# Half-Year Review of Ireland's Energy & Related Emissions

## Provisional monthly electricity, gas, and oil data from January to June 2023

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November 2023

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**Sustainable Energy Authority of Ireland**

SEAI is Ireland's national energy authority investing in, and delivering, appropriate, effective and sustainable solutions to help Ireland's transition to a clean energy future. We work with the public, businesses, communities and the Government to achieve this, through expertise, funding, educational programmes, policy advice, research and the development of new technologies.

SEAI is funded by the Government of Ireland through the Department of Communications, Climate Action and Environment.

# Contents

# 1 Aim

The availability of timely and trusted data on Ireland's energy has never been more important. Policy updates and targets are operating on increasingly shorter timescales to drive faster annual emission reductions and guide us toward net-zero emissions by 2050, for example:

- Annual updates to the national climate action plan (CAP) actions
- 5-year periods for carbon budgets and sectoral emission ceilings
- Milestone for Ireland's overall Renewable Energy Share (RES) results in 2022, 2025, 2027, and 2030

The aim of this short note is to support timely and informed discussions on these energy policies and targets, by accelerating the pace at which key data and insights on Ireland's energy and related $CO_2$ emissions are published by SEAI. By leveraging the *provisional* monthly data collected to satisfy Ireland's international reporting obligations to the EU, SEAI can make early in-year *estimates* on key areas of energy supply and emissions.

While these provisional estimates are not as definitive as the annual data published by SEAI in the annual National Energy Balance, or by the EPA in the National Greenhouse Gas Emissions Inventory, monthly surveys offer far greater timeliness. Analysis of monthly data is typically available just a few weeks after the fact, making it ideal for the *early identification* of shifts and trends in energy and emissions that will later be more fully quantified and verified by definitive annual surveys. The complementary use of both fast-but-provisional *monthly* data and slow-but-definitive *annual* data balances the competing needs of timeliness and authority in Ireland's energy statistics.

This short note provides a 'half-year review' of the quantity and composition of electricity-generated, oil-product delivered, and gas-supplied into the Irish market in the first 6-months of 2023. Comparing data from this 6-month period to what has previously been observed in other years helps identify trends and insights into the following key areas of energy supply and related emissions:

- Emissions from electricity generation (section 3.1)
- Renewables in electricity generation (section 3.2)
- Emissions from the transport sector (section 4.2)
- Heat demand in the residential sector (section 5.1)

Going forward, SEAI aims to deliver this data in early September of each year, synchronised to the release of the full National Energy Balance. The co-publication of *definitive* annual data from the previous year (in the energy balance) with the *provisional* monthly data from the first 6-months of the current year (in the half-year review note) will deliver a more complete and current assessment of Ireland's national energy system.

# 2 Summary

## Electricity generation

- Ireland's electricity emissions in the first half of 2023 (*i.e.* H1-2023) were 16.7% lower than in the same period in 2022.
- The quantity of electricity generated from renewables in H1-2023 was 2.8% lower than in the same period in 2022, mainly due to the variability and weather-dependence of wind-generation.
- Indigenous generation of electricity in H1-2023 was 5.0% lower than in the same period in 2022.
- In H1-2023, renewable sources accounted for 43.0% of electricity generated in Ireland, up by 0.9 percentage points on the first half of the previous year.
- Ireland's electricity demand in H1-2023 was 2.5% higher than in the same period in 2022.
- In H1-2023, net-imports accounted for 8.2% of Ireland's electricity demand.
- Ireland's increased use of imported electricity over indigenous generation was the key driver of the reduced emissions observed in H1-2023.

## Road transport

- Petrol deliveries in H1-2023 were 9.1% higher than in the same period in 2022.
- Diesel deliveries in H1-2023 were 1.7% higher than in the same period in 2022.
- H1-2023 deliveries of diesel and petrol have rebounded to 99.5% and 94.7% of their H1-2019 levels (the last H1-period not affected by COVID impacts), respectively.
- Road transport emissions in H1-2023 were 2.4% higher than in the same period in 2022.
- If the upward trend in road transport emissions for H1-2023 continues into H2-2023, then overall transport emissions in 2023 will be higher than those in 2022.
- To stay within the transport sector's Sectoral Emission Ceiling (SEC) of 54 $MtCO_2e$ in the 2021-2025 carbon budget period, transport sector emissions in 2023 need to be going down.

## Residential heating

- Demand for residential gas and kerosene 'heating oil' in H1-2023 were both 26% lower than in the same period 2-years ago (*i.e.* H1-2021).
- Recent reductions in residential heat demand are likely due to a range of factors, including price elasticity, weather effects, fuel-switching due to upgrades, and changing work-from-home behaviours.
- Residential gas demand in H1-2023 was 15.8% lower than in the same period in 2022.
- Kerosene 'heating oil' demand in H1-2023 was 2.4% lower than in the same period in 2022.

## Ireland's natural gas supply

- Approximately half of Ireland's consumption of natural gas is for electricity generation.
- Ireland's indigenous gas supply in H1-2023 was 15.4% lower than in the same period in 2022, driven by declining output from the Corrib gas fields.
- 5-years previously (in H1-2018), Ireland's indigenous gas supply was three times higher than H1-2023 levels.
- In H1-2023, 76.8% of Ireland's gas supply was imported.
- 5-years previously (in H1-2018), 35.6% of Ireland's gas supply was imported.

# 3 Electricity generation

SEAI collects monthly data from network operators on the primary fuel inputs and energy outputs of indigenous electricity generation, as well as the imports and exports across international interconnectors, and the inputs and outputs of pumped and battery storage facilities. From this monthly data, SEAI can provisionally estimate both the fraction of renewable electricity supplied to the national grid, and the carbon emissions associated with indigenous electricity generation.

## 3.1 Electricity emissions

Definitive annual data from SEAI's 2022 National Energy Balance indicates that electricity generation accounted for almost a third (30.1%) of all energy-related emissions. Figure 1 shows SEAI's estimate of emissions from electricity generation in mega-tonnes (millions of tonnes) of carbon dioxide ($MtCO_2$), for the last 5-years, based on provisional monthly data from suppliers. The data is aggregated into 6-month blocks, with the H1 (January to June) data in dark blue, and the H2 (July to December) data in light blue. Ireland's electricity emissions in H1-2023 were 16.7% lower than for the same period in 2022. This reduction in emissions was predominantly due to increased use of electricity imports - see Figure 3 (left) – which resulted in a reduced demand for indigenous electricity generation. Emissions from electricity imported into Ireland do not count towards national electricity emissions within the carbon budgets – see Section 3.3

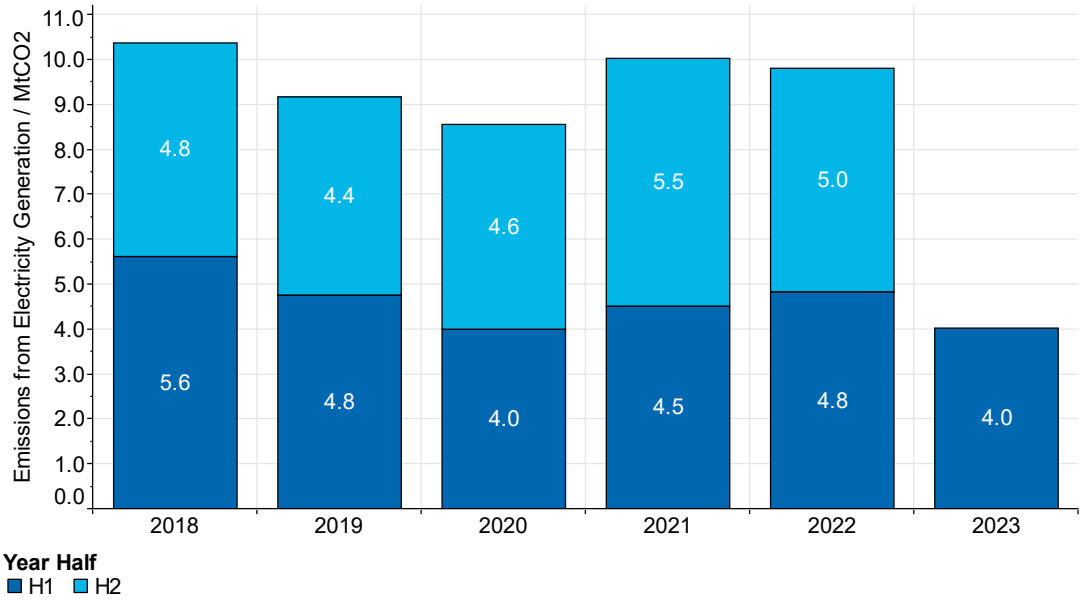


**Figure 1. Estimated $CO_2$ emissions from electricity generation, based on monthly data from suppliers, aggregated into 6-month blocks. Data source: SEAI and EirGrid.**

## 3.2 Renewables in electricity generation

Figure 2 shows the quantity of electricity generated from renewable sources in TWh for the last 5 years, aggregated into 6-month blocks, with the H1 (January to June) data in dark green, and the H2 (July to December) data in light green. The quantity of electricity generated from renewables in H1 2023 was 2.8% lower than the same period in 2022, mainly due to the variability and weather-dependence of wind-generation. This variability makes 'to-end-of-year' extrapolations of renewable electricity generation almost impossible to determine with any statistical confidence, *i.e.* performance in H1 is not a useful predictor of performance in H2.

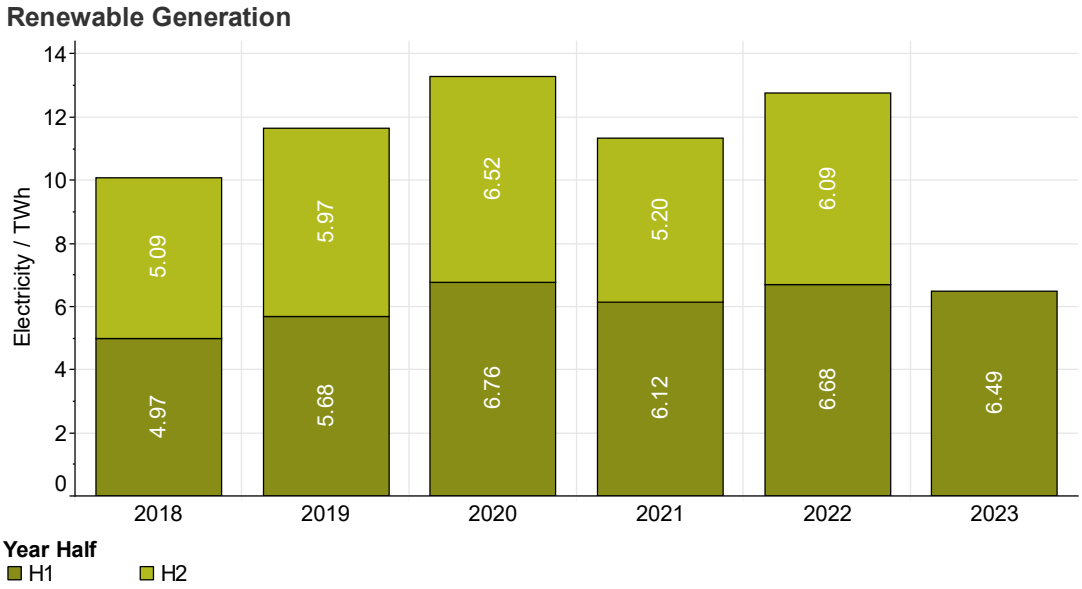


**Figure 2. Indigenous electricity generated from renewables over the last 5 years, aggregated into 6-month blocks. Data source: SEAI and EirGrid.**

Figure  shows a pair of pie-charts that compare the fraction of indigenous generation due to renewable and non-renewable sources in the first six-months of this year (H1-2023) with the same period last year (H1-2022). Despite the absolute quantity of electricity generated from renewables in H1-2023 being *less* than that generated in H1-2022 – see Figure 2 – the fraction of indigenous generation due to renewables *increased* across that period. In H1-2023, renewables accounted for 43.0% of electricity generated, an *increase* of 0.9 percentage points on the first half of the previous year. This counter-intuitive result of a *decreasing* quantity of renewable generation, and an *increasing* fraction of renewable generation arose because overall indigenous generation reduced more significantly than renewable generation across that period – see Figure 4 (left).

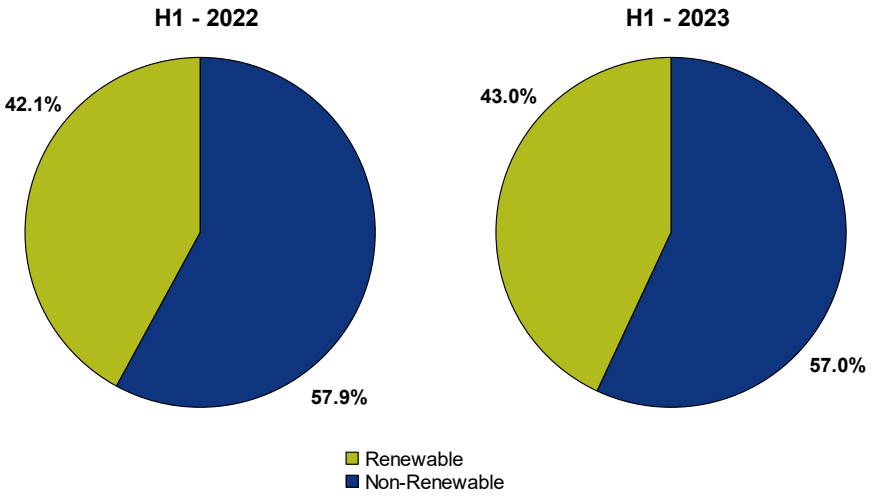


**Figure 3. The renewable split in indigenous electricity generation for H1-2023 and H1-2022. Data source: SEAI and EirGrid.**

## 3.3 Indigenous generation *vs.* grid available electricity

Indigenous generation is the production of electricity within Ireland's national boundaries. A fuller measure of the electricity delivered to the grid (*i.e.* the *'grid available'* electricity) necessary to satisfy Ireland's electricity demand, is the sum of the following three components:

1. Indigenous generation
2. Net imports through international interconnections (*i.e.* imported electricity, less exported electricity)
3. Net pumped and battery storage (*i.e.* electricity output from pumped and battery storage, less electricity input to pumped and battery storage)

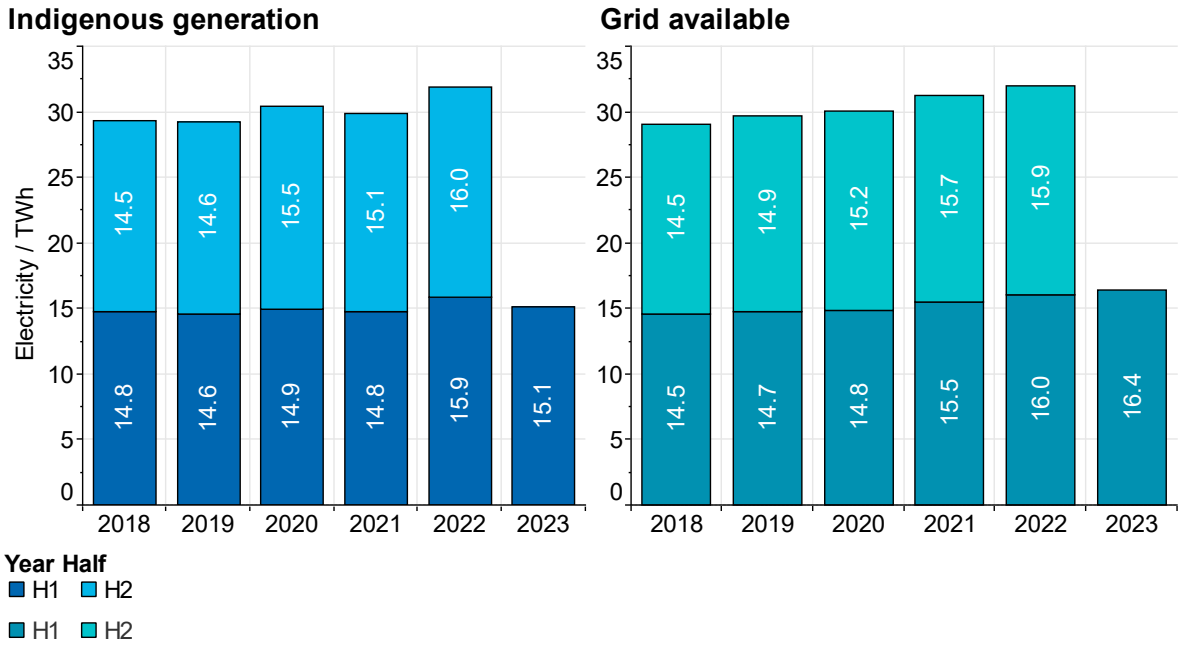


**Figure 4. Electricity supply over the last 5 years (left: indigenous generation; right: 'grid available'), aggregated into 6-month blocks. Data source: SEAI and EirGrid.**

Figure 4 (left) shows Ireland's indigenous generation in TWh for the last 5 years, based on provisional monthly data from suppliers. The data is aggregated into 6-month blocks, with the H1 (January to June) data in dark blue, and the H2 (July to December) data in light blue. Figure 4 (right) shows Ireland's 'grid available' electricity for the same periods, aggregated in the same way.

Indigenous generation in H1-2023 was 5.0% *lower* than in H1-2022. Conversely, the 'grid available' electricity necessary to satisfy Ireland's demand was 2.5% *higher* than in the same period in 2022. The differential between *increased* electricity demand and *decreased* indigenous generation was driven by *increased* use of net imports of electricity. In H1-2023, net-imports accounted for 8.2% of Ireland's grid available electricity.

The increased use of imported electricity in H1-2023 was likely driven by UK carbon prices trading at a steep discount with respect to those in the EU since March 2023. In some circumstances this carbon price differential means that electricity can be generated from fossil fuels more cheaply in the UK than in Ireland, making it more cost-effective to import electricity through the interconnectors rather than generating it indigenously. SEAI estimates that price differences of €10 per MWh for electricity generated from natural gas, and €25 per MWh for electricity generated from coal, existed across the two jurisdictions at the end of

H1-2023[1]. Note that the increased use of imported electricity is unlikely to have displaced renewable generation in Ireland. Rather, the carbon price difference means that *fossil-based* generation in Ireland was displaced by *fossil-based* generation in the UK.

When considering imported electricity in terms of the 'renewable energy share of electricity' (RES-E) calculation, or national greenhouse gas emission calculations for the carbon budgets, it is important to note that:

1. Imported electricity is considered *fully non-renewable* for the purpose of the RES-E calculations, regardless of the fuel-mix used in its generation.
2. Imported electricity does not give rise to any emissions in the country that imports it – all emissions are assigned to the country that generated-and-exported the electricity.

Ireland's increased use of imported electricity over indigenous generation was a key driver behind the reduced emissions in H1-2023 highlighted in Figure 1. It is currently unclear if-or-how the increased use of imported electricity will impact Ireland's RES-E, if at all. Although all imports are treated as non-renewable in the RES-E calculation, the recent electricity imports have mainly acted to displace fossil-based generation in Ireland, which is likewise treated as non-renewable in the RES-E calculation.

[1] Based on price of UKA and EUA daily futures on 30 June 2023. Available from https://www.ice.com/products/

# 4 Road transport

SEAI collects monthly oil product data from the national oil levy administration (OLA) database, maintained by the Department of the Environment, Climate and Communication (DECC). From this monthly data, SEAI can provisionally estimate the gross inland delivery[2] of oil products and biofuels to Ireland, as well as the carbon emissions associated with the combustion of those oil-products. This section focuses on the use of oil products for road transport, specifically diesel, gasoline, and blended biofuels. Road transport accounts for the bulk of energy consumption in the overall transport sector (77% in 2022) and almost all *national* greenhouse gas emissions[3] in the transport sector (96% in 2022).

## 4.1 Road transport energy consumption

Figure 5 (left) shows petrol deliveries in TWh for the last 5 years, aggregated into 6-month blocks, with the H1 (January to June) data in dark purple, and the H2 (July to December) data in light purple. Figure 5 (right) shows diesel deliveries for the same periods, aggregated in the same way. The data in Figure 5 shows the quantities of *blended* petrol and diesel deliveries, *i.e.* the summed total of fossil-based petrochemical and biofuel components in the fuels, and so is reflective of forecourt filling station consumption.

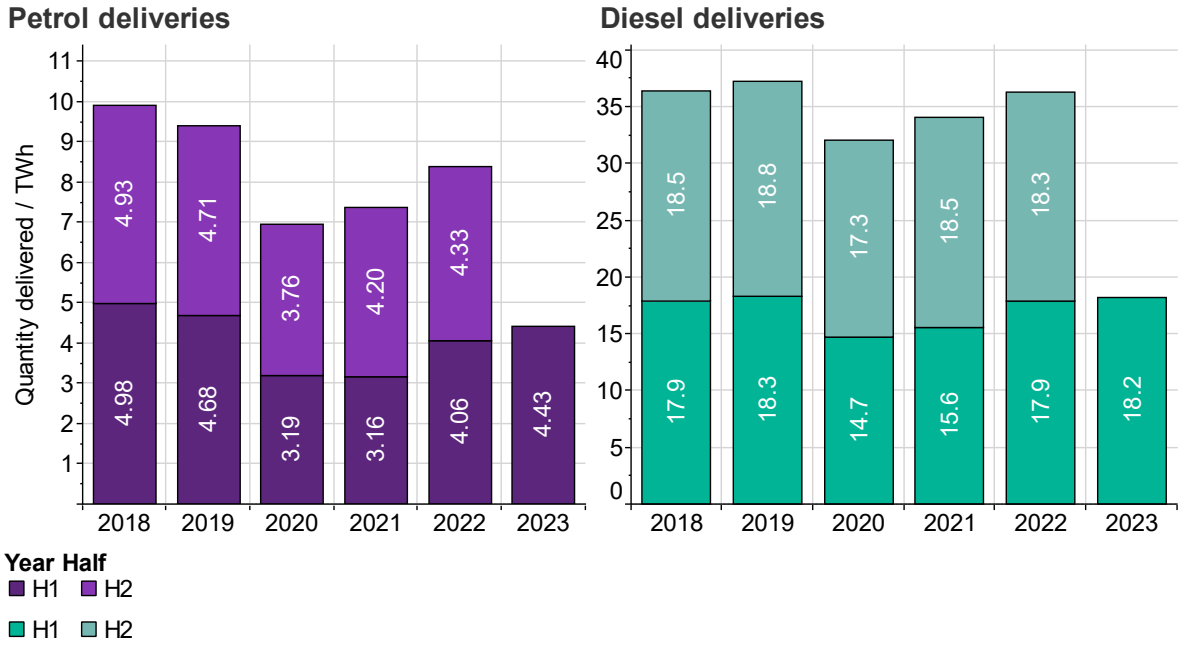


**Figure 5. Road transport fuel deliveries (left: petrol; right: diesel) over the last 5 years, aggregated into 6-month blocks. Data source: SEAI and DECC.**

Petrol deliveries in H1-2023 were 9.1% higher than in the same period in 2022. Diesel deliveries in H1-2023 were 1.7% higher than in the same period in 2022. The combined sum of petrol and diesel deliveries in H1-2023 was 3.1% higher than in the same period in 2022. H1-2023 diesel deliveries have rebounded to 99.5% of their H1-2019 levels (the last H1-period not affected by COVID impacts). H1-2023 petrol deliveries have rebounded to 94.7% of their H1-2019 level. The combined sum of petrol and diesel deliveries in H1-2023 have rebounded to 96.0% of their H1-2019 levels, indicating an almost full return to pre-COVID levels.

[2] Gross inland delivery is the quantity of an oil product flowing through the market from production to delivery that is ready for sale or consumption.

[3] International aviation does not contribute towards national greenhouse gas totals, as per IPCC and UNFCCC guidance.

Figure 5 shows that diesel deliveries dropped less severely (and rebounded more quickly) than petrol deliveries after the initial COVID demand shocks in 2020. This difference can be explained by the fact that the commercial vehicle fleet is almost entirely diesel-based, and many commercial vehicles, particularly heavy goods vehicles, remained in almost full service during COVID-impacted periods, delivering goods and supplies. Conversely, practically all petrol demand comes from the private car fleet, where short-term COVID travel restrictions and longer-term work-from-home behaviours resulted in sharper initial drops and slower rebounds.

The recent increase in petrol consumption may be partly due to the increased number of private cars with petrol engines[4] on Irish roads. Data provided by the Department of Transport shows a 2.7% increase in the number of private cars with petrol engines between the start of 2022 and 2023. In the same period, the number of private cars with diesel engines decreased by 1.2%[5].

## 4.2 Road transport emissions

Figure 6 shows SEAI's estimate of emissions from the combined use of petrol and diesel on Irish roads in megatons of carbon dioxide ($MtCO_2$), for the last 5-years. The data is aggregated into 6-month blocks, with the H1 (January to June) data in dark grey, and the H2 (July to December) data in light grey. Emissions from petrol and diesel for road transport account for approximately 96% of all *national* transport sector emissions. This makes it an excellent proxy for results against transport's sectoral emission ceiling (SEC) in the carbon budgets. Road transport emissions for H1-2023 were 2.4% higher than the same period in 2022, with approximately 80% of these emissions due to diesel. If this trend continues into H2-2023, then transport emissions in 2023 will be *higher* than those in 2022, when they need to be *reducing* to stay within their 2021-2025 SEC of 54 $MtCO_2e$.

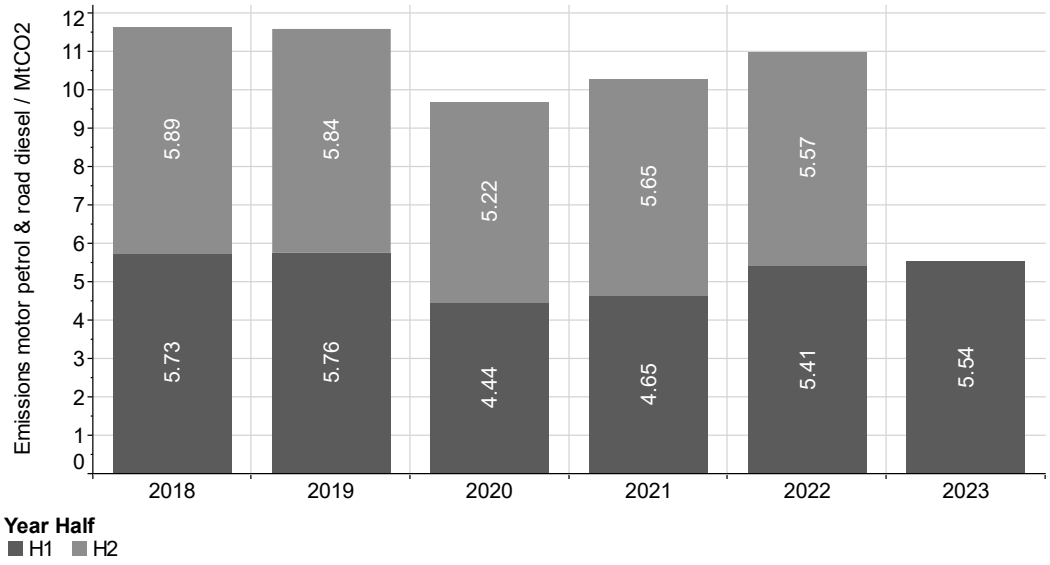


**Figure 6. $CO_2$ emissions from petrol and diesel used for road transport over the last 5 years, aggregated into 6-month blocks. Data source: SEAI and DECC.**

[4] The 'petrol engine' category includes fully petrol, conventional petrol hybrids, and plug-in petrol hybrids
[5] Data provided to SEAI by the Vehicle Registration Unit, Department of Transport

# 5 Residential heating

SEAI collects monthly kerosene 'heating oil' data from the national oil levy administration (OLA) database and receives monthly residential gas supply data from Gas Networks Ireland (GNI). Approximately 95% of kerosene 'heating oil' is consumed in the residential sector, making it an excellent proxy for oil-based home heating. By its nature, residential heating demand is both seasonally and weather dependent.

## 5.1 Residential heat demand

Residential energy demand is satisfied by a broad range of energy products. The top three energy products consumed in the residential sector in 2022 were oil (40%), electricity (26%) and gas (20%). High quality provisional monthly data for all energy products involved in residential heating are not available. However reliable monthly data exists for both residential gas demand and kerosene 'heating oil' deliveries. Importantly, monthly gas and heating oil deliveries cover trends in both urban/suburban homes connected to the gas network, and the semi-rural/rural homes primarily using oil boilers for heating, which provides a broadly representative basis for *provisional* residential heating estimates. Note that heating oil deliveries do not exactly coincide with heating oil consumption. Heating oil can be purchased and stored when consumers deem the price to be favourable, whereas residential gas can only be consumed 'on demand' from the gas grid at the current price.

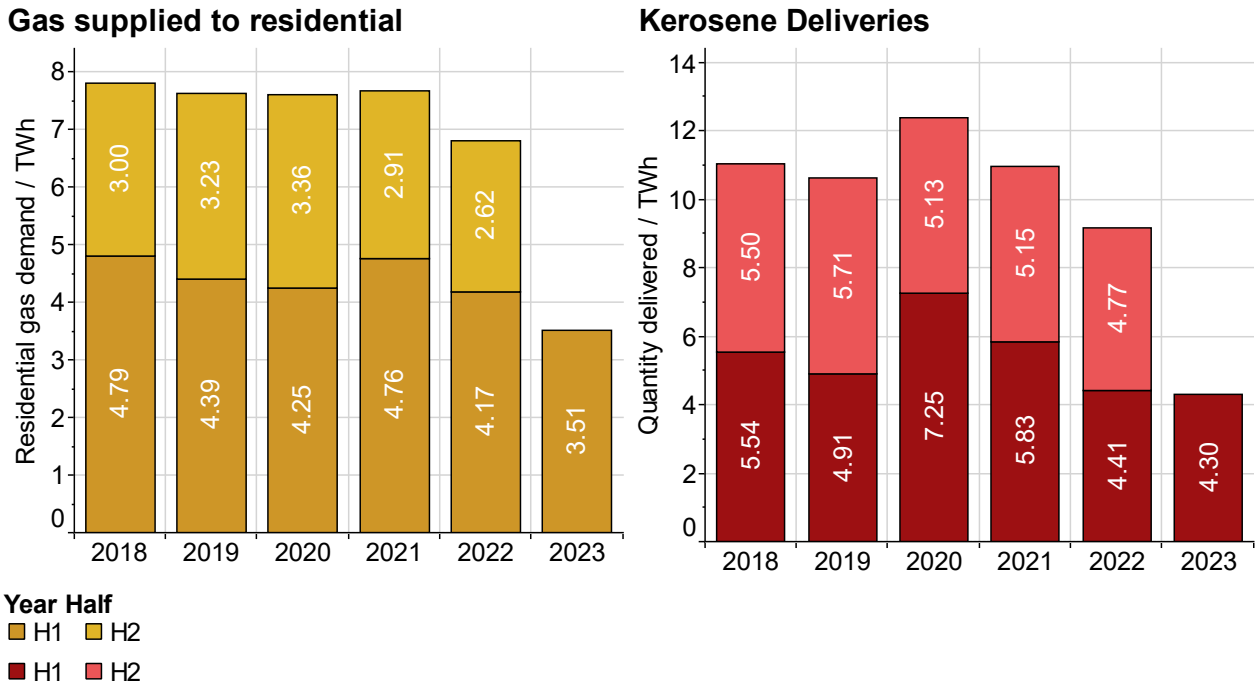


**Figure 7. Residential heating demand (left: gas demand; right: kerosene deliveries) over the last 5 years, aggregated into 6-month blocks. Data source: SEAI, GNI, and DECC.**

Figure 7 (left) shows residential gas supplied in TWh for the last 5 years, aggregated into 6-month blocks, with the H1 (January to June) data in dark orange, and the H2 (July to December) data in light orange. Figure 7 (right) shows kerosene 'heating oil' deliveries for the same periods, aggregated in the same way. Figure shows that demand for residential gas and kerosene 'heating oil' in H1-2023 were both 26% lower than in the same period 2-years previously (H1-2021). This very substantial reduction in residential heat demand was

likely due to a range of factors, including price elasticity, weather effects[8], fuel-switching due to upgrades, and changes to work-from-home behaviours, all of which are best investigated through the definitive annual data of the national energy balance.

Demand for residential gas and kerosene 'heating oil' in H1-2023 both reduced by the same fraction compared to H1-2021 levels, but this is not the case when comparing H1-2023 demand to H1-2022 demand. Residential gas demand in H1-2023 was 15.8% lower than in the same period last year, while kerosene 'heating oil' demand in H1-2023 was just 2.4% lower for kerosene 'heating oil' demand than in the same period last year. The larger reduction in residential gas demand was likely driven by the combined effects of higher price and the lack of availability for local storage. Whereas home heating oil can be purchased and stored when consumers deem the price to be low (or purchased somewhat later if prices are deemed particularly high), residential gas can only be consumed 'on demand' at the current price. The price of residential gas in H1-2023 was significantly higher than in H1-2022, which added a continuing downward pressure on demand across that 1-year period. Conversely, the price of kerosene 'heating oil' in H1-2023 was almost on parity with H1-2022 prices, and down significantly down on H2-2022 prices, which may have incentivised homeowners to 'stock up' on oil in the first half of 2023, despite the generally high prices.

If the H1-2023 trends for residential gas and kerosene 'heating oil' continue into H2-2023, and if they are representative of all energy products used in residential heating (including peat and coal), then 'Built Environment (Residential)' emissions of the carbon budget in 2023 will be lower than in 2022. However, the high sensitivity of residential heat demand to weather and prices, complicated further by fuel-switching effects, make 'to-end-of-year' extrapolations almost impossible to determine with any statistical confidence.

[8] The effect of weather on heating fuel demand can be assessed using heating degree day (HDD) data from weather stations across Ireland and weighting the data by local population. In H1-2023 the number of HDDs was 11% *below* the 30-year H1-average. Conversely, the number of HDDs in H1-2022 was 12% *above* this average. This implies a large 'weather effect' difference across the H1-2023 and H1-2021 periods that may have been a substantial driver of the observed difference in heat demand.

# 6 Ireland's gas supply

Ireland has a mixed supply of natural gas on the national network, with indigenous production at the Corrib gas field in Mayo supplemented by gas imported through two international interconnectors to Moffat in Scotland. The total grid gas available in any given month is the sum of indigenous production and imported gas supply. Ireland exports no grid gas – all flows across the interconnectors are one-way only, into Ireland. Approximately half of Ireland's total grid gas goes to electricity generation and half is directly consumed by the industry-, services-, and residential-sectors.

## 6.1 Indigenous and imported supply of gas

Figure 8 (left) shows Ireland's indigenous supply of gas in TWh for the last 5 years, aggregated into 6-month blocks, with the H1 (January to June) data in dark orange, and the H2 (July to December) data in light orange. Figure 8 (right) shows the quantity of imported gas for the same periods, aggregated in the same way.

Ireland's indigenous supply of gas has reduced every year in this 5-year window, with year-to-year reductions varying significantly from 5% to 20%. Ireland's indigenous gas supply in H1-2023 was 15.4% lower than the same period in 2022 and a third of what was produced in the same period 5-years ago (H1-2018). Ireland's imported gas supply has increased every year in the same 5-year window, to compensate for the reduced indigenous production. In H1-2023, 76.8% of Ireland's gas supply was imported. Five years previously, in H1-2018, only 35.6% of Ireland's gas supply was imported. Ireland's import dependency on grid gas has therefore doubled in the last 5-years.

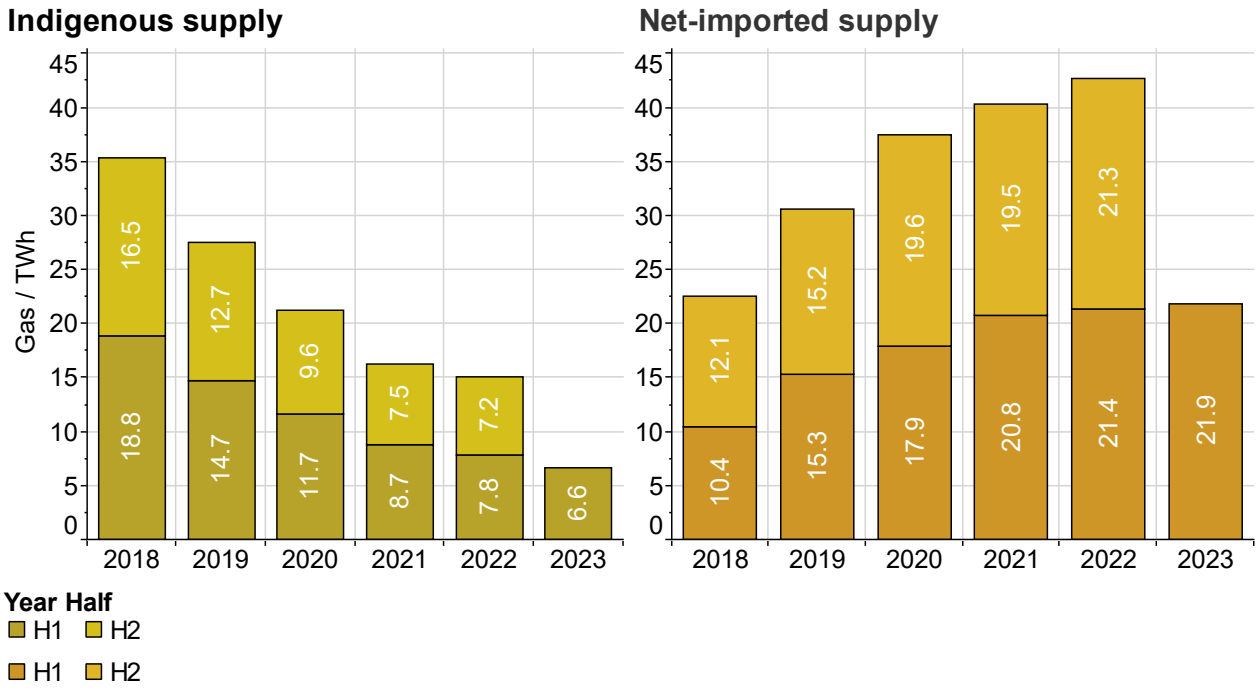


**Figure 8. Natural gas supply (left: indigenous supply; right: net-imported supply) over the last 5 years, aggregated into 6-month blocks. Data source: SEAI and GNI**

# 7 Methodology notes

## Electricity generation

Monthly data on indigenous electricity generation, imports & exports across interconnections, and pumped storage is collected by SEAI from Eirgrid and other data suppliers, for statistical purposes, under the European Energy Statistics Regulation of 2008 (no.1099). Monthly electricity data is collected in units of MWh, with SEAI making simple provisional estimates of the $CO_2$ emissions from monthly indigenous generation by applying weighted effective emission factors. The effective emission factors applied to the monthly indigenous generation values are based on definitive annual emission data gathered by the EPA, under the EU Emission Trading System, and SEA's Energy Balance. Where these annual effective emission factors lag monthly reporting, the most recent annual data is used. Where electricity generation sources use a blend of renewable and non-renewable fuel inputs, *i.e.* co-fired peat & biomass, wastes, and other inputs, SEAI applies a renewable / non-renewable 'split' based on the most recent definitive annual data collected from SEAI's Energy Balance.

## Road transport

Monthly gross inland deliveries (GID) of oil products are determined by SEAI based on the aggregation of confidential submissions made by oil suppliers to Ireland's Oil Levy Administration (OLA) database, which is administered and maintained by the Department of the Environment, Climate and Communications (DECC). SEAI determines and submits monthly gross inland deliveries of oil products to satisfy Ireland's international reporting obligations under the European Energy Statistics Regulation of 2008 (no.1099). GID are the quantities of oil-products flowing through the market from production to delivery that are now ready for sale or consumption. Refinery outputs, imports, and stock draws act to increase GID quantities. Exports, international marine bunkers (*i.e.* products purchased for and consumed by vessels carrying out international shipping), and stock-builds act to decrease GID quantities. Inter-product transfers describe the reclassification of products and are therefore reported as a negative value for one product, compensated by a positive value for another product. Oil delivery data is sourced from the OLA database in units of volume (*i.e.* litres) with SEAI making the conversion to units of energy. Monthly oil delivery data is published in terms of net calorific value (NCV). SEAI makes simple provisional estimates of the $CO_2$ emissions from monthly oil deliveries by applying a weighted effective emission factor.

## Residential heating

The residential heating data in this short note has not been normalised for weather effects. Please refer to the most recent *Energy in Ireland* report for a more complete analysis of residential heat demand, including time-series going back two decades.

## Ireland's gas supply

Monthly Gas Supply data is collected in units of TJ, and in terms of gross calorific values (GCVs), as opposed to the net calorific values (NCVs) mandated for SEAI's Energy Balance. SEAI makes simple provisional estimates of the $CO_2$ emissions from the monthly gas supply by applying a weighted effective emission factor.

## 8 Further reading

Further details and insights on *monthly energy data* are available on the SEAI website:

https://www.seai.ie/data-and-insights/seai-statistics/monthly-energy-data/

Ireland's national energy balance provides *definitive annual* data back to 1990, and is available on the SEAI website:

https://www.seai.ie/data-and-insights/seai-statistics/key-publications/national-energy-balance/

## 9 Acknowledgements

SEAI gratefully acknowledges the co-operation of all the organisations, agencies, energy suppliers and distributors that provide data and respond to its questionnaires throughout the year. This co-operation is especially appreciated in recent years, when energy suppliers have been asked to submit more data within shorter deadlines, as SEAI works to produce ever more timely energy insights to help inform government policy.

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