 2019** to **36 kgCO_2/boe by 2035** as the proportion of imported gas increases.

This assumes the carbon intensity of imported gas remains constant at current levels, however in reality it would be expected that the intensity would decrease over time with implementation of carbon reduction initiatives.

Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Ireland's Electricity Grid Mix – Projections to 2035



Assuming that in the future, Ireland's Grid uses the **same proportions** of domestically produced gas and imported gas and the 2023 Climate Action Plan **targets are met**:

In the Inishkea West 1 TCF scenario there is the same trend of increasing imported gas until Inishkea West starts producing in 2028.

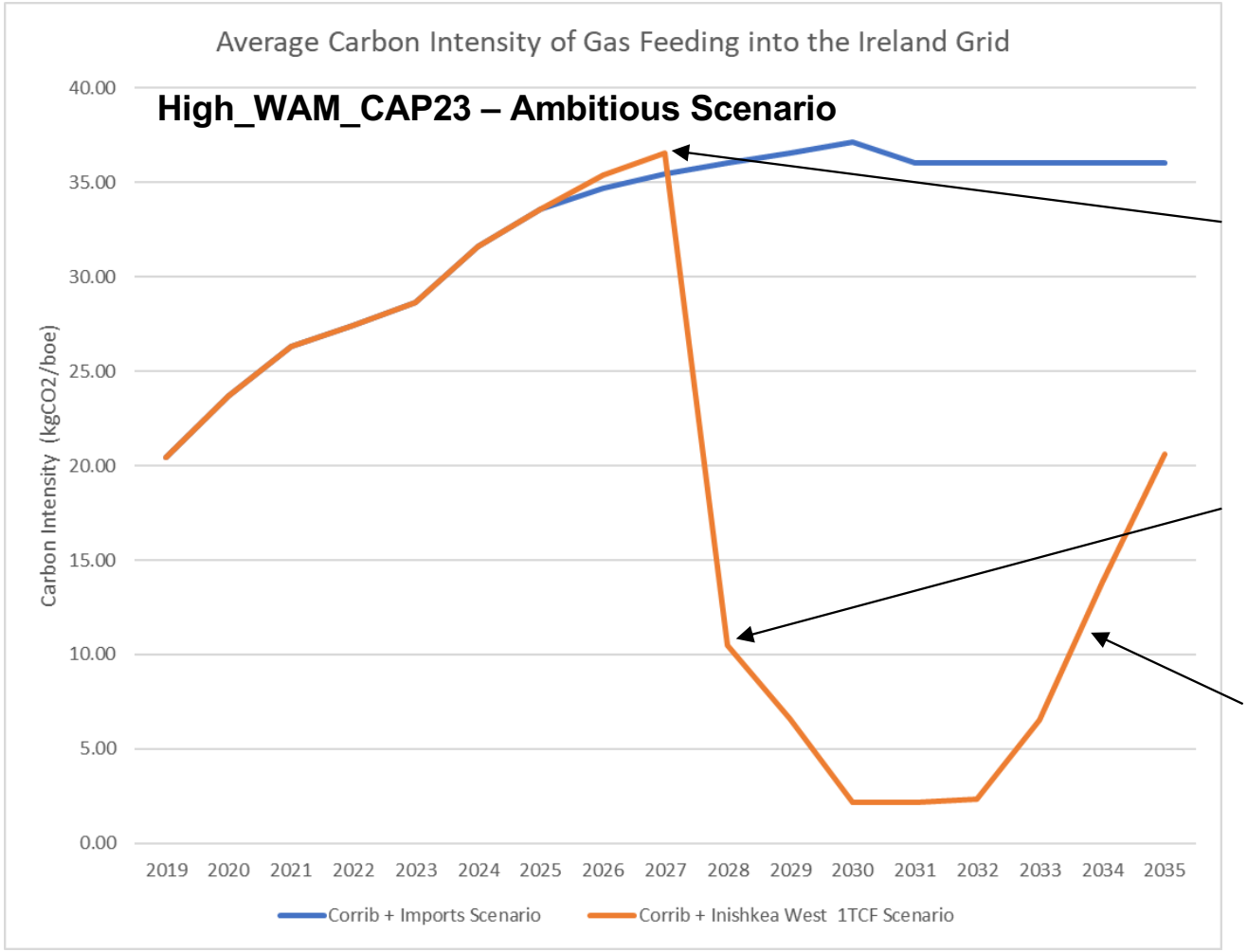
At this point the **gas used for electricity production becomes predominantly domestic gas** (75%) and the **carbon intensity drops significantly**.

Because it has been assumed that the mix of gas used for electricity (domestic vs imports) is the same as for the overall gas demand projections, **some imported gas is still assumed to be needed for electricity after Inishkea West comes online**.

Additional gas from Inishkea West could **satisfy the other demands for gas** across the Irish economy.

Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Ireland's Electricity Grid Mix – Projections to 2035



Assuming that in the future, Ireland's Grid uses the **same proportions** of domestically produced gas and imported gas and the 2023 Climate Action Plan **targets are met**:

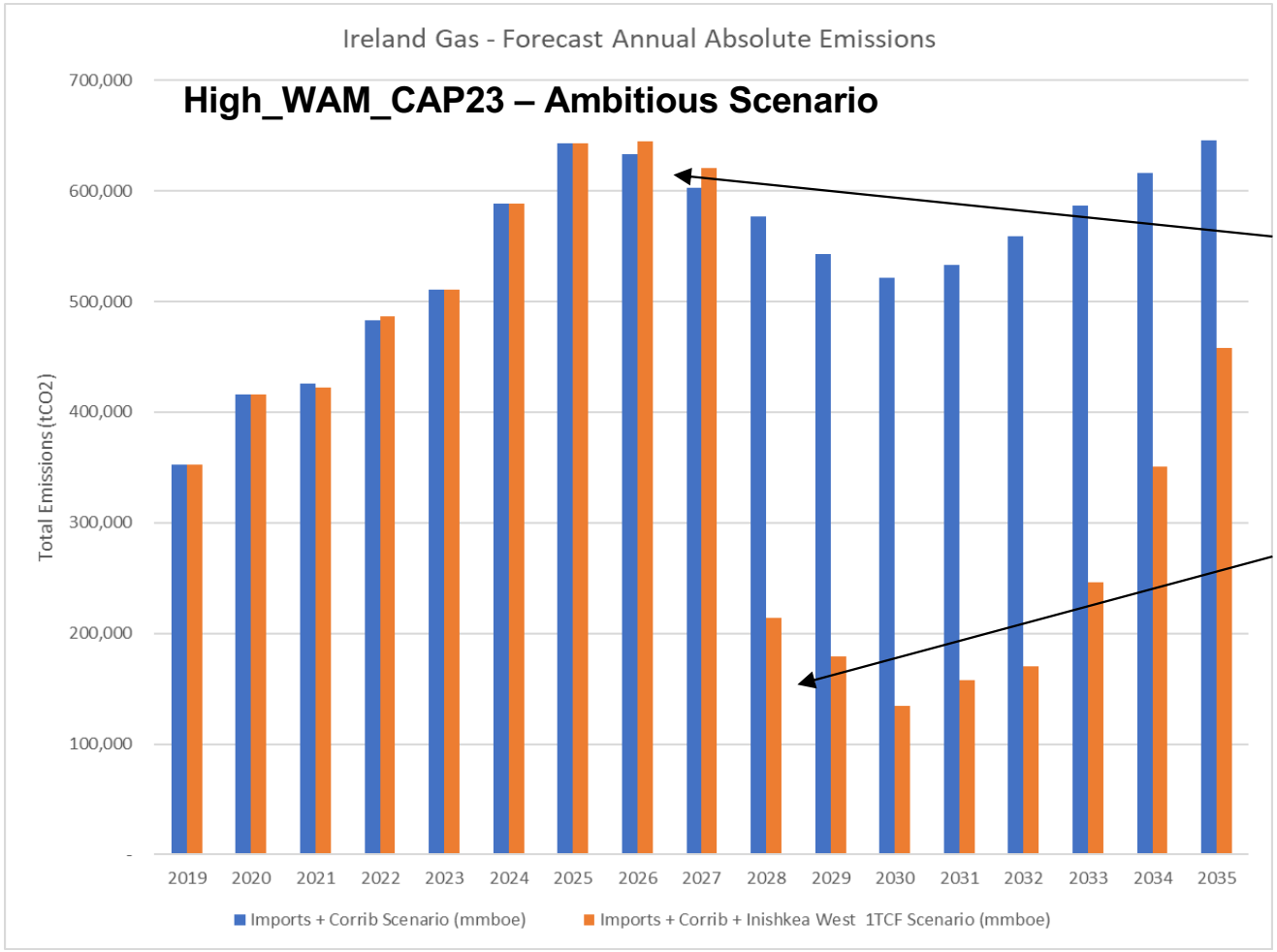
Slight **increase in emissions intensity in 2026 and 2027** in the Corrib + Inishkea West 1 TCF scenario due to development emissions associated with Inishkea West.

Sharp drop in average carbon intensity in 2028 as Inishkea West begins production and **replaces** more carbon intensive imports.

Carbon intensity will **rise again from 2032** as production from Inishkea West **declines**.

Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Ireland's Electricity Grid Mix – Projections to 2035



Assuming that in the future, Ireland's Grid uses the **same proportions** of domestically produced gas and imported gas and the 2023 Climate Action Plan **targets are met:**

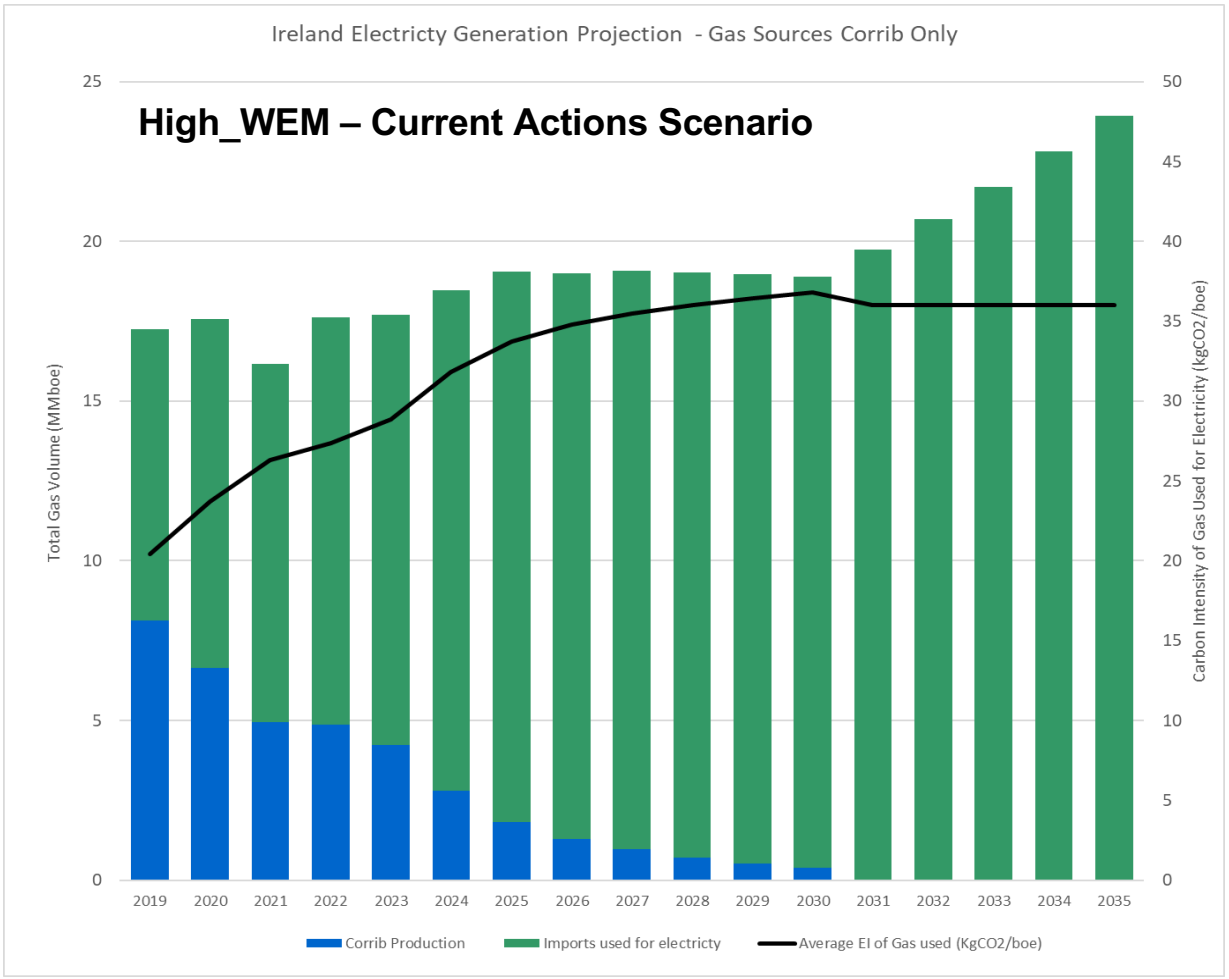
Slight increase in absolute annual emissions in 2026 and 2027 in the Corrib + Inishkea West 1TCF scenario due to development emissions associated with Inishkea West.

Sharp drop in absolute annual emissions in 2028 as Inishkea West begins production and replaces more carbon intensive gas imports.

The overall absolute emissions reduction from the Corrib + Inishkea West 1TCF scenario compared to Corrib only is approximately: **2.5 $MtCO_2$.**

Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Ireland's Electricity Grid Mix – Projections to 2035



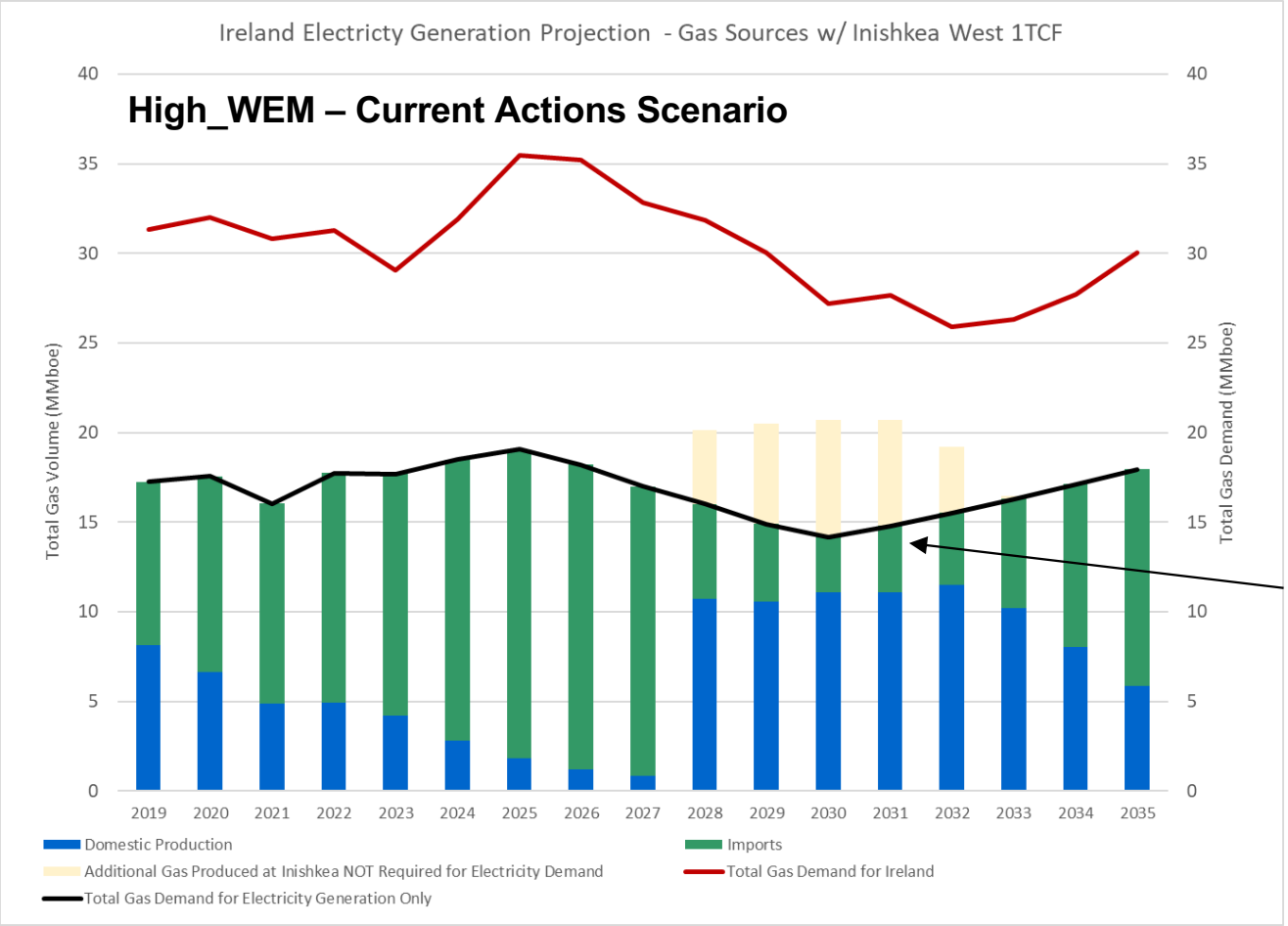
Assuming that in the future, Ireland's Grid uses the **same proportions** of domestically produced gas and imported gas and only **70% renewables are installed by 2030**:

Corrib will account for **less than 10% of the gas used for electricity generation by 2025** due to declining production.

The **carbon intensity** of the gas used for electricity generation will increase year on year **from ca. 20 $kgCO_2$/boe in 2019** to **36 $kgCO_2$/boe by 2035** as the proportion of imported gas increases.

Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Ireland's Electricity Grid Mix – Projections to 2035



Assuming that in the future, Ireland's Grid uses the **same proportions** of domestically produced gas and imported gas and **only 70% renewables are installed by 2030**:

In the Inishkea West 1 TCF scenario there is the same trend of increasing imported gas until Inishkea West starts producing in 2028.

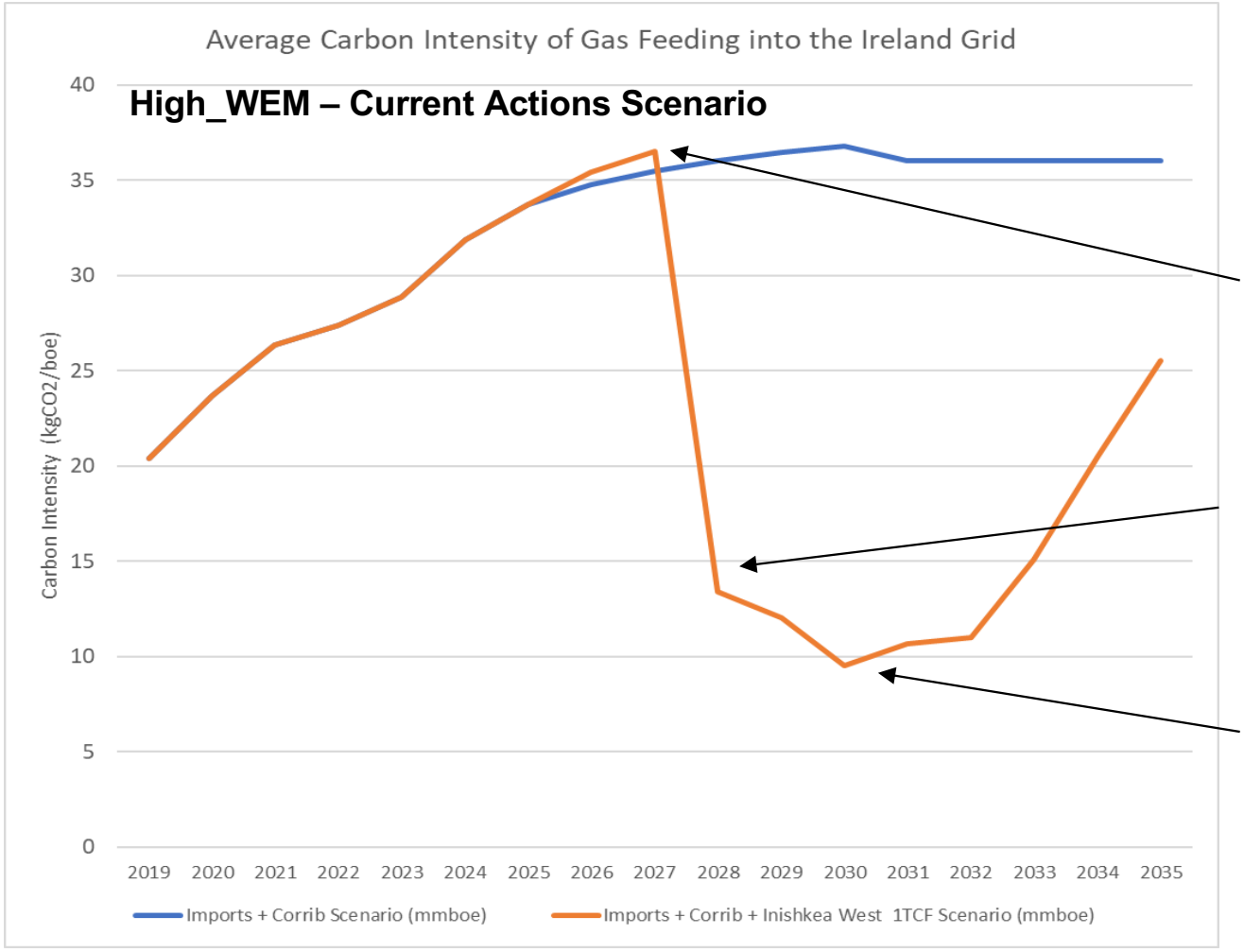
At this point the **gas used for electricity production becomes predominantly domestic gas** (67%) and the **carbon intensity drops significantly**.

Because it has been assumed that the mix of gas used for electricity (domestic vs imports) is the same as for the overall gas demand projections, **some imported gas is still assumed to be needed for electricity after Inishkea West comes online**.

Additional gas from Inishkea West could partially **satisfy the other demands for gas** across the Irish economy.

Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Ireland's Electricity Grid Mix – Projections to 2035



Assuming that in the future, Ireland's Grid uses the **same proportions** of domestically produced gas and imported gas and **only 70% renewables are installed by 2030**:

Slight **increase in emissions intensity in 2026 and 2027** in the Corrib + Inishkea West 1 TCF scenario due to development emissions associated with Inishkea West.

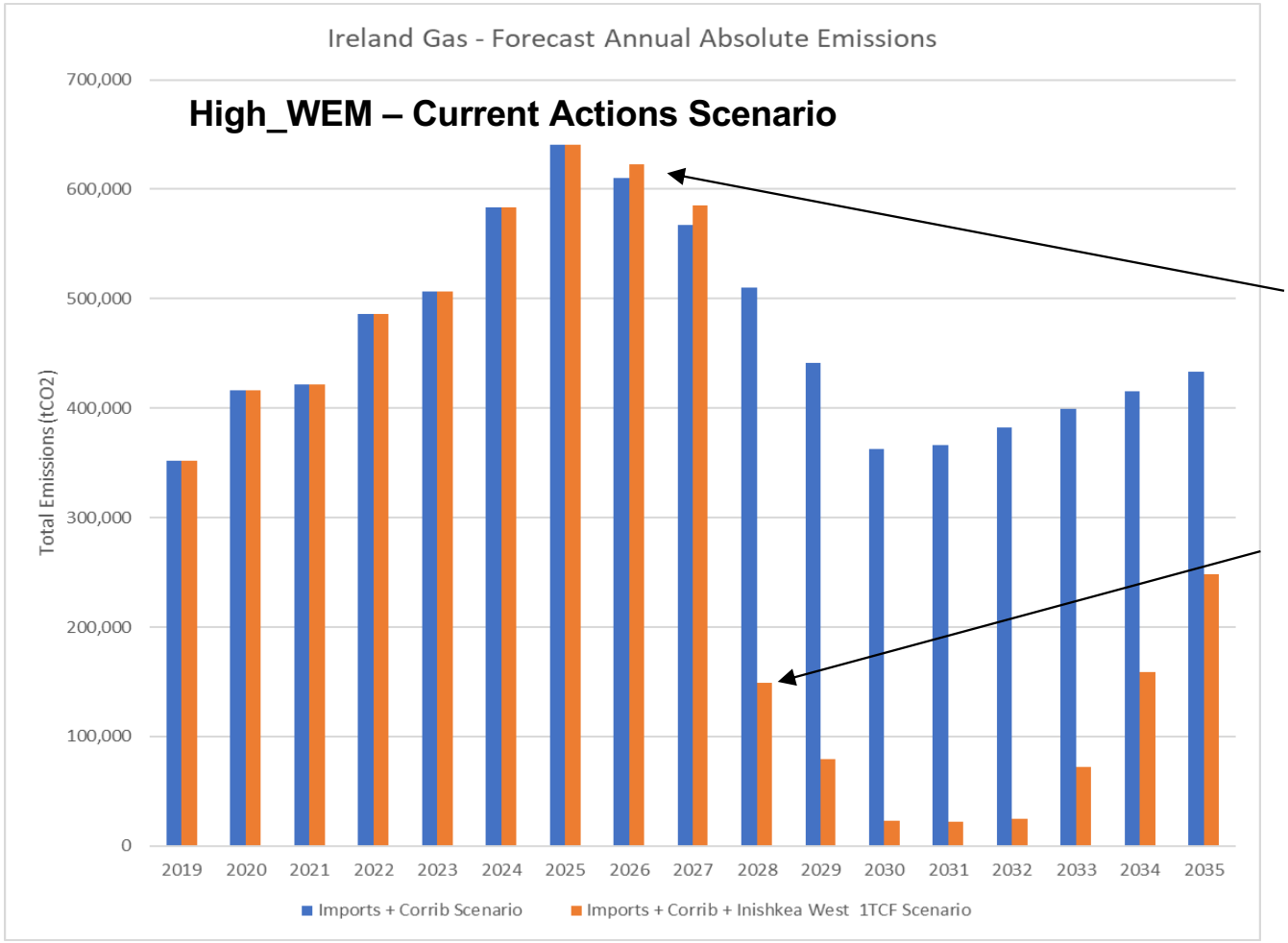
Sharp drop in average carbon intensity in 2028 as Inishkea West begins production and **replaces** more carbon intensive imports.

Carbon intensity doesn't drop as low as in the other scenario because **more imported gas with an assumed higher carbon intensity is required** to meet demand.

Carbon intensity will **rise again from 2032** as production from Inishkea West **declines**.

Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Ireland's Electricity Grid Mix – Projections to 2035



Assuming that in the future, Ireland's Grid uses the **same proportions** of domestically produced gas and imported gas and **only 70% renewables are installed by 2030**:

Slight increase in absolute annual emissions in 2026 and 2027 in the Corrib + Inishkea West 1TCF scenario due to development emissions associated with Inishkea West.

Sharp drop in absolute annual emissions in 2028 as Inishkea West begins production and replaces more carbon intensive gas imports.

The overall absolute emissions reduction from the Corrib + Inishkea West 1TCF scenario compared to Corrib only is approximately: **2.6 $MtCO_2$.**

Source: Irish Government's Climate Action Plan 2023: https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Thank you

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