SUSTAINABLE ENERGY AUTHORITY OF IRELAND

ENERGY IN IRELAND

2020 Report

ENERGY IN IRELAND

2020 Report

December 2020

SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Sustainable Energy Authority of Ireland (SEAI)

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 Government, homeowners, businesses and communities 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 the Environment, Climate and Communications.

SEAI is the official source of energy data for Ireland. We develop and maintain comprehensive national and sectoral statistics for energy production, transformation and end-use. These data are a vital input in meeting international reporting obligations, for advising policymakers and informing investment decisions. SEAI's core statistics functions are to:

- Collect, process and publish energy statistics to support policy analysis and development in line with national needs and international obligations;
- Conduct statistical and economic analyses of energy services sectors and sustainable energy options;
- Contribute to the development and promulgation of appropriate sustainability indicators.

Acknowledgements

SEAI gratefully acknowledges the cooperation of all the organisations, agencies, energy suppliers and distributors that provided data and responded to questionnaires throughout the year.

Foreword

William Walsh

2020 has been a year of significant change and challenge for many of us. Due to the global health crisis and measures deployed to mitigate its effects, the way we use energy has also changed markedly. We have seen large reductions in transport energy use in particular, and after an initial decrease in electricity use, we saw all time high levels of demand following the recent easing of restriction leading into Christmas 2020.

The highlights from this report illustrate continued success in decarbonisation of electricity, primarily through the reduction of coal and peat use for electricity generation, and from the addition of further installed capacity of wind. This is to be welcomed and significant momentum exists from all stakeholders to continue to drive Ireland forward as a world leader in incorporating renewable energy on to our electricity system.

A bigger story however can be found in sectors where the data did not change significantly in 2019. Energy use for heat in homes and businesses decreased by a mere 0.7% in 2019 when the impact of a warmer year is taken into account. Collectively these sectors account for over one third of our national energy use and CO_2 emissions from fossil fuel use. The slow level of progress is not yet near the rate required to live up to the Government's ambition in the Climate Action Plan, or the more recent and ambitious Programme for Government. The data in this report supports the urgent delivery of actions outlined in those plans.

As Ireland's National Retrofit Delivery Body, SEAI is closely collaborating with Government and a broad range of stakeholders to support households and businesses to get the necessary work done. This work will accelerate in 2021 with thanks to increased budgets recently committed by Government, together with new suites of programmes and increased human resources dedicated to the task. SEAI is further supporting the Department of Environment, Climate and Communications to analyse pathways to fully decarbonise Ireland's heat use by 2050 – a very significant challenge, but one that can be met if given sufficient national priority.

The work required to upgrade our homes and business is good for the economy. It creates jobs, enables householders to save on energy costs now and in the future, and it makes business more efficient – leading to competitiveness gains. The environmental benefits are clear. When we burn less fossil fuels, Ireland contributes to global emissions reductions, and at home we experience better air quality, benefitting us all. Deploying energy efficiency to reduce fossil fuel use and generating more energy from our vast national renewable sources will also improve our security of energy supply.

At SEAI we have continued to develop our energy statistics to provide an analytical foundation for policy makers for the many decisions and actions required to decarbonise our energy system. I would like to take this opportunity to recognise Martin Howley's significant contribution to this process over the last 19 editions of this report. Martin was instrumental in the establishment and development of an Irish energy statistical system which is now world class. The foundations laid by Martin will provide the platform for the next wave of data and insights from SEAI.

At SEAI we remain focussed on delivering insights and taking actions that will support the transformation of Ireland's energy system at world leading rates of change. Something we see as entirely possible, as together we make decarbonisation and climate action a national priority.

William Walsh

Chief Executive

Sustainable Energy Authority of Ireland

2020 Reflections

Martin Howley

Energy in Ireland is now in its 19th edition and it feels a bit like the current '*how it started, how it's going*' meme doing the rounds. It started in 2002 when SEAI took over the production and reporting of energy statistics, which was also around the same time that Ireland ratified the Kyoto Protocol. The first edition covered the period 1990 to 2001 and was designed to provide information on energy supply and use in Ireland and how it contributed to our new commitments under the Protocol. We are now living through the final year of the second commitment period of the Kyoto Protocol and have since signed up to the landmark Paris Agreement.

The current edition of Energy in Ireland reports on energy use up to 2019 and interestingly, overall energy use in Ireland in 2019 was at almost the same level as in 2001, but CO_2 emissions from energy are down by almost one fifth, while the economy is one and a half times as large.

Over the years since the first edition, SEAI has worked to increase the range and depth of energy statistics to meet increased demands for data both nationally and internationally. This data is used to monitor progress, develop policy, and to inform and educate us all, as a society, on the role we play in transitioning to a sustainable future. We are most grateful for the cooperation of all those that we request data from and for the help and guidance of the CSO in progressing the development of energy statistics in Ireland.

This year we've added to the range and depth of energy statistics by incorporating the Business Energy Use survey results from the CSO into the energy balance and historic energy timeseries. This adds more detail to the subsectors of industry and provides a new breakdown of the services sector into a range of subsectors. We've also added some new energy sources and expanded the detail on others.

One of the big stories of 2019 is the further reduction in CO_2 emissions intensity of electricity. Back in 2001, wind supplied approximately 1% of our electricity and coal 20%. The emissions intensity was 807 gCO_2/kWh back then but in 2019, with coal generating less than 2% and wind 32%, the intensity is less than half at 324 gCO_2/kWh. This was difficult to imagine back then but now the target of 40% of electricity from renewables sources is within sight by the end of this year.

Another first in 2019 was that energy use for air travel in Ireland reached a new high. How quickly things can change. Who could have foreseen the global pandemic that ensued this year? Transport is the sector that has been most affected by the pandemic in energy terms, with large falls in petrol and diesel usage during lockdown periods, and air transport suffering most since March. It is estimated that energy use for air travel in Ireland is down 64% year-to-date on last year and was down by over 80% in some months. These are levels of use that were last seen in the mid to late 1990s. We have included a short section in this year's report on the effect that the pandemic has had on energy use.

This highlights the need for short-term and more detailed energy statistics. In times of crisis we need to know as quickly as possible what's happening to demand and where potential problems are likely to arise. It is also helpful when we are getting close to crunch time for target deadlines that we know where we stand with regard to progress, or not, towards the final finishing line. We have had monthly data on our website on electricity and gas supply for some time now, and during the pandemic, we started producing a monthly report on these along with deliveries of oil products (petrol, diesel, kerosene etc) into the market. These reports are available on our website and next year we will add the monthly oil data on the website.

So '*how is it going*' with Energy in Ireland. Well it has come a considerable distance since the first edition and this year's report, and the statistics behind it, have taken a further step forward. Our commitment is to continue to develop the Irish energy statistical system to provide accurate, coherent, comprehensive, timely and independent data and information as a support to policy formation and monitoring and to feed into research and projecting future requirements.

Martin Howley

Programme Manager Energy Statistics

Sustainable Energy Authority of Ireland

Highlights 2019*

Overview

- Final energy demand fell by 0.6%, while the economy grew by 3.2% as measured by modified domestic demand (MDD). Most of this reduction occurred in the residential sector, and was mostly due to 2019 being a warmer year than 2018.
- Primary energy demand fell by 1.2%. This includes losses in electricity generation and other energy transformation sectors.
- Fossil fuel use for energy decreased by 3.0% in 2019 and was 17% lower than in 2005.

Energy-related CO_2 emissions

- Energy-related CO_2 emissions from the combustion of fossil fuels accounted for 57% of Ireland's total greenhouse gas (GHG) emissions.
- Energy-related CO_2 emissions fell by 4.5%, or 1.7 million tonnes of CO_2, and are now 21% below 2005 levels. This was the largest drop in energy related emissions since 2011, at the height of the last recession.
- Energy-related CO_2 emissions outside of the EU Emissions Trading Scheme (non-ETS emissions) fell by 2.4%. This includes transport and heating in households, the commercial sector and small industry.

Renewable energy targets

- Renewables made up 12.0% of gross final consumption, relative to a 2020 target of 16.0%.
- This avoided 5.8 million tonnes of CO_2 emissions and over €500 million of fossil fuel imports.
- The share of electricity generated from renewable sources increased from 33.2% in 2018 to 36.5% in 2019 (normalised). The 2020 target is 40%.
- The renewable share of energy used for transport (including weightings) increased from 7.2% in 2018 to 8.9% in 2019. The 2020 target is 10%.
- The renewable share of energy used for heat remained flat at 6.3% in 2019. The 2020 target is 12.0%.

*Note: All percentage changes are 2019 compared to 2018, unless otherwise stated.

Transport

- Transport continues to dominate as the largest energy-consuming sector, with a 42% share of final energy consumption and accounting for 41% of energy related emissions.
- Transport energy use increased by 0.5%, but CO_2 emissions from transport decreased by 0.1%, due to increased biofuel blending in petrol and diesel.
- Electric vehicles made up 3.0% of new private cars in 2019, but just 0.3% of the total stock of private cars.

Electricity

- The amount of electricity generated increased by 1.5%, but there was a 1.8% reduction in the fuels used for electricity generation, and an 11.8% reduction in the CO2 emissions from electricity generation.
- This was due to a 70% reduction in coal use for electricity generation, which is much less efficient and more carbon intensive than gas or renewables.
- Coal and peat generated just 8% of electricity, but were responsible for 29% of electricity CO_2 emissions. The remaining CO_2 emissions from electricity generation are almost all from gas.
- Wind generation accounted for 32% of all electricity generated and avoided 3.9 million tonnes of CO_2 emissions.
- The use of renewables in electricity generation in 2019 reduced CO_2 emissions by 4.8 million tonnes and avoided an estimated €297 million in fossil fuel imports.
- The carbon intensity of electricity fell by 14% in 2019 to 324 gCO_2/kWh. This was is the lowest level recorded in over 70 years.

Heat

- Energy use for heat in homes and businesses decreased by 3.1%. When corrected for weather the decrease was 0.7%.
- Energy use for heat in industry decreased by 1.0%.
- Energy use for heat in households decreased by 5.9%. When corrected for weather the decrease was 2.1%.
- Energy use for heat in services increased by 1.0%, or 5.3% when corrected for weather.

2019 Key Figures

ECONOMIC GROWTH (Modified Domestic Demand)	OVERALL ENERGY USE	ENERGY-RELATED CO_2 EMISSIONS
+3.2%	**-1.2%**	**-4.5%**

	Final Energy Use	Energy-related CO_2 Emissions (including electricity emissions)
Residential	-4.6%	-9.3%
Transport	+0.5%	-0.1%
Industry	+0.1%	-5.4%
Services	+2.2%	-7.6%

PROGRESS TO RENEWABLE ENERGY TARGETS

		2020 TARGETS
Overall Renewable Energy Target	12.0%	16.0%
Transport	8.9%	10.0%
Heat	6.3%	12.0%
Electricity	36.5%	40.0%

Note all figures are 2019 compared with 2018, unless otherwise stated.

Transport

LARGEST
ENERGY USERS

39%

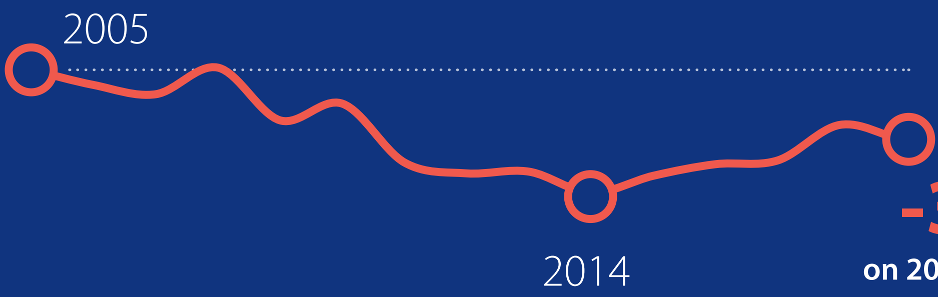
21%

15%

22% INCREASE IN BIOFUELS USED FOR TRANSPORT

Heat

ENERGY
USED
FOR HEAT



-3.1%
on 2018, due mostly to warmer winter

Electricity

CO$_2$ INTENSITY
OF ELECTRICITY

-14%
to a new low of **324 gCO$_2$/kWh**

ELECTRICITY GENERATED

+1.5%

COAL USED FOR
ELECTRICITY GENERATION

-70%

SHARES OF ELECTRICITY GENERATED BY FUEL

GAS
51%

WIND
32%

COAL & PEAT
8%

Note all figures are 2019 compared with 2018, unless otherwise stated.

Table of Contents

Foreword			**3**
2020 Reflections			**4**
Highlights 2019			**5**
Infographic			**6**
1	**Introduction**		**13**
	1.1	Note on revisions to historical energy balance data due to improved data on business energy use	14
	1.2	Early look at the effects of COVID 19 on 2020 energy use	14
	1.3	Energy balance for 2019	15
2	**Final energy use**		**16**
	2.1	Final energy by fuel	16
	2.2	Final energy by sector	18
	2.3	Final energy by mode	19
	2.4	Heat	20
	2.4.1	Heat final energy by sector	20
	2.4.2	Heat final energy by fuel	21
	2.5	Transport	23
	2.5.1	Transport final energy by sub-sector	23
	2.5.2	Transport final energy by fuel	24
	2.6	Electricity	26
	2.6.1	Electricity final energy by sector	26
3	**Primary energy supply**		**27**
	3.1	Primary energy by fuel	27
	3.2	Primary energy by sector	28
	3.3	Primary energy by mode	29
4	**Electricity generation and other transformation processes**		**31**
	4.1	Electricity generation	31
	4.1.1	Primary fuel inputs into electricity generation	33
	4.1.2	Electricity generated by fuel type	35
	4.1.3	Efficiency of electricity supply	36
	4.1.4	Carbon intensity of electricity supply	37
	4.1.5	Combined heat and power generation	38
	4.2	Oil refining	40
	4.3	Other transformation processes	40
5	**Drivers of energy demand**		**41**
	5.1	Energy, economy and emissions	41
	5.2	Energy and the weather	43
	5.3	Economic energy intensities	44
6	**Policy perspectives**		**46**
	6.1	Progress towards renewable energy targets	46
	6.1.1	Transport energy from renewable sources (RES-T)	48
	6.1.2	Electricity from renewable energy sources (RES-E)	50
	6.1.3	Heat from renewable energy sources (RES-H)	52
	6.1.4	CO_2 displacement and avoided fuel imports	54
	6.2	Greenhouse gas emissions targets	55
	6.3	Energy security	59
	6.4	Cost competitiveness	61
	6.4.1	Energy prices in industry	61

7	**Sectoral trends and indicators**	**65**
7.1	Industry	65
7.1.1	Industry energy intensity	68
7.2	Transport	69
7.2.1	Transport energy by fuel	69
7.2.2	Transport energy demand by mode	70
7.2.3	Private car activity	72
7.2.4	CO_2 intensity of new private cars	72
7.2.5	Energy efficiency of new private cars	74
7.2.6	Heavy goods vehicle activity	74
7.3	Residential	77
7.3.1	Average dwelling energy use	80
7.4	Commercial and public services	82
7.4.1	Energy intensity of the commercial and public services sector	83
7.4.2	Public sector developments	85
8	**Energy statistics revisions and corrections**	**86**
	Glossary of abbreviations	**91**
	Glossary of terms	**92**
	Sources	**94**
	Bibliography	**95**
	Bibliography (continued)	**96**
	Energy balance 2019	**97**

Table of Figures

Figure 1: Main energy flows in Ireland	13
Figure 2: Energy flow in Ireland 2019	15
Figure 3: Total final consumption by fuel	16
Figure 4: Total final consumption by sector	18
Figure 5: Final energy in heat, transport and electricity	19
Figure 6: Final energy use for heat, actual and weather corrected	20
Figure 7: Final consumption of heat by sector	21
Figure 8: Final consumption of heat by fuel	22
Figure 9: Final consumption of oil for heat	22
Figure 10: Transport energy demand by mode	23
Figure 11: Final consumption of transport by fuel	24
Figure 12: Final consumption of electricity by sector	26
Figure 13: Total primary energy requirement	27
Figure 14: Total primary energy requirement by sector	28
Figure 15: Primary energy by mode of application	29
Figure 16: Primary energy by mode and fuel	30
Figure 17: Primary energy inputs to transformation processes	31
Figure 18: Flow of energy in electricity generation, 2019	32
Figure 19: Flow of energy in electricity generation, 2019 – outputs by fuel	32
Figure 20: Primary fuel mix for electricity generation	33
Figure 21: Change in fuel inputs to electricity generation in 2019 compared with 2018	34
Figure 22: Electricity generated by fuel type	35
Figure 23: Change in electricity generation by source in 2019 compared with 2018	36
Figure 24: Efficiency of electricity supply	36
Figure 25: CO_2 emissions per kWh of electricity supplied, with contributions by fuel	37
Figure 26: CHP fuel input and thermal/electricity output, 2000 – 2019	39
Figure 27: CHP electricity as percentage of total electricity generation, 2005 – 2019	39
Figure 28: Outputs from oil refining	40
Figure 29: Index of modified domestic demand, final energy demand and energy price	41
Figure 30: Index of final energy, primary energy and energy-related CO_2	42
Figure 31: CO_2 intensity of primary energy by mode	43
Figure 32: Deviation from average heating degree days and resulting weather adjustment	44
Figure 33: Primary, final and electricity intensities	45
Figure 34: Progress to targets, 2019	47
Figure 35: Renewable energy (%) contribution to gross final consumption (Directive 2009/28/EC)	47
Figure 36: Renewable energy (%) contribution to gross final consumption by mode	48
Figure 37: Progress towards renewable transport energy target	49
Figure 38: Renewable energy contribution to gross electricity consumption (RES-E normalised)	51
Figure 39: Installed wind generating capacity, 2000 – 2019	51
Figure 40: Renewable energy contribution to thermal energy (RES-H)	52
Figure 41: Composition of biomass and renewable wastes used for heat in total final consumption, in 2019	53
Figure 42: Avoided CO_2 from renewable energy, 2005 – 2019	54
Figure 43: Greenhouse gas emissions by source	55
Figure 44: Energy-related CO_2 emissions by sector	56
Figure 45: Energy-related CO_2 emissions by mode of energy application	57
Figure 46: Non-emissions trading energy-related CO_2	58
Figure 47: Import dependency of Ireland and the EU	59
Figure 48: Indigenous energy by fuel	60
Figure 49: Imported energy by fuel	60
Figure 50: Electricity prices to industry	61
Figure 51: Oil prices to industry	62
Figure 52: Natural gas prices to industry	63

Figure 53: Real energy price changes to industry since 2015 in EU-15 (index)	64
Figure 54: Industry final energy use by fuel	66
Figure 55: Industry energy-related CO_2 emissions by fuel	67
Figure 56: Industry energy intensity	68
Figure 57: Transport final energy use by fuel	69
Figure 58: Transport energy demand by mode, 2005 – 2019	71
Figure 59: Total private car annual vehicle-kilometres, 2000 – 2019	72
Figure 60: Shares of new private cars in each emissions band, 2005 –2019 (October 2020 to date)	73
Figure 61: Specific CO_2 emissions of new cars, 2005 – 2019 (2020 estimated)	73
Figure 62: Weighted average test specific fuel consumption of new cars, 2005 – 2019	74
Figure 63: Road freight activity, 2000 – 2019	75
Figure 64: Road freight activity by main type of work done, 2000 – 2019	75
Figure 65: Residential final energy	77
Figure 66: Residential final energy use by fuel	78
Figure 67: Residential energy-related CO_2 by fuel	79
Figure 68: Energy per dwelling (permanently occupied)	80
Figure 69: Unit energy-related CO_2 emissions per dwelling	81
Figure 70: Commercial and public services final energy use by fuel	82
Figure 71: Commercial and public services sector CO_2 emissions by fuel	83
Figure 72: Energy intensity of the commercial and public services sector	84
Figure 73: Energy per employee in the commercial and public services sector	84

Table of Tables

Table 1: Growth rates, quantities and shares of final energy	17
Table 2: Growth rates, quantities and shares of final energy by sector	18
Table 3: Growth rates, quantities and shares of final energy in heat, transport and electricity	19
Table 4: Growth rates, quantities and shares of heat final energy by sector	21
Table 5: Growth rates, quantities and shares of heat final energy by fuel	21
Table 6: Growth rates, quantities and shares of transport final energy demand by mode	23
Table 7: Growth rates, quantities and shares of final consumption in transport	25
Table 8: Growth rates, quantities and shares of electricity final consumption	26
Table 9: Growth rates, quantities and shares of primary energy fuels	27
Table 10: Growth rates, quantities and shares of primary energy by sector	29
Table 11: Growth rates, quantities and shares of electricity generation fuel mix (primary fuel inputs)	33
Table 12: Growth rates, quantities and shares of electricity generated by fuel type	35
Table 13: Number of units and installed capacity by fuel, 2019	38
Table 14: GDP, modified domestic demand, final energy, primary energy, and energy-related CO_2 growth rates	42
Table 15: Renewable energy progress to targets	46
Table 16: Biofuels growth and as a proportion of road and rail transport energy – 2005, 2010, 2013 to 2019	50
Table 17: Renewable energy contribution to gross electricity consumption (RES-E normalised)	50
Table 18: Annual capacity factor for wind and hydro generation in Ireland – 2005, 2010, 2013 to 2019	52
Table 19: Growth rates, quantities and shares of primary energy-related CO_2 by sector	56
Table 20: Growth rates, quantities and shares of energy-related CO_2 emissions by mode of application	57
Table 21: Growth rates, quantities and shares of ETS and non-ETS energy-related CO_2 emissions since 2005	57
Table 22: Electricity price to industry change since 2015	62
Table 23: Oil prices to industry change since 2015	62
Table 24: Natural gas prices to industry change since 2015	63
Table 25: Growth rates, quantities and shares of final consumption in industry	66
Table 26: Growth rates, quantities and shares of energy-related CO_2 emissions in industry	67
Table 27: Growth rates, quantities and shares of final consumption in transport	70
Table 28: Growth rates, quantities and shares of energy-related CO_2 emissions in transport	70
Table 29: Growth rates, quantities and shares of transport final energy demand by mode	71
Table 30: Road freight activity	75
Table 31: Growth rates, quantities and shares of final consumption in the residential sector	78
Table 32: Growth rates, quantities and shares of energy-related CO_2 emissions in the residential sector	79
Table 33: Growth rates and quantities of energy consumption and CO_2 emissions per dwelling	80
Table 34: Growth rates, quantities and shares of final consumption in the commercial and public services sector	83
Table 35: Growth rates, quantities and shares of CO_2 emissions in commercial and public services	83
Table 36: Growth rates and quantities of energy per employee in commercial and public services	85

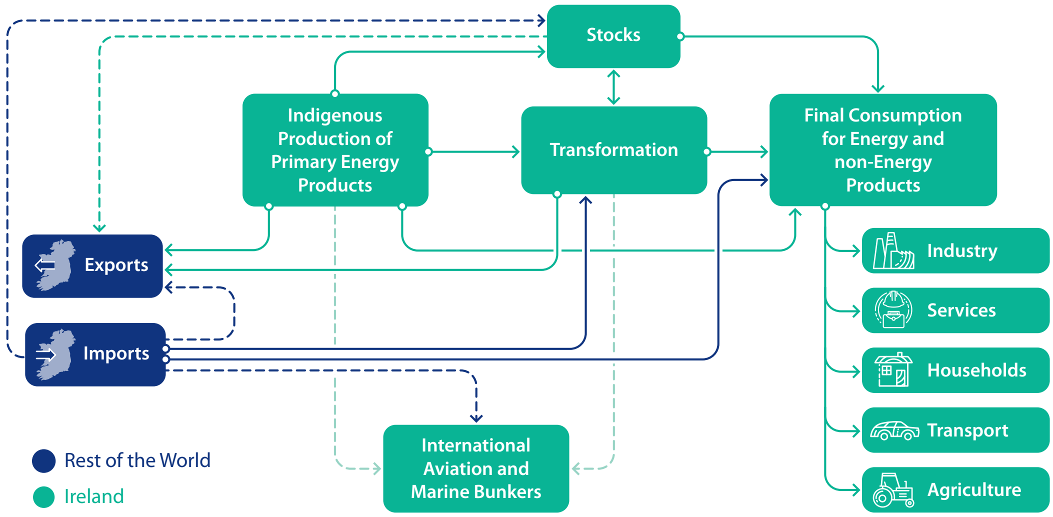
1 Introduction

This annual publication from SEAI presents national energy statistics on energy use in Ireland over the period 2005 to 2019. The report shows the trends in energy production and consumption and provides updates on Ireland's progress towards EU energy and climate targets. It also presents data and provides discussion on the underlying drivers of energy use in each sector.

Timely and reliable energy statistics underpin evidence-based decision-making. To this end, this publication presents a comprehensive overview of energy supply and demand in Ireland in order to inform Government policy and the wider energy debate. As the dialogue on climate change continues to gain momentum, it is now more important than ever that rational debate is based on robust statistical evidence from all emitting sectors.

The information in the report is based on annual energy balances for the country that show the flow of energy from production and transformation through to final consumption in different sectors of the economy. These flows are illustrated in *Figure 1*. The energy balance is the starting point for the construction of various indicators of energy intensity, energy efficiency, and also of other areas of national interest such as energy-related greenhouse gas emissions.

Figure 1: Main energy flows in Ireland



The data in the energy balance are based on monthly and annual surveys received from approximately 300 organisations, including energy producers, import/export companies and energy supply companies. In addition, SEAI uses these data to fulfil Ireland's energy statistics reporting obligations to Eurostat[1], under the EU Energy Statistics Regulation (EC 1099/2008), and to the International Energy Agency (IEA) through the completion of almost of two hundred annual, quarterly, monthly and ad hoc questionnaires each year.

The energy balance develops continuously as data revisions and new methodologies become available. This ensures that the best information is available. The main changes related to the period 2005 – 2019 are presented in this report.

A companion publication, *Energy Statistics – 2019 Report*, is also available, presenting the background data for the analysis contained herein. Additionally, *Energy in Ireland Key Statistics* is available, which summarises Ireland's energy statistics in a concise pocket-sized booklet. These publications are intended to serve as resources for policymakers, analysts, researchers and anyone with an interest in energy use in Ireland.

An energy data portal containing the background data that this report is based upon, together with energy forecast data, and an electronic version of this and other statistical reports, are available on SEAI's website at https://www.seai.ie/data-and-insights/.

Feedback and comments on this report are welcome. Contact details are available on the back cover of this report.

1.1 Note on revisions to historical energy balance data due to improved data on business energy use

In December 2018 the Central Statistics Office (CSO) published the results of the Business Energy Use Survey (BEUS) for the first time. This new data source provides a basis for the breakdown of energy use in the commercial services, public services and industrial sectors, at a level of detail not previously possible. SEAI have revised the National Energy Balances from 1990 to 2018 incorporating this new improved data.

SEAI have prepared a special report that explains the background to the BEUS, describes the new data that is available, how this compares to previous estimates, how the National Energy Balance has been revised to incorporate the new data, and gives a detailed comparison of the before and after estimates of energy use by fuel and by sector. That report is available from the SEAI website at www.seai.ie/NationalEnergyBalance/.

This Energy in Ireland 2020 report presents the revised data from 2005 to 2018 and the new statistics for 2019. Because of the extensive revisions to the historical data, it is important to note that it is not possible to combine the data on energy use by sector in this report with the data in previous editions in this series, or with other SEAI statistics reports published prior to November 2020, as they are no longer consistent with each other.

Developing the National Energy Balance is a continuous and ongoing process, and revisions are made whenever improved data becomes available. We welcome any feedback, which can be sent to epssu@seai.ie.

1.2 Early look at the effects of COVID 19 on 2020 energy use

2020 has seen dramatic changes to all of our lives following the COVID 19 pandemic. While this report focuses on the recently published annual data for 2019, there are a number of shorter term data sets that we can look at to get an early indication of the effects of such an extreme disruption to business as usual.

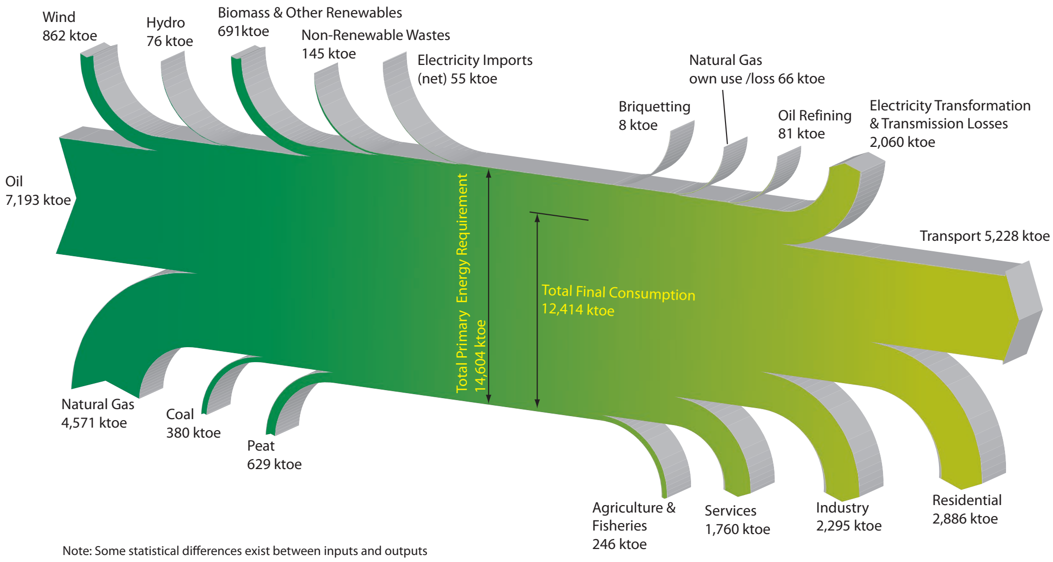
The data up to the end of October 2020 shows:

- By far the biggest impact of COVID-19 on energy use has been on transport energy, particularly air transport. During the peak summer season jet kerosene was down over 80% on 2019, and up until the end of October 2020 it was down 64% on the same period in 2019.
- There has also been an impact on petrol and diesel, but not as much as jet kerosene. Up until the end of October 2020, petrol and road diesel were down 23% and 15% respectively on the same period in 2019.
- Heating oil actually saw large increases in March 2020, likely due to a sharp drop in prices, and potentially due to a degree of stock-piling at the start of lock-down. For the year up until the end of October 2020, heating oil was up 15% on the same period in 2019. This may even out somewhat over the second half of the year as the tanks that were filled in March may last homes and businesses through the first half of the 20-21 winter season.
- During the first lock-down in April and May electricity use was initially down somewhat on 2019, but from late summer on electricity use has been up on the previous year. On December 7th 2020, during cold weather spell, a new all-time peak electricity demand of 5,357 MW was set. This was 245 MW higher than the previous peak set back in 2010 during the very extreme cold weather event that winter.
- There has been no discernible impact on natural gas use throughout the year.
- If society returns to a level or normality in 2021, energy use will likely return to near normal levels also, and any reduction in energy use in 2020 will not be significant in the context of medium or long term decarbonisation goals.

1.3 Energy balance for 2019

Figure 2 shows the energy balance for Ireland in 2019 as a flow diagram. This is a simplified view of the energy flows shown in *Figure 1*. This illustrates clearly the significance of each of the energy/fuel inputs, shown on the left, as well as showing how much energy is lost in transformation and the sectoral split of final energy demand.

Figure 2: Energy flow in Ireland 2019[2]



Source: SEAI

Fossil fuels used include oil, natural gas, coal and peat. In total they accounted for 12,774 ktoe (87%) of primary energy use in 2019. Oil dominated as a fuel, accounting for 7,193 ktoe, representing 49% of the total primary energy requirement. Renewables are disaggregated into wind, hydro and other renewables in *Figure 2,* and accounted for 11% of primary energy. Non-renewable wastes and electricity imports accounted for the remaining energy in 2019.

Transport continues to be the largest of the end-use sectors. It accounted for 5,228 ktoe in 2019, representing 42% of total final energy consumption.

Energy losses associated with the generation and transmission of electricity amounted to 2,060 ktoe in 2019. This was equivalent to 14% of total primary energy requirement or to 46% of the primary energy used for electricity generation. This compares to 2005, when losses associated with electricity generation represented 19% of the total primary energy requirement and 59% of the primary energy used for electricity generation. Energy losses in electricity generation are decreasing as more efficient fuels and technologies are adopted, and older, less efficient thermal generators are phased out.

2 All energy inputs shown here represent the sum of indigenous production plus, where applicable, net imports i.e. imports minus exports.

2 Final energy use

Final energy is the energy that is consumed directly by the end-user. It includes all the energy that is delivered for activities as diverse as manufacturing, transport of people and goods, and the day-to-day energy requirements of living, such as heating and cooking. We look at the final energy split by fuel and sector, and we look in detail at the final energy used in heat, transport, and electricity.

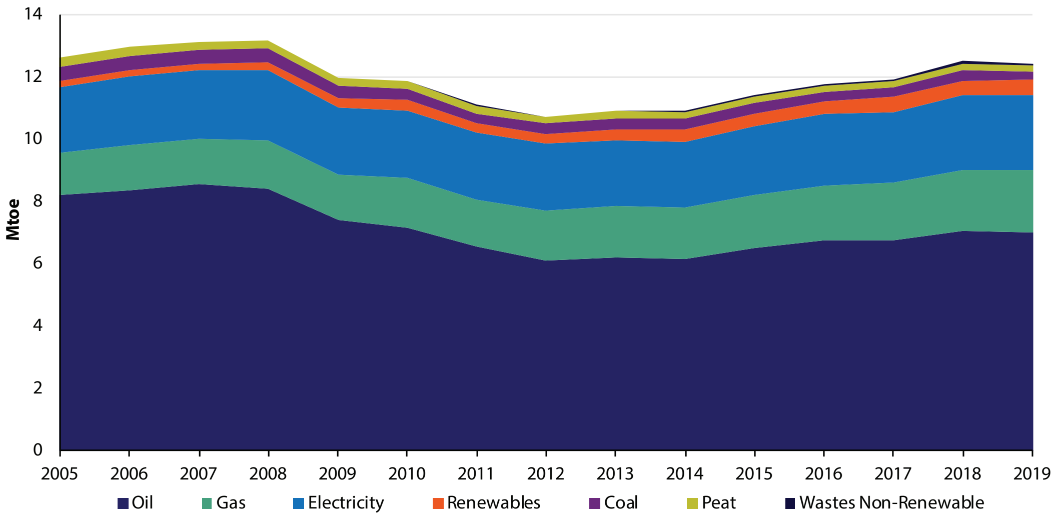
Final energy does not include the energy consumed by the energy industry itself in the transformation sector or distribution losses. For example it includes the electricity used by consumers, but not the energy that was used to produce the electricity, such as coal, gas or wind. Similarly, it includes the energy in petrol and diesel used by end-users, but not the energy used to convert crude oil to petrol and diesel in a refinery. It is important to consider final energy as this is the energy that people and businesses have direct control of.

2.1 Final energy by fuel

Total final energy consumption fell in 2019, by 0.6% (0.5% increase weather corrected). This was the first fall since 2014. Energy used for heat reduced, but this was largely due to 2019 being a warmer year than 2018. Transport and electricity final energy use continued to increase in 2019. In 2019 total final energy use was 16% above the 2012 low point, but was 5.9% lower than the peak in 2008.

Figure 3 shows the split of final energy demand by fuel for the period 2005 – 2019. Oil has by far the largest share in Ireland's energy mix, accounting for 57% in 2019, more than all other fuel types combined. This is as a result of the almost complete dependence on oil for transport and on the fact that transport makes up the largest share of final energy use.

Figure 3: Total final consumption by fuel



Source: SEAI

The changes in the growth rates, quantities and respective shares of individual fuels in final consumption over the period are shown in *Table 1*. For more details on absolute values associated with *Table 1* see the companion document Energy Statistics 1990 – 2019.

Oil has by far the largest share of final energy use at 57% in 2019, more than all other fuel types combined. Transport and home heating account for 86% of oil use.

Table 1: Growth rates, quantities and shares of final energy

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Fossil Fuels (Total)	-8.7	-0.6	-1.4	1.9	-1.6	10,324	9,425	81.9	75.9
Coal	-47.3	-4.5	-1.8	-7.3	-27.4	484	255	3.8	2.1
Peat	-33.0	-2.8	-4.5	-2.3	-7.0	274	183	2.2	1.5
Oil	-14.4	-1.1	-2.0	2.0	-0.7	8,196	7,014	65.0	56.5
Natural Gas	44.1	2.6	1.5	3.6	0.6	1,369	1,973	10.9	15.9
Renewables (Total)	159.0	7.0	5.2	5.0	5.0	188	488	1.5	3.9
Wastes (Non-Renewable)	-	-	38.8	6.5	3.5	0	57	0.0	0.5
Combustible Fuels (Total)	-6.4	-0.5	-1.2	2.0	-1.3	10,507	9,839	83.3	79.3
Electricity	16.7	1.1	0.3	2.5	2.0	2,094	2,444	16.6	19.7
Total	**-1.5**	**-0.1**	**-0.8**	**2.1**	**-0.6**	**12,606**	**12,414**		
Total (Weather Corrected)	**-2.3**	**-0.2**	**-0.1**	**2.5**	**0.5**	**12,695**	**12,399**		

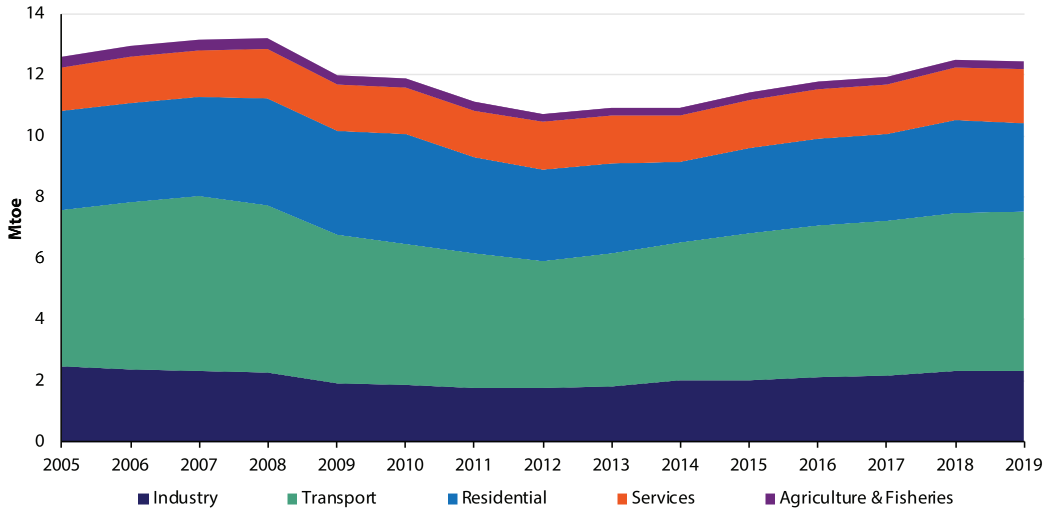
The most significant changes can be summarised as follows:

- Total final energy consumption was 12,414 ktoe in 2019, a decrease of 0.6% on 2018. When corrected for weather[3], it increased by 0.5%.
- Final energy use of fossil fuels fell by 1.6%. Direct use of coal, peat and oil fell while natural gas increased.
- Final energy consumption of electricity increased by 2% in 2019 to 2,444 ktoe (or 28,424 GWh). In 2019, electricity accounted for 19.7% of total final consumption.
- Final energy use of all renewable energy increased by 5% overall. Renewables accounted for 3.9% of final energy use.[4]
- Final energy use of oil fell by 0.7% in 2019. Oil accounted for 56.5% of final energy consumption in 2019.
- Final energy use of natural gas increased by 0.6% in 2019. It accounted for 15.9% of total final energy consumption.
- Final energy use of coal fell by 27.4% in 2019. It accounted for 2.1% of total final energy consumption. Coal use fell by 25% in industry and by 29% in the residential sector.
- Final energy use of peat fell by 7% in 2019. It accounted for 1.5% of total final energy consumption. Final use of peat was almost exclusively in the residential sector.

2.2 Final energy by sector

Figure 4 shows final energy split by sector. Final energy demand across all sectors fell during the economic downturn between 2008 and 2012. Industry, transport and services returned to growth after 2012, as did residential after 2014. Transport continues to dominate as the largest energy-consuming sector, with a share of 42% in 2019. The residential sector had the next largest share of final energy in 2019 at 24%, followed by industry at 18% and services at 14%.

Figure 4: Total final consumption by sector



Source: SEAI

Table 2: Growth rates, quantities and shares of final energy by sector

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Industry	-7.7	-0.6	1.4	3.5	0.1	2,486	2,295	19.7	18.5
Transport	2.8	0.2	0.8	2.2	0.5	5,084	5,228	40.3	42.1
Residential	-10.9	-0.8	-4.9	0.9	-4.6	3,240	2,886	25.7	23.2
Services	24.5	1.6	0.8	2.2	2.2	1,414	1,760	11.2	14.2
Agriculture & Fisheries	-35.8	-3.1	-5.6	2.7	-2.0	383	246	3.0	2.0
Total	**-1.5**	**-0.1**	**-0.8**	**2.1**	**-0.6**	**12,606**	**12,414**		

The changes in growth rates, quantities and shares are shown in *Table 2* and summarised as follows:

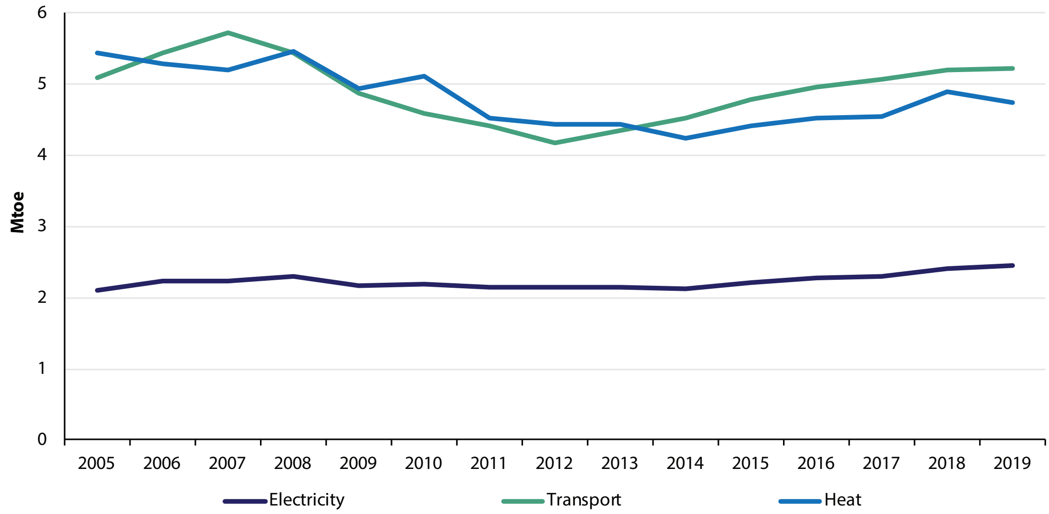
- Overall final energy consumption fell by 0.6% in 2019. Almost all of decrease occurred in the residential sector.
- Final energy use in the residential sector fell by 4.6% in 2019 (140 ktoe). Correcting for weather, residential energy use increased by 0.5%.
- There was a 2.2% increase (38 ktoe) in final energy use in the services sector in 2019. Correcting for weather, the increase was 4.7%.
- In 2019, final energy use in industry grew by 0.1% (3.3 ktoe).
- Energy use in transport grew in 2019 by 0.5% (26 ktoe). Transport remains the dominant end use sector, accounting for 42% of all final energy in 2019.
- The agricultural and fisheries sector's share of final energy use fell from 3.0% in 2005 to 2.0% in 2019. Agriculture and fisheries' final energy consumption fell in 2019 by 2.0% (5 ktoe).

Overall final energy consumption fell by 0.6% in 2019. Almost all of decrease occurred in the residential sector.

2.3 Final energy by mode

Energy use can also be split into electricity, transport and heat. These three modes represent distinct energy services or markets. Where thermal or transport energy is provided by electricity (e.g. electric heaters or electric vehicles), this energy is counted under electricity, and not under thermal or transport. This means that there is no overlap and the modes can be added together to give total final energy use. *Figure 5* shows final energy split by mode.

Figure 5: Final energy in heat, transport and electricity



Source: SEAI

Table 3: Growth rates, quantities and shares of final energy in heat, transport and electricity

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Electricity	16.7	1.1	0.3	2.5	2.0	2,094	2,444	16.6	19.7
Transport	2.8	0.2	0.8	2.2	0.5	5,079	5,221	40.3	42.1
Heat	-12.6	-1.0	-2.9	1.9	-3.1	5,433	4,749	43.1	38.3

Transport has had the largest share of final energy demand since 2014. In 2019, transport accounted for 42% of final energy, closely followed by heat at 38%. Electricity has the smallest share of final demand, accounting for 20% in 2019.

Transport energy decreased sharply after the economic crash in 2008, but returned to growth in 2013, and has increased every year since. For more details on energy use in transport see *Section 2.5* and *Section 7.2*.

Heat final energy use shows greater year to year fluctuations than transport or electricity. This is due to the effects of weather. For more on how weather affects heating energy see *Section 5.2*. Energy use for heat in 2019 fell by 3.1%, but when corrected for weather the reduction was just 0.7%. Final energy use for heat is discussed further in *Section 2.4*.

Electricity use increased steadily every year from 1990 to 2008, but following the recession it reduced by 7% between 2008 and 2012. Electricity use remained flat between 2012 and 2014, but from 2015 it returned to growth, and in 2018 electricity use surpassed the previous 2008 peak. In 2019 electricity use grew again and was 7% above the 2008 level . Electricity consumption as a share of total final consumption increased from 17% to 20% between 2005 and 2019. Electricity final energy use is discussed in *Section 2.6* and electricity generation is discussed in section *Section 4.1*

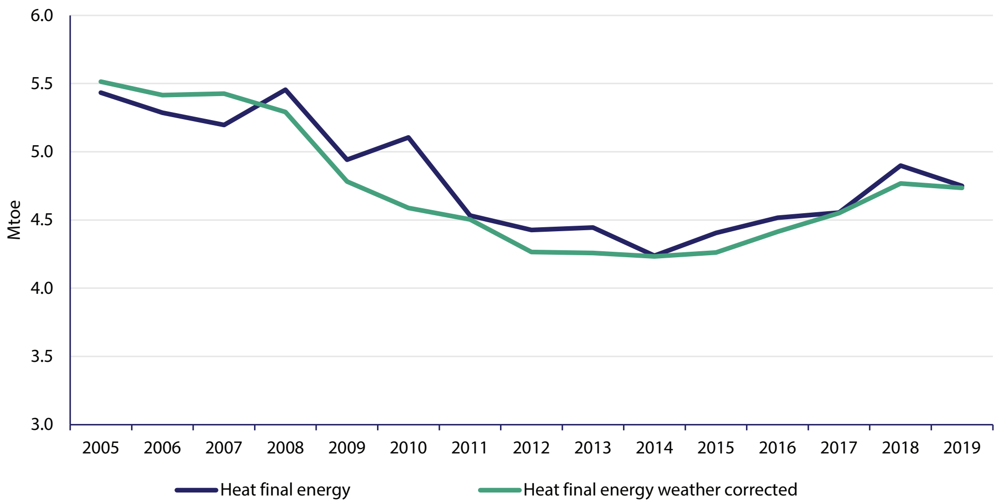
2.4 Heat

Figure 6 shows final energy used for heat between 2005 and 2019 along with the heat final energy use adjusted to correct for the effects of warmer or colder years. This correction is done using the concept of degree-days, which is discussed more in *Section 5.2.*

When corrected for temperature variations, overall energy use for heat declined between 2008 and 2014, but increased between 2014 and 2018. Energy use for heat in 2019 fell by 3.1%, but when corrected for weather the reduction was just 0.7%. The reduction in heat use between 2008 and 2014 was due to the effects of the recession coupled with a period of record high oil prices, along with efficiency improvements. After 2013, with the recovery of the economy, and reduced oil prices, demand for heat increased. That trend reversed in 2019, but it is too early to say whether it is simply a one year reversal due to weather effects, or part of some deeper, longer lasting trend.

Weather corrected heat final energy use reduced slightly in 2019, having increased for the previous four years in a row.

Figure 6: Final energy use for heat, actual and weather corrected



Source: SEAI

2.4.1 Heat final energy by sector

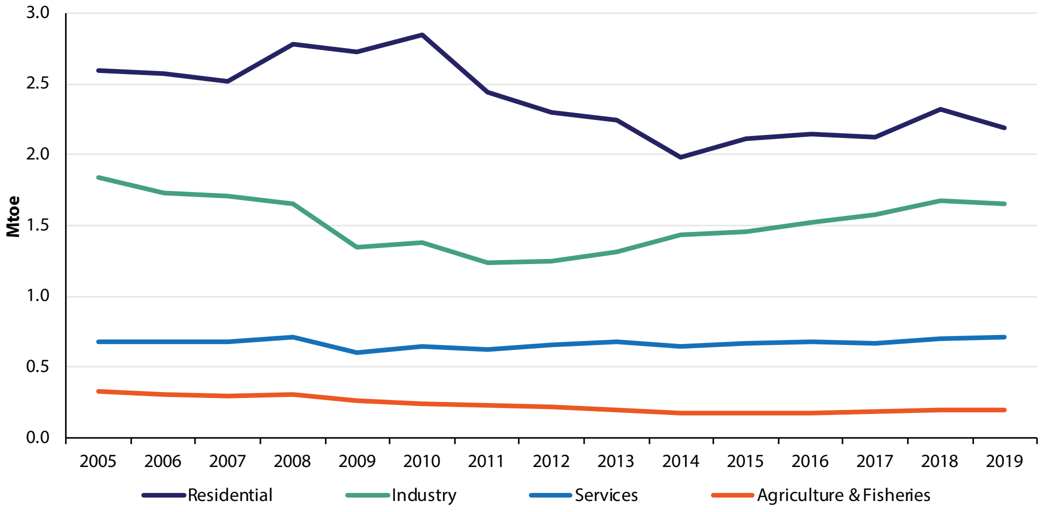
Figure 7 and *Table 4* show the trends for energy used for heat, split by sector. Households are the single largest consumer of heat energy, larger than industry. This is partly because Ireland has very little energy intensive heavy industry, such as steel or car manufacturing. Direct energy use for heat in households decreased by 5.9% in 2019.

Household heat energy demand is the most strongly affected by weather. Peak household heat energy demand occurred in 2010, which had periods of extremely cold weather. From 2010 to 2014 household energy demand decreased due to a combination of reduced disposable incomes during the recession, record high fuel prices, and energy efficiency improvements. Between 2014 and 2018 this trend reversed due to the recovering economy and a drop in fuel prices. Household heat energy use reduced by 5.9% in 2019. When corrected for weather, energy use for heat in households still declined by 2.1% in 2019.

Industry use peaked in 2005, and fell in 2009 following the economic crisis. Industry heat use increased after 2012 and in 2019 was 32% above 2012, but still remained 10% below the 2005 peak.

Direct energy use for heat in services increased by 1.0% in 2019, or 5.3% when corrected for weather. In 2019 it was just 0.5% below the 2008 peak.

Figure 7: Final consumption of heat by sector



Source: SEAI

Table 4: Growth rates, quantities and shares of heat final energy by sector

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Residential	-15.7	-1.2	-5.8	0.9	-5.9	2,594	2,186	47.7	46.0
Industry	-10.0	-0.7	1.1	3.3	-1.0	1,836	1,653	33.8	34.8
Services	5.1	0.4	0.9	1.4	1.0	676	710	12.4	15.0
Agriculture & Fisheries	-39.3	-3.5	-6.9	3.6	-1.8	328	199	6.0	4.2
Total	**-12.6**	**-1.0**	**-2.9**	**1.9**	**-3.1**	**5,433**	**4,749**		

2.4.2 Heat final energy by fuel

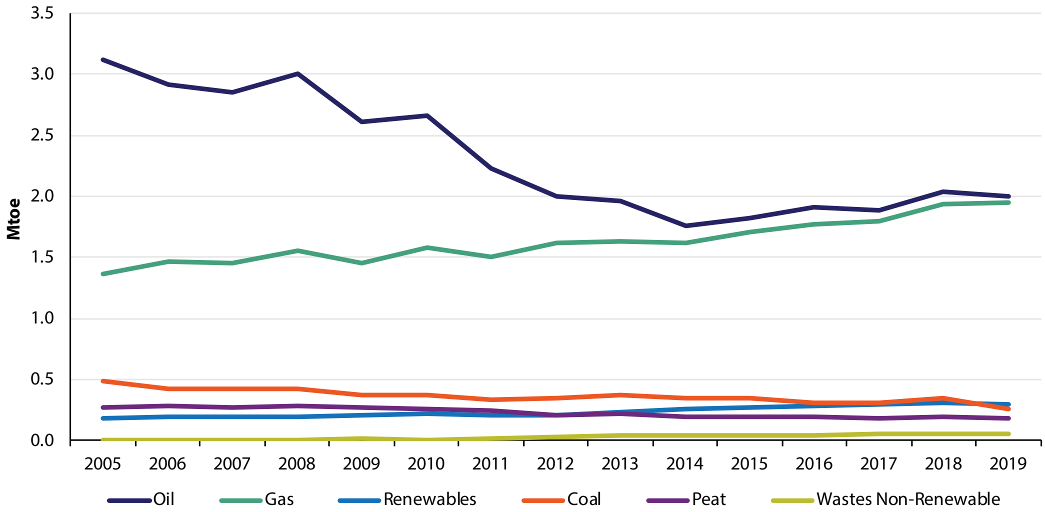
Table 5 and *Figure 8* show the trends for energy used for heat, split by fuel. The use of energy for heat was dominated by oil use from 1990 to 2010. Oil was still the most prominent fuel for heat energy in 2019 but its share has fallen, from 57% in 2005 to 42% in 2019. Gas use for heat has steadily increased since 1990. By 2005 it accounted for 25% of heat energy and increased to 41% by 2019 due to the expanding gas network, falling oil use and fuel switching in industry from oil to gas.

Table 5: Growth rates, quantities and shares of heat final energy by fuel

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Fossil Fuels	-16.3	-1.3	-3.5	1.8	-3.1	5,246	4,393	96.6	92.5
Oil	-36.0	-3.1	-7.2	2.2	-2.3	3,120	1,999	57.4	42.1
Gas	43.1	2.6	1.5	3.4	0.8	1,367	1,955	25.2	41.2
Coal	-47.3	-4.5	-1.8	-7.3	-27.4	484	255	8.9	5.4
Peat	-33.0	-2.8	-4.5	-2.3	-7.0	274	183	5.0	3.9
Renewables	60.0	3.4	4.5	2.4	-3.5	187	300	3.4	6.3
Wastes (Non-Renewable)	-	-	38.8	6.5	3.5	0	57	0.0	1.2
Total	**-12.6**	**-1.0**	**-2.9**	**1.9**	**-3.1**	**5,433**	**4,749**		

There has been a shift from oil to gas for heat. In 2000, 59% of heat was from oil and 24% from gas whereas, in 2019, 42% of heat was from oil and 41% from gas.

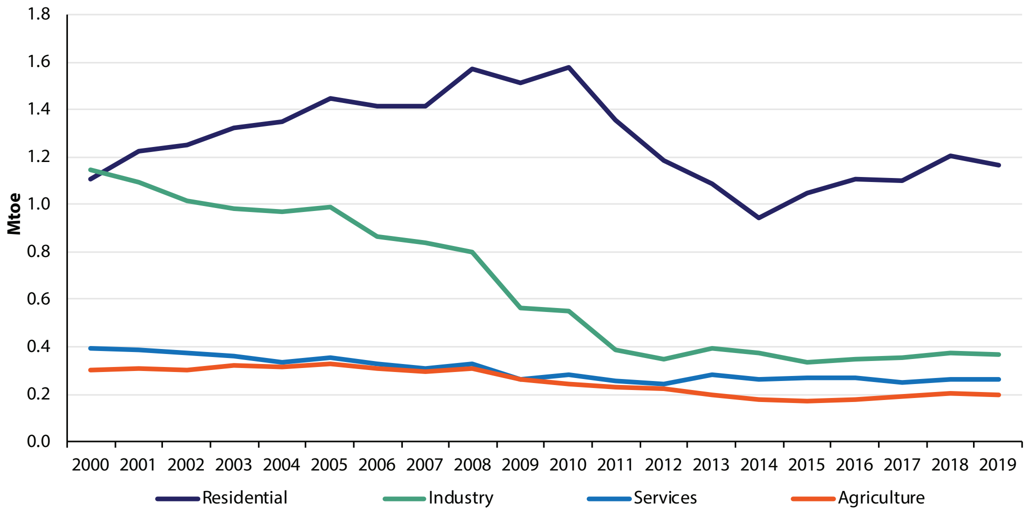
Figure 8: Final consumption of heat by fuel



Source: SEAI

Figure 9 shows in more detail the trends in oil use for heat from 2005 to 2019. Most of the reduction in oil use for heat between 2005 and 2019 happened in industry, although it has reduced in all sectors. In industry, oil use in 2019 was 63% lower than in 2005. In households, oil use decreased 40% between the peak in 2010 and the low in 2014, but increased by 23% between 2014 and 2019. Oil use in services also decreased, and in 2019 was 19% lower than the peak in 2008. The economic recession from 2009 to 2012 and the record high oil prices experienced between 2011 and 2014 were significant factors during this time period.

Figure 9: Final consumption of oil for heat



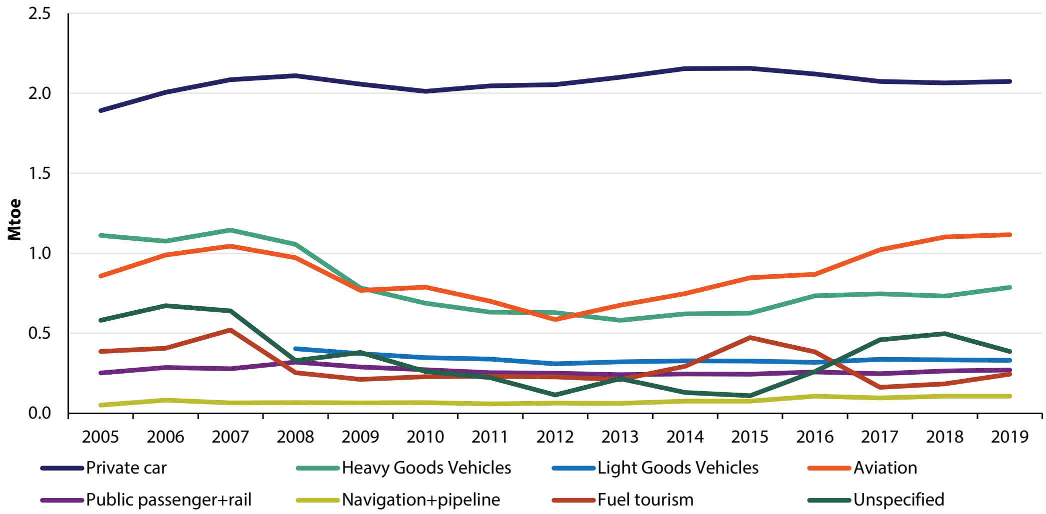
Source: SEAI

2.5 Transport

2.5.1 Transport final energy by sub-sector

Figure 10 and *Table 6* show the trends for transport's energy use by sub-sector. Private car energy use clearly dominates. Private car energy use declined following the economic crash during 2009 and 2010 but returned to growth soon after, in 2011. It grew year on year between 2011 and 2015, but reduced slightly between 2015 and 2019[5].

Figure 10: Transport energy demand by mode



Source: SEAI

Table 6: Growth rates, quantities and shares of transport final energy demand by mode

	Overall Growth %	Average Annual Growth %					Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'05 – '10	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Heavy Goods Vehicle (HGV)	-29.3	-2.4	-9.2	-1.9	5.9	7.4	1,112	787	21.9	15.1
Light Goods Vehicle (LGV)	-	-	-	-1.2	0.3	-0.9	0	330	0.0	6.3
Private Car	9.6	0.7	1.2	1.4	-1.0	0.4	1,891	2,072	37.2	39.7
Public Passenger	-12.8	-1.0	0.9	-4.1	0.8	-0.1	157	137	3.1	2.6
Rail	0.0	0.0	0.0	-2.1	2.7	4.6	40	40	0.8	0.8
Fuel Tourism	-36.8	-3.2	-10.0	15.7	-15.2	32.6	387	245	7.6	4.7
Navigation	79.7	4.3	5.4	2.1	5.7	6.5	50	89	1.0	1.7
Aviation	30.0	1.9	-1.7	1.5	7.1	1.2	859	1,116	16.9	21.4
Pipeline	672.2	15.7	-0.9	13.2	44.4	-24.5	2	17	0.0	0.3
Unspecified	-33.4	-2.9	-14.8	-16.0	37.2	-22.3	581	387	11.4	7.4
Total	**2.8**	**0.2**	**-2.0**	**0.8**	**2.2**	**0.5**	**5,079**	**5,221**		

Aviation energy use also reached a peak in 2007, and decreased sharply afterwards due to the recession. By 2012, aviation had reduced by 44% compared to 2007. Aviation energy use returned to growth in 2013 and since then it has recovered much more strongly than car or freight, increasing by 90% between 2012 and 2019. In 2018 aviation surpassed the previous 2007 peak for the first time and in 2019 it was 6.8% above the 2007 level.

Heavy goods vehicle (HGV) road freight energy use reduced by 49% between 2007 and 2013 as a result of reduced activity during the recession. It increased by 29% between 2013 and 2017, decreased by 1.8% in 2018 but increased again in 2019 by 7.4%. This was due to changes in levels of activity, i.e. the amount of tonne-kilometres transported. In 2019 the amount of energy used by heavy goods vehicles remained 29% below the 2005 level.

Heavy goods vehicles showed the strongest growth in energy use in transport in 2019, increasing by 7.4%.

2.5.2 Transport final energy by fuel

Figure 11 and *Table 7* show the trends for transport's energy use by fuel type between 2005 and 2019 (electricity is excluded as electricity used for transport or heat is counted under electricity in this breakdown).

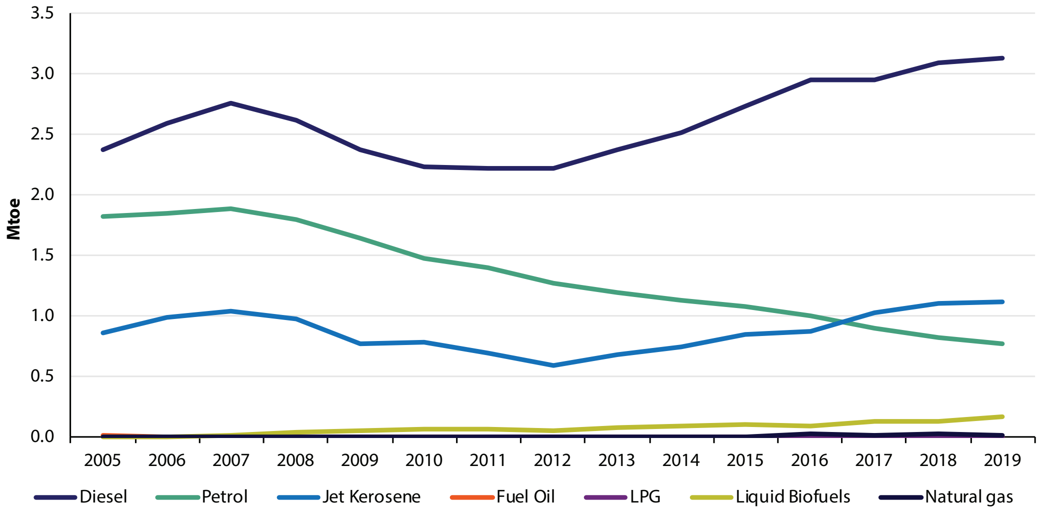
The biggest shift in the fuels used for transport has been from petrol to diesel. Diesel consumption increased by 31%, while petrol use fell by 58%. Diesel's overall market share grew from 47% in 2005 to 60% in 2019 while the market share of petrol fell from 36% to 15% over the same period.

Transport energy use peaked in 2007, at 5,712 ktoe, and fell each year thereafter until 2013. As the economy started to expand again, transport energy use grew every year from 2013 to 2010, and in 2019 was 25% higher than in 2012. Energy consumption in transport was 2.8% higher in 2019 than in 2005, but 8.6% lower than the peak in 2007.

In 2019, overall energy use in transport increased by 0.5% compared with the previous year.

- Petrol use continued to fall in 2019, reducing by 5.8% to 774 ktoe. Petrol consumption is now 59% lower than the peak in 2007.
- Diesel consumption grew by 1% during 2019, to 3,124 ktoe. Diesel has by far the largest share of transport fuel use, accounting for 60% in 2019.
- Jet kerosene consumption increased by 1.2% in 2019, to 1,116 ktoe, accounting for 21% of transport's final energy use, the second largest fuel share after diesel.

Figure 11: Final consumption of transport by fuel



Source: SEAI

Table 7: Growth rates, quantities and shares of final consumption in transport

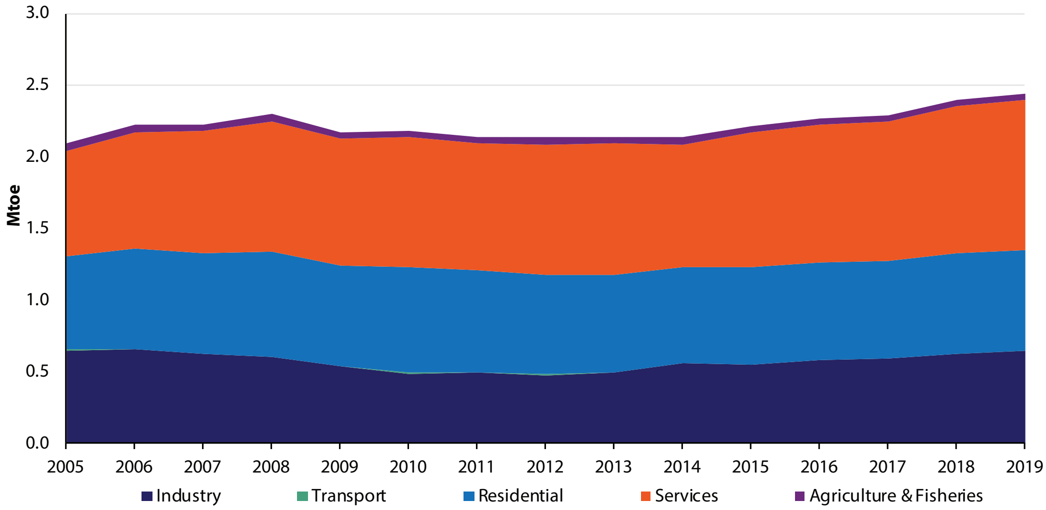
	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Fossil Fuels (Total)	-0.9	-0.1	0.7	2.0	-0.2	5,078	5,033	100.0	96.4
Total Oil	-1.2	-0.1	0.7	1.9	-0.1	5,076	5,015	99.9	96.1
Petrol	-57.5	-5.9	-6.2	-7.9	-5.8	1,822	774	35.9	14.8
Diesel	31.4	2.0	4.1	3.5	1.0	2,378	3,124	46.8	59.8
Jet Kerosene	30.2	1.9	1.5	7.1	1.2	857	1,116	16.9	21.4
LPG	59.9	3.4	37.5	-10.4	-12.0	1	2	0.0	0.0
Natural Gas	690.6	15.9	13.3	45.1	-22.8	2	17.42	0.0	0.3
Renewables	17027.1	44.4	6.7	10.1	21.9	1	188	0.0	3.6
Combustible Fuels (Total)	2.3	0.2	0.8	2.2	0.5	5,079	5,195	100.0	99.5
Total	**2.8**	**0.2**	**0.8**	**2.2**	**0.5**	**5,079**	**5,221**		

2.6 Electricity

2.6.1 Electricity final energy by sector

Figure 12 shows the final electricity consumption in each of the main sectors. Final electricity demand peaked in 2008, at 2,294 ktoe before falling in the subsequent recession. It began to grow again in 2015 and in 2018 it surpassed the previous peak for the first time. In 2019 it grew by 2% to 2,444 ktoe (28,424 GWh), 6.6% higher than in 2008.

Figure 12: Final consumption of electricity by sector



Source: SEAI

The service sector has the largest share of final electricity use at 43%.

Table 8 shows changes in electricity demand by sector. Electricity demand grew in all sectors in 2019, except for the residential and agriculture sectors. Services had the largest share of electricity use in 2019 at 43%, with the residential sector the second largest at 29%. Transport experienced the largest relative growth in electricity use at 26%, but this was from a very small base. Electricity use in transport includes that used by the Dublin Area Rapid Transit (DART) rail system and the Luas light rail system, and electric vehicles on the road. Transport accounted for just 0.3% of electricity use in 2019, or 79 GWh. Of this, electric vehicles are estimated to account for approximately 27 GWh.

Table 8: Growth rates, quantities and shares of electricity final consumption

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Industry	-1.2	-0.1	2.3	4.0	3.2	650	642	31.0	26.2
Transport	33.5	2.1	-0.8	15.7	25.9	5	7	0.2	0.3
Residential	8.3	0.6	-1.6	0.8	-0.5	646	699	30.8	28.6
Services	42.2	2.5	0.7	2.8	3.0	738	1,050	35.3	42.9
Agriculture & Fisheries	-15.4	-1.2	0.0	-0.6	-2.5	55	47	2.6	1.9
Total	**16.7**	**1.1**	**0.3**	**2.5**	**2.0**	**2,094**	**2,444**		

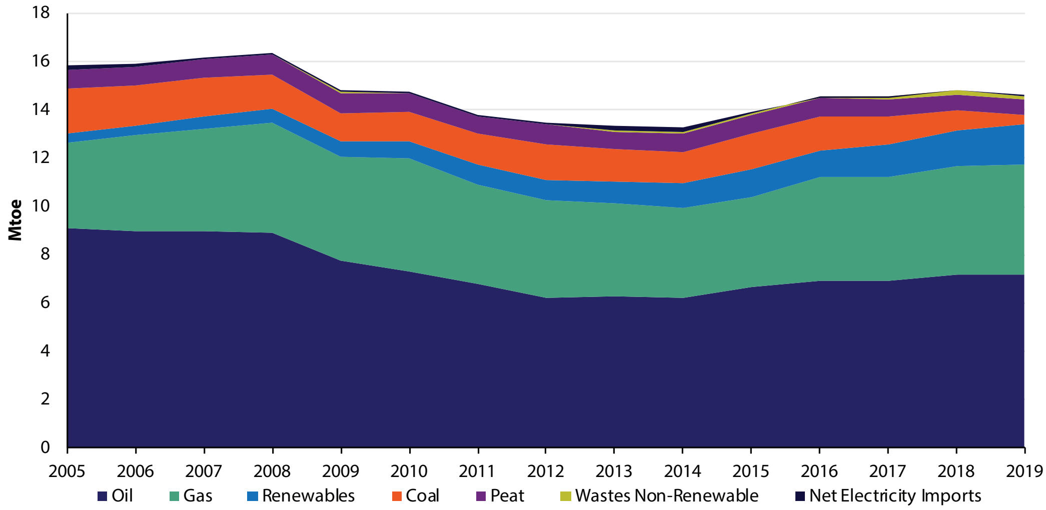
3 Primary energy supply

Primary energy is the total amount of energy required, including all the energy that is consumed for energy transformation processes such as electricity generation and oil refining. We look at primary energy by fuel, sector and mode.

For energy that goes through a transformation process, such as electricity generation, the primary energy requirement depends on the efficiency of the transformation process, as well as the underlying demand for final energy.

3.1 Primary energy by fuel

Figure 13: Total primary energy requirement[6]



Source: SEAI

Figure 13 illustrates the trend in primary energy requirement over the period 2005 – 2019, emphasising changes in the fuel mix. Primary energy consumption in Ireland in 2019 was 14,604 ktoe, a 1.2% fall on the previous year. Over the period 2005 – 2019, Ireland's annual primary energy requirement fell in absolute terms by 7.9% (0.6% per annum on average).

The individual fuel growth rates, quantities and shares are shown in *Table 9*. Primary energy requirement peaked in 2008 and has fallen by 11% since then.

Table 9: Growth rates, quantities and shares of primary energy fuels

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Fossil Fuels (Total)	-16.6	-1.3	-2.0	0.3	-3.0	15,311	12,774	96.6	87.5
Coal	-79.8	-10.8	3.4	-28.5	-53.3	1,882	380	11.9	2.6
Peat	-20.5	-1.6	0.0	-4.8	-8.3	791	629	5.0	4.3
Oil	-21.3	-1.7	-1.8	2.0	0.1	9,134	7,193	57.6	49.3
Natural Gas	30.5	1.9	-4.4	4.9	2.0	3,503	4,571	22.1	31.3
Renewables (Total)	339.8	11.2	10.9	9.4	10.3	370	1,629	2.3	11.2
Hydro	40.4	2.5	6.1	2.4	27.7	54	76	0.3	0.5
Wind	801.1	17.0	18.5	11.1	16.0	96	862	0.6	5.9
Biomass	45.3	2.7	2.3	3.5	-3.9	180	262	1.1	1.8
Other Renewables	971.0	18.5	8.7	11.9	7.0	40	429	0.3	2.9
Wastes (Non-Renewable)	-	-	51.7	20.6	-0.1	-	145	-	1.0
Electricity Imports (net)	-68.5	-7.9	7.4	-1.1	-	176	55	1.1	0.4
Total	**-7.9**	**-0.6**	**-1.1**	**1.2**	**-1.2**	**15,857**	**14,604**		

6 'Wastes (Non-Renewable)' in the graph represents energy from non-renewable wastes.

The following are the main trends in primary energy:

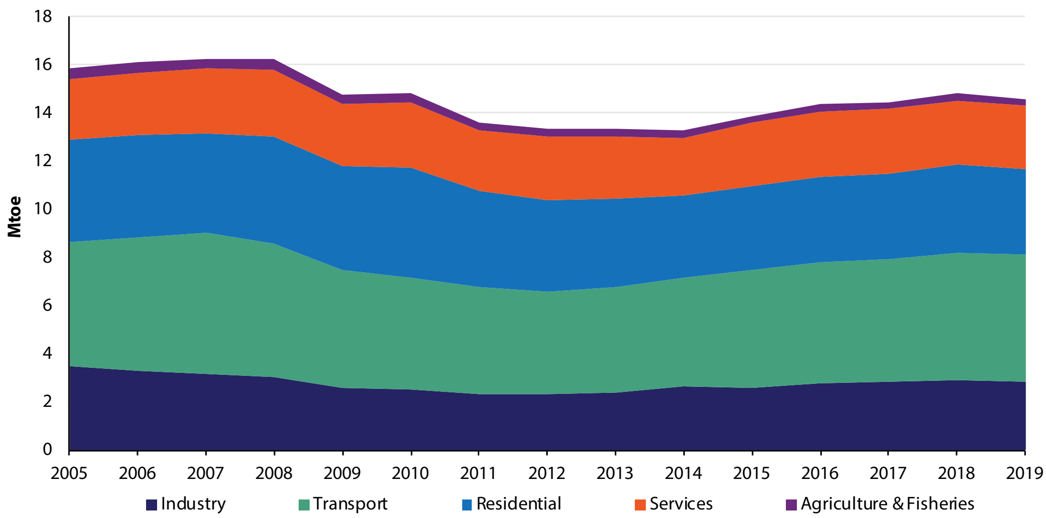
- Overall primary energy use fell by 1.2% in 2019.
- Fossil fuels accounted for 87% of all the energy used in Ireland in 2019. Demand for fossil fuels fell by 3% in 2019, and was 17% lower than in 2005.
- Coal use decreased by 53% in 2019 and its share of total primary energy requirement fell to 2.6%, down from 10.5% in 2015. Since 2005, coal demand has fallen by 80% (10.8% per annum).
- Peat use fell by 8.3% in 2019 and its share of overall energy use was 4.3%.
- Oil continues to be the dominant energy source and maintained a 49% share of total primary energy requirement in 2019. The share of oil in overall energy use peaked in 1999 at 60%. Consumption of oil increased by 0.1% in 2019, but was still 21% lower than in 2005.
- Natural gas use increased by 2% in 2019, and its share of total primary energy requirement increased to 31%. Natural gas use was 30% higher than in 2005.
- Total renewable energy increased by 10.3% during 2019. Hydro and wind increased by 28% and 16% respectively. Biomass use fell by 3.9% in 2019 and other renewables increased by 7%. The overall share of renewables in primary energy stood at 11.2% in 2019, up from 10% in 2018.
- Energy from non-renewable wastes fell by 0.1% in 2019, and accounted for 1% of primary energy.
- Ireland returned to be a net importer of electricity in 2019 for the first time since 2015, importing 55 ktoe.

> Demand for fossil fuels fell by 3% in 2019, to 12,774 ktoe, and was 17% lower than in 2005.

3.2 Primary energy by sector

Figure 14 allocates Ireland's primary energy supply to each sector of the economy. Where primary fuels are used directly in a particular sector, the allocation is straightforward. Where fuels first undergo a transformation process, for example electricity generation, the primary energy required to generate the electricity used in the sector is allocated to that sector.

Figure 14: Total primary energy requirement by sector[7]



Source: SEAI

7 International air transport kerosene is included in the transport sector in these graphs. Later graphs showing CO_2 emissions by sector omit international air transport energy emissions following UN Intergovernmental Panel on Climate Change (IPCC) guidelines. In addition, the effects of cross-border trade (fuel tourism) and the smuggling of diesel and petrol are not included in this analysis. Estimates of fuel tourism are included in the energy balance and presented in the transport section (*Table 7.2*).

Table 10 shows the growth rates of the different sectors in terms of total primary energy requirement and also provides the percentage shares for 2005 and 2019.

Table 10: Growth rates, quantities and shares of primary energy by sector

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Industry	-17.4	-1.4	0.7	2.4	-0.7	3,469	2,865	21.9	19.6
Transport	2.1	0.2	0.8	2.1	0.3	5,181	5,292	32.7	36.3
Residential	-17.3	-1.4	-5.0	-0.1	-5.2	4,236	3,502	26.7	24.0
Services	5.8	0.4	-0.9	0.5	-0.3	2,502	2,647	15.8	18.1
Agriculture & Fisheries	-38.7	-3.4	-5.3	1.3	-3.3	468	287	3.0	2.0

Changes in sectoral primary energy consumption presented in *Table 10* are as follows:

- In 2019, primary energy use in households fell by 5.2%. The residential share of primary energy was 24% .
- Transport's primary energy use increased in 2019 by 0.3%. Transport's primary energy use fell by 27% between 2007 and 2012, but has increased by 25% since then. Transport remains the largest energy-consuming sector, with a 36% share of primary energy in 2019.
- Use of primary energy in the commercial and public services sector decreased by 0.3% in 2019 and its share of primary energy was 18%.
- Industry's primary energy use decreased by 0.7% in 2019 and its share of primary energy was 20%.
- Agriculture and fisheries' primary energy use decreased by 3.3% in 2019, and accounted for 2% of primary energy use.

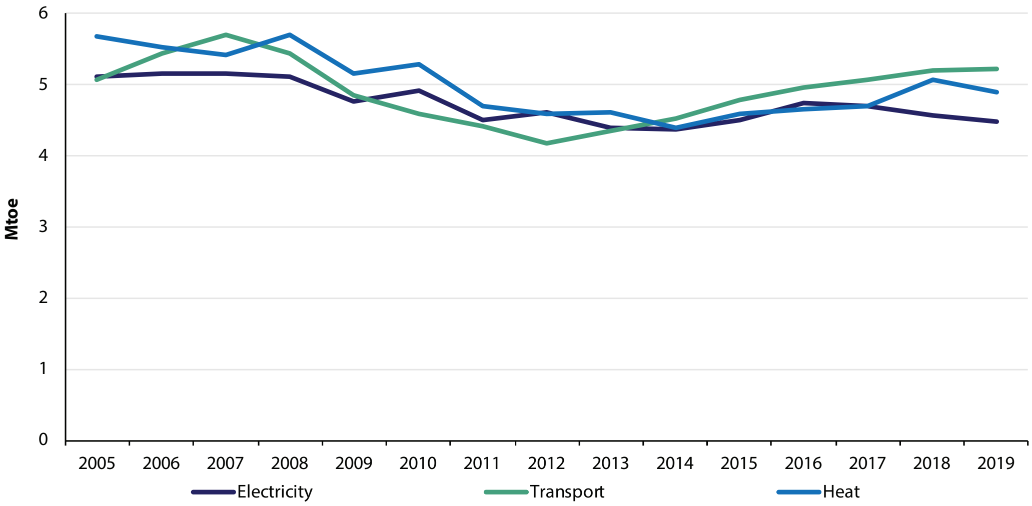
Sectoral energy-related CO_2 emissions are discussed in *Section 6.2*.

3.3 Primary energy by mode

Figure 15 shows primary energy split by heat, transport and electricity. Where thermal or transport energy is provided by electricity this energy is counted under electricity, and not under thermal or transport.

In primary energy terms, all three modes have a broadly similar share. Since 2014, transport has had the largest share, accounting for 35.7% of primary energy in 2019, followed by heat at 33.6% and electricity at 30.7%. Compared to *Figure 5*, electricity makes up a far higher share of primary energy than it does of final energy. This is because primary energy includes the large amount of energy that is lost as waste heat in the electricity generation process. For more information on electricity generation inputs, outputs and efficiency see *Section 4.1.*

Figure 15: Primary energy by mode of application



Source: SEAI

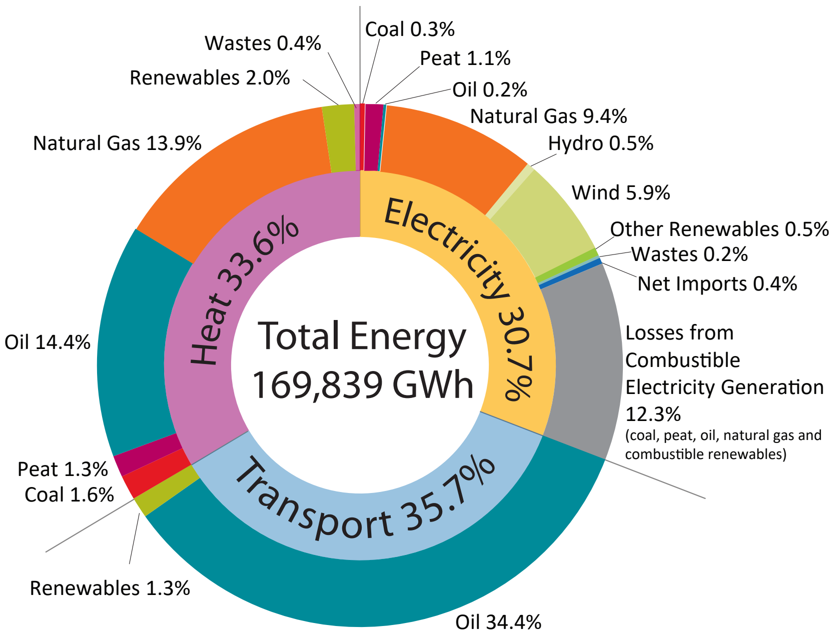
Figure 16 shows an alternative view of the 2019 energy balance. Total primary energy is shown as 169,839 GWh (14,604 ktoe) in the centre, and then the shares by mode in the next circle, and finally the shares of energy sources used in each of the modes in the outer circle. All of the percentages shown are of the total primary energy figure in the centre.

Taking transport as an example in *Figure 16*, it can be seen that transport accounted for 35.7% of overall primary energy. The bulk of transport energy use was oil (96% of transport energy), and this accounted for 34.4% of all primary energy use. Renewable energy use in transport accounted for just 1.3% of total primary energy requirement.

The energy used for heat accounted for 33.6% of primary energy, and oil and gas make up the largest proportions of energy use for heat. Oil use for heat accounted for 14.4% of overall energy, natural gas 13.9%, followed by renewables at 2.0%.

Energy used to generate electricity accounted for 30.7% of all energy use in Ireland in 2019. A significant proportion of this is lost in the form of waste heat during the electricity generation process. Energy losses in electricity generation accounted for 12.3% of all energy use in Ireland in 2019. The figures in the outer circle show the proportions of the electricity generated by the different energy sources and their share of overall primary energy. The largest share of the electricity generated came from natural gas and represented 9.4% of primary energy use. This is followed by wind, which accounted for 32% of the electricity generated and 5.9% of primary energy. Coal generated electricity represented 0.3% of primary energy in 2019, and peat 1.1%.

Figure 16: Primary energy by mode and fuel



Source: SEAI

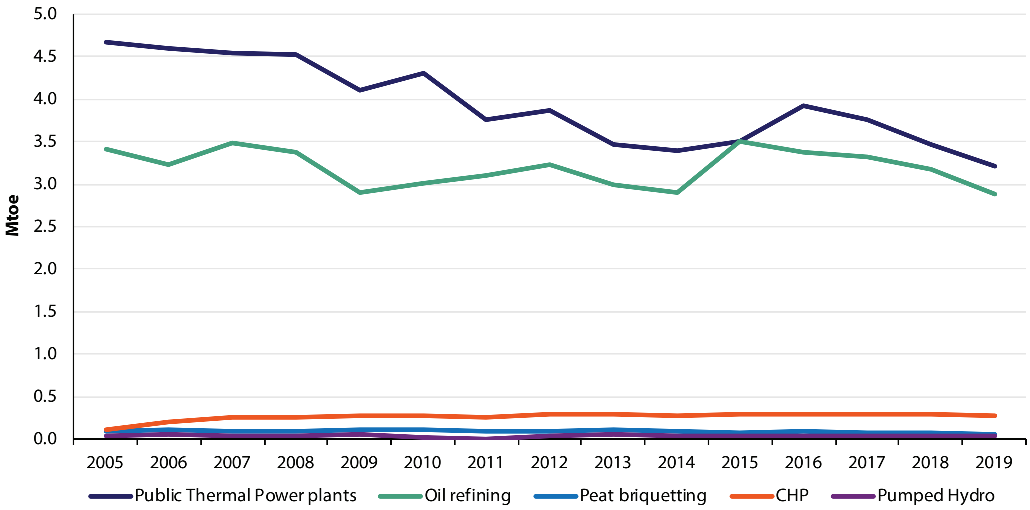
4 Electricity generation and other transformation processes

Transformation is the process of converting energy from one type of fuel to another, such as transforming crude oil into petrol and diesel, or converting coal and gas into electricity. Around half of all primary energy in Ireland is put through a transformation process before the energy reaches the final end-user.

Primary energy considers all the inputs to the energy transformation sector, while final energy only considers the outputs from energy transformation. The outputs are less than the inputs due to the energy required to make the transformation and losses from the process.

The two most significant energy transformation processes are electricity generation and oil refining, as shown in *Figure 17*.

Figure 17: Primary energy inputs to transformation processes[8]



Source: SEAI

4.1 Electricity generation

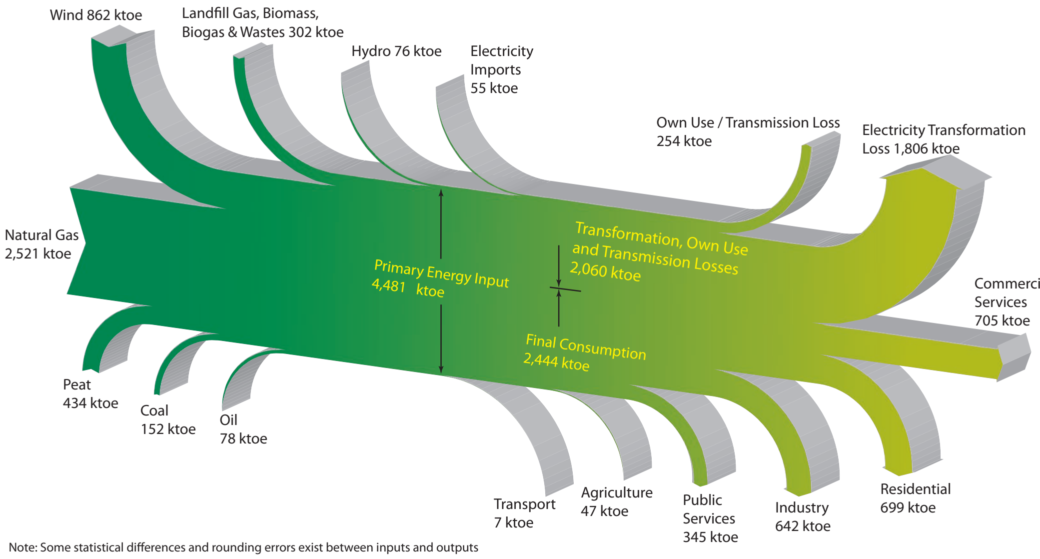
Modern economies and societies are dependent on reliable and secure supplies of electricity. We have seen in *Figure 15* that the generation of electricity accounts for one third of all energy use each year in Ireland. *Figure 18* shows the flow of energy in electricity generation[9]. Total energy inputs to electricity generation in 2019 amounted to 4,483 ktoe, 31% of total primary energy requirement. The relative size of the useful final electricity consumption compared with the energy lost in transformation and transmission is striking. These losses represent 46% of the energy inputs. The growing contribution from renewables (hydro, wind, landfill gas and biomass) is also notable, as is the dominance of gas in the generation fuel mix. In 2019, natural gas accounted for 56% (2,521 ktoe) of the fuel inputs for electricity generation – a 2.5% increase compared with the previous year.

In 2019, the share of renewables in the generation fuel mix increased to 25.7%, compared with 22.3% in 2018 due, mainly, to increased wind generation. Overall, the use of renewables in the electricity generation fuel mix increased by 13% in 2019 (relative to 2018).

Total energy inputs to electricity generation in 2019 amounted to 4,483 ktoe, 1.9% less than in 2018 and 12% less than in 2005.

8 In this graph, non-combustable renewables such as hydro, wind and solar are not included under electricity, as technically they do not involve energy transformation. However in the following section on electricity generation non-combustible renewables are included.

Figure 18: Flow of energy in electricity generation, 2019



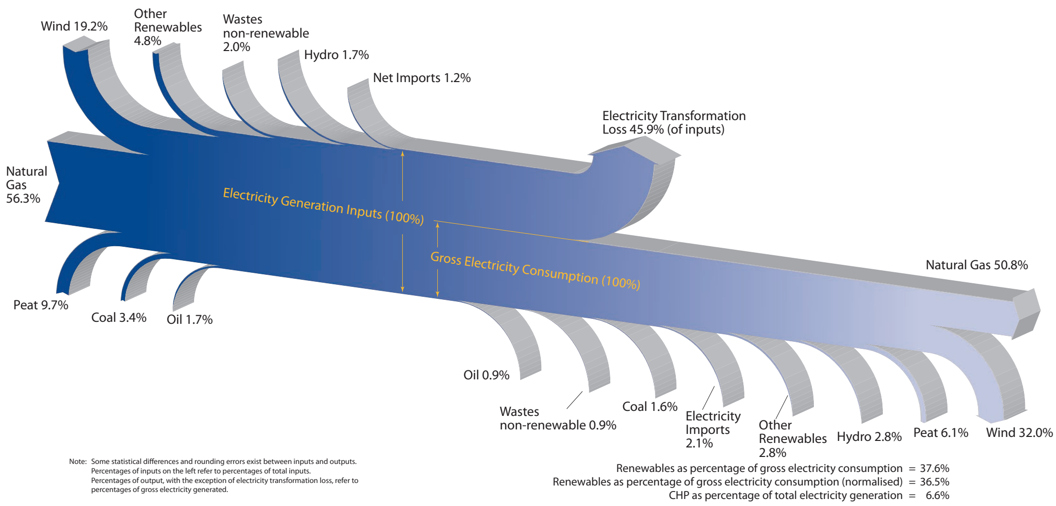
Source: SEAI

Figure 19 shows a similar picture to *Figure 18* except that the electricity outputs are represented by the fuel used to generate the electricity and as percentages, for the purposes of comparing them against the various targets. Renewable generation consists of wind, hydro, landfill gas, biomass (including the renewable portion of wastes) and other biogases. In 2019, electricity generated from renewable sources amounted to 11,780 GWh, accounting for 37.6% of gross electricity consumption (compared with 33% in 2018).

In calculating the contribution of hydro and wind power for the purposes of Ireland's 2020 renewable targets as specified by the Renewable Energy Directive[10], the effects of weather variation and capacity change are smoothed through the use of a normalisation rule[11]. Using normalised figures for wind and hydro, renewables accounted for 36.5% of gross electricity consumption in 2019, compared with 33.3% in 2018. The national target is to achieve at least a 40% share by 2020.

In 2019, wind generation accounted for 32% (31.3% normalised) of the electricity generated. It was again the second largest source of electricity generation after natural gas, and generated more than three times that of coal, peat and oil combined.

Figure 19: Flow of energy in electricity generation, 2019 – outputs by fuel



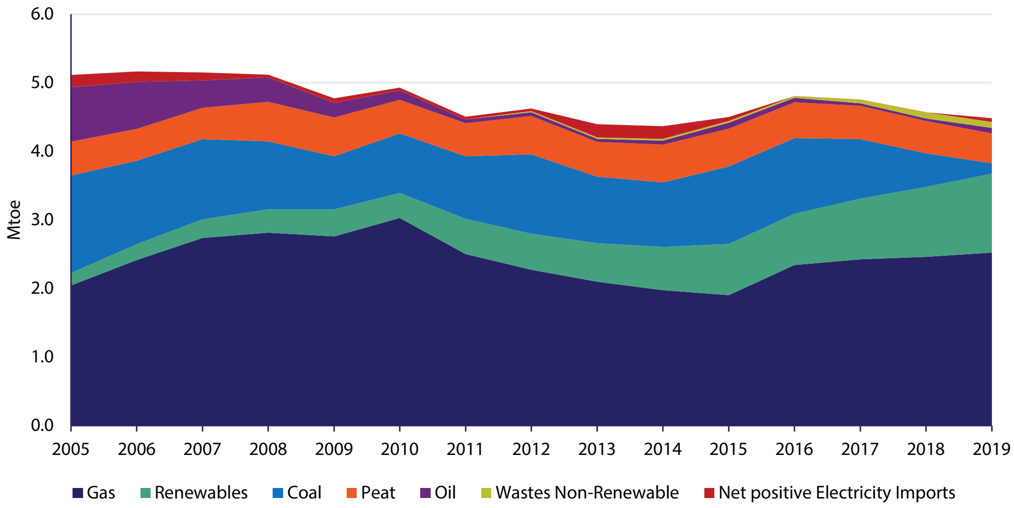
Source: SEAI

4.1.1 Primary fuel inputs into electricity generation

The trends in the mix of primary fuels employed for electricity generation are shown in *Figure 20*. The most striking trend in recent years has been the dramatic reduction in coal used for electricity generation, which fell by 86% between 2016 and 2019. The strong growth of renewable generation since the early 2000's is also evident.

In the past three years coal use in electricity generation fell by 86%.

Figure 20: Primary fuel mix for electricity generation



Source: SEAI

The primary energy requirement for electricity generation peaked in 2001 at 5,258 ktoe. Between 2001 and 2014 the primary energy inputs to electricity generation reduced by 17%, while at the same time the amount of electricity generated increased by 15%. In 2019, 4,483 ktoe of energy was used to generate electricity, 1.9% less than in 2018 and 14% less than peak levels in 2001. The fall in inputs to electricity generation in 2019 is against the backdrop of a 1.5% increase in the amount of electricity generated and a 2% increase in indigenous demand. The difference between generation and demand is because of an increase in net imports of electricity. The fuel inputs to electricity generation were less than one third (31%) of the total primary energy requirement in 2019. *Table 11* shows the growth rates, quantities and shares of the primary fuel mix for electricity generation over the period 2005 – 2019.

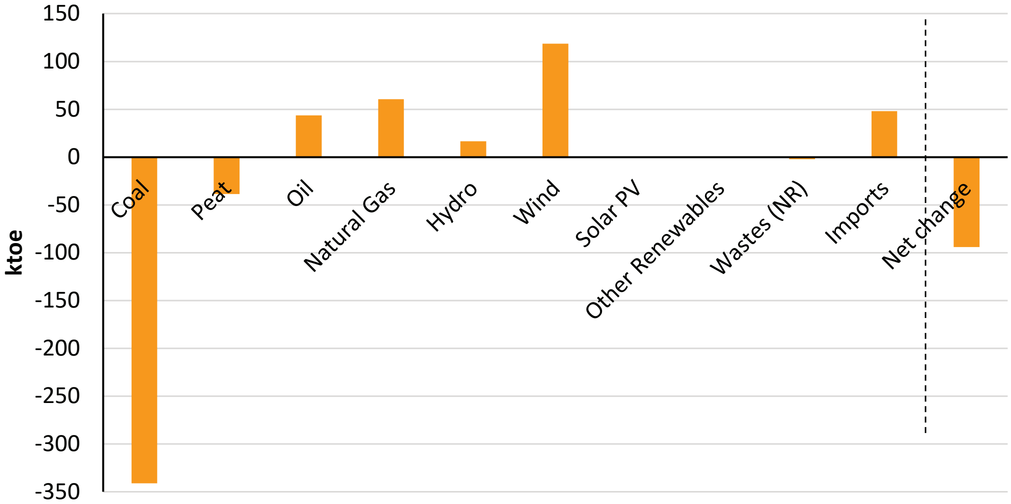
Table 11: Growth rates, quantities and shares of electricity generation fuel mix (primary fuel inputs)

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Fossil Fuels (Total)	-33.0	-2.8	-4.1	-3.5	-7.8	4,756	3,186	93.0	71.1
Coal	-89.3	-14.8	5.4	-39.4	-68.9	1,422	152	27.8	3.4
Peat	-12.5	-0.9	2.4	-5.9	-8.2	496	434	9.7	9.7
Oil	-90.1	-15.2	-8.9	-2.3	125.9	794	78	15.5	1.8
Natural Gas	23.4	1.5	-8.9	7.3	2.5	2,044	2,521	40.0	56.2
Renewables (Total)	541.5	14.2	15.3	11.3	13.0	180	1,153	3.5	25.7
Hydro	40.4	2.5	6.1	2.4	27.7	54	76	1.1	1.7
Wind	801.1	17.0	18.5	11.1	16.0	96	862	1.9	19.2
Other Renewables	621.6	15.2	9.2	16.8	-1.1	30	215	0.6	4.8
Wastes (Non-Renewable)	-	-	-	37.5	-2.3	-	89	-	2.0
Combustible Fuels Total	-29.1	-2.4	-3.8	-2.7	-7.4	4,786	3,391	93.6	75.6
Electricity Imports (net)[12]	-68.5	-7.9	7.4	-1.1	-	176	55	3.4	1.2
Total	**-12.3**	**-0.9**	**-1.8**	**-0.1**	**-1.9**	**5,112**	**4,483**		

12 There was a change from net exports in 2018 to net imports in 2019. There were 2 ktoe net exports of electricity in 2018 and 55 ktoe net imports in 2019.

Figure 21 shows the differences, by fuel, of the inputs for electricity generation between 2018 and 2019, along with the net overall change.

Figure 21: Change in fuel inputs to electricity generation in 2019 compared with 2018



Source: SEAI

The main trends are:

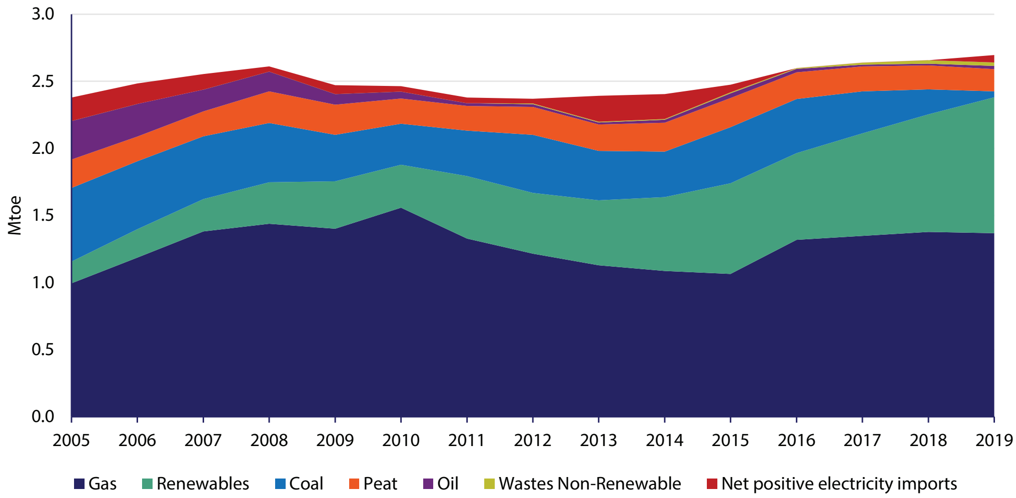
- Overall energy inputs to electricity generation decreased by 2% (97 ktoe) in 2019, to 4,483 ktoe (52,126 GWh), while the amount of electricity generated increased by 1.5%, to 2,695 ktoe (31,340 GWh). Net electricity imports increased by 58 ktoe.
- The overall share of fossil fuels used in electricity generation was 71% in 2019 (3,186 ktoe), down from 93% in 2005 and down on the 2018 figure of 76%.
- In 2019, coal used for electricity generation fell by 70%, and it accounted for 3.4% of the energy used in electricity generation. However, just 1.6% of the electricity generated in 2019 was from coal. In the past three years coal use in electricity generation fell by 86%.
- Natural gas' share of the energy used in electricity was 56% in 2019, up from 54% the previous year. Natural gas use in electricity generation increased by 2.5% in 2019, and generated 51% of electricity.
- Oil's share of the energy used in electricity generation was 1.8% in 2019, an increase of 126%, but from a very low base, and it generated just 0.9% of electricity.
- Peat consumption in electricity generation fell by 8.2% in 2019 and accounted for 9.7% of the energy inputs. 6.1% of the electricity generated in 2011 was from peat.
- Overall, renewables' contribution to the electricity inputs increased by 13% in 2019. Renewables accounted for 26% of the inputs to electricity generation in 2019 but they were responsible for 38% of the electricity generated. This is because non-combustible renewables such as wind, hydro and solar are considered 100% efficient, and so no energy is lost in generating electricity, unlike traditional thermal generation such as coal or peat.
- Wind and hydro's contribution to electricity generation increased by 16% and 28% respectively, in 2019, while the use of other renewables in electricity generation fell by 1.1%.
- The use of energy from non-renewable wastes for electricity generation fell by 2.3% in 2019, and accounted for 2% of all fuel inputs and 0.9% of the electricity generated.
- Electricity imports increased by 34% (48 ktoe) while exports fell by 6.9% (10 ktoe), resulting in net imports of electricity increasing by 58 ktoe.

The primary energy attributed to hydro and wind is equal to the amount of electrical energy generated. It is therefore more common to see the share of hydro and wind reported as a percentage of gross electricity generated. Electricity generated from hydro accounted for 2.8% (2.4% normalised) and wind accounted for 32.0% (31.3% normalised) of the total in 2019.

4.1.2 Electricity generated by fuel type

Figure 22 and *Table 12* show the growth rates, quantities and shares of the electricity generated by fuel over the period 2005 – 2019.

Figure 22: Electricity generated by fuel type



Source: SEAI

Table 12: Growth rates, quantities and shares of electricity generated by fuel type

	Overall Growth %	Average Annual Growth %				Quantity (GWh)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Coal	-92.1	-16.5	6.5	-43.2	-76.4	6,389	508	23.1	1.6
Peat	-21.3	-1.7	2.9	-6.5	-7.8	2,450	1,927	8.9	6.1
Oil	-91.6	-16.2	-7.6	-8.9	101.0	3,340	280	12.1	0.9
Natural Gas	37.4	2.3	-7.3	6.5	-0.7	11,574	15,906	41.8	50.8
Renewables (Total)	528.8	14.0	16.1	10.6	15.5	1,873	11,780	6.8	37.6
Hydro	40.4	2.5	6.1	2.4	27.7	631	887	2.3	2.8
Wind	801.1	17.0	18.5	11.1	16.0	1,112	10,019	4.0	32.0
Solar	-	-	48.2	58.3	28.6	-	21	-	0.07
Other Renewables	554.3	14.4	8.8	15.5	0.5	130	852	0.5	2.7
Wastes (Non-Renewable)	-	-	-	41.2	-2.3	-	295	-	0.9
Electricity Imports (net)[13]	-68.5	-7.9	7.4	-1.1	-	2,044	645	7.4	2.1
Total	**13.3**	**0.9**	**0.1**	**2.2**	**1.5**	**27,671**	**31,340**		

Comparing *Figure 20* and *Figure 22*, the most striking difference is that renewable energy makes up a much larger share of electricity generated than of the inputs to electricity generation. This is because a large part of the combustible fossil fuel energy that is used for electricity generation is lost as waste heat, as is the case for combustible renewable sources such as biomass. However the large majority of renewable electricity sources, including wind hydro and solar, are considered 100% efficient, in that electricity is produced directly, so the primary energy is equal to the final energy.

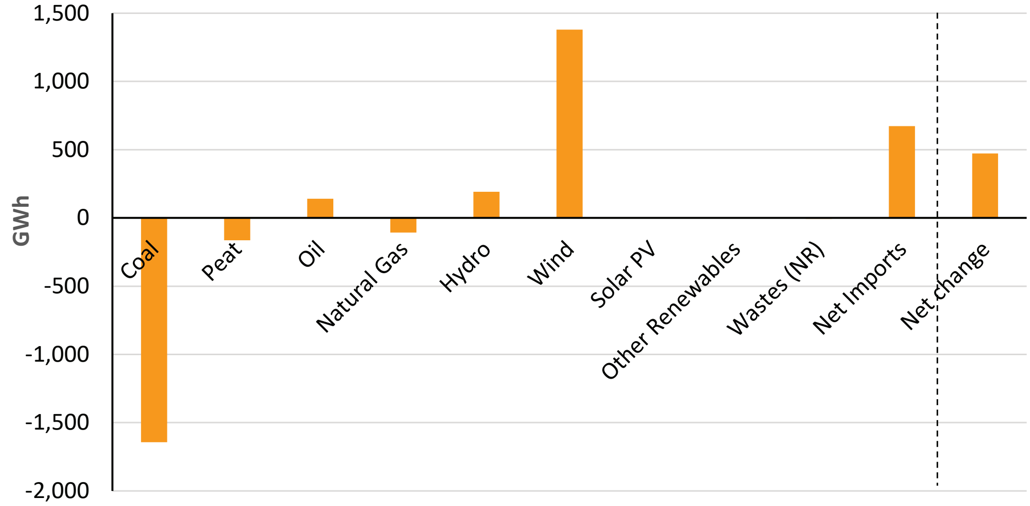
The share of electricity generated by renewables was 37.6% in 2019, up from 33.0% in 2018. Normalising for wind and hydro as per EU Directive 2009/28/EC the share of electricity generated from renewables in 2019 was 36.5%.

In 2019, wind generation accounted for 32.0% (31.3% normalised) of the electricity generated and was again the second largest source of electricity generation after natural gas.

13 Change from net exports in 2018 to net imports in 2019. There were 28 GWh net exports of electricity in 2018 and 645 GWh net imports in 2019.

In 2019, the most significant change was that coal generation was very much reduced for much of the year. As shown in *Figure 23*, this resulted in 1,644 GWh less being generated from coal. There was another reduction in generation from peat of 164 GWh. Interestingly generation from gas also reduced, falling by 108 GWh. These shortfalls were made up from the other sources, with wind being the most significant (contributing 1,380 GWh), oil (141 GWh), hydro (192 GWh) and other renewables (9 GWh). A reduction in exports and an increase in imports contributed another 672 GWh.

Figure 23: Change in electricity generation by source in 2019 compared with 2018

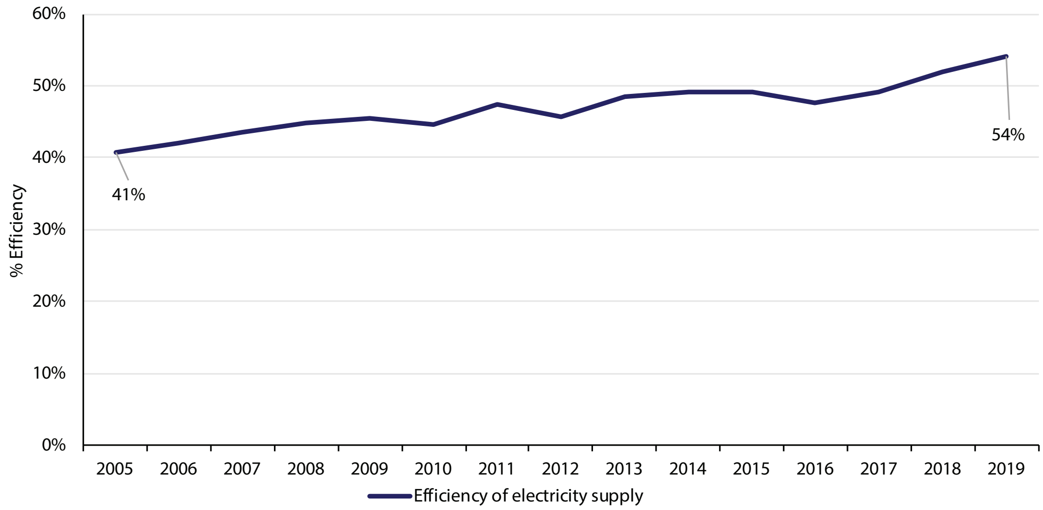


Source: SEAI

4.1.3 Efficiency of electricity supply

The efficiency of electricity supply, shown in *Figure 24,* is defined as the final consumption of electricity divided by the fuel inputs required to generate this electricity, and it is expressed as a percentage[14]. The inputs include combustible fuels such as gas, coal and biomass, that incur transformation losses, and non-combustible sources such as wind, hydro and solar, which are direct renewable inputs and so do not have transformation losses.

Figure 24: Efficiency of electricity supply



Source: SEAI

In 2019, the supply efficiency was 54%. Or put another way, 46% of all energy used to generate electricity was lost before it reached the final customer. The size of this loss is due to electricity in Ireland being predominantly generated thermally (76% of the energy used to generate electricity and 63% of the electricity generated in 2019). This ratio of primary to final[15] energy in electricity consumption fell from 3.0 in 1990 to 1.9 in 2019.

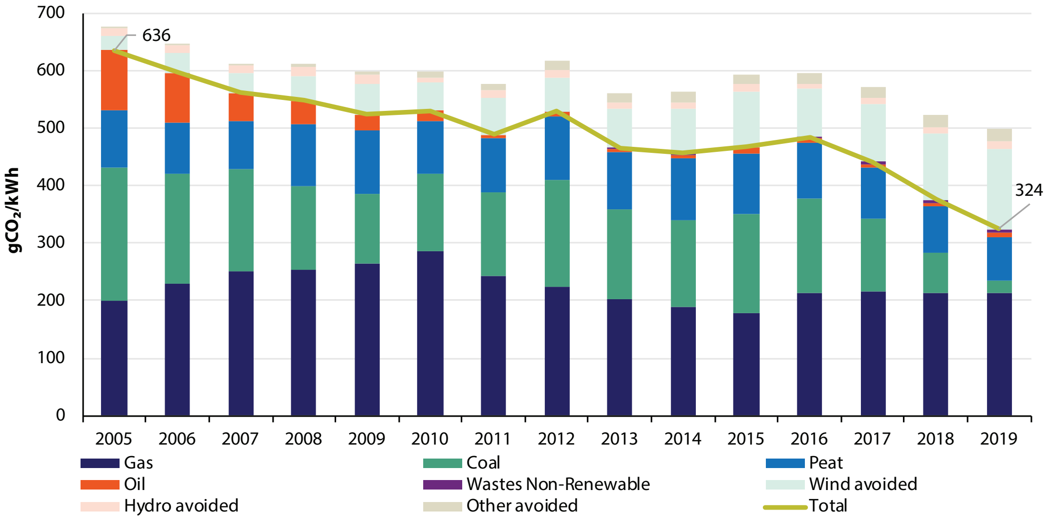
15 On a net calorific value basis.

From the mid-1990s onwards the efficiency of the electricity generation began to increase due to the introduction of higher efficiency natural gas plant[16], the increase in production from renewable sources, the closure of old peat-fired stations, and an increase in electricity imports. Additionally in 2018 and 2019, there was a large reduction in the use of coal generation.

4.1.4 Carbon intensity of electricity supply

Figure 25 shows, as stacked bars, the shares of the various fuels contributing to the overall emissions intensity of electricity, as well as the reduction in intensity as a result of emissions avoided by renewable generation from wind, hydro and other renewables. It is important to note that this graph represents the contributions of the fuels to the overall intensity and not the intensity of the generation by the individual fuels themselves. The net overall intensity is shown as a line graph in *Figure 25*.

Figure 25: CO_2 emissions per kWh of electricity supplied, with contributions by fuel



Source: SEAI

The carbon intensity of electricity fell to 324 gCO_2/kWh in 2019. This is the lowest level since the 1940's, and is 64% lower than in 1990 (896 gCO_2/kWh) and 49% lower than in 2005 (636 gCO_2/kWh), and 33% lower than in 2016 (484 gCO_2/kWh). The dramatic reduction since 2016, was the result of an 86% reduction in coal and a 54% increase in renewables used for electricity generation.

Between 2016 and 2019 there was an 86% reduction in coal and a 54% increase in renewables used for electricity generation, leading to a 33% reduction in the CO_2 emitted for each unit of electricity produced.

Over the longer term, there has been a shift away from coal and oil, two of the fuels with the highest CO_2 intensity. These fuels have been replaced by a combination of high efficiency gas CCGT generation, and zero carbon renewables. Imported electricity is also considered as zero carbon from Ireland's perspective as emissions are counted in the jurisdiction in which they are emitted.

Looking in detail at 2019, the reasons for the reduction in the carbon intensity were:

- 69% reduction in coal use in generation (down to 3.4% share of inputs);
- 16% increase in wind generation (19% share of inputs);
- 8.2% reduction in peat use in generation (9.7% share of inputs);
- 28% increase in hydro generation (1.7% share of inputs);

16 The following high efficiency CCGT gas electricity generation plant were opened in Ireland since 2005: Tynagh (384 MW) in 2006; Huntstown 2 (401 MW) in 2007; Whitegate (445 MW) and Aghada (435 MW) in 2010; Great Island (460 MW) in 2015.

- switch to net imports of electricity.

Countering these were a:

- 2.5% increase in gas used in generation, increasing the gas share in fuel inputs to 56%;
- 1.1% fall in the use of bioenergy (biomass, landfill gas and renewable waste – 2% share of inputs);
- 126% increase in oil use in generation (1.8% share of inputs).

4.1.5 Combined heat and power generation

Combined heat and power (CHP) is the simultaneous generation of usable heat and electricity in a single process. In conventional electricity generation much of the input energy is lost as waste heat. Typically, up to 60% of the input energy is lost, with as little as 40% being transformed into electricity. CHP systems channel this extra heat to useful purposes so that usable heat and electricity are generated in a single process. The efficiency of a CHP plant can typically be 20% to 25% higher than the combined efficiency of heat-only boilers and conventional power stations. Also, if embedded in the network close to the point of electrical consumption, CHP can avoid some of the transmission losses incurred by centralised generation. Therefore, in the right circumstances CHP can be an economic means of improving the efficiency of energy use and achieving environmental targets for emissions reduction.

The installed capacity[17] of CHP in Ireland at the end of 2019 was 362 MWe (456 units[18]) – up from 354 MWe (438 units) in 2018 (see *Table 13*). Of the 456 units, only 319 were reported as being operational. The operational installed capacity increased by 3.1 MWe, to 322.3 MWe, in 2019 compared with 2018.

Table 13: Number of units and installed capacity by fuel, 2019

	No. of Units	Installed Capacity (MWe)	No. of Units %	Installed Capacity %
Natural Gas	402	328.9	88	91
Solid Fuels	2	5.2	0	1
Biomass	4	6.7	1	2
Oil Fuels	23	8.7	5	2
Biogas	25	12.3	5	3
Total	**456**	**362**	**100**	**100**

Source: SEAI

Natural gas was the fuel of choice for 329 MWe (402 units) in 2019. It is worth noting that there is one single 160 MWe gas plant that dominates. Biogas and oil products[19] made up the next most significant shares with 12.3 MWe and 8.7 MWe, respectively (25 and 23 units), and the remainder was biomass at 6.7 MWe (4 units) and solid fuels at 5.2 MWe (2 units). CHP in Ireland is examined in more detail in a separate SEAI publication[20].

Figure 26 illustrates the contribution from CHP to Ireland's energy requirements in the period 2000 – 2019. Fuel inputs increased by 191% (5.8% per annum) while the thermal and electrical outputs increased by 312% (7.7% per annum) and 257% (6.9% per annum), respectively, over the period. In 2019, fuel input fell by 4.7% and thermal output decreased by 3.6%, while the electricity generated fell by 3.0%. The large increase in 2006 is accounted for by the Aughinish Alumina plant which came online in that year.

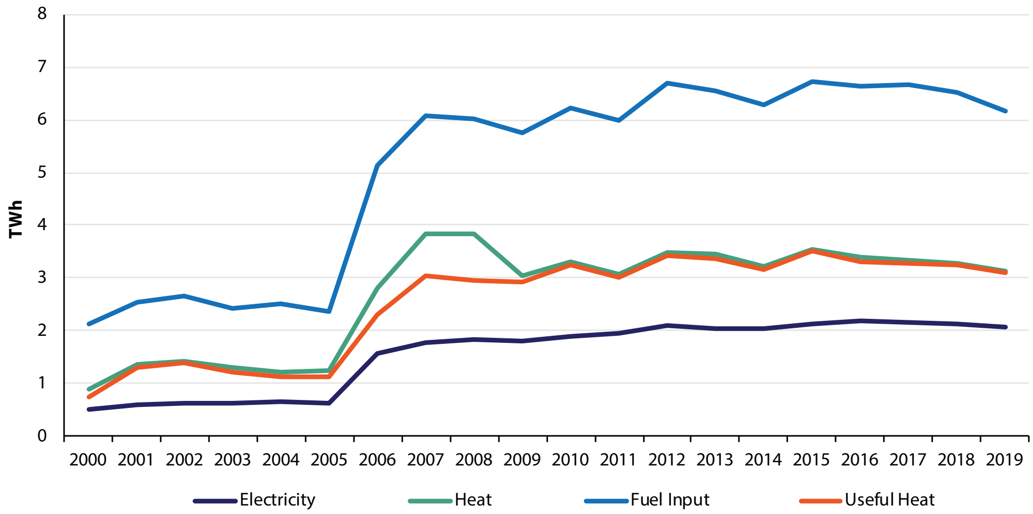
17 Megawatt electrical or MWe is the unit by which the installed electricity generating capacity or size of a CHP plant is quantified, representing the maximum electrical power output of the plant.

18 Note that units are distinct from CHP plants or schemes and that there may be more than one CHP unit at a site

19 Oil products are comprised of LPG, heavy fuel oil, refinery gas and biodiesel.

20 SEAI (2019), *Combined Heat and Power in Ireland – 2019 Update*. Available from: https://www.seai.ie/publications/CHP-Update-2019.pdf

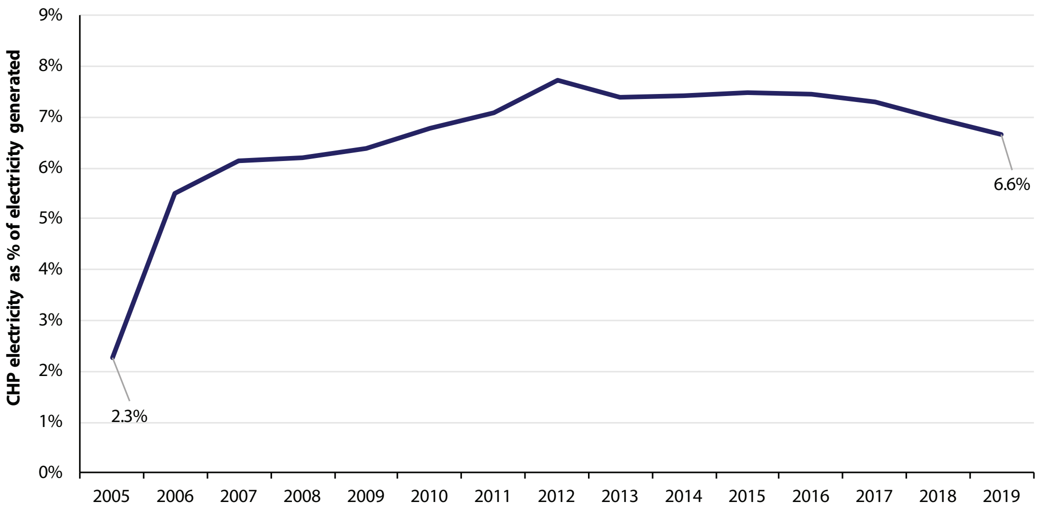
Figure 26: CHP fuel input and thermal/electricity output, 2000 – 2019



Source: SEAI

Figure 27 focuses on CHP-generated electricity in Ireland as a proportion of gross electricity consumption (i.e. electricity generation plus net imports) in the period 2005 – 2019. In 2019, 6.6% of total electricity generation was generated in CHP installations compared with 7.0% in 2018. Some CHP units export electricity to the national grid. In 2019, there were 17 units exporting electricity to the grid. These units exported 1,337 GWh of electricity in 2019, a decrease of 4.1% on 2018.

Figure 27: CHP electricity as percentage of total electricity generation, 2005 – 2019



Source: SEAI

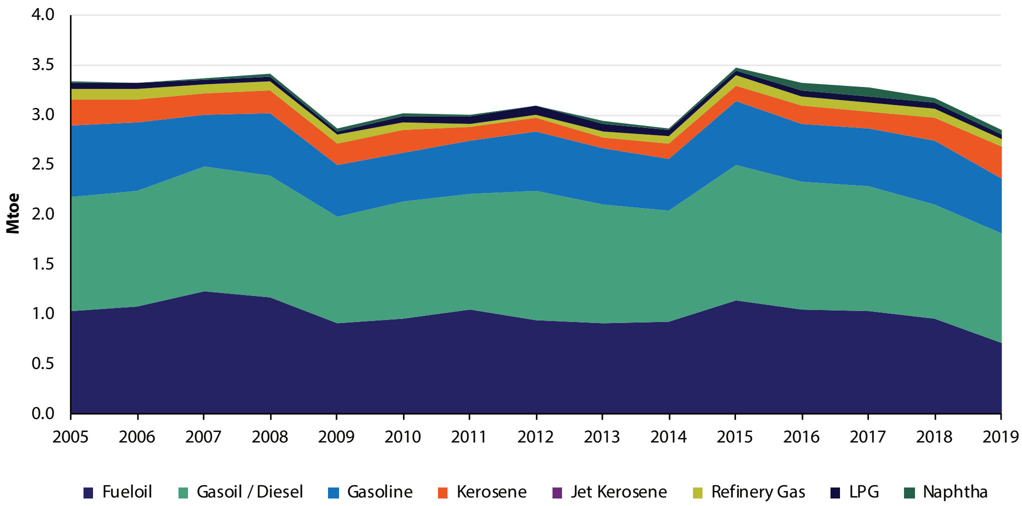
4.2 Oil refining

Ireland has one oil refinery, located at Whitegate, Co. Cork, which is currently operated by Irving Oil. Whereas electricity generation has a variety of fuel inputs and just one output (electricity), oil refining has one major fuel input, crude oil, and multiple fuel outputs, such as petrol, diesel and jet kerosene. *Figure 28* shows the outputs from oil refining from 2005 to 2019. Heavy fuel oil, diesel and petrol (gasoline) are the main outputs.

The outputs of the refinery are not heavily influenced by the demand in the Irish market, due to the highly international nature of the oil market. Much of the output of the refinery is exported directly, and the majority of oil products used for final energy in Ireland is imported directly in the form of finished products, rather than being produced in the refinery.

Nonetheless the refinery is an important piece of infrastructure from the point of view of energy security.

Figure 28: Outputs from oil refining



Source: SEAI

4.3 Other transformation processes

There are a number of other transformation processes in operation in the Irish energy sector, though they are all very small in comparison to electricity generation, oil refining, and CHP.

Pumped hydro electricity storage

Pumped hydro electricity storage is the process of using electricity to pump water to an uphill reservoir, and later releasing the water from the reservoir back down through a turbine to generate electricity. In this way the pumped storage facility acts like a battery to store relatively large amounts of electricity. There is one pumped hydro station in Ireland, at Turlough Hill, Co. Wicklow, with a total capacity of 292 MW.

The electricity generated from pumped hydro storage is not considered hydro-electricity and is not counted as renewable, as the pumped storage facility merely stores electricity that has previously been generated by another source. Although it is not a renewable source, pumped hydro storage has attributes which are beneficial for integrating variable non-synchronous renewable electricity sources, such as wind, onto the electricity system.

Use of Turlough Hill peaked in 2013 when there was, 50 ktoe, or 585 GWh of electricity inputs and 30 ktoe, or 345 GWh, of outputs. In 2019, this had reduced to 41 ktoe (478 GWh) of inputs and 21 ktoe (245 GWh) of outputs. The overall efficiency of Turlough hill fell since the 1990s, when it was over 70%, to 51% in 2019.

Peat briquetting

Peat briquetting converts milled peat into briquettes for residential use. Peat briquette production has been reducing since the early 1990s. In 2019, 54 ktoe of peat briquettes were produced, more than 50% below the early 2000s.

5 Drivers of energy demand

This section takes a high level view of the trends in the economy, weather, energy use, and energy-related CO_2 emissions since 2005.

5.1 Energy, economy and emissions

Energy supply depends on the demand for energy services (heating, transportation and electricity) and how that demand is satisfied. Energy service demand is driven primarily by economic activity and by the energy end-use technologies employed in undertaking such activity.

The relationship between economic activity and energy demand is less straightforward in Ireland than it is for most other countries. GDP is the most widely accepted measure of economic activity, but in Ireland GDP is strongly influenced by the activities of multinational companies. Some of the activities of these companies result in large amounts of value added[21], but very little consumption of energy. This was very well illustrated in 2015 when GDP grew by 25% as a result of the transfer into Ireland of intellectual property. Therefore, care must be taken when comparing macro-economic indicators, such as energy per unit GDP, across countries.

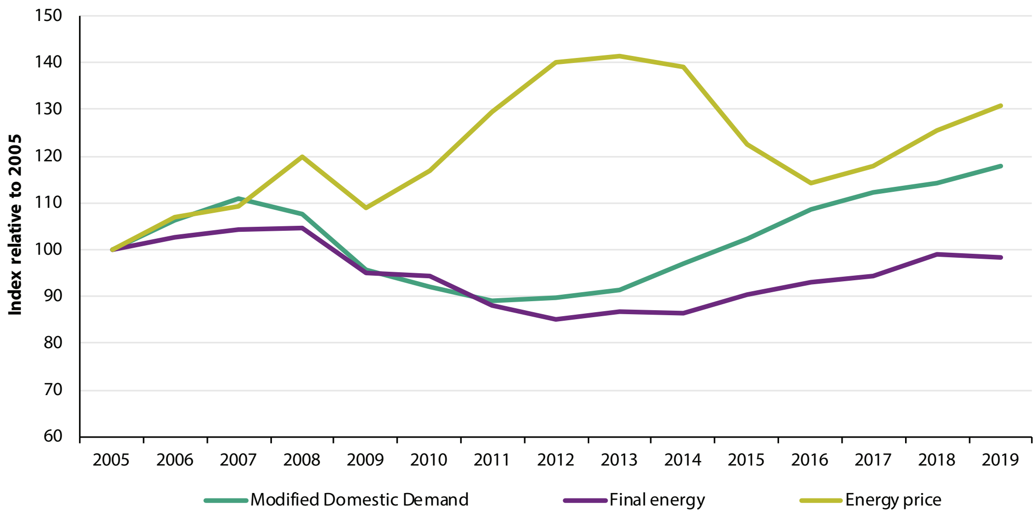
The Central Statistics Office (CSO) have developed new indicators of economic activity as alternatives to GDP, to more accurately reflect the level of activity in the domestic economy, and to remove the distorting effects of globalisation. Modified domestic demand[22] was first published in the Quarterly National Accounts[23] results for Quarter 1 2017 and excluded trade by aircraft leasing companies and exports and imports of R&D services and of R&D-related IP products (effectively, all trade in R&D-related intangibles). In contrast to GDP, modified domestic demand grew by 5.3% in 2015.

Figure 29 shows the historical trends for modified domestic demand, energy prices and final energy, each expressed as an index relative to 2005. This captures the changes in economic growth between 2005 and 2019, showing the economic downturn between 2008 and 2012 and the subsequent return to growth after 2013.

Table 14 displays the growth rates for the economy (GDP and modified domestic demand), primary energy, final energy and energy-related CO_2 emissions for the period 2005 to 2019. 2005 is chosen because of its significance with respect to Ireland's 2020 greenhouse gas emissions target.

Transport and industry have been more responsive to changes in economic activity, while, in the short term, residential and services energy use is heavily influenced by annual variations in weather and energy prices.

Figure 29: Index of modified domestic demand, final energy demand and energy price



Source: Based on SEAI and CSO data

.

Table 14: GDP[24], modified domestic demand, final energy, primary energy, and energy-related CO_2 growth rates[25]

	Growth %	Average annual growth rates %				
	2005 – 2019	2005 – '19	2005 – '10	2010 – '15	2015 – '19	2019
GDP	75.5	4.3	0.4	6.8	6.3	5.6
Modified Domestic Demand	31.4	1.2	-1.7	2.2	3.6	3.2
Final Energy	15.6	-0.1	-1.2	-0.8	2.1	-0.6
Primary Energy	8.5	-0.6	-1.5	-1.1	1.2	-1.2
Energy-Related CO_2	-2.5	-1.7	-2.5	-1.6	-0.9	-4.5

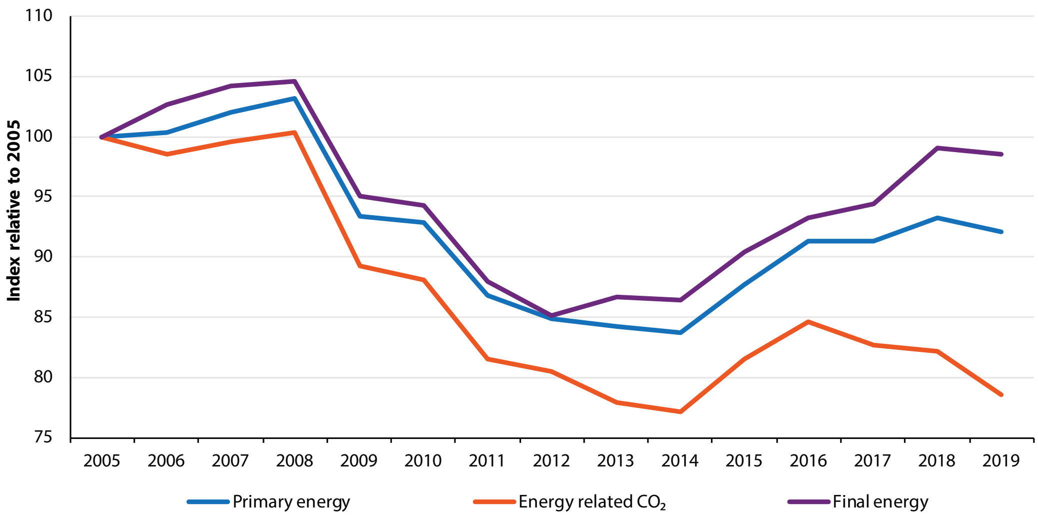
In 2009 all sectors of the economy experienced reductions in energy use and related emissions, tracking the decline in the economy. 2010 was an exceptionally cold year and saw record high energy use for heat in the residential sector, which resulted in energy demand staying flat despite the reduction in economic activity.

Modified domestic demand held flat in 2012 but energy demand continued to fall, mostly in the transport and residential sectors, partially due to record high energy prices, including a sustained period with oil prices of over $100 per barrel. Modified domestic demand returned to strong growth in 2014. Energy demand and energy-related CO_2 emissions followed after a one year lag, returning to growth in 2015, following the easing of energy prices. Final energy demand increased every year between 2014 and 2018. In 2019, final energy demand fell by 0.6%, compared to growth in modified domestic demand of 3.2%. Most of the reduction in final energy demand in 2019 can be explained by a reduction in heat use due to a warmer weather. When corrected for weather variation, final energy use in 2019 increased by 0.5%.

Final energy use increased every year between 2014 and 2018, but in 2019 it fell by 0.6%. However when corrected for weather variation, final energy use in 2019 increased by 0.5%.

Figure 30 shows the relationship between final energy demand, primary energy use and energy-related CO_2 emissions, expressed as an index relative to 2005. The difference between the trends in final energy demand and primary energy requirement is due to changes in the efficiency of the energy transformation sector, particularly in electricity supply. Electricity supply has gone from an overall efficiency as low as 33% in the early 1990s, to 41% in 2005, and to 54% in 2019. This is due to the introduction of higher efficiency gas CCGT generators, a large reduction in inefficient coal generation, and the large amounts of wind generated electricity now on the grid, which is considered 100% efficient.

Figure 30: Index of final energy, primary energy and energy-related CO_2

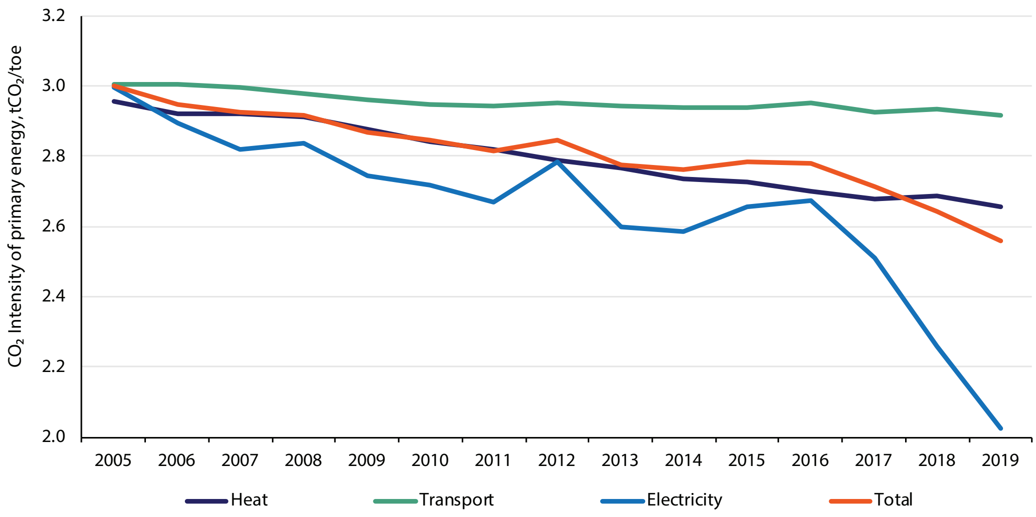


Source: SEAI

24 GDP rates are calculated using constant market prices chain-linked annually and referenced to 2018.
25 Throughout the report, where annual growth rates are across multiple years they always refer to *average annual growth rates*.

The difference between the trends for energy-related CO_2[26] and primary energy in *Figure 30* is due to changes in the CO_2 intensity of the fuel mix used across all sectors. Changes in the CO_2 intensity of Ireland's fuel mix is examined in more detail in *Figure 31*, which shows the CO_2 intensity per unit of primary energy in each of the heat, transport and electricity sectors.

Figure 31: CO_2 intensity of primary energy by mode



Source: SEAI

Electricity has seen the greatest reduction in CO_2 intensity, especially since 2016. This is due to the 86% reduction in high CO_2 intensity coal generation, and the 54% increase in zero carbon renewable generation between 2016 and 2019.

There has also been a reduction in carbon intensity in heat. This has been due to the switch away from fuels with higher CO_2 intensity, for instance the shift from oil to gas in industry, and a continuing reduction in coal and peat use in the residential sector. There has also been an increase in renewable energy use.

There has been little reduction in the carbon intensity of transport energy, as it remains almost entirely dependent on oil products. There has been an increase in the use of renewable liquid biofuels in transport, but these still only accounted for 4.7% of transport primary energy use in 2019, so the reduction in carbon intensity has been small.

5.2 Energy and the weather

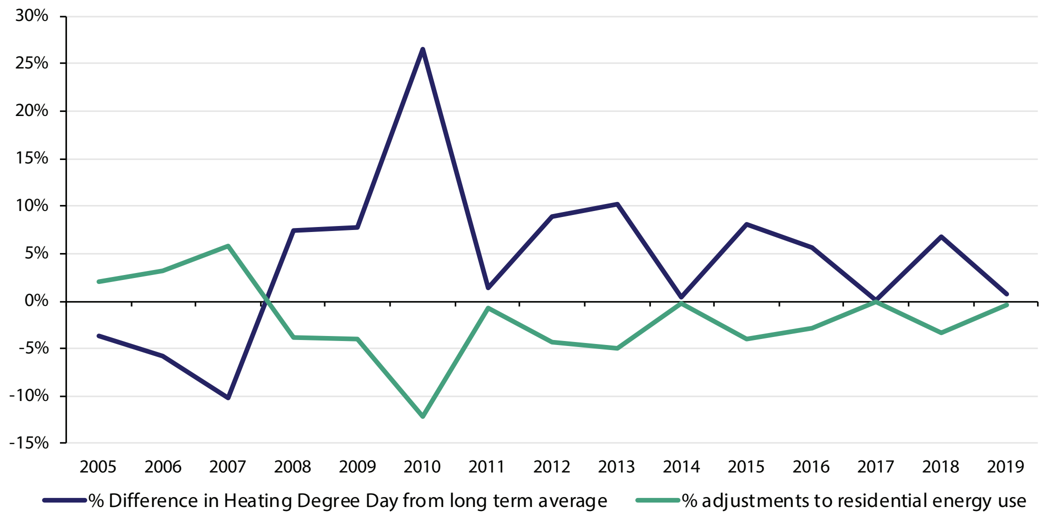
Weather variations from year to year can have a significant effect on the energy demand of a country, in particular on the portion of the energy demand associated with space heating. A method to measure the weather, or climatic variation, is the use of 'degree days'.

Degree days are the measure or index used to take account of the severity of the weather when looking at energy use in terms of heating (or cooling) load on a building. A degree day is a measure of how cold (or warm) it is outside, relative to a day on which little or no heating (or cooling) would be required. It is thus a measure of the cumulative temperature deficit (or surplus) of the outdoor temperature relative to a neutral target temperature (base temperature) at which no heating or cooling would be required. The larger the number of heating degree days, the colder the weather. If, for example, the outdoor temperature for a particular day is 10 degrees lower on average than the base temperature (15.5 degrees), this would contribute 10 degree days to the annual or monthly total. The typical heating season in Ireland is October to May.

Met Éireann calculates degree day data for each of its synoptic weather stations. SEAI calculates a population weighted average of these data to arrive at a meaningful degree day average for Ireland that is related to the heating energy demand of the country.

26 Energy-related CO_2 emissions shown here cover all energy-related CO_2 emissions associated with total primary energy requirement, including emissions associated with international air transport. These are usually excluded from the national GHG emissions inventory in accordance with the reporting procedures of the UN Framework Convention on Climate Change (UNFCCC) guidelines.

Figure 32: Deviation from average heating degree days and resulting weather adjustment



Source: Met Eireann and SEAI

Figure 32 shows the percentage deviation in the number of heating degree days from the long-term average between 2005 and 2019. 2010 was the coldest year recorded over that period and 2007 was the warmest. The portion of each fuel that is assumed to be used for heating is adjusted by multiplying it by the ratio of the long-term average number of degree days to the number of degree days in the given year. This adjustment yields a lower normalised energy consumption in cold years, and yields a higher normalised consumption in mild years. Typically, the weather adjustment is within plus or minus 6% of the actual energy consumption. The largest correction over the period was for 2010, an exceptionally cold year, where the weather-corrected energy consumption was 12% less than the actual energy consumption.

5.3 Economic energy intensities

Energy intensity is defined as the amount of energy required to produce a functional output. In the case of the economy, the measure of output is generally taken to be the GDP[27]. GDP measured in constant prices is used to remove the influence of inflation. The inverse of energy intensity represents the energy productivity of the economy.

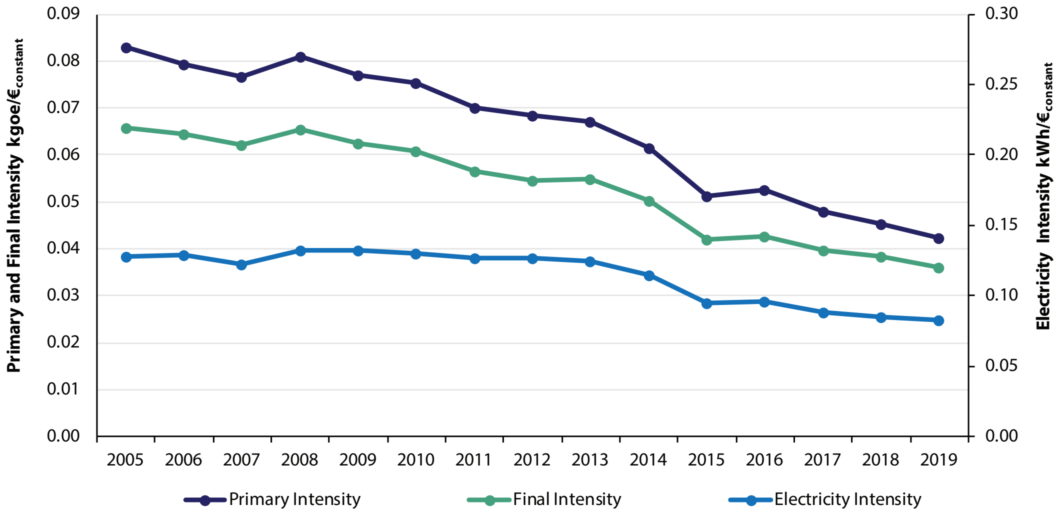
Figure 33 shows the trend in both primary (primary energy divided by GDP) and final (final energy consumption divided by GDP) energy intensities of the economy (at constant 2018 prices). The difference between these two trends reflects the amount of energy lost in the transformation of primary energy into final energy – mostly for electricity generation. The electricity intensity of the economy (electricity generated divided by GDP) is also shown.

The primary and final energy intensity of the economy has been falling (reflecting improving energy productivity) since 2005, with the exception of 2008. In 2005, it required 83 grammes of oil equivalent (goe) to produce 1 euro of GDP (in constant 2018 values), whereas in 2007 just 77 goe was required. Between 2005 and 2019 primary energy intensity of the economy fell by 49% (4.7% per annum) to 42 goe/$€_{2018}$.

Between 2010 and 2019, the primary and final intensity trends converged slightly, with primary energy intensity falling at a slightly faster rate, 44% (6.2% per annum), compared with a 41% (5.7% per annum) fall in final intensity. This was due to increased efficiency in electricity generation.

The sharp fall in the energy intensity of the economy in 2015 of 16% must be viewed in the context of the 25% increase in GDP (the result of the transfer of assets into Ireland). This should be viewed as an adjustment rather than a reduction in intensity, as the increase in GDP had little or no effect on energy consumption. This is a good example of why energy intensity is not a good measure of energy efficiency progress.

Figure 33: Primary, final and electricity intensities



Source: SEAI

The final electricity intensity of the economy has not been falling as fast as primary or final energy intensities. Over the period 2005 – 2019, electricity intensity fell by 35% (3.1% per annum). This is attributed to the shift towards increased electricity consumption in energy end-use. Final electricity intensity increased by 6.4% between 2007 and 2010, but fell by 37% between 2010 and 2019.

There are many factors that contribute to how trends in energy intensity of the economy evolve. These factors include: technological efficiency and the fuel mix, particularly in relation to electricity generation; economies of scale in manufacturing; and, not least, the structure of the economy. The structure of the economy, in Ireland, has changed considerably over the past 20 to 30 years. It has shifted in the direction of the high value added sectors, such as pharmaceuticals , electronics and services. Relative to traditional 'heavier' industries, such as car manufacturing and steel production, these growing sectors are not highly energy intensive. Examples of changes to the structure of the industry sector include the cessation of steel production in 2001, of fertiliser production in late 2002, and of sugar production in 2007.

The energy intensity of the economy will continue to decrease if, as expected, the economy becomes increasingly dominated by high value added, low energy-consuming sectors. This results in a more productive economy from an energy perspective but does not necessarily mean that the actual processes used are more energy efficient, or that less energy is being used overall in the economy.

6 Policy perspectives

The energy trends discussed in *Section 2* and *Section 3* are analysed to assess performance with regard to Government policies and targets. This section focuses on the targets detailed in the EU Directives related to renewable energy and greenhouse gases, and also examines the issues of energy security and cost competitiveness.

6.1 Progress towards renewable energy targets

The Renewable Energy Directive (RED)[28] is the most important legislation influencing the growth of renewables in the European Union (EU) and Ireland.[29] The RED sets out two mandatory targets for renewable energy in Ireland to be met by 2020.

The first relates to overall renewable energy share (RES), and is commonly referred to as the overall RES target. For Ireland, the overall RES target is for at least 16% of gross final energy consumption (GFC)[30] to come from renewable sources in 2020.

The second mandatory target set by the RED relates to the renewable energy used for transport. This is commonly referred to as the RES-T target. The RES-T target is for at least 10% of energy consumed in road and rail transport to come from renewable sources.[31]

In addition to these EU mandatory targets, Ireland has two further national renewable energy targets for 2020 . These are for the electricity and heat sectors and are designed to help Ireland meet the overall RES target.

The renewable electricity target is commonly referred to as the RES-E target. The RES-E target is for 40% of gross electricity consumption to come from renewable sources in 2020.[32]

The renewable heat target is commonly referred to as the RES-H target. The RES-H target is for 12% of energy used for heating and cooling to come from renewable sources in 2020.

Table 15 shows the progress towards the individual national modal targets and towards the overall RED target for the period 2005 – 2019. Here, the percentages in each row (RES-E, RES-T and RES-H) relate to the specific modal targets, while the percentages in the final row relate to the overall target, using the definition in the RED.

Table 15: Renewable energy progress to targets[33]

					Progress Towards Targets %					Target %
Target	**2005**	**2010**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
RES-E (normalised)	7.2	15.6	21.3	23.5	25.5	26.8	30.1	33.3	36.5	40
RES-T (weighted)	0	2.5	4.9	5.3	5.9	5.2	7.5	7.2	8.9	10
RES-H	3.4	4.3	5.2	6.2	6.2	6.3	6.6	6.3	6.3	12
Overall RES	**2.8**	**5.7**	**7.5**	**8.6**	**9.0**	**9.1**	**10.4**	**10.9**	**12.0**	**16**

Source: SEAI

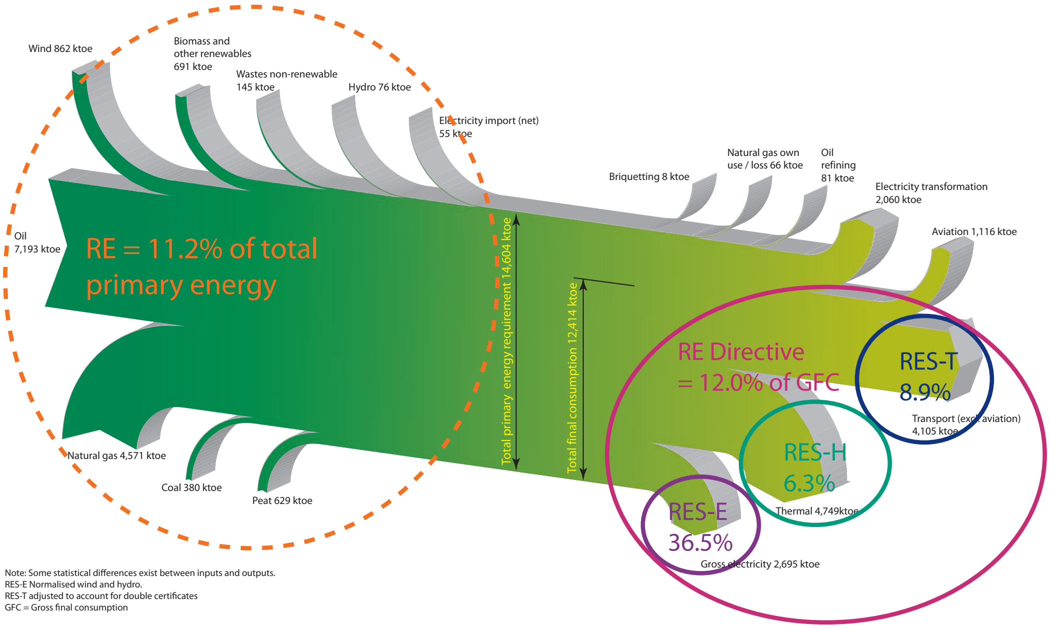
RES-E increased by 3.2 percentage points in 2019, to 36.5% (towards the 40% 2020 target). RES-T increased to 8.9% (towards the 10% 2020 target) from 7.2% in 2018 (see Section *6.1.1*). RES-H remained at 6.3% (towards the 12% 2020 target).

Ireland is not on track to meet its 2020 renewable energy targets.

Figure 34 illustrates where the various renewable targets fit within overall energy use in Ireland and the progress towards those targets in 2019. Towards the right of the figure, the 2019 percentages of renewables are shown relative to the amount of final energy to which they refer. Also shown is how these relate to the RED's targets.

33 Note that individual target percentages are not additive. RES-T includes double certificates for advanced biofuels.

Figure 34: Progress to targets, 2019



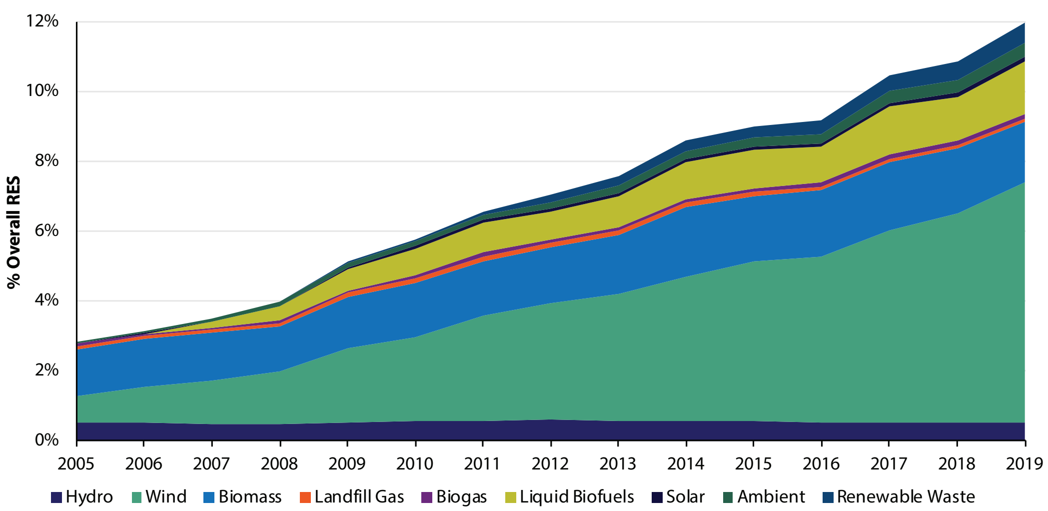
Source: SEAI

Towards the left of *Figure 34*, the overall contribution of renewable energy to total primary energy requirement is shown at 11.2%. While there is no specific target for this figure, it does help to illustrate the position of renewables in the overall energy use in Ireland.

Wind accounted for 57% of the contribution towards Ireland's renewable energy target in 2019, bioenergy accounted for 34%.

Figure 35 shows the contribution of each renewable energy source, as per the RED methodology, from 2005 to 2018.

Figure 35: Renewable energy (%) contribution to gross final consumption (Directive 2009/28/EC)

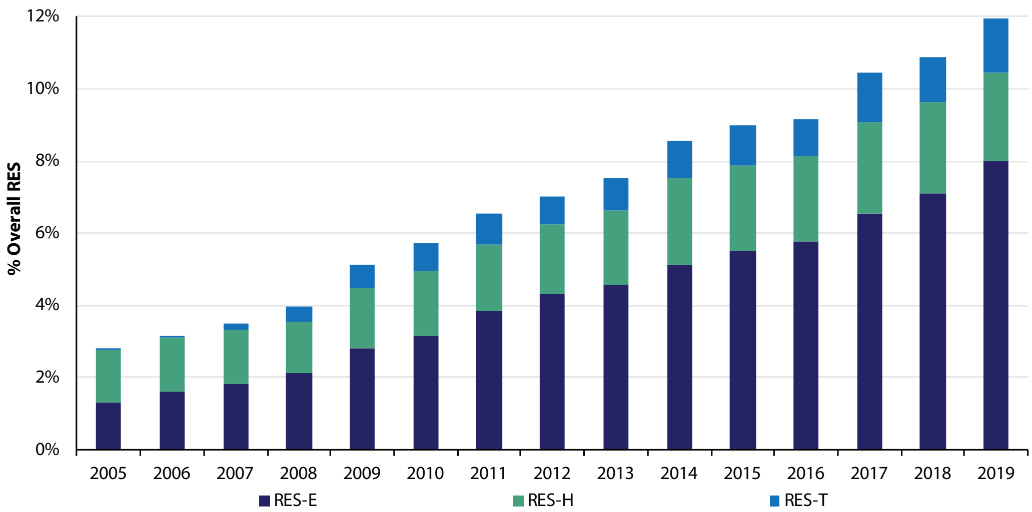


Source: SEAI

Wind accounted for 57% of the contribution towards the RED target. Bioenergy accounted for 34% of the contribution, which consists of biomass at 19 percentage points, liquid biofuels at 13 percentage points and biogas at 1.8 percentage points. The remaining contribution came from hydro and ambient energy at 4.3% and 3.4% respectively, and solar at 1.1%.

Figure 36 shows the renewable energy percentage contributions to gross final consumption by mode.

Figure 36: Renewable energy (%) contribution to gross final consumption by mode[34]



Source: SEAI

A more detailed discussion of renewable energy in Ireland can be found in SEAI's publication *Renewable Energy in Ireland*[35]. This section presents key graphs and updates where available from the renewables report.

Transport had the largest share of energy consumption but the smallest share of renewable energy in 2019.

6.1.1 Transport energy from renewable sources (RES-T)

The RED established a mandatory minimum 10% target for the contribution of renewable energy in the final consumption of energy in transport by 2020. According to the RED for this target, a weighting of 5 is applied to the electricity from renewable energy sources consumed by electric road vehicles and a weighting of 2.5 is applied to electricity from renewable energy sources consumed by rail transport, where the contribution is calculated as the share of electricity from renewable energy sources as measured two years before the year in question. Also, supported through a weighting factor of 2, are second-generation biofuels, and biofuels from waste. These weighting factors are used for the calculation of RES-T only and do not apply when calculating the transport contribution to the overall RES share.

In 2010, a Biofuel Obligation Scheme was established which required fuel suppliers to include, on average, 4% biofuel by volume (equivalent to approximately 3% in energy terms) in their annual sales. The Biofuel Obligation Scheme is a certificate-based scheme that grants one certificate for each litre of biofuel placed on the market in Ireland; two certificates are granted to biofuel that is produced from wastes and residues. Oil companies are required to apply to the National Oil Reserves Agency for certificates and to demonstrate that the quantities of biofuel for which they are claiming certificates are accurate. Since the introduction of the Sustainability Regulations (SI 33 of 2012), companies are also required to demonstrate that the biofuel being placed on the market is sustainable, fulfilling the requirements of the RED. Biofuel that is not deemed to be sustainable will not be awarded certificates and cannot be counted towards the biofuel obligation.

The obligation was increased to 6% in 2013, to 8% in 2017[36], to 10% in January 2019[37], and 11% in January 2020.

In 2015, new rules[38] came into force that amended the legislation on biofuels – specifically Directive 2009/29/EC and Directive 2009/30/EC – to reduce the risk of indirect land use change and to prepare the transition towards advanced biofuels.

The amendment:

- Limits the share of biofuels from crops grown on agricultural land that can be counted towards the 2020 renewable energy targets to 7%.

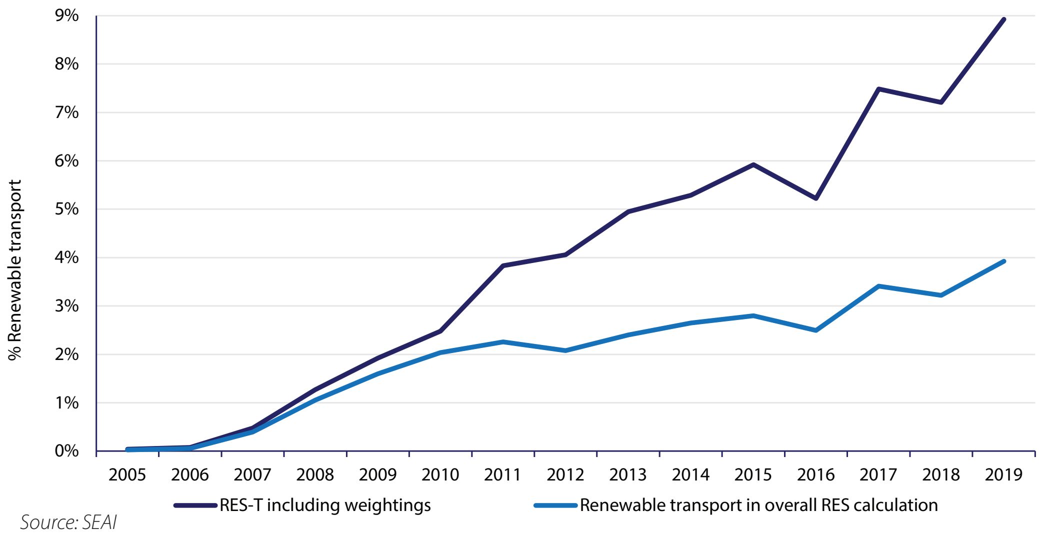
34 RES-T double certification for advanced biofuels is not included in the overall RES target.

- Proposes a specific sub-target of at least 0.5% for advanced biofuels in road and rail energy from 2021, rising to 3.6% in 2030[39].
- Harmonises the list of feedstocks for biofuels whose contribution would count as double towards the 2020 target of 10% for renewable energy in transport, across the EU.
- Requires that biofuels produced in new installations emit at least 60% fewer GHGs than fossil fuels.
- Introduces stronger incentives for the use of renewable electricity in transport. The renewable portion of electricity consumed by rail transport carries a multiplier of 2.5. For the calculation of the electricity from renewable energy sources consumed by electric road vehicles, that consumption is considered to be five times the energy content of the input of electricity from renewable energy sources.
- Includes a number of additional reporting obligations for the fuel providers, EU countries, and the European Commission.

Figure 37 shows the progress for renewable transport energy, in terms of the RES-T target and also in terms of the contribution of transport to the overall RES target.

The figure for RES-T in 2019 was 8.9% when the weightings for biofuels and renewable electricity are applied in accordance with the RED, up from 7.2% in 2018. Eleven per cent of the required certificates for 2019 were carried forward from 2017 and 2018, as allowed under the Biofuels Obligation Scheme[40]. In 2019, all of the biodiesel and approximately 16% of the bioethanol used for road transport were eligible for double certificates[41].

Figure 37: Progress towards renewable transport energy target



Source: SEAI

There are some important differences between how the share of renewable transport energy is calculated for the RES-T target and for the overall RES target. The weightings for advanced biofuels and electricity only apply to the RES-T target, not to the overall RES target. Another difference is that aviation is not included in the denominator for the RES-T target, but it is for the overall RES target. *Figure 37* shows the share of renewable transport from the perspective of the overall RES target, which was just 3.9% in 2019. Most of the difference between the two is due to the double weighting for advanced biofuels. The significant gap between the RES-T share and the share of renewable transport energy from the perspective of the overall RES target has contributed to the poor progress towards the overall RES target.

39 COM (2016) 767 final/2 http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52016PC0767R(01)&from=EN
40 http://www.nora.ie/regulationslegislation/biofuels-obligation-scheme.152.html
41 https://www.nora.ie/_fileupload/457-20X0088%20-%20BOS%20Annual%20Report%20for%202019%20for%20publication.pdf

Table 16: Biofuels growth and as a proportion of road and rail transport energy – 2005, 2010, 2013 to 2019

Fuel	2005	2010	2013	2014	2015	2016	2017	2018	2019
Petrol (ktoe)[42]	1,822	1,478	1,155	1,093	1,036	967	872	792	746
Diesel (ktoe)[43]	2,378	2,236	2,351	2,501	2,708	2,930	2,934	3,072	3,102
Biofuels (ktoe)	1.1	92.6	102.2	116.2	128.1	118.5	160.6	154.2	188.1
Renewable Electricity		0.4	0.7	0.7	0.8	1.0	1.1	1.4	2.0
Petrol plus Diesel	4,200	3,713	3,506	3,594	3,744	3,897	3,806	3,865	3,848
Biofuel Penetration	***0.0%***	***2.4%***	***2.8%***	***3.1%***	***3.3%***	***3.0%***	***4.1%***	***3.9%***	***4.7%***
Weighted Renewables (ktoe)	1	94	177	195	228	208	295	288	361
Weighted Renewables Share	***0.0%***	***2.5%***	***4.9%***	***5.2%***	***5.9%***	***5.2%***	***7.4%***	***7.2%***	***8.9%***

Renewable energy share in transport (RES-T) in 2019 was 8.9% when the weightings for biofuels and renewable electricity are applied.

6.1.2 Electricity from renewable energy sources (RES-E)

Electricity generation has been the most successful of the three modes for the development of energy from renewable sources. Renewable energy sources are now the second largest source of electricity after natural gas. Ireland has no mandatory target for RES-E for 2020 but has set an ambitious national target of 40%. RES-E forms the backbone of Ireland's strategy to achieve the overall 16% renewable energy target for 2020.

The total contribution from renewable energy to gross electricity consumption in 2019 was 36.5% normalised (compared with 33.3% in 2018). The share of electricity from renewable energy increased fivefold between 2005 and 2019 – from 7.2% to 36.5% – an increase of 29 percentage points over 14 years. In absolute terms, there has been a sixfold increase in the volume of renewable electricity generated, from 1,873 GWh in 2005 to 11,780 GWh in 2019.

Table 17 and *Figure 38* show how electricity production from wind energy increased to the point where it accounted for 85% of the renewable electricity generated in 2019. Electricity generated from biomass accounted for 7.2% of renewable electricity in 2019. Biomass consists of contributions from solid biomass, landfill gas, the renewable portion of waste and other biogases.

Wind energy accounted for 85% of the renewable electricity in 2019.

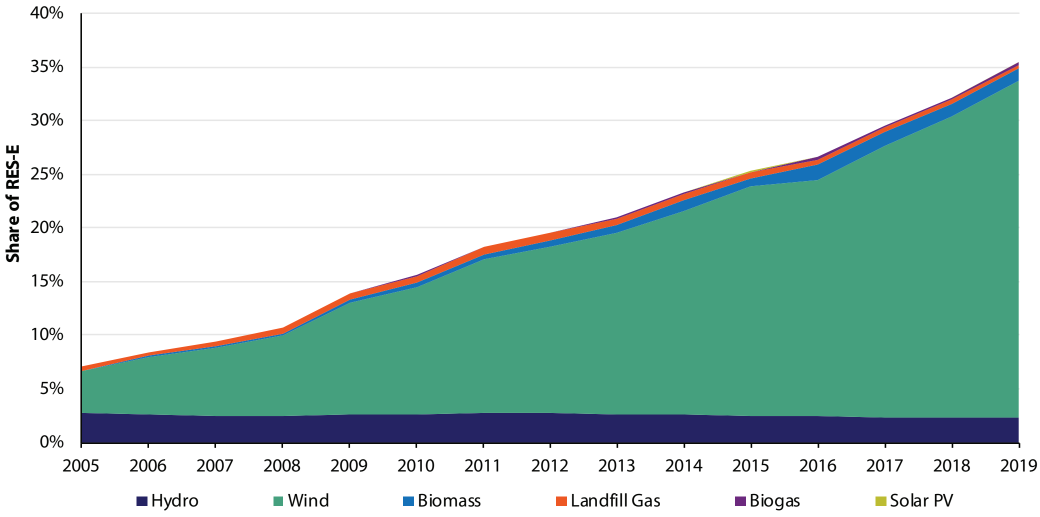
Wind, hydro and bioenergy generated electricity respectively, accounted for 31.3%, 2.4% and 2.7% of Ireland's gross electricity consumption in 2019. Solar photovoltaic (PV) accounted for 0.07%.

Table 17: Renewable energy contribution to gross electricity consumption (RES-E normalised)

Renewable Electricity %	2005	2010	2013	2014	2015	2016	2017	2018	2019
Hydro (normalised)	2.7	2.6	2.7	2.6	2.5	2.5	2.4	2.3	2.4
Wind (normalised)	4.0	11.9	16.9	19.0	21.3	22.0	25.2	28.1	31.3
Biomass	0	0.4	0.8	0.9	0.7	1.3	1.3	1.1	1.1
Renewable Waste	0	0	0.3	0.3	0.3	0.3	0.5	1.1	1.0
Landfill Gas	0.4	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.4
Biogas	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Solar PV	0	0	0	0.01	0.01	0.02	0.04	0.05	0.07
Overall	**7.2**	**15.6**	**21.3**	**23.5**	**25.5**	**26.8**	**30.1**	**33.3**	**36.5**

42 Using Renewable Directive calorific value.
43 Ibid

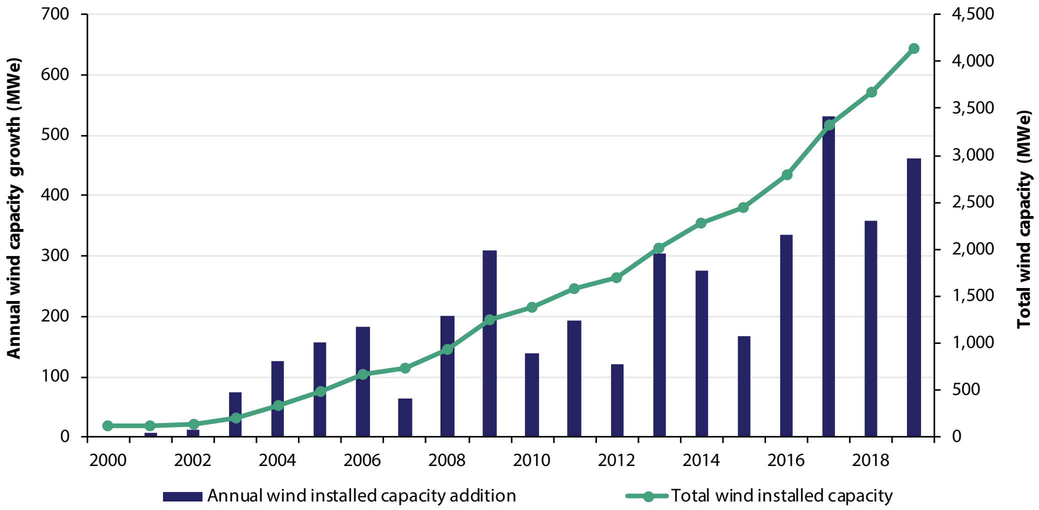
Figure 38: Renewable energy contribution to gross electricity consumption (RES-E normalised)



Source: SEAI

Figure 39 shows the annual growth in installed wind generation capacity and overall cumulative capacity since 2000. By the end of 2019, the installed capacity of wind generation reached 4,137 MW. The peak recorded wind power output was 3,337 MW, delivered on 21 February 2020[44] at 18:45 hr (it represented 72% of demand at that time). During 2019, 461 MW of wind capacity was installed.

Figure 39: Installed wind generating capacity, 2000 – 2019[45]



Source: EirGrid

EirGrid and ESB Networks note that as of 2020 there is 1,754 MW of additional wind generation planned, either with connection contracts in place or applications for connection underway. Historically, there has been a maximum of just over 500 MW installed in any one year since 2005 and on average the installation rate has been 200 MW.

The output from wind and hydro generation is affected by the amount of the resource (wind and rainfall) in a particular year. It is also affected by the extent of outages of the plant for reasons such as faults, maintenance and curtailment. An indication of how these factors affect the output of wind and hydro can be obtained by examining the capacity factors for these generation types. The capacity factor is the ratio of average electricity produced to the theoretical maximum possible if the installed capacity was generating at a maximum for a full year.

The rates of capacity increase each year can have a significant impact on the capacity factor in periods of large annual capacity increases. If significant capacity is added late in the year, this artificially reduces the capacity factor for the year.

45 *Installed Wind Report*, EirGrid: http://www.eirgridgroup.com/customer-and-industry/general-customer-information/connected-and-contracted-generators/ and ESB Networks, http://www.esb.ie/esbnetworks/en/generator-connections/Connected-Contracted-Generators.jsp

To mitigate this, the wind capacity factors in *Table 18* are calculated using the average of the installed capacity in any given year and the previous year.

Table 18: Annual capacity factor for wind and hydro generation in Ireland – 2005, 2010, 2013 to 2019

Capacity Factor %	2005	2010	2013	2014	2015	2016	2017	2018	2019
Wind	30.6	23.7	27.9	27.3	31.7	26.8	27.8	28.2	29.3
Hydro	30.8	28.9	28.9	34.1	38.8	32.8	33.3	33.4	42.7

Source: EirGrid and SEAI

The average countrywide wind capacity factor was 30% in 2005 but fell to 24% in 2010 largely due to it being a low wind year compared with historic average levels. The hydro capacity was also at its lowest level since 2003 due to the low level of rainfall in 2010. The wind capacity factor increased to 29% in 2019. The hydro capacity factor increased to 43% in 2019.

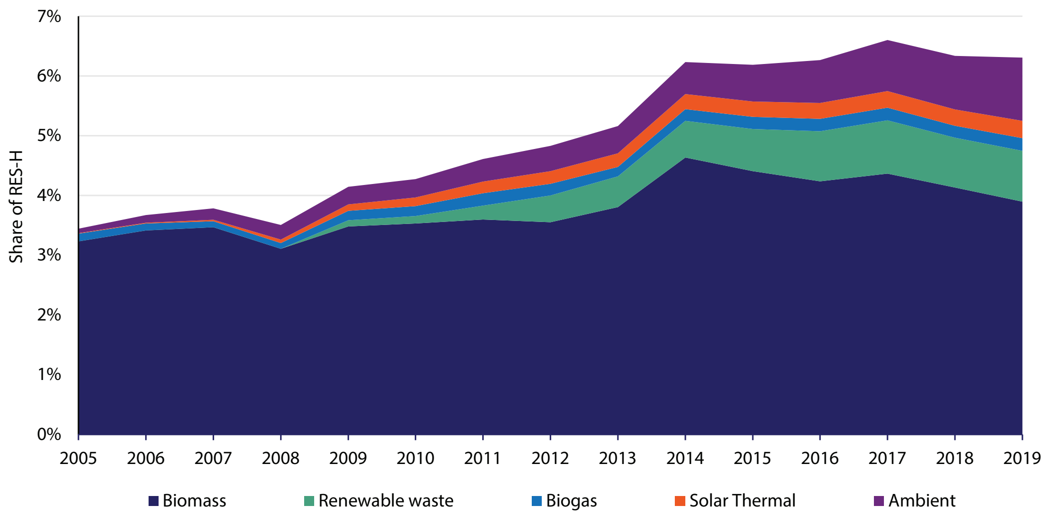
6.1.3 Heat from renewable energy sources (RES-H)

Although there is no mandatory target for RES-H set in the RED, Ireland has set a target of 12% RES-H to help deliver the overall mandatory target of 16% renewable energy by 2020. *Figure 40* shows the contribution from renewable energy to heat or thermal energy uses as a share of overall heat use.

RES-H grew from 3.4 % in 2005 to a peak of 6.6% in 2017. In 2018 it fell to 6.3% and remained at this level in 2019. The absolute amount of renewable heat energy used fell by 3.5% in 2019. Overall between 2005 and 2019, the amount of fossil fuels used for heat has reduced by 16%, which contributed positively towards the RES-H target, as the share of renewable heat is measured against a smaller total.

Renewable heat energy is dominated by solid biomass use (62%), in particular in industry. The use of ambient energy (ground-source and air-source) has grown more than ten-fold between 2005 and 2019 and is now a significant source of renewable heat energy, accounting for approximately 17% of renewable heat energy in 2019.

Figure 40: Renewable energy contribution to thermal energy (RES-H)



Source: SEAI

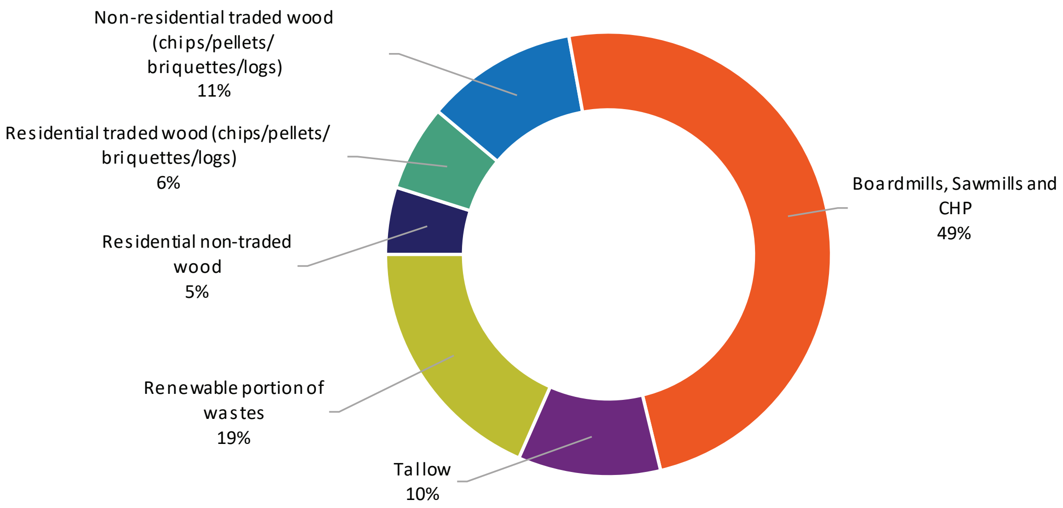
Recent growth in renewable energy use for heat has been due to increased use of renewable wastes in industry and increased use of heat pumps delivering ambient energy in the residential and services sectors. The latter is mostly due to revisions to building regulations for new dwellis and also the support of grant schemes.

> There has been a large increase in the use of air-source heat pumps in the residential sector.

Figure 41 shows the composition of biomass and renewable wastes in total final consumption in 2019. Forty-nine per cent of all solid biomass (including renewable wastes) is consumed in the wood and wood products industry sub-sector, where wood wastes or wood residues from that sector are being combusted for heat. Similarly tallow, a by-product or output of the food sector, is combusted for heat in that sector and is also being refined for use as a biofuel in transport. Tallow accounts for 10% of all solid biomass. In 2019, a further 19% of solid biomass was used for heat in the cement industry in the form of the renewable portion of solid wastes.

Wood chips, pellets and briquettes make up 17% of all the solid biomass consumed in Ireland. The remaining 5% is an estimate of the non-traded wood logs that are used in open fires or stoves in households. Non-traded wood consumption is estimated in the absence of available data and varies with different methodologies. However, as it is only a small part of the total solid biomass consumption, the variation in estimates is small relative to the overall solid biomass consumption total used for the calculation of RES-H.

Figure 41: Composition of biomass and renewable wastes used for heat in total final consumption, in 2019



Source: SEAI

6.1.4 CO_2 displacement and avoided fuel imports

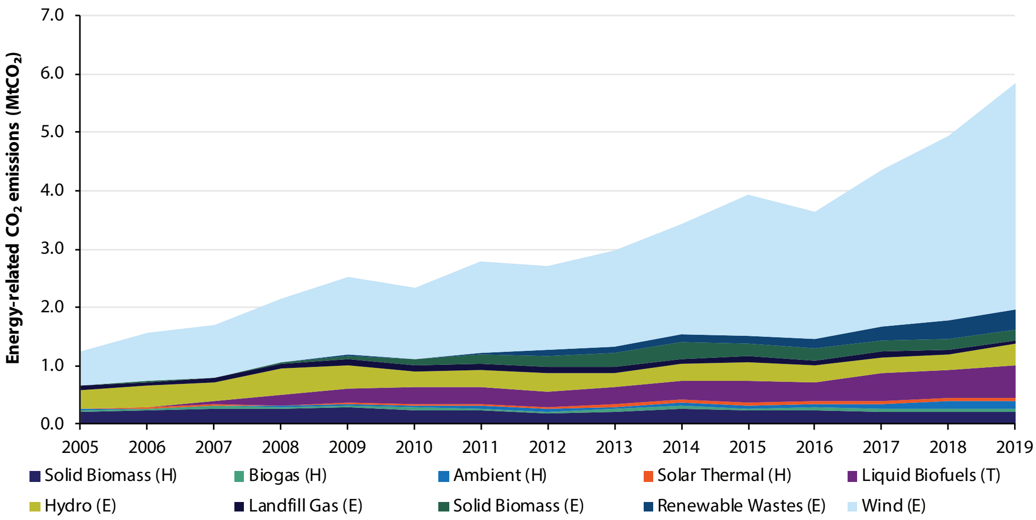
The use of renewable energy displaces the use of fossil fuels thereby avoiding CO_2 emissions and reducing the amount of fossil fuels we need to import. We estimate the amount of CO_2 avoided and fossil fuel imports displaced using the primary energy equivalent approach. This estimates the quantity of fossil fuels that would have been required to replace renewable energy use. The estimates for electricity are based on the use of marginal generation fuel that would otherwise have been required to produce the electricity. The results obtained using this methodology have been further refined, using the results of a more detailed dispatch model of the operation of the entire all-island electricity system in the year 2012, so that the effects of ramping and cycling of fossil fuel plants are accounted for[46,47].

Figure 42 shows the trend in avoided CO_2 emissions from renewable energy for the period 2005 – 2019. The estimated amount of CO_2 avoided through the use of renewable energy increased by 395% over the period 2005 – 2019, reaching 5,838 kt CO_2 in 2019. Wind energy avoided majority of emissions, at 3,879 kt CO_2 in 2019, followed by bioenergy at 1,394 kt CO_2, hydro at 367 kt CO_2, ambient heat at 146 kt CO_2 and solar at 52 kt CO_2.

Electricity generation is covered by the EU emissions trading system (ETS), therefore CO_2 emissions savings achieved in electricity generation do not count directly towards Ireland's EU targets to reduce greenhouse gas (GHG) emissions outside of the ETS (non-ETS). However, decarbonising the electricity system combined with increased electrification of heat and transport through the use of electric vehicles (EV) and heat pumps is an important part of the strategy for decarbonising the energy system as a whole. The use of renewable electricity at current levels helps ensure that switching to EVs and heat pumps does not result in greater CO_2 emissions than the fossil fuel alternative. Electrification of heat and transport reduces direct fossil fuel use in the non-ETS sector, thereby contributing to meeting the non-ETS GHG emissions reduction target.

In relation to the displacement of fossil fuels by renewable energy, it is estimated that in 2019 approximately €501 million in fossil fuel imports were avoided, of which €248 million was avoided by wind generation.

Figure 42: Avoided CO_2 from renewable energy, 2005 – 2019



Source: SEAI

In 2019, approximately €501 million in fossil fuel imports were avoided by the use of renewables, of which €248 million was avoided by wind.

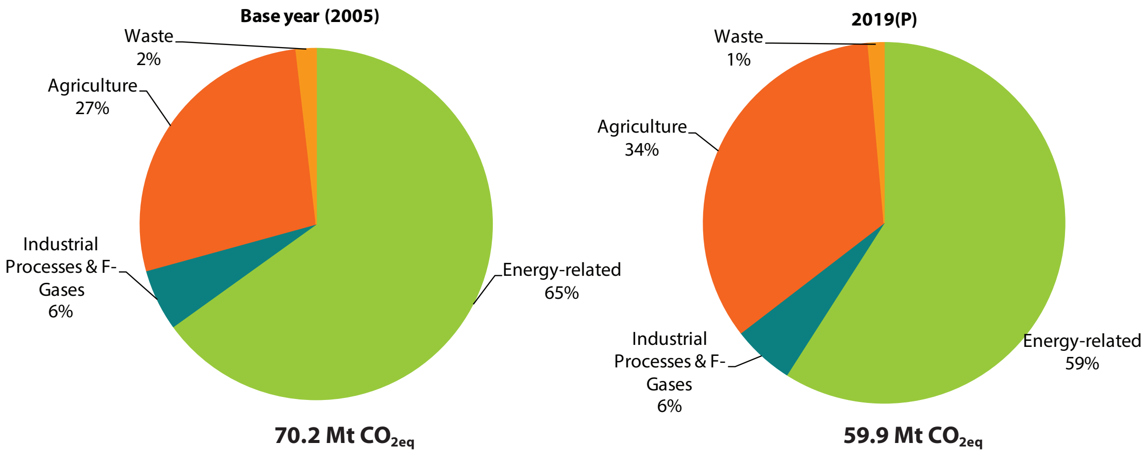
6.2 Greenhouse gas emissions targets

In 2008, the EU agreed a climate and energy package that included a target to reduce GHG emissions across the EU by 20% below 1990 levels by the year 2020. This resulted in two specific pieces of GHG emissions legislation affecting Ireland:

- Directive 2009/29/EC requiring ETS companies to reduce their emissions by 21% below 2005 levels by 2020;
- Decision 406/2009/EC requiring Ireland to reduce non-ETS emissions by 20% below 2005 levels by 2020.

Figure 43 shows GHG emissions by source for 2005 and provisional figures for 2019 (excluding land use and land use change), as reported by the Environmental Protection Agency (EPA).

Figure 43: Greenhouse gas emissions by source



Source: Based on EPA data

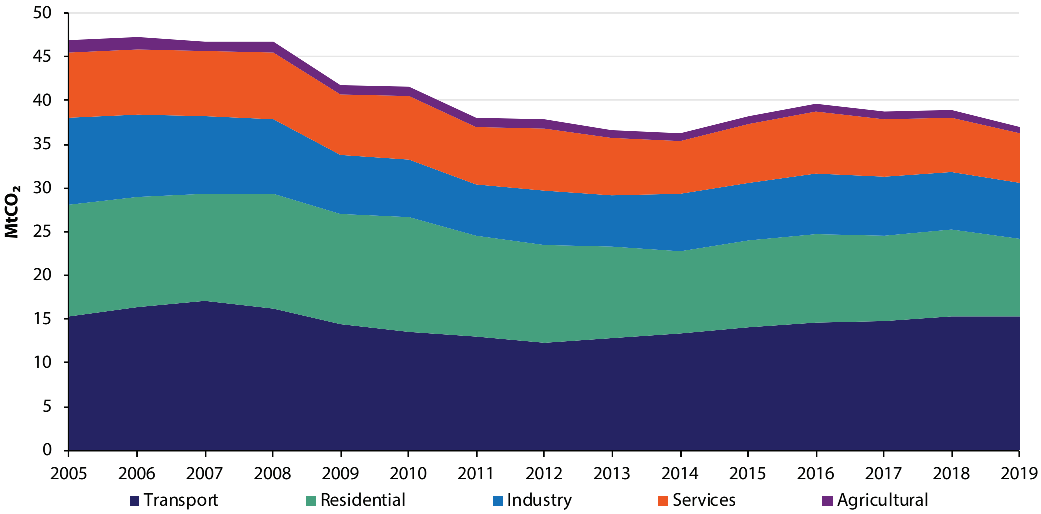
Figure 43 shows that the share of energy-related emissions of the total GHG emissions has fallen since 2005. The share of GHG emissions arising from energy-related activities was 59% (35.2 Mt) in 2019, compared with 65% (45.7 Mt) in 2005. The share from agriculture increased from 27% to 34% in the same period, from 19.3 Mt to 20.5 Mt. It is interesting to note that for the EU as a whole, energy production and use represented 79% of GHG emissions in 1990. The significant role of agriculture in the Irish economy underlies Ireland's variance from the EU average.

The sectoral energy-related CO_2 emissions presented in *Figure 44* and *Table 19* are based on the economic sectoral disaggregation contained in the energy balance, with the upstream emissions from electricity generation and other energy transformations allocated to the economic sectors where that electricity is used. This differs from the way in which national GHG emissions inventories are reported by the EPA, where the 'energy sectors' (for example, electricity generation and oil refining) are reported separately according to UNFCCC and UN IPCC reporting guidelines.

> The share of GHG emissions arising from energy-related activities was 59% (35.2 Mt) in 2019, compared with 65% (45.7 Mt) in 2005. Energy-related GHG emissions fell by 4.9% in 2019.

The sectoral breakdown of energy-related CO_2 emissions shown in *Figure 44* represents 96% of energy-related GHG emissions, with the remaining 4% accounted for by energy-related nitrous oxide (N_2O) and methane (CH_4). Energy-related CO_2 emissions in 2019 were 13% higher than 1990 levels but 24% lower than in 2005.

Figure 44: Energy-related CO_2 emissions by sector[48,49]



Source: SEAI

As shown in *Table 19,* transport accounted for the largest share of energy-related CO_2 emissions, with a share of 41% in 2019, up from 33% in 2005. The residential sector accounted for the second largest share in 2019, at 24%, followed by industry at 17% and services at 15%. Energy-related CO_2 emissions in agriculture and fisheries accounted for just 2.1%.

Table 19: Growth rates, quantities and shares of primary energy-related CO_2 by sector

	Overall Growth %	Average Annual Growth %				Quantity (kt CO_2)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Industry	-37.0	-3.3	-0.3	-0.7	-5.5	10,047	6,326	21.4	17.1
Transport	-0.3	0.0	0.7	2.0	-0.1	15,299	15,260	32.7	41.2
Residential	-29.5	-2.5	-5.3	-2.6	-9.3	12,770	9,002	27.3	24.3
Services	-22.3	-1.8	-1.3	-4.3	-7.7	7,314	5,683	15.6	15.3
Agriculture & Fisheries	-44.4	-4.1	-5.6	-0.1	-5.8	1,414	787	3.0	2.1

A more detailed discussion can be found in SEAI's publication *Energy-Related CO_2 Emissions in Ireland*.

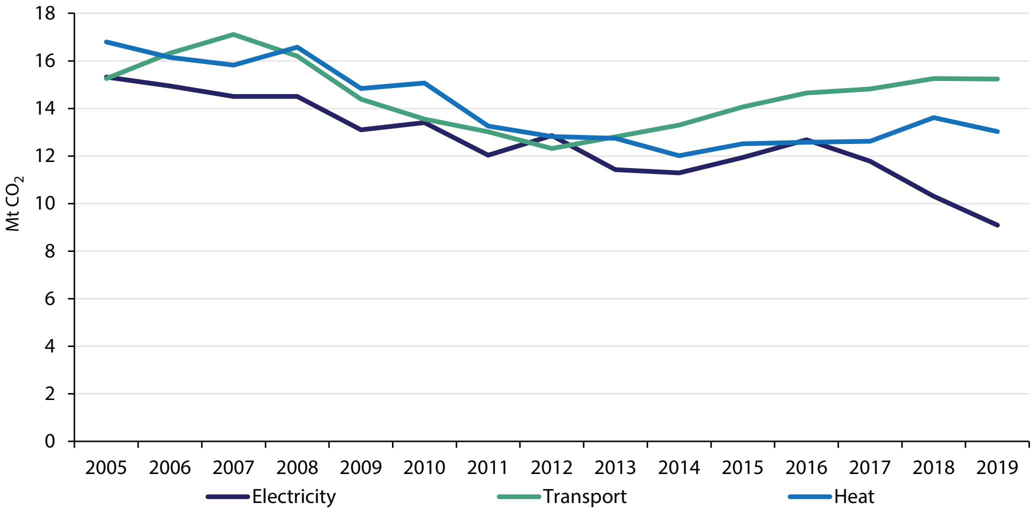
Figure 45 and *Table 20* illustrate the variations in emissions by mode of energy use. Here the emissions are allocated according to whether the energy used is for transport, electricity, or thermal energy. These modes also represent distinct energy markets.

Transport accounted for the largest share of energy-related CO_2 emissions, with a share of 41% in 2019, up from 33% in 2005.

48 *Figure 44* and *Table 19* are based on SEAI estimates and use a different methodology to that used by the EPA for compiling the national inventory. International air transport emissions are excluded from the national GHG emissions inventory in accordance with the reporting procedures established by the UNFCCC guidelines, but are included in the National Energy Balance and so are included here..

49 Emissions for agriculture shown in the chart and the table are for energy-related emissions only.

Figure 45: Energy-related CO_2 emissions by mode of energy application



Source: SEAI

In 2019, CO_2 emissions fell by 0.1% in transport, 11.8% in electricity, and by 4.2% in heat, and the shares of energy-related CO_2 emissions from transport, electricity and heat were 41.2%, 24.6% and 34.2% respectively.

Energy-related CO_2 emissions in all three modes declined during the recession after 2007, but transport returned to steady growth as early as 2013 with heat and electricity returning to growth after 2014. The most significant trends in recent years have been the continued growth in CO_2 emissions from transport and the dramatic reduction in CO_2 emissions from electricity generation after 2016, due to the reduction in coal and increase in renewables used for electricity generation. CO_2 emissions from electricity in 2019 were 41% lower than in 2005. CO_2 emissions from heat were also down 22% in 2019 compared to 2005, while the outlier is transport, where CO_2 emissions were just 0.2% below 2005 levels in 2019, or 11% below the 2007 peak.

Table 20: Growth rates, quantities and shares of energy-related CO_2 emissions by mode of application

	Overall Growth %	Average Annual Growth %				Quantity (kt CO_2)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2018	2005	2019
Transport	-0.2	0.0	0.7	2.0	-0.1	15,261	15,234	32.7	41.2
Electricity	-40.7	-3.7	-2.3	-6.6	-11.8	15,325	9,091	32.8	24.6
Heat	-21.7	-1.7	-3.7	1.2	-4.2	16,104	12,617	34.5	34.2
Total	**-20.9**	**-1.7**	**-1.7**	**-0.7**	**-4.6**	**46,690**	**36,942**		

Source: SEAI

Given that the binding target at the national level is for the non-ETS[50] sectors, *Table 21 and Figure 46* show the trends in non-ETS energy-related CO_2 emissions for the transport, residential, services and agriculture[51] sectors since 2005, non-ETS industry from 2005 onwards and non-ETS transport since 2012. This excludes emissions associated with electricity use by these sectors as these emissions are included in the ETS.

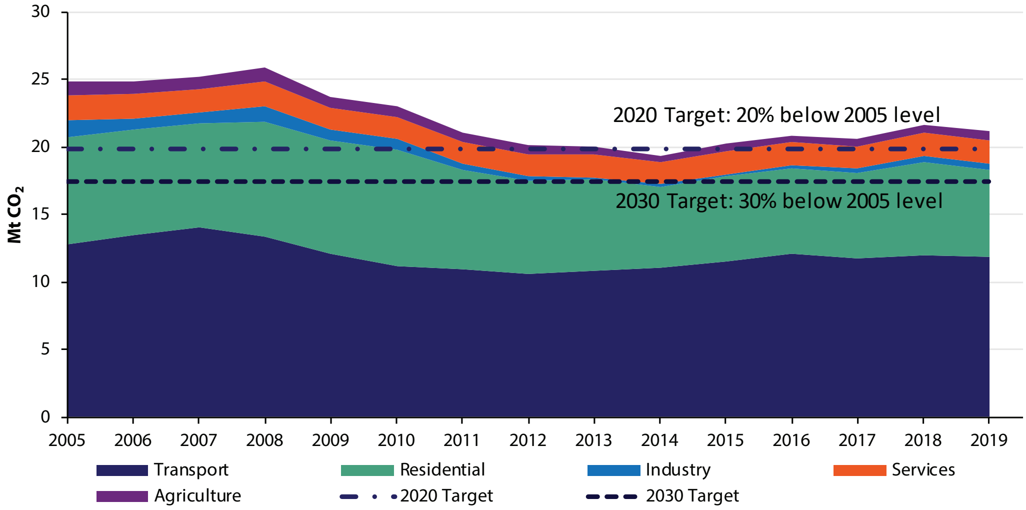
Table 21: Growth rates, quantities and shares of ETS and non-ETS energy-related CO_2 emissions since 2005

	Overall Growth %	Average Annual Growth %				Quantity (kt CO_2)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
ETS CO_2	-27.6	-2.3	-0.7	-2.9	-7.4	22,039	15,955	47.0	43.0
Non-ETS CO_2	-14.9	-1.1	-2.5	1.1	-2.5	24,805	21,121	53.0	57.0
Total Energy-Related CO_2	**-21.5**	**-1.7**	**-1.6**	**-0.9**	**-4.5**	**47,556**	**37,349**		

Table 21 shows that non-ETS sectors' (including non-ETS industry) energy-related CO_2 emissions decreased by 2.5% per annum between 2010 and 2015, with emissions increasing by 1.1% per annum between 2015 and 2019. Non-ETS energy-related CO_2 emissions were 15% below 2005 levels in 2019. Under EU Decision 406/2009/EC, there is a requirement for Ireland to achieve a 20% reduction in total non-ETS GHG emissions (including, notably, methane emissions from agriculture) from 2005 levels by 2020.

The emissions trading sector has experienced a 28% fall in energy-related emissions since 2005, and emissions fell by 7.4% in 2019 compared with the previous year. The share of emissions covered in the ETS in overall energy-related emissions stood at 43% in 2019.

Figure 46: Non-emissions trading energy-related CO_2[52]



Source: SEAI

52 The 2020 target of 20% below 2005 levels refers to total GHG emissions and not just energy-related CO_2 emissions. While there's no specific target for energy-related CO_2, the datum of 20% below 2005 levels is shown here for illustrative purposes.

6.3 Energy security

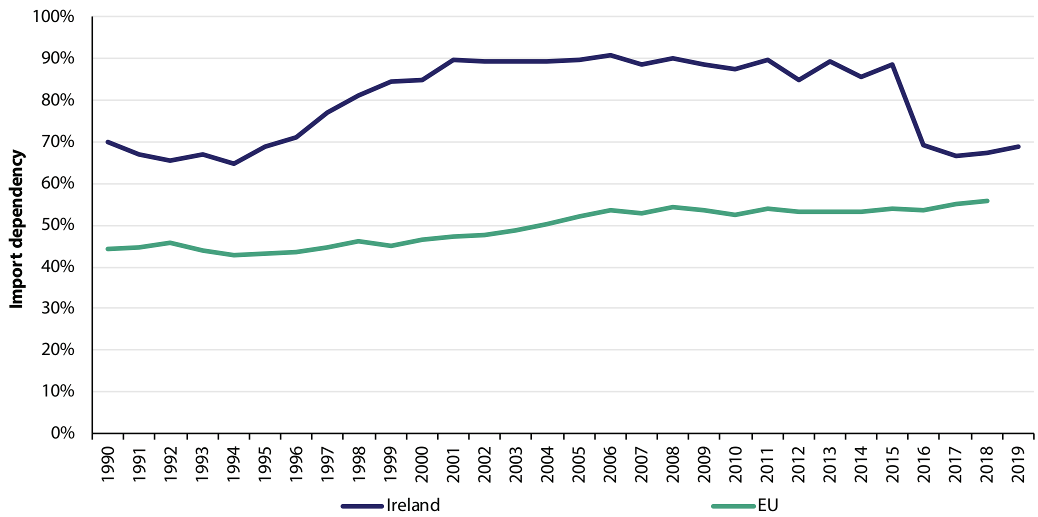
Energy security, in its simplest terms, means having uninterrupted access to reliable, affordable supplies of energy. Secure supplies of energy are essential for our economy and for maintaining safe and comfortable living conditions.

Energy import dependency is one of the simplest and most widely used indicators of a country's energy security, with indigenous energy sources generally considered to be more secure than imported energy. While the overall import dependency figure provides a useful context, a deeper understanding of energy security requires more detailed information on individual energy sources. This includes the countries from where each fuel is sourced, global market conditions, transportation and other infrastructure requirements. It also requires analysis of the current trends in energy use, and of the significant changes that will occur in energy use both nationally and globally over the coming years. Energy security is considered in more detail in a separate SEAI publication[53].

Figure 47 illustrates the trend in import dependency since 1990, comparing it with that for the EU as a whole, and shows the dramatic change in Ireland's import dependency in 2016 resulting from the start of natural gas production from the Corrib gas field. Indigenous production accounted for 32% of Ireland's energy requirements in 1990. From the mid-1990s import dependency grew significantly due to the increase in energy use, together with the decline in indigenous natural gas production at Kinsale since 1995, and decreasing peat production. Ireland's overall import dependency reached 90% in 2006. It varied between 85% and 90% until 2016 when it fell sharply following the opening of the Corrib gas field. It fell to a low of 66% in 2017, but increased again in 2018 and 2019. In 2019 import dependency was 69%.

We estimate that the cost of all energy imports to Ireland in 2019 was approximately €4.5 billion. This was down from approximately €5.0 billion in 2018, due mainly to lower prices for oil and gas.

Figure 47: Import dependency of Ireland and the EU



Source: SEAI and Eurostat

This trend reflects the fact that Ireland is not endowed with significant indigenous fossil fuel resources and has only in recent years begun to harness significant quantities of renewable resources and more recently natural gas from the Corrib gas field.

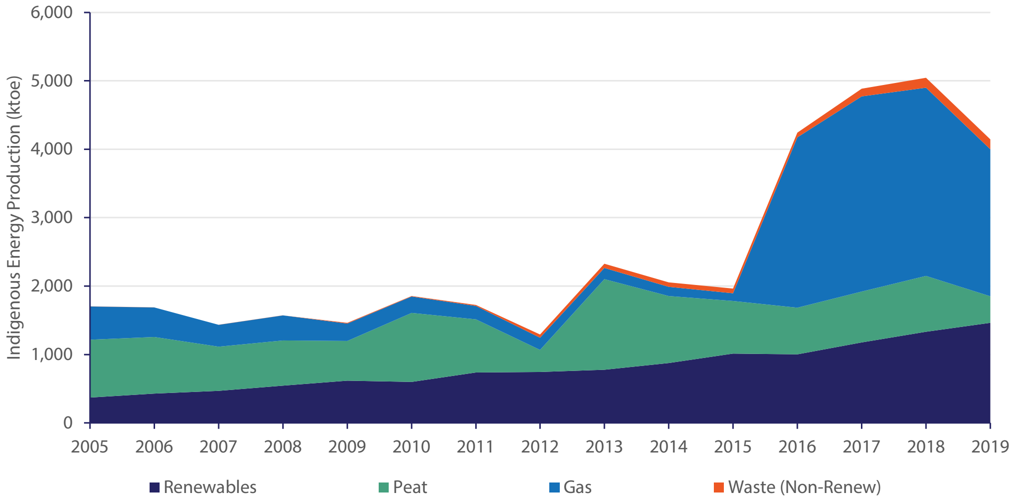
> Ireland's import dependency varied between 85% and 90% until Corrib gas field started production in 2016. It fell to 66% in 2017 but has increased again to 69% in 2019.

Figure 48 shows the indigenous energy fuel mix for Ireland over the period. Indigenous production of natural gas decreased by 95% from the previous peak in 1995 to a low of 106 ktoe in 2015. It increased dramatically in 2016 and rose again in 2017, to 2,854 ktoe. This was the highest natural gas production level ever recorded in Ireland. Production from the Corrib gas field has already begun to decline and in 2019 it was 2,147 ktoe, 25% below the 2017 peak. It is expected to decline significantly over the coming years[54].

Peat production was down 49% in 2019 on the previous year. Indigenous renewable energy production increased by 294% between 2005 and 2019, to 1,461 ktoe. Most of this is from wind energy.

Total indigenous energy production in Ireland reached the highest level ever in 2018 of 5,040 ktoe, but declined to 4,144 ktoe in 2019 due to declining natural gas and peat production.

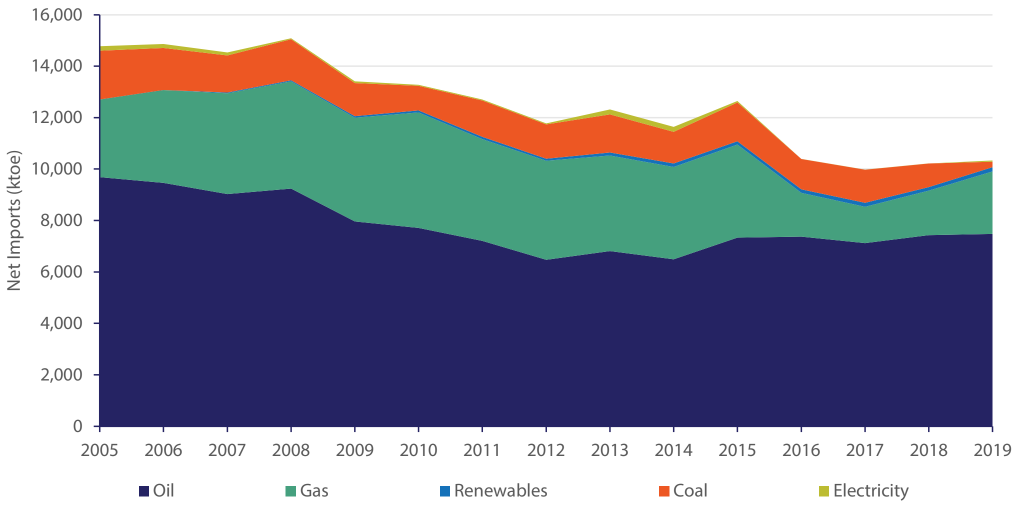
Figure 48: Indigenous energy by fuel



Source: SEAI

Figure 49 shows the trend for net fuel imports (imports minus exports) over the period 2005 – 2019. The most striking feature is the dependence on oil, due largely to energy use in transport. Oil, which includes crude oil and oil products such as diesel and petrol, accounted for 72% of all energy imports in 2019, and were up 1% on the previous year. Gas imports increased by 40% in 2019 due to declining indigenous production, and accounted for 23% of energy imports. Coal imports fell by 77% due to less coal use in electricity generation. Coal accounted for 2.0% of net imports. Renewable energy imports were up 20% in 2019, mostly due to increased imports of biodiesel to meet the increased blending requirements. Renewable energy accounted for 1.6% of total energy imports. Ireland was a net importer of electricity in 2019 for the first time since 2015. There were net imports of 55 ktoe of electricity in 2019, 0.5% of total energy imports. Total net energy imports increased by 1% in 2019 but were 31% lower than in the peak in 2008.

Figure 49: Imported energy by fuel



Source: SEAI

54 https://www.cru.ie/wp-content/uploads/2020/08/CRU20101-GNI-draft-Ten-year-Network-Development-Plan-2019.pdf

6.4 Cost competitiveness

Energy use is an important part of economic activity and therefore the price paid for energy is a determining factor in the competitiveness of the economy. Ireland has a high import dependence on oil and gas and is essentially a price-taker on these commodities. The EU has introduced competition into the electricity and gas markets through the liberalisation process in order to reduce energy costs to final consumers.

Since 2015, energy prices[55] in Ireland have increased by 6.7% in real terms, compared with an average increase of 1.6% in OECD (Organisation for Economic Co-operation and Development) Europe, and a 1.4% decrease in the United States over the same period based on data from the IEA. In 2019, overall energy prices in Ireland were 4.3% higher than in 2018, compared with an increase of 1.1% in OECD Europe and a 3.9% decrease in the US.

Crude oil prices averaged around $64/barrel in 2019, compared with $71/barrel on average in 2018. Up to mid-November 2020, the average price for Brent crude oil was $41/barrel[56] having fallen as low as 9$ in April during the early stages of the global COVID-19 pandemic.

The price of natural gas at the UK National Balancing Point[57] was, on average, 42% lower in 2019 compared with 2018.

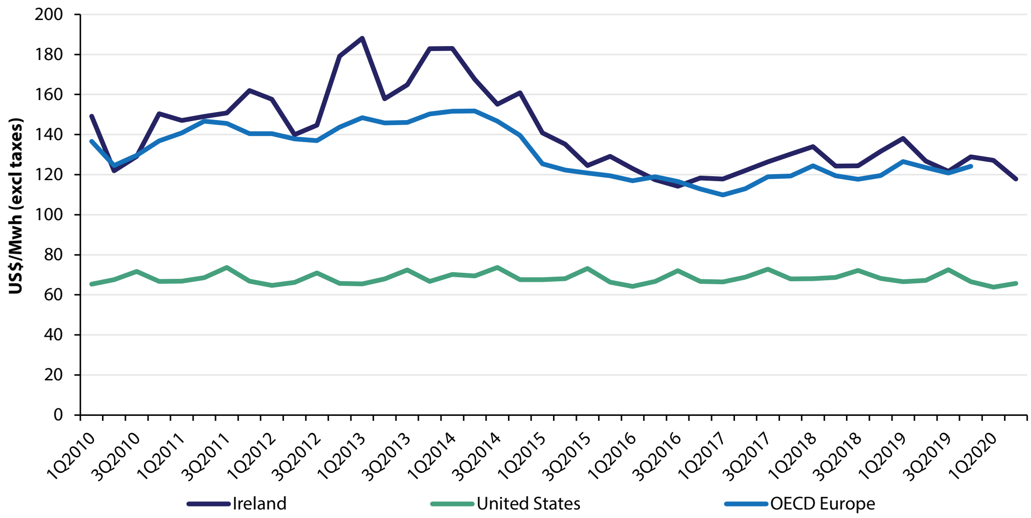
SEAI publishes biannual reports titled *Electricity and Gas Prices in Ireland*[58] based on data collected under EU legislation on the transparency of gas and electricity prices, which came into effect in January 2008. These reports focus specifically on gas and electricity prices using data published by Eurostat, and are a useful reference on cost-competitiveness and cover both business and households.

This section focuses on business energy prices. It presents comparisons of the cost of energy in various forms in Ireland and compares prices in OECD Europe and the US. The source of the data presented here is the IEA's Energy Prices and Taxes. This data source was chosen because it is produced quarterly and the latest complete data is available for the second quarter of 2020. Prices shown are in US dollars and are in current (nominal) money[59]. Relative price increases since 2015, however, are tabulated for EU-15 countries and the US in index format in both nominal and real terms.

6.4.1 Energy prices in industry

Table 22 shows that electricity prices to Irish industry increased by 2% in real terms between 2015 and 2019. The fuel mix for electricity generation is one factor that has a key bearing on the variation in the price of electricity. In the EU, Ireland has a high overall dependency for electricity generation on fossil fuels, at 69%, behind Greece at 78%, the Netherlands at 80% and Poland at 84%. Ireland also has a high dependency on gas generation, at 51%.

Figure 50: Electricity prices to industry



Source: Energy Prices and Taxes © OECD/IEA, 2018

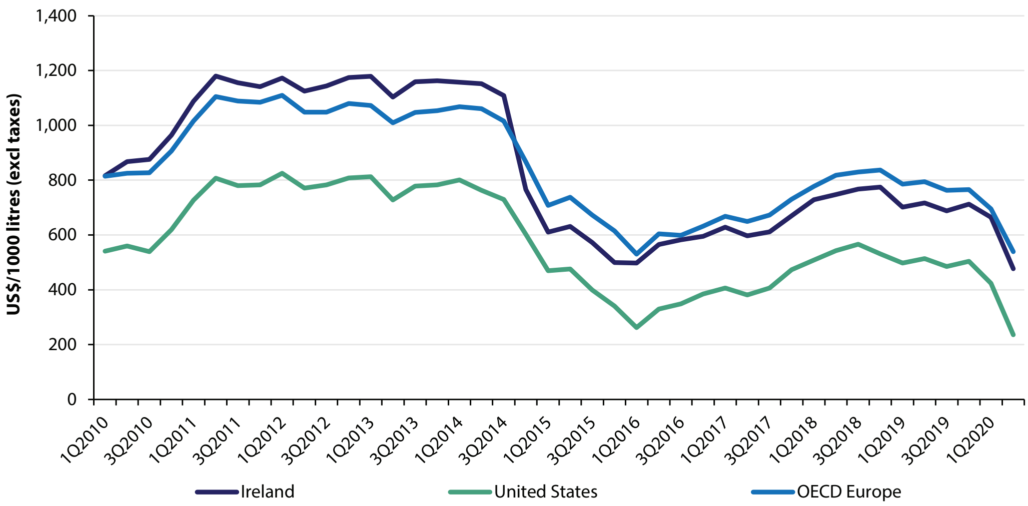
Table 22: Electricity price to industry change since 2015

Index 2015 = 100	OECD Europe	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Sweden	United Kingdom	United States
2nd qtr 2020 (nominal)	112	99	101	74	97	91	94	98	**90**	85	115	100	92	89	125	117	95
2nd qtr 2020 (real)	98	97	96	73	98	92	90	107	**102**	84	105	100	92	90	114	109	93

Source: Energy Prices and Taxes © OECD/IEA, 2018

Table 23 shows that oil prices to industry in Ireland were 2% higher in real terms in 2019 than in 2015. The average oil price in Europe fell by 9%, and by 13% in the US. Crude oil prices averaged around $64/barrel in 2019, compared with $71/barrel on average in 2018. Up to mid-November 2020, the average price for Brent crude oil was $41/barrel having fallen as low as $9 in April during the early stages of the global COVID-19 pandemic.

Figure 51: Oil prices to industry



Source: Energy Prices and Taxes © OECD/IEA, 2018

Table 23: Oil prices to industry change since 2015

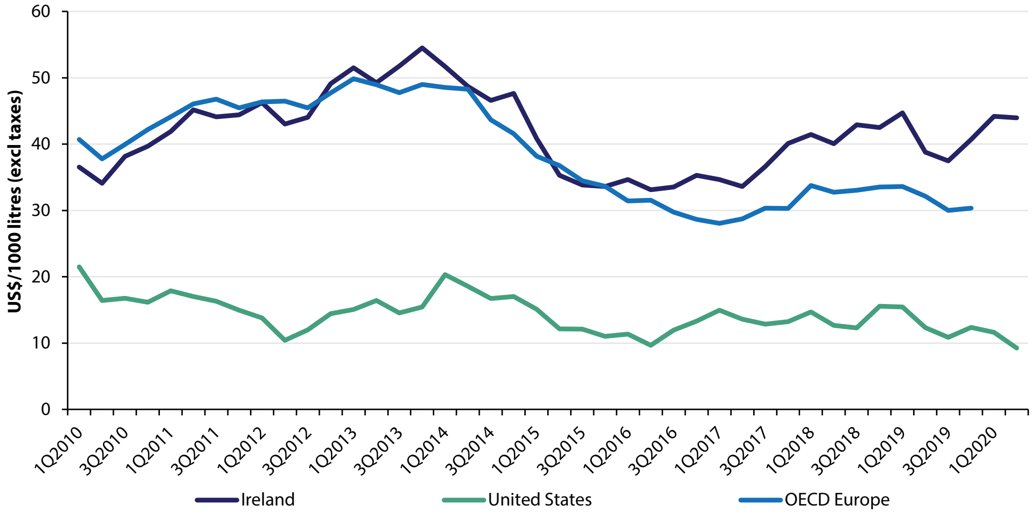
Index 2015 = 100	OECD Europe	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Sweden	United Kingdom	United States
2nd qtr 2020 (nominal)	98	74	105	90	90	103	91	95	**91**	91	88	97	99	90	103	98	87
2nd qtr 2020 (real)	91	72	100	88	91	104	88	104	**103**	90	80	98	99	90	93	91	86

Source: Energy Prices and Taxes © OECD/IEA, 2018

Crude oil prices averaged around $64/barrel in 2019, compared with $71/barrel on average in 2018.

As can be seen in *Figure 52*, natural gas prices to Irish industry increased from the second quarter of 2010 until the end of 2013. Prices had been relatively stable from the middle of 2015 until the middle of 2017 when they started to rise again. In the second quarter of 2020 the price of gas to industry in Ireland was 40% above 2015 levels in real terms. *Figure 52* also shows the gap between gas prices in Europe and the US.

Figure 52: Natural gas prices to industry



Source: Energy Prices and Taxes © OECD/IEA, 2018

Table 24: Natural gas prices to industry change since 2015

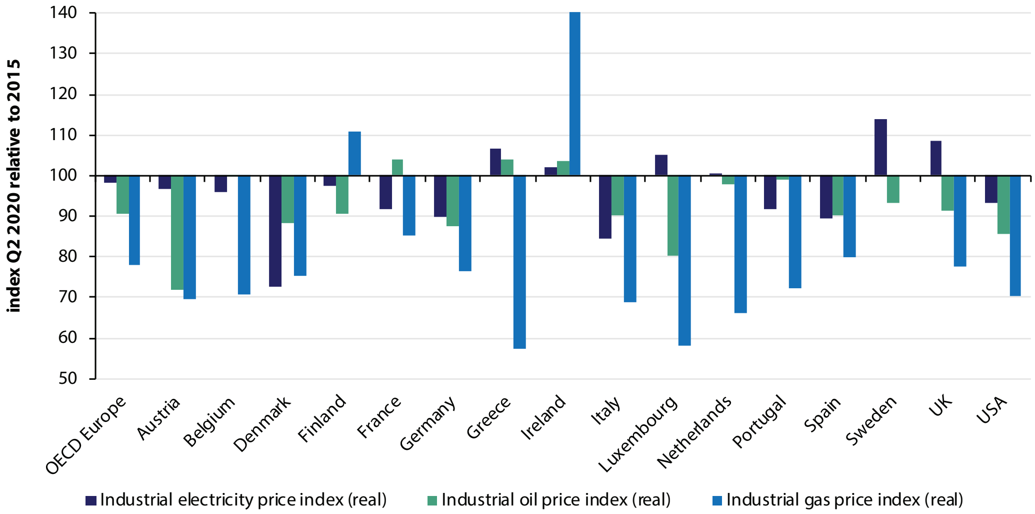
Index 2015 = 100	OECD Europe	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Sweden	United Kingdom	United States
2nd qtr 2020 (nominal)	89	72	74	77	110	85	80	53	**123**	70	64	66	72	79		83	72
2nd qtr 2020 (real)	78	70	71	76	111	85	76	58	**140**	69	58	66	72	80		78	70

Source: Energy Prices and Taxes © OECD/IEA, 2018

The price of natural gas at the UK National Balancing Point was, on average, 42% lower in 2019 compared with 2018.

Figure 53 summarises the data presented in *Table 22*, *Table 23* and *Table 24*. The IEA publishes an overall energy price index (real) for industry, which shows that the overall energy price to Irish industry between 2015 and 2019 increased by 11%, compared with an increase of 2.1% for OECD Europe and a 1.2% increase in the US.

Figure 53: Real energy price changes to industry since 2015 in EU-15 (index)



Source: Energy Prices and Taxes © OECD/IEA, 2018

In 2019, energy prices for industry in Ireland increased by 6.6% in real terms compared with 2018. In OECD Europe, the increase was 1.4%, while in the US energy prices increased by 1.3%.

The year 2019 saw global oil price falling, from around $71/barrel on average in 2018 to $41/barrel on average in 2019. Natural gas prices at the UK Balancing Point were, on average, 42% lower in 2019 compared with 2018.

The overall energy price to Irish industry between 2015 and 2019 increased by 11%, compared with an increase of 2.1% for OECD Europe and a 1.2% increase in the US.

7 Sectoral trends and indicators

This section explores in more detail the changes in energy use in each of the main sectors: industry, transport, residential, and services.

Revisions to historical data on energy use by sector due to improved data on business energy use

In December 2018 the Central Statistics Office (CSO) published the results of the Business Energy Use Survey (BEUS) for the first time. This new data source provides a basis for the breakdown of energy use in the commercial services, public services and industrial sectors, at a level of detail not previously possible. SEAI have revised the National Energy Balances from 1990 to 2018 incorporating this new improved data.

SEAI have prepared a special report that explains the background to the BEUS, describes the new data that is available, how this compares to previous estimates, how the National Energy Balance has been revised to incorporate the new data, and gives a detailed comparison of the before and after estimates of energy use by fuel and by sector. That report is available from the SEAI website at www.seai.ie/NationalEnergyBalance/.

This Energy in Ireland 2020 report presents the revised data from 2005 to 2018 and the new statistics for 2019. Because of the extensive revisions to the historical data, it is important to note that it is not possible to combine the data on energy use by sector in this report with the data in previous editions in this series, or with other SEAI statistics reports published prior to November 2020, as they are no longer consistent with each other.

Developing the National Energy Balance is a continuous and ongoing process, and revisions are made whenever improved data becomes available. We welcome any feedback, which can be sent to epssu@seai.ie.

7.1 Industry

Trends in 2019

The economic activity of industry increased in 2019 by 3.2%, and final energy use grew by 0.1% compared with the previous year, to 2.3 Mtoe. The main trends in final energy use in industry were:

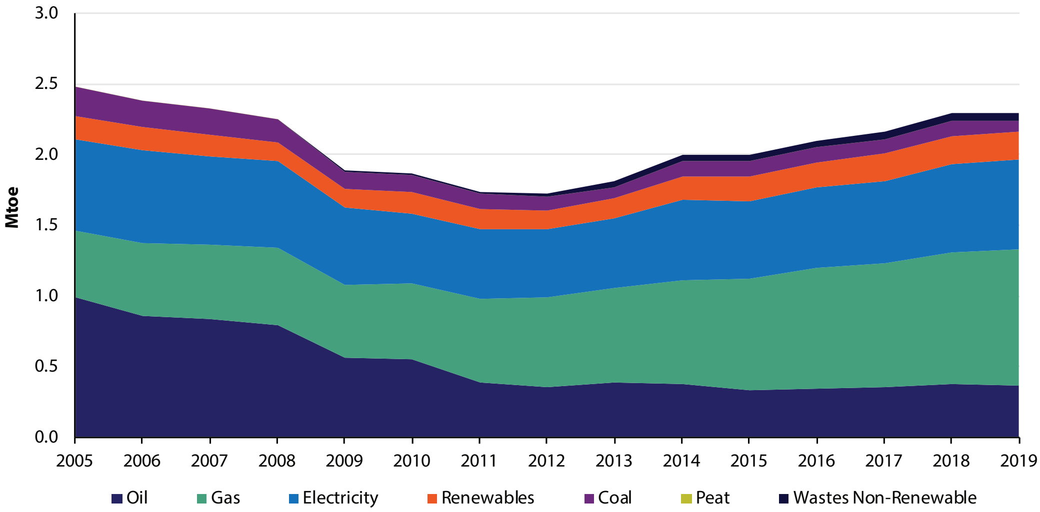
- Natural gas consumption in industry increased by 2.2% in 2018, to 958 ktoe, and accounted for 42% of industry's final energy demand.
- Electricity consumption in industry increased by 3.2%, to 642 ktoe, and accounted for 28% of final energy consumption in industry.
- Oil use fell by 0.9%, to 371 ktoe, and accounted for 16% of industry's energy use.
- Renewable energy use in industry fell by 4.4%, to 188 ktoe, in 2019 and accounted for 8.2% of industry's energy use.
- Coal use fell by 25%, to 79 ktoe, and accounted for 3.5% of the energy share of industry.
- The use of non-renewable wastes in industry increased by 3.5% in 2019, to 57 ktoe, and accounted for 2.5% of energy use in industry.

Trends in 2005 – 2019

Final energy use in industry was 7.7% lower in 2019 than in 2005. Between 2005 and 2012, there was an 30% fall in industrial final energy use. Between 2012 and 2019 energy use in industry increased by 33%. In 2019, it increased by 0.1% and was 7.7% below 2005 levels.

Figure 54 shows that over the period 2005 – 2019 electricity, natural gas, wastes and renewables have all increased their shares of industrial energy use, while the shares of oil and coal have decreased. Since 2009, non-renewable wastes have been used in industry, and in 2019 accounted for 2.5% of industry's energy use. The share of electricity has risen from 26% to 28%, natural gas from 19% to 42% and renewables from 6.6% to 8.2% (see *Table 25*). The increase in renewables is mainly due to the use of biomass in the wood-processing industry, the use of tallow in the rendering industry and the use of the renewable portion of wastes in cement manufacturing.

Figure 54: Industry final energy use by fuel



Source: SEAI

Table 25 shows the growth rates, quantities and relative shares of energy used in industry by fuel.

Table 25: Growth rates, quantities and shares of final consumption in industry

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Fossil Fuels (Total)	-15.8	-1.2	0.3	3.4	-0.7	1,673	1,408	67.3	61.4
Coal	-62.5	-6.8	-3.1	-7.0	-24.9	212	79	8.5	3.5
Oil	-62.6	-6.8	-9.3	2.4	-0.9	991	371	39.9	16.2
Gas	104.0	5.2	7.9	5.0	2.2	470	958	18.9	41.8
Renewables	15.2	1.0	3.2	1.3	-4.4	163	188	6.6	8.2
Wastes (Non-Renewable)	-	-	38.8	6.5	3.5	-	57	0.0	2.5
Combustible Fuels (Total)	-12.2	-0.9	0.8	3.2	-1.0	1,836	1,613	73.9	70.3
Electricity	-1.2	-0.1	2.3	4.0	3.2	650	642	26.1	28.0
Total	**-7.7**	**-0.6**	**1.4**	**3.5**	**0.1**	**2,486**	**2,295**		

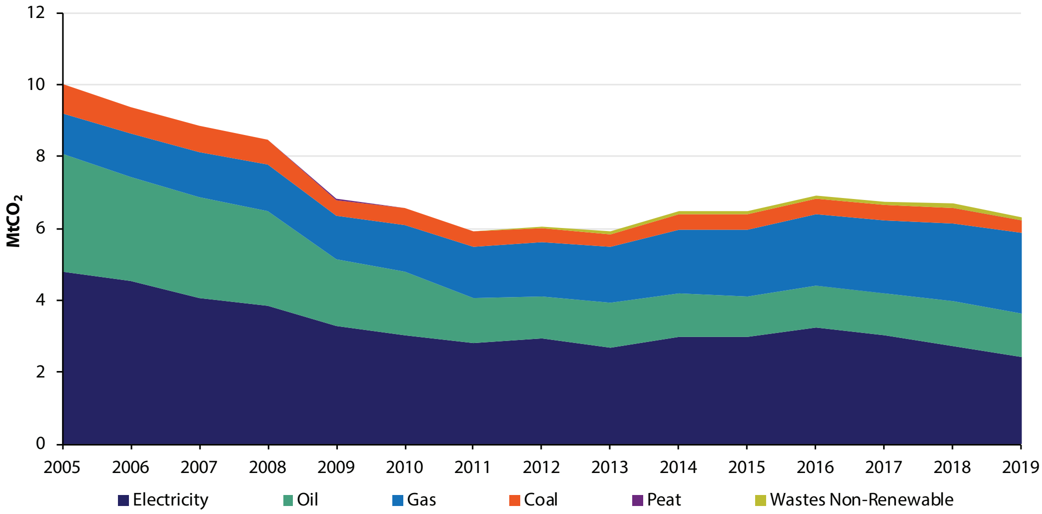
Direct use of all fossil fuels accounted for 61% of energy use in industry in 2019 and fell by 0.7%. Over the period 2005 – 2019, use of fossil fuels in industry fell by 16%.

There was also significant fuel switching from coal and oil to natural gas during this period. Between 2005 and 2019, coal and oil consumption in industry both fell by 63%, while natural gas use increased by 104%. Because gas is less carbon intensive than oil or coal, this fuel switching, along with increased use of renewable energy, has resulted in lower average emissions per unit of energy used in industry during this period.

Energy-related CO_2 emissions – including emissions associated with electricity

In order to determine industry's total energy-related CO_2 emissions, it is necessary to include estimations of upstream emissions for the electricity consumed by industry. *Figure 55* shows the primary energy-related CO_2 emissions from industry, detailing the on-site CO_2 emissions associated with direct fuel use and the upstream emissions associated with electricity consumption.

Figure 55: Industry energy-related CO_2 emissions by fuel



Source: SEAI

Table 26 shows the growth rates, quantities and relative shares of energy-related CO_2 emissions in industry.

As detailed in *Table 26*, industrial energy-related CO_2 emissions fell by 5.5% in 2019, to 6.3 $MtCO_2$. Electricity consumption was responsible for 38% of industry's energy-related CO_2 emissions in 2019.

The economic activity of industry increased in 2019, by 3.2%, and energy use grew by 0.1% compared with the previous year, to 2.3 Mtoe.

Table 26: Growth rates, quantities and shares of energy-related CO_2 emissions in industry

	Overall Growth %	Average Annual Growth %				Quantity (kt CO_2)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Coal	-62.6	-6.8	-3.1	-7.0	-24.9	838	313	8.3	5.0
Oil Total	-62.4	-6.7	-8.6	2.2	-1.2	3,289	1,238	32.7	19.6
Kerosene	-72.5	-8.8	-1.1	0.6	0.1	104	29	1.0	0.5
Fuel Oil	-93.8	-18.0	-33.4	-7.8	-3.0	1,502	94	15.0	1.5
LPG	19.4	1.3	4.5	8.7	2.4	128	153	1.3	2.4
Gas Oil	-30.6	-2.6	-0.1	3.1	0.1	608	422	6.0	6.7
Petroleum Coke	-42.7	-3.9	11.5	2.4	-2.9	944	541	9.4	8.6
Natural Gas	100.4	5.1	7.8	4.5	2.2	1,117	2,238	11.1	35.4
Wastes (Non-Renewable)	-	-	40.9	6.5	3.5	-	119	0.0	1.9
Total Combustible Fuels	-25.5	-2.1	-0.3	2.6	-1.8	5,246	3,909	52.2	61.8
Electricity	-49.7	-4.8	-0.3	-5.1	-11.0	4,801	2,417	47.8	38.2
Total	**-37.0**	**-3.3**	**-0.3**	**-0.7**	**-5.5**	**10,047**	**6,326**		

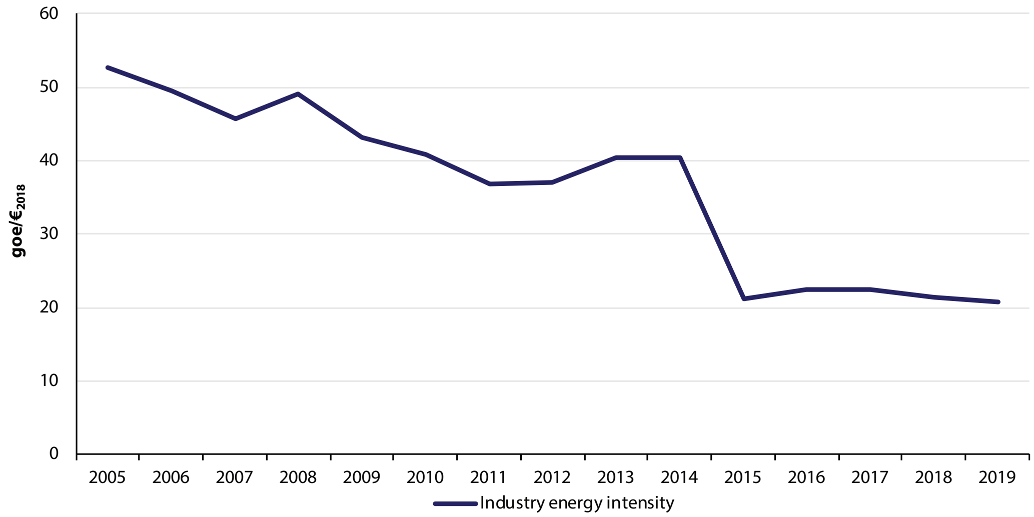
Energy-related CO_2 emissions – excluding emissions associated with electricity

If upstream electricity-related emissions are omitted, then there was a 1.8% fall in CO_2 emissions from combustible fuels used on-site in industry in 2019. This is as a result of changes in the volume and fuel mix used in industry, with decreased oil (-0.9%), coal (-25%), countered by increased natural gas (+2.2%) and a reduction in renewables (-4.4%).

7.1.1 Industry energy intensity

Industrial energy intensity is the amount of energy required to produce a unit of value added, measured in constant money values. *Figure 56* shows the industrial energy intensity between 2005 and 2019 expressed in kilograms of oil equivalent per euro of industrial value added at 2018 money value (kgoe/€$_{2018}$). Over the period, industrial energy consumption fell by 7.7%, while value added increased by 136%, resulting in a reduction in intensity of 61%. In other words, to generate a euro of value added in 2019, it took less than half of the amount of energy it took in 2005.

Figure 56: Industry energy intensity



Source: SEAI

Value-added output from industry was 91% higher in 2015 compared with 2014. The large increase in gross value added in 2015 is explained by a number of one-off factors, such as the transfer of assets into Ireland, and what are known as reverse takeovers. This increase in gross value added incurred no additional energy consumption.

The step change in industry energy intensity in 2015 illustrates the fact that energy intensity is not a good indicator of energy efficiency, as variations may be the result of many factors, such as structural changes, or changes to the fuel mix or activity.

7.2 Transport

7.2.1 Transport energy by fuel

Trends in 2019

In 2019, overall energy use in transport increased by 0.5% compared with the previous year.

- Petrol use continued to fall in 2019, reducing by 5.8% to 774 ktoe. Petrol consumption is now 59% lower than the peak in 2007 and accounts for 15% of transport energy use.
- Diesel consumption grew by 1% during 2019, to 3,124 ktoe. Diesel has by far the largest share of transport fuel use, accounting for 60% in 2019.
- Jet kerosene consumption increased by 1.2% in 2019, to 1,116 ktoe, accounting for 21% of transport's final energy use, the second largest fuel share after diesel.

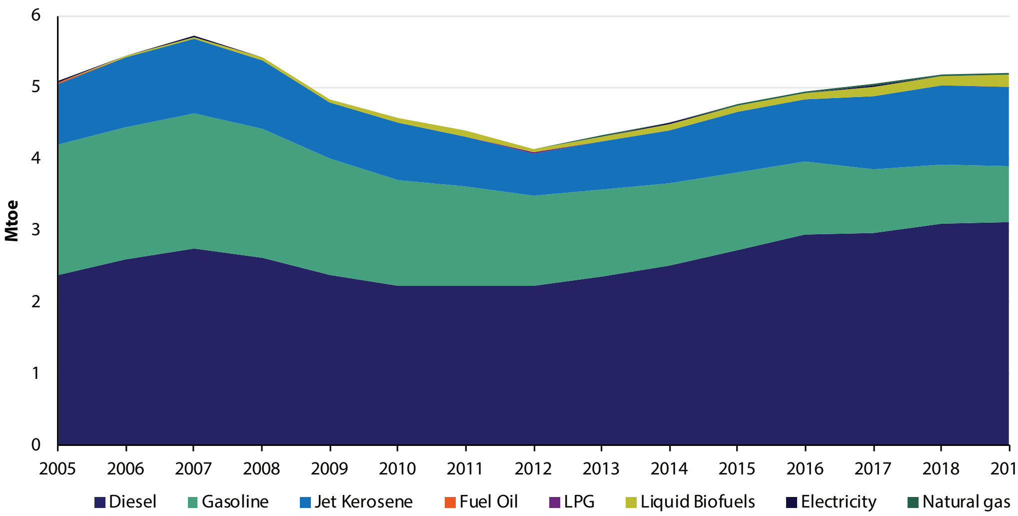
Trends in 2005 – 2019

Figure 57 and *Table 27* show the trends in transport's final energy use split by fuel type between 2005 and 2019. The biggest shift over the period was from petrol to diesel. While consumption of diesel increased by 31%, petrol use fell by 58%. Diesel's overall market share grew from 47% in 2005 to 60% in 2019.

Transport's energy use peaked in 2007, at 5,716 ktoe, and fell each year thereafter, until 2013. As the economy started to expand again, transport's energy use grew. It expanded every year after 2013, and in 2019 it was 25% higher than in 2012. Energy consumption in transport was 2.8% higher in 2019 than in 2005, but remained 8.5% lower than the peak in 2007.

Transport energy use has increased every year since 2012, and in 2019 it was 25% higher than in 2012, but still 8.5% lower than the 2007 peak.

Figure 57: Transport final energy use by fuel[60]



Source: SEAI

Jet kerosene use increased by 1.2% in 2019 and is now greater than petrol use, which declined by 5.8%.

60 This is based on data of fuel sales in Ireland rather than fuels consumed in Ireland. .

Table 27: Growth rates, quantities and shares of final consumption in transport

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Fossil Fuels (Total)	-0.9	-0.1	0.7	2.0	-0.2	5,078	5,033	99.9	96.3
Total Oil	-1.2	-0.1	0.7	1.9	-0.1	5,076	5,015	99.8	95.9
Petrol	-57.5	-5.9	-6.2	-7.9	-5.8	1,822	774	35.8	14.8
Diesel	31.4	2.0	4.1	3.5	1.0	2,378	3,124	46.8	59.8
Jet Kerosene	30.2	1.9	1.5	7.1	1.2	857	1,116	16.9	21.3
LPG	59.9	3.4	37.5	-10.4	-12.0	1	2	0.0	0.0
Natural Gas	690.6	15.9	13.3	45.1	-22.8	2	17	0.0	0.333
Renewables	17027	44.4	6.7	10.1	21.9	1	188	0.0	3.6
Combustible Fuels (Total)	2.3	0.2	0.8	2.2	0.5	5,079	5,195	99.9	99.4
Electricity	33.5	2.1	-0.8	15.7	25.9	5	7	0.1	0.1
Total	**2.8**	**0.2**	**0.8**	**2.2**	**0.5**	**5,084**	**5,228**		

Energy-related CO_2 emissions

The growth rates and shares of the energy-related CO_2 emissions from the different transport fuels, which are shown in *Table 28*, closely match the changes in transport fuel consumption. Between the 2007 peak and 2012, primary energy-related CO_2 emissions fell by 28%. Transport emissions began to rise again in 2013and increased every year until 2019, when they declined by 0.1%. In 2019 transport CO_2 emissions were 15.26 $MtCO_2$, just 0.1% below the 2005 level.

Table 28: Growth rates, quantities and shares of energy-related CO_2 emissions in transport

	Overall Growth %	Average Annual Growth %				Quantity (kt CO_2)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '18	2019	2005	2019	2005	2019
Total Oil Products	-0.4	0.0	0.7	2.0	-0.1	15,256	15,193	99.7	99.6
Petrol	-57.5	-5.9	-6.2	-7.9	-5.8	5,337	2,267	34.9	14.9
Diesel	31.4	2.0	4.1	3.5	1.0	7,299	9,587	47.7	62.8
Jet Kerosene	30.2	1.9	1.5	7.1	1.2	2,562	3,335	16.7	21.9
LPG	59.9	3.4	37.5	-10.4	-12.0	3	4	0.0	0.0
Natural Gas	676.5	15.8	13.2	44.4	-22.8	5	41	0.0	0.3
Electricity	-31.8	-2.7	-3.2	5.6	8.8	37	26	0.2	0.2
Total	**-0.3**	**0.0**	**0.7**	**2.0**	**-0.1**	**15,299**	**15,260**		

7.2.2 Transport energy demand by mode

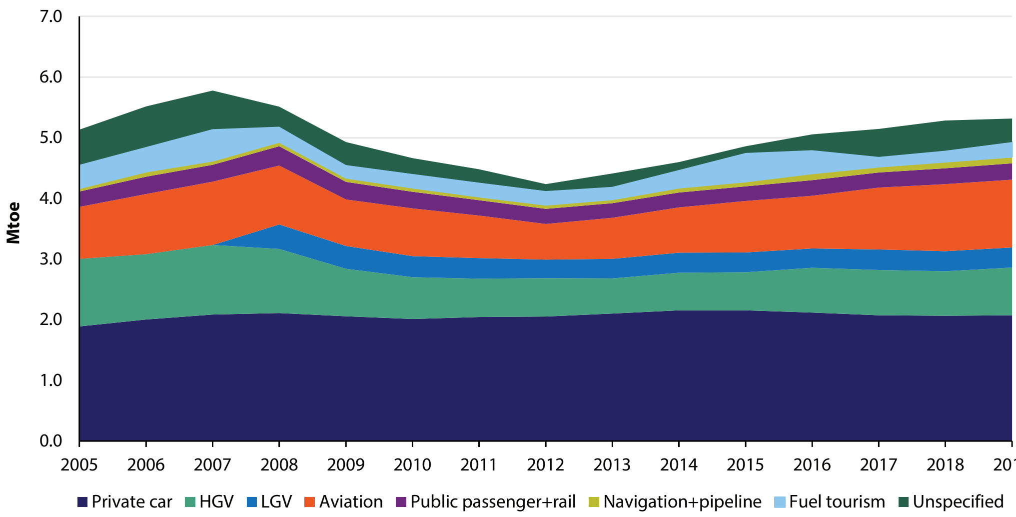
Fuel consumption in transport is often closely aligned to the mode of transport used: jet kerosene is used for air transport, fuel oil for shipping and petrol and LPG are almost exclusively used for road transport. Diesel consumption is used for road transport, navigation and rail.

The contribution from each mode of transport to energy demand is detailed in *Table 29* and shown in *Figure 58*. In 2014, a new category of 'light goods vehicle') was added. Energy use identified under this category was previously included in the 'unspecified' category.

Table 29: Growth rates, quantities and shares of transport final energy demand by mode

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Heavy Goods Vehicle	-29.3	-2.4	-1.9	5.9	7.4	1,112	787	21.9	15.0
Light Goods Vehicle	-	-	-1.2	0.3	-0.9	-	330	-	6.3
Private Car	9.7	0.7	1.4	-1.0	0.5	1,891	2,075	37.2	39.7
Bus & Taxi	-12.8	-1.0	-4.1	0.8	-0.1	157	137	3.1	2.6
Rail	-1.4	-0.1	-2.1	3.0	4.5	45	44	0.9	0.8
Aviation	30.0	1.9	1.5	7.1	1.2	859	1,116	16.9	21.4
Fuel Tourism	-36.8	-3.2	15.7	-15.2	32.6	387	245	7.6	4.7
Navigation	79.7	4.3	2.1	5.7	6.5	50	89	1.0	1.7
Pipeline	**672.2**	**15.7**	**13.2**	**44.4**	**-24.5**	**2**	**17**	**0.0**	**0.3**
Unspecified	-33.4	-2.9	-16.0	37.2	-22.3	581	387	11.4	7.4
Total	**2.8**	**0.2**	**0.8**	**2.2**	**0.5**	**5,084**	**5,227**		

Figure 58: Transport energy demand by mode, 2005 – 2019



Source: SEAI

Trends in 2019

Overall energy use in transport increased by 0.5% in 2019. There was a fall in the energy consumption of light goods vehicles (-0.9%), while there were increases in heavy goods vehicles (7.4%) and private cars (0.5%). Aviation energy use increased by 1.2%, fuel tourism by 32.6% and rail by 4.5%.

Private car energy consumption accounted for just under 40% of transport energy use in 2019. Petrol consumption by private cars fell by 7.7% in 2019, to 622 ktoe, and diesel consumption increased by 3.4%, to 1,355 ktoe, and biofuels use increased by 20% to 94 ktoe.

Road transport accounted for 63% of transport's total final consumption in 2019, or 76% if unspecified and fuel tourism are included as road transport. Private car use accounted for almost two thirds (63%) of road transport, with goods vehicles accounting for almost another one third (32%), and public passenger services the rest (4%).

Aviation was responsible for 21% of transport's total final consumption in 2019. In contrast, public passenger (road), which includes buses and taxis, was 2.6% and rail just 0.8%.

Trends in 2005 to 2019

Figure 58 shows the trend for energy use of transport by mode. Private car energy use clearly dominates. Private car energy use declined following the economic crash during 2009 and 2010 but returned to growth soon after in 2011. It grew year on year between 2011 and 2014, but reduced slightly each year between 2014 and 2018. This is due to amount of kilometres driven by private cars levelling off and the efficiency of the car stock improving. Private car energy use increased very slightly in 2019 by 0.2%.

Heavy goods vehicles road freight energy use reduced by 49% between 2007 and 2013 as a result of reduced activity during the recession. The energy consumption of heavy goods vehicles increased by 29% between 2013 and 2017, but decreased by 1.9% in 2018. This is again due to changes in levels of activity, i.e. the amount of tonne-kilometres transported. In 2019 the amount of energy used by heavy goods vehicles increased by 7.4% but remained 29% below the 2005 level.

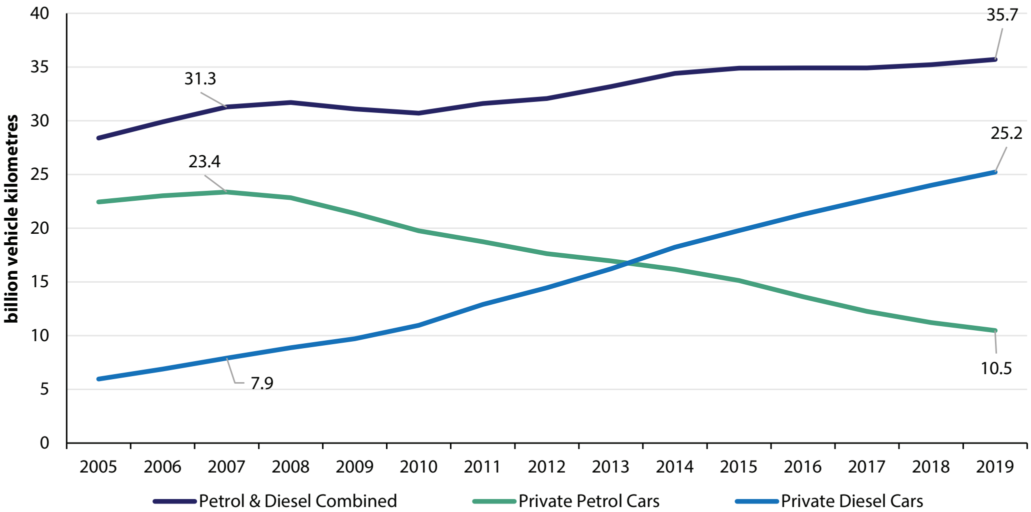
Aviation energy use also reached a peak in 2007, and decreased sharply afterwards due to the recession. By 2012, aviation had reduced by 44% compared to 2007. Aviation energy use returned to growth in 2013 and since then it has recovered much more strongly than car or freight, increasing by 90% between 2012 and 2019. In 2018 aviation surpassed the previous 2007 peak for the first time, and reached another new peak in 2019 at 6.8% above the previous 2007 peak.

7.2.3 Private car activity

Figure 59 shows the total kilometres driven by private cars in Ireland each year from 2005 to 2019, based on an analysis of NCT data[61]. The total number of kilometres travelled declined following the economic crash (during 2009 and 2010) but returned to growth soon after, in 2011. Between 2011 and 2015 total vehicle-kilometres increased by 13.6%, or 2.6% per annum. Between 2015 and 2019 this growth levelled off. In 2019, total kilometres travelled by private cars increased by 1.4%.

There was a clear shift from petrol to diesel cars in this period. This was already underway prior to the changes in motor taxation in 2008 but accelerated sharply after that. Overall travel by petrol cars reduced by 55% between the peak in 2007 and 2019. Travel by diesel cars increased by 219% over the same period. In 2007, 75% of total private car mileage was fuelled by petrol and 25% by diesel. In 2019, petrol accounted for 29% and diesel for 71%.

Figure 59: Total private car annual vehicle-kilometres, 2000 – 2019



Source: Based on NCT Data

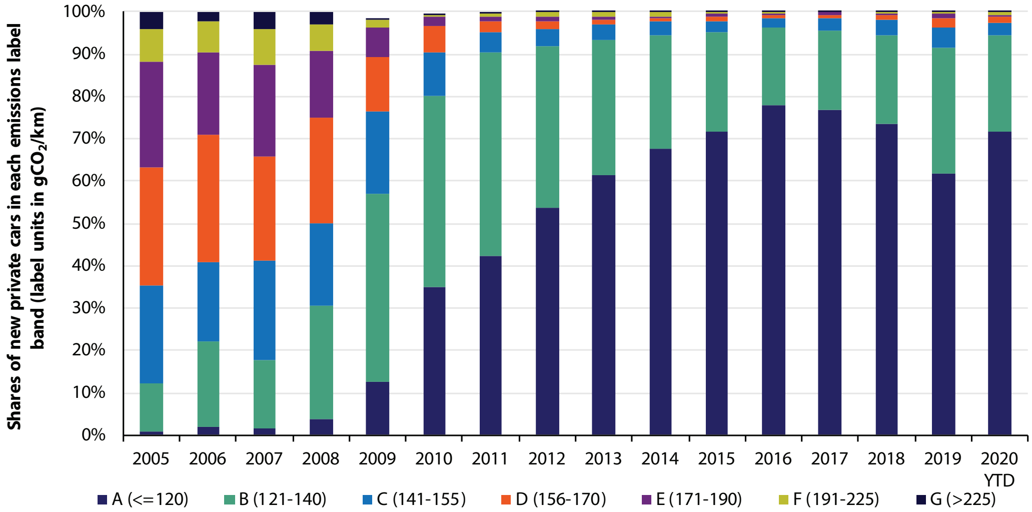
7.2.4 CO_2 intensity of new private cars

Figure 60 shows the shares of new car sales[62] between 2005 and 2019, classified by emissions label band, and includes an estimate for 2020 based on sales to date. *Figure 61* shows the change in the weighted average specific CO_2 emissions of new cars between 2005 and 2019, with an estimate for 2020.

Since 2008, the combined effect of the EU legislation obligating manufacturers to reduce average fleet emissions and the changes to the Irish taxation system for private cars has been to shift new car purchases from higher to lower CO_2 emissions bands, as seen in *Figure 60*, and to reduce the average specific CO_2 emissions of new cars, as seen in *Figure 61*.

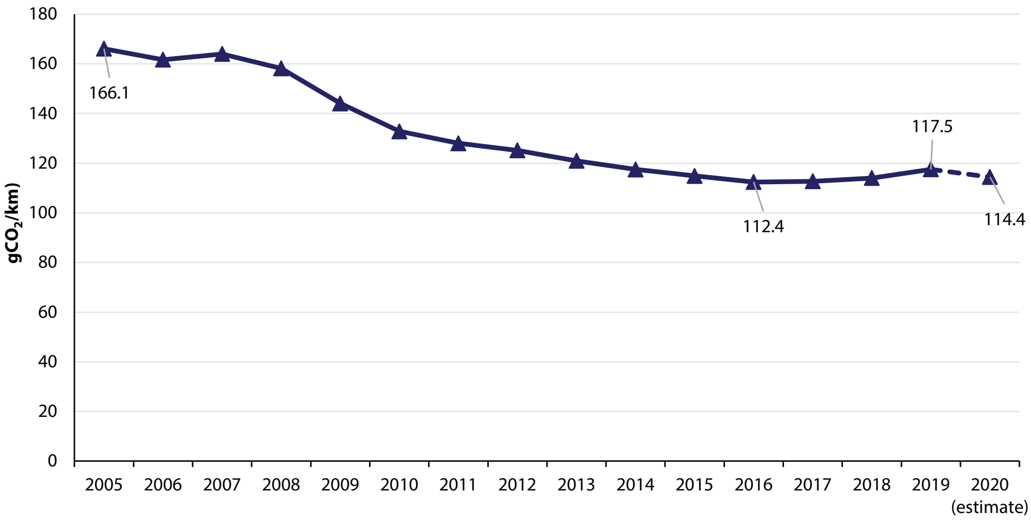
By 2016, 78% of new cars purchased were in the A category, and the average specific CO_2 emissions of new cars fell to 112.4 gCO_2/km. This trend has reversed since 2016. In 2019, the share of A-rated cars dropped to 62% and the specific CO_2 emissions increased to 117.5 gCO_2/km. Figures for 2020 (up until the end of October) show the share of A-rated vehicles increased again to 72% and the specific CO_2 emissions falling to 114.4 gCO_2/km.

Figure 60: Shares of new private cars in each emissions band, 2005 –2019 (October 2020 to date)



Source: Dept. Transport, Vehicle Registration Unit

Figure 61: Specific CO_2 emissions of new cars, 2005 – 2019 (2020 estimated)



Source: Dept. Transport, Vehicle Registration Unit data

Data on the carbon emissions ratings of new cars prior to September 2018 was based on the results of a standardised laboratory test procedure called the New European Driving Cycle (NEDC).

The difference between the test emissions and the emissions actually produced in real-world driving conditions is referred to as the on-road factor. A number of reports by the International Council on Clean Transportation highlighted that the on-road factor increased dramatically after 2008, and that the real-world fuel consumption and carbon emissions of new vehicles is increasingly higher than the reported test values under the NEDC procedure[63].

From September 2018, a new test methodology called the Worldwide Harmonised Light Vehicle Test Procedure (WLTP) came into force for all new cars. This new test is expected to better reflect real-world driving profiles. For new vehicles tested and sold across the EU in 2018, the European Environment Agency reports that the WLTP emissions factors were, on average, 20% higher than the NEDC emissions factors for the same vehicles. This change in the testing procedure is not responsible for the increase in specific CO_2 emissions of new cars seen in 2018 and 2019 in *Figure 61* as the data here is all based on the NEDC.

63 For more information see www.theicct.org.

The average specific CO_2 emissions of new cars has increased each year between 2016 and 2019 but is showing signs of falling again in 2020.

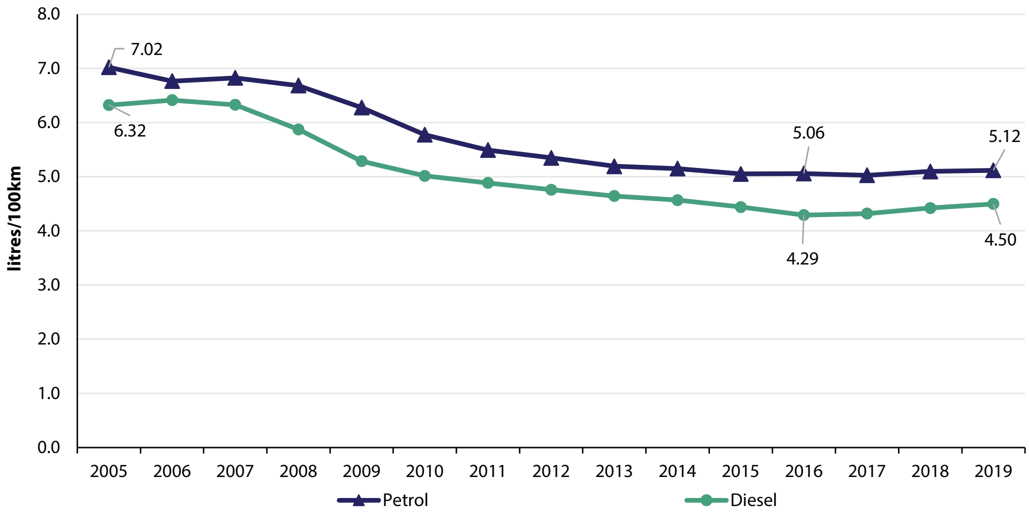
7.2.5 Energy efficiency of new private cars

The average specific fuel consumption of new cars in Ireland from 2005 to 2019 is shown in *Figure 62* [64,65,66]. The specific fuel consumption of new cars is based on the same standardised test procedures as the specific CO_2 emissions of new cars, discussed in *Section 7.2.4*.

In 2019 the fuel efficiency of the average new petrol car was 5.12 litres/100 km. This was 25% lower than in 2008 but 0.4% higher than the previous year. In 2019 the average new diesel car was 29% more fuel efficient than in 2008, and 1.7% higher than 2018. As discussed in *Section 7.2.4,* when the test procedure switches from the NEDC to the WLTP, it is expected that this will to result in an increase in the measured specific fuel consumption of new cars.

Since 2008, there has been a 23% improvement in the average fuel efficiency of new diesel cars as measured by the NEDC test procedure.

Figure 62: Weighted average test specific fuel consumption of new cars, 2005 – 2019



Source: Based on Vehicle Registration Unit and VCA data

7.2.6 Heavy goods vehicle activity

Heavy goods vehicle freight transport was responsible for the largest share of the decrease in transport sector energy demand in the period 2007 – 2013. This was primarily the result of reduced activity in the sector, which contracted more sharply than economic growth after the economic crisis of 2008.

The main metric used to measure activity in the road freight sector is tonne-kilometres, which is the total weight of material transported multiplied by the distance over which it is transported. *Figure 63* and *Table 30* present data on road freight tonne-kilometres, along with data on eonomic growth as measured by modified domestic demand. In *Figure 63* the data is presented as an index with respect to 2000. The data are taken from the CSO's Road Freight Transport Survey, which considers, for example, vehicles taxed as goods vehicles, those weighing over two tonnes unladen and those which are actually used as goods vehicles, rather than for service-type work. We estimate the energy use of heavy goods vehicles based on the activity, as measured by tonne-kilometres, and the energy consumption per tonne-kilometre, based on the EU average.

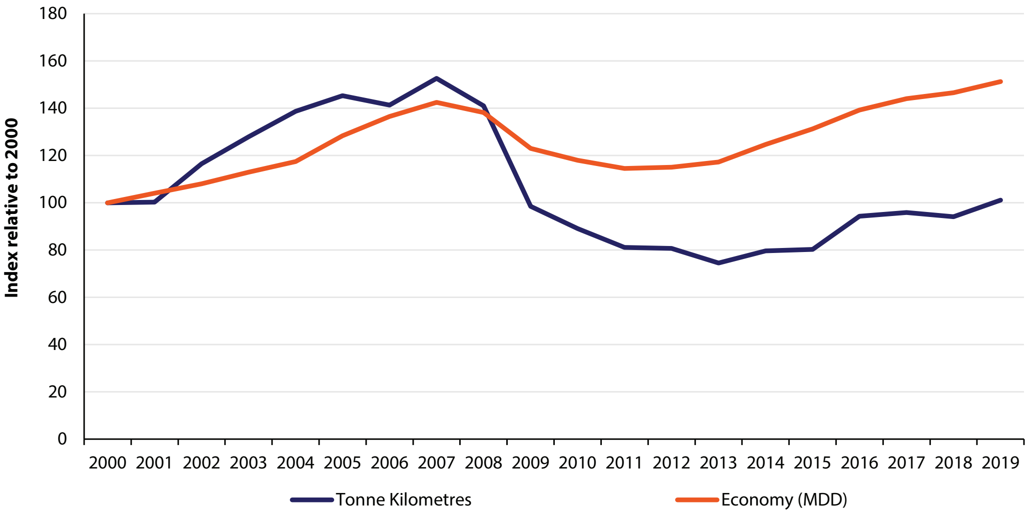
In 2019 there were 7.5% more tonne-kilometres travelled than in 2018, but 34% fewer than the peak in 2007.

64 Fuel consumption and CO_2 emissions data were sourced from the Vehicle Certification Agency. The database can be downloaded at http://www.dft.gov.uk/vca/fcb/new-car-fuel-consump.asp

65 New private cars licensed for the first time. This does not include imported second-hand cars. It only includes brand new cars.

66 The figures regarding litres/100km for petrol and diesel are not directly comparable as petrol and diesel have different energy content (calorific values).

Figure 63: Road freight activity, 2000 – 2019



Source: CSO

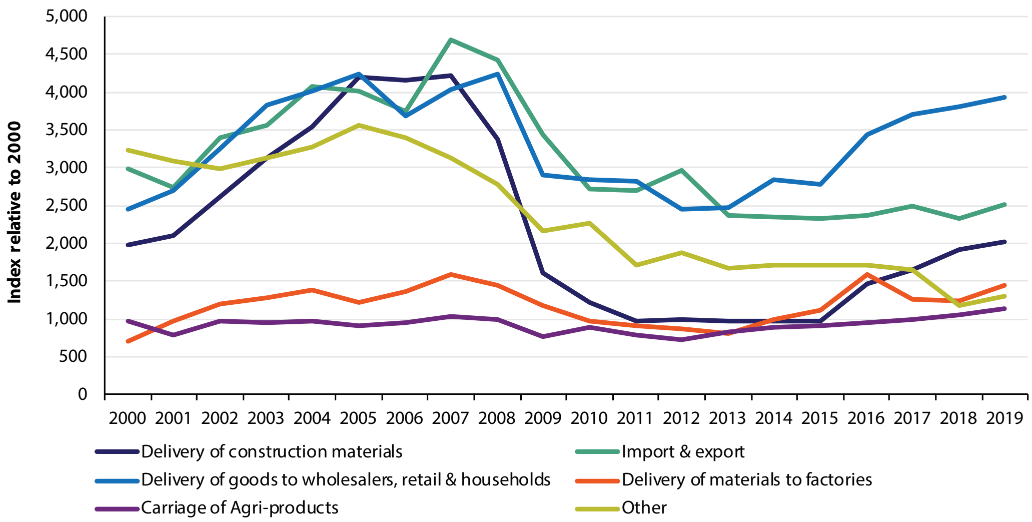
Table 30: Road freight activity

	Growth %		Average Annual Growth %				Quantity	
	'05 – '19	05 – '19	'05 – '10	'10 – '15	'15 – '19	2019	2005	2019
Mega tonne-Kilometres	-30.4	-2.6	-9.3	-2.1	5.9	7.5	17,819	12,403
Modified Domestic Demand (billion € 2018)	17.8	5.1	-1.7	2.2	3.6	3.2	154	182

Source: CSO

The CSO provides data on heavy goods vehicle activity, classed by main type of work done. The trends for tonne-kilometres in each category between 2000 and the peak in 2007, the contraction from 2007 to the low point in 2013, and the period 2013 – 2019 are shown in *Figure 64.*

Figure 64: Road freight activity by main type of work done, 2000 – 2019



Source: CSO

Between 2007 and 2013, the category 'Delivery of construction materials' experienced both the largest absolute decrease (3,248 Mtkm) and the largest percentage decrease (77%). It was responsible for the largest share of the total reduction in activity from 2007 to 2013, accounting for 34%. This corresponds to the collapse of activity in the construction sector in this time period. The next biggest contributor to the fall of transport activity was 'Import & export'. Between 2007 and 2013 it reduced by 49%, and accounted for 24% (2,315 Mtkm) of the total reduction.

Despite the recovery of the economy between 2012 and 2019, the heavy goods vehicle activity in most categories has not recovered to 2007 levels. In 2019 'Delivery of construction materials' remained 52% below 2007, 'Import & export' was 46% below and 'Other' was 58% below.

For 'Delivery of construction materials', this is to be expected, as despite the recovery in the economy, activity in both new house construction and motorway construction is well below 2007 levels, and may never reach the exceptional output of those years again. For 'Import & export' and 'Other' it is not as clear why these remain so far below 2007 levels, or if they are ever likely to reach those levels again.

Despite the recovery of the economy between 2012 and 2019, heavy goods vehicle activity has not recovered to 2007 levels. It is not clear if it will return to those levels again

7.3 Residential

Trends in 2019

Residential energy use fell by 4.6% in 2019 compared to 2018. On average, the weather was warmer in 2019 (5.1% fewer degree days). When corrections for weather effects[67] are taken into account, energy use in the residential sector was 1.6% lower in 2019 than in 2018 (see *Table 31*).

The main trends in energy use in the residential sector are as follows:

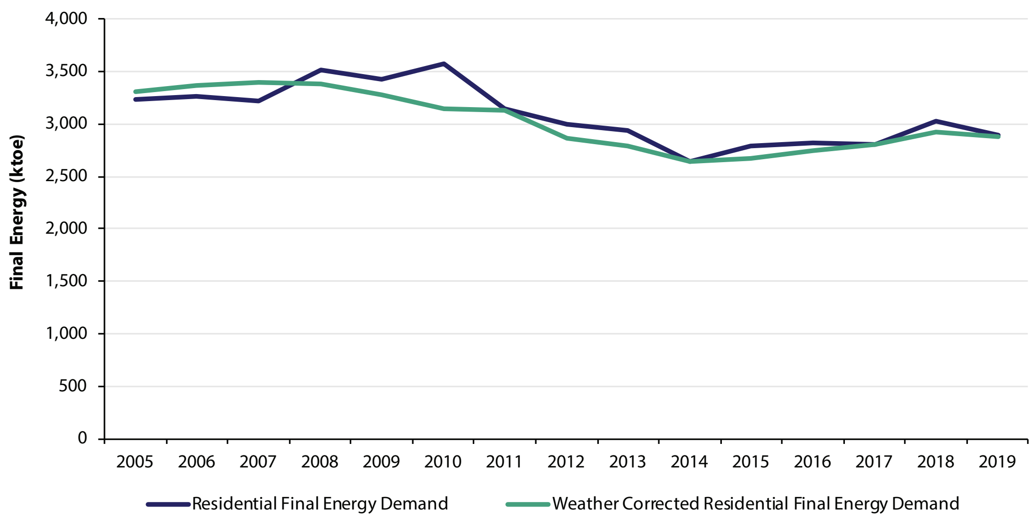
- Overall direct fossil fuel use in households fell by 6.1%, to 2,114 ktoe, in 2019 and accounted for 73% of household energy use.
- Oil consumption in households fell by 3.4 in 2019, to 1,164 ktoe. Oil's share of household energy stood at 40% in 2019.
- Electricity consumption fell by 0.5% in 2019, to 699 ktoe (8,133 GWh), and its share of residential final consumption was 24%.
- Natural gas use fell by 2.1% in 2019, to 591 ktoe, and accounted for 20% of residential energy use.
- Direct renewables use in households increased in 2019 by 0.7%, to 73 ktoe, and its share stood at 2.5%.
- Coal use in households fell in 2019 by 29%, to 175 ktoe, and a 6.1% share of the residential sector's energy use.
- Peat use also fell by 6.6% in 2019 and peat briquette use fell by 19%. Total peat consumption was 183 ktoe in 2019. The peat and briquette share in household energy was 6.4% in 2019.

Weather-corrected energy use in the residential sector fell by 1.6% in 2019 compared to 2018.

Trends in 2005 – 2019

Figure 65 shows the trend for residential sector final energy consumption between 2005 and 2019, with and without weather correction. Weather correction yields a lower normalised energy consumption in cold years (e.g. 2010), and yields a higher normalised consumption in mild years (e.g. 2007). Accounting for weather variations, residential energy demand decreased every year between 2007 and 2014 but increased between 2015 and 2018. Residential final energy use in 2019 was 2,886 ktoe, 10.9% below the level recorded in 2005. Correcting for weather variations, 2019 residential final energy use was 13% below 2005.

Figure 65: Residential final energy



Source: SEAI

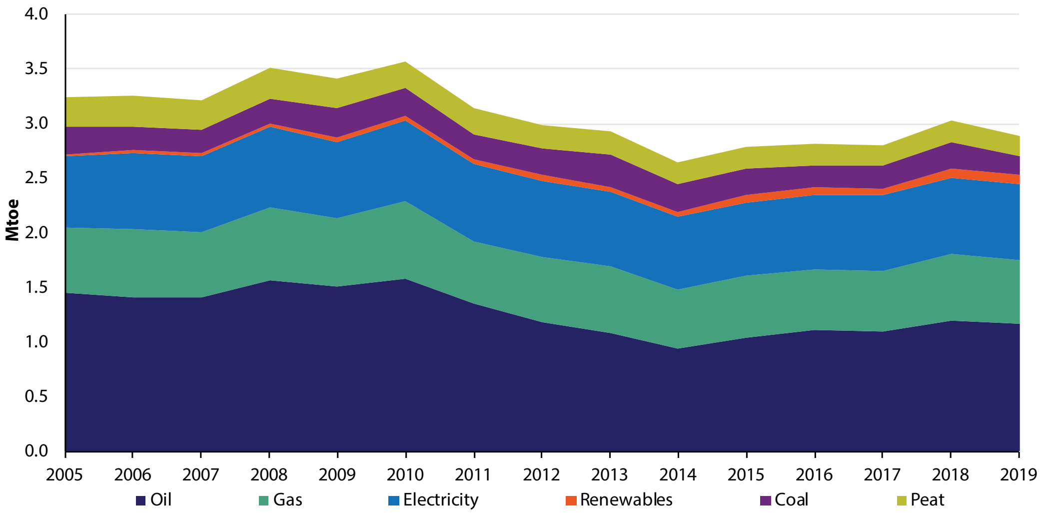
Figure 66 shows the mix of fuels consumed in the residential sector between 2005 and 2019. The fuel shares were relatively stable, with a gradual increase in the share of electricity and of gas and a continuing though gradual decline in coal, peat and oil use.

Oil remains the dominant fuel in the residential sector, though its share reduced slightly, from 45% in 2005, to 40% in 2019. Electricity was the second largest source of energy in the sector in 2019, at 24%, with natural gas having the next largest share at 20%. The renewables share of final energy used directly in households in 2019 was 2.5%. The growth rates, quantities and shares are shown in *Table 31*.

Looking at the period 2007 – 2014, overall residential energy use declined by 18%, or 569 ktoe. The majority of the reduction was from oil, which fell by 33%, or 469 ktoe, followed by gas, which fell by 9.7%, or 57 ktoe. Some reasons for this may be: the higher oil price, and the greater increase in price of oil compared to gas, in the period 2010 – 2015; the potentially greater opportunities for fuel switching to peat and non-traded wood in rural areas, where the majority of oil-fired dwellings are located.

It is also notable that total electricity consumption peaked in 2010 and has fallen by 4.8% since then.

Figure 66: Residential final energy use by fuel



Source: SEAI

Table 31: Growth rates, quantities and shares of final consumption in the residential sector

	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Fossil Fuels (Total)	-17.9	-1.4	-6.1	0.8	-6.1	2,574	2,114	79.4	73.2
Coal	-28.8	-2.4	-1.2	-7.5	-28.6	246	175	7.6	6.1
Peat	-32.8	-2.8	-4.6	-2.2	-6.6	273	183	8.4	6.4
Briquettes	-38.2	-3.4	-3.7	-6.5	-19.0	90	56	2.8	1.9
Oil	-19.6	-1.5	-7.8	2.6	-3.4	1,448	1,164	44.7	40.3
Gas	-2.5	-0.2	-4.8	1.6	-2.1	607	591	18.7	20.5
Renewables	267.2	9.7	6.7	4.2	0.7	20	73	0.6	2.5
Combustible Fuels (Total)	-17.4	-1.4	-5.9	0.7	-6.2	2,590	2,139	79.9	74.1
Electricity	8.3	0.6	-1.6	0.8	-0.5	646	699	19.9	24.2
Total	**-10.9**	**-0.8**	**-4.9**	**0.9**	**-4.6**	**3,240**	**2,886**		
Total (Weather Corrected)	**-13.0**	**-1.0**	**-3.2**	**1.8**	**-1.6**	**3,305**	**2,876**		

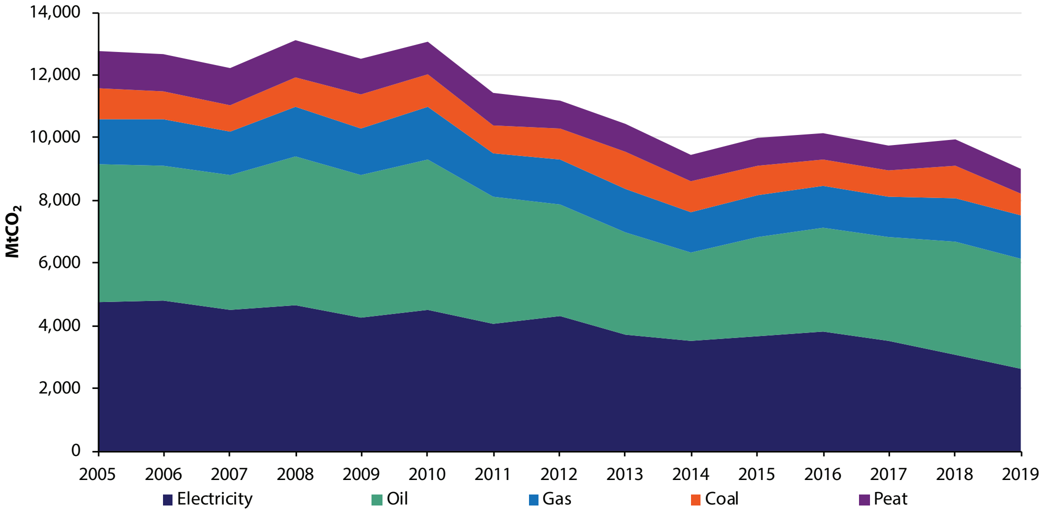
Source: SEAI

Energy-related CO_2 emissions – including emissions associated with electricity

Energy-related CO_2 emissions from the residential sector are shown in *Figure 67*. There was a reduction in energy-related CO_2 emissions between 2010 and 2014, but there was a return to growth in 2015, 2016, and again in 2018. In 2019 residential sector energy-related CO_2 emissions (including upstream electricity emissions) fell by 9.3%, to 9,002 kt CO_2. This was due to a combination of reduced residential energy use in 2019, and the reduced carbon intensity of electricity.

Energy-related CO_2 emissions[68] from the residential sector in 2019 were 29% below 2005 levels. In 2019 the residential sector accounted for 24% of the total energy-related CO_2 emissions, the second largest source after transport, which accounted for 41%.

Figure 67: Residential energy-related CO_2 by fuel



Source: SEAI

Table 32: Growth rates, quantities and shares of energy-related CO_2 emissions in the residential sector

	Overall Growth %	Average Annual Growth %				Quantity (kt CO_2)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Coal	-28.0	-2.3	-1.0	-7.4	-28.6	989	712	7.7	7.9
Peat	-32.7	-2.8	-4.6	-2.1	-6.4	1,170	787	9.2	8.7
Briquettes	-38.2	-3.4	-3.7	-6.5	-19.0	374	231	2.9	2.6
Oil	-20.6	-1.6	-7.9	2.6	-3.4	4,393	3,487	34.4	38.7
Gas	-4.3	-0.3	-4.9	1.1	-2.1	1,443	1,381	11.3	15.3
Renewables	-	-	-	-	-	-	-	0.0	0.0
Combustible Fuels (Total)	-20.3	-1.6	-5.9	0.3	-7.2	7,995	6,368	62.6	70.7
Electricity	-44.8	-4.2	-4.0	-8.0	-14.2	4,775	2,634	37.4	29.3
Total	**-29.5**	**-2.5**	**-5.3**	**-2.6**	**-9.3**	**12,770**	**9,002**		

Energy-related CO_2 emissions – excluding emissions associated with electricity

If the upstream emissions associated with electricity use are excluded, the CO_2 emissions from direct fossil fuel use in the residential sector in 2019 were 20% lower than in 2005. This was achieved through a combination of a less carbon-intensive fuel mix and a reduction in overall energy use post-2010. Excluding upstream electricity emissions, direct CO_2 emissions from the household sector were 6,368 kt, and were 7.2% lower in 2019 compared with 2018 (see *Table 32*).

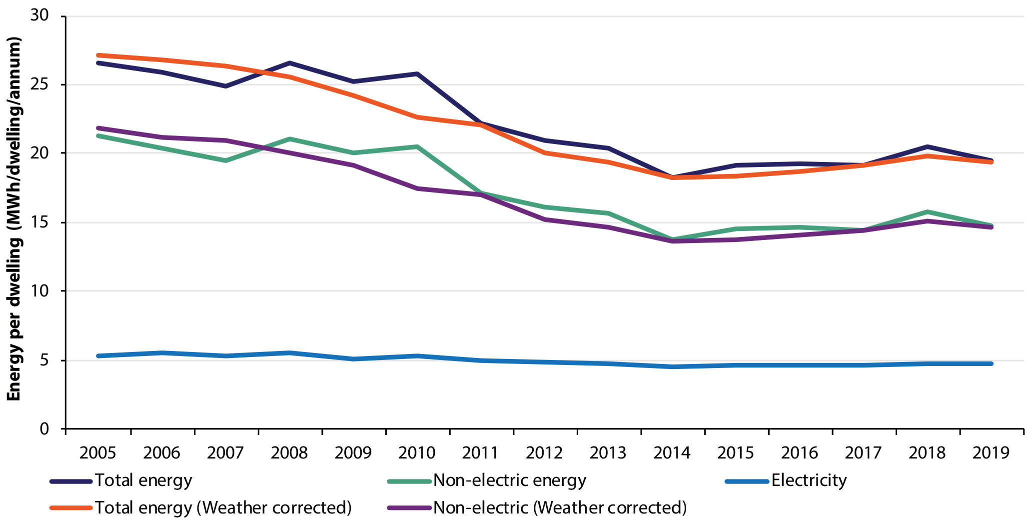
7.3.1 Average dwelling energy use

In 2019, the average dwelling consumed a total of 18,748 kWh of energy, 5.2% lower than in 2018. This comprised 14,204 kWh (76%) of direct fuels and 4,544 kWh (24%) of electricity.

> In 2019, the average dwelling consumed a total of 18,682 kWh of energy; 76% of this was direct fuel use and the remainder electricity.

Figure 68 shows the trend in final energy consumption per dwelling with and without weather correction. Weather corrected final energy use per dwelling reduced by 33% 2005 and 2014, before returning to growth between 2015 and 2018. Weather-corrected final energy consumption per dwelling fell by 2.2% in 2019, and is still 31% below 2005 levels. Most of the reduction was in non-electric fuel use, which was 35% below 2005 levels in 2019, with electricity down 15% over the same period.

Figure 68: Energy per dwelling (permanently occupied)



Source: Based on SEAI, CSO and Met Éireann data

Table 33: Growth rates and quantities of energy consumption and CO_2 emissions per dwelling

Energy per dwelling	Overall Growth % 2005 – 2019	Average Annual Growth % '05 – '19	'10 – '15	'15 – '19	2019	Quantity (kWh/dwelling) 2005	2019
Total Energy	-29.5	-2.5	-5.9	0.3	-5.2	26,591	18,748
Non-electric fuel use	-33.3	-2.8	-6.8	0.3	-6.4	21,289	14,204
Electricity	-14.3	-1.1	-2.7	0.2	-1.1	5,302	4,544
Energy per dwelling (weather corrected)						**Quantity (kWh/dwelling)**	
Total Energy	-31.1	-2.6	-4.7	1.2	-2.2	27,130	18,682
Non-electric fuel use	-35.2	-3.0	-5.3	1.5	-2.7	21,808	14,141
Electricity	-14.7	-1.1	-2.8	0.4	-0.5	5,322	4,541
Energy-related CO_2 emissions per dwelling						**Quantity (tCO_2/dwelling)**	
Total Energy	-44.2	-4.1	-6.3	-3.1	-9.8	9.0	5.0
Non-electric fuel use	-37.0	-3.2	-6.9	-0.3	-7.7	5.6	3.6
Electricity	-56.2	-5.7	-5.1	-8.5	-14.5	3.4	1.5

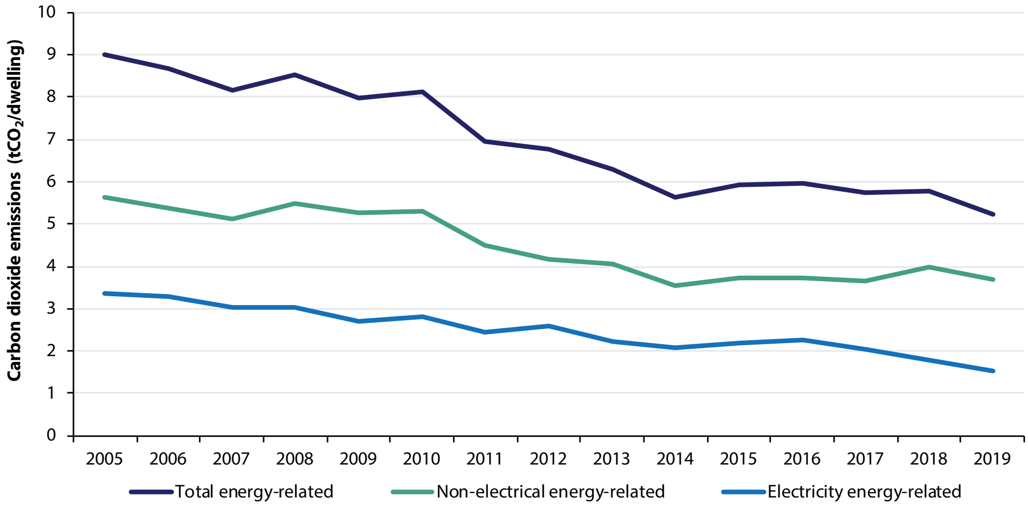
Energy-related CO_2 emissions per dwelling

The emissions of energy-related CO_2 per dwelling fell by 44% over the period 2005 – 2019, while the reduction for unit energy use was 31% (see *Table 33* and *Figure 69)*. In 2019, the average dwelling was responsible for emitting 5.6 tonnes of energy-related CO_2. A total of 3.9 tonnes of CO_2 (69%) came from non-electric fuel use in the home and the remainder indirectly from electricity use.

Energy-related CO_2 emissions per dwelling for non-electric fuel use fell by 37% between 2005 and 2019, primarily as a result of reduced energy consumption per dwelling. CO_2 emissions from electricity use reduced by 56% in the same time period due to a combination of reduced electricity use and the reduced carbon intensity of the electricity grid. The carbon intensity of grid electricity has improved by 33% since 2016 due to a reduction in coal and an increase in renewables used for electricity generation.

Emissions from energy use in the residential sector fell by 9.3% in 2019, due to the decreased CO_2 intensity of the electricity supplied and reduced fossil fuel consumption due to warmer weather. Emissions from non-electric fuel use fell by 7.2% in 2019.

Figure 69: Unit energy-related CO_2 emissions per dwelling



Source: SEAI

In 2019, the average dwelling was responsible for emitting 5.6 tonnes of energy-related CO_2, including upstream emissions from electricity generation. This was 44% less than in 2005.

7.4 Commercial and public services

Trends in 2019

Commercial and public services' energy use increased by 2.2% in 2019. As 2019 was warmer than 2018 (5.1% fewer degree days), when corrections for weather effects are taken into account, energy use in services increased by 4.7% (see *Table 34*). This is against the backdrop of the economic activity of services, as measured by value added, increasing by 6.4%.

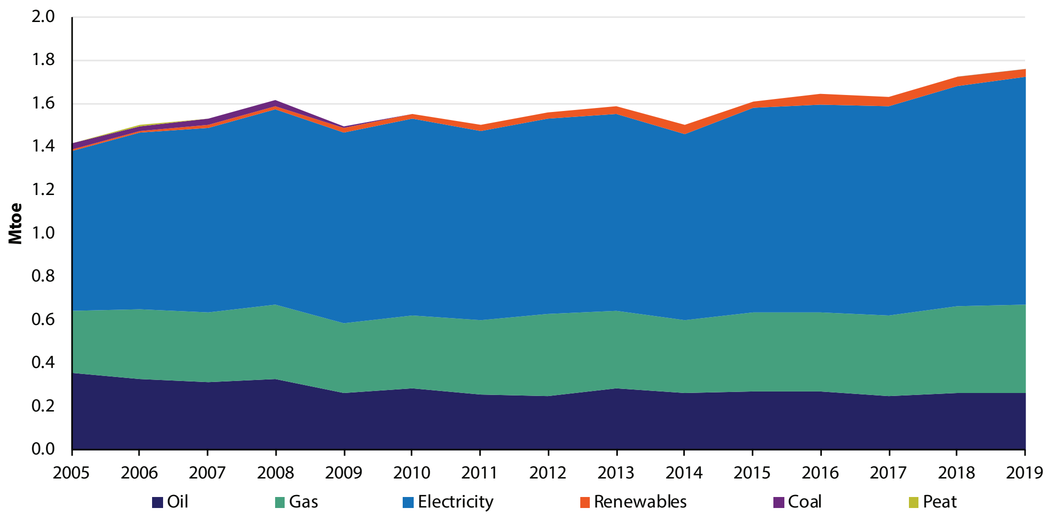
The key trends in 2019 were as follows:

- Final energy use in services grew by 2.2% in 2019, to 1,760 ktoe; however when corrected for weather effects the increase was 4.7%.
- Oil, gas and electricity make up 98% of the energy consumed in the services sector. The contributions from coal and peat are negligible.
- Electricity consumption in services increased by 3%, to 1,050 ktoe, and accounted for 60% of final energy consumption in services in 2019.
- Oil consumption increased by 0.5%, to 265 ktoe. The share of oil in the sector's final consumption was 15%.
- Natural gas consumption increased by 2.1%, to 406 ktoe, and its share of the sector's final consumption was 23%.
- Overall direct fossil fuel use in services increased by 1.5%, to 671 ktoe.
- Renewable energy use in services fell by 6.2%, to 39 ktoe, in 2019. The share of renewables in services' final energy consumption was 2.2%.

Trends in 2005 – 2019

Final energy use in the commercial and public services sector increased by 24% (1.6% per annum) over the period 2005 – 2019, to 1,760 ktoe. The increase was 22% if weather-corrected energy use is considered. During this period, the value added generated by the sector grew by 66%, while the numbers employed increased by 27%.

Figure 70: Commercial and public services final energy use by fuel



Source: SEAI

Figure 70 shows the changes in the fuel mix in the services sector over the period. The range of fuels used in this sector is small – essentially oil, gas and electricity. Oil and gas are used predominantly for space heating, but also for water heating, cooking and, in some sub-sectors, laundry. Gas consumption has increased by 40% since 2005, to 406 ktoe. Electricity is used in buildings for heating, air conditioning, water heating, lighting, and information and communications technology (ICT). Electricity in services is also used for public lighting and water and sanitation services.

Electricity consumption in services increased by 42% (2.5% per annum) between 2005 and 2019, to 1,050 ktoe (12,207 GWh), and had a higher share, at 60%, than any other individual source in services (up from 52% in 2005). Electricity use in services is driven by the changing structure of this sector and the general increase in the use of ICT, electric heating and air conditioning. Data centres are also included under commercial services.

Growth rates, quantities and shares are shown in *Table 34*.

Table 34: Growth rates, quantities and shares of final consumption in the commercial and public services sector

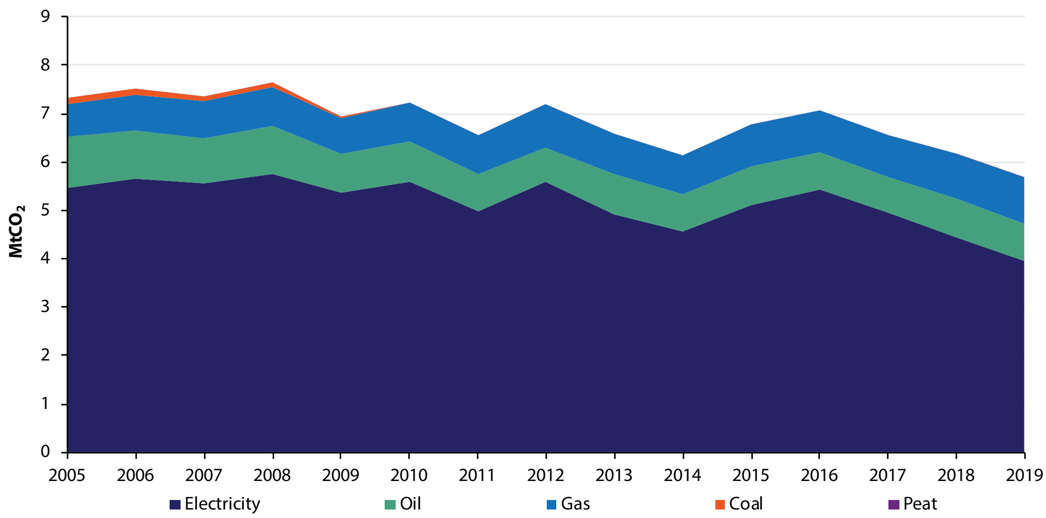
	Overall Growth %	Average Annual Growth %				Quantity (ktoe)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Fossil Fuels (Total)	0.0	0.0	0.6	1.3	1.5	672	671	47.5	38.2
Coal	-98.0	-24.3	12.0	12.5	0.0	27	1	1.9	0.0
Oil	-25.1	-2.0	-0.9	-0.4	0.5	354	265	25.0	15.1
Natural Gas	39.8	2.4	1.7	2.5	2.1	290	406	20.5	23.1
Renewables	862.8	17.6	8.7	4.5	-6.2	4	39	0.3	2.2
Combustible Fuels (Total)	2.8	0.2	0.7	1.2	0.9	675	694	47.7	39.4
Electricity	42.2	2.5	0.7	2.8	3.0	738	1,050	52.2	59.6
Total	**24.5**	**1.6**	**0.8**	**2.2**	**2.2**	**1,414**	**1,760**		
Total (Weather Corrected)	**22.1**	**1.4**	**2.1**	**3.0**	**4.7**	**1,437**	**1,755**		

Energy-related CO_2 emissions – including emissions associated with electricity

Figure 71 shows the primary energy-related CO_2 emissions of the services sector, distinguishing between the on-site CO_2 emissions associated with direct fuel use and the upstream emissions associated with electricity consumption. Emissions from non-electrical energy fell by 6.9% over the period and the emissions associated with electricity consumption fell by 27%. In 2019, non-electricity emissions in services increased by 1.3% and electricity-associated emissions fell by 11%. Overall energy-related CO_2 emissions in this sector fell by 7.6% in 2019, to 5.7 $MtCO_2$.

In the services sector, the share of emissions associated with electricity demand in 2019 was 70%, compared to 75% in 2005 (see *Table 35*).

Figure 71: Commercial and public services sector CO_2 emissions by fuel



Source: SEAI

Table 35: Growth rates, quantities and shares of CO_2 emissions in commercial and public services

	Overall Growth %	Average Annual Growth %				Quantity (kt CO_2)		Shares %	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019	2005	2019
Combustible Fuels	-6.9	-0.5	0.4	0.8	1.3	1,857	1,729	25.4	30.4
Electricity	-27.4	-2.3	-1.8	-6.2	-11.0	5,457	3,962	74.6	69.6
Total	**-22.2**	**-1.8**	**-1.3**	**-4.3**	**-7.6**	**7,314**	**5,691**		

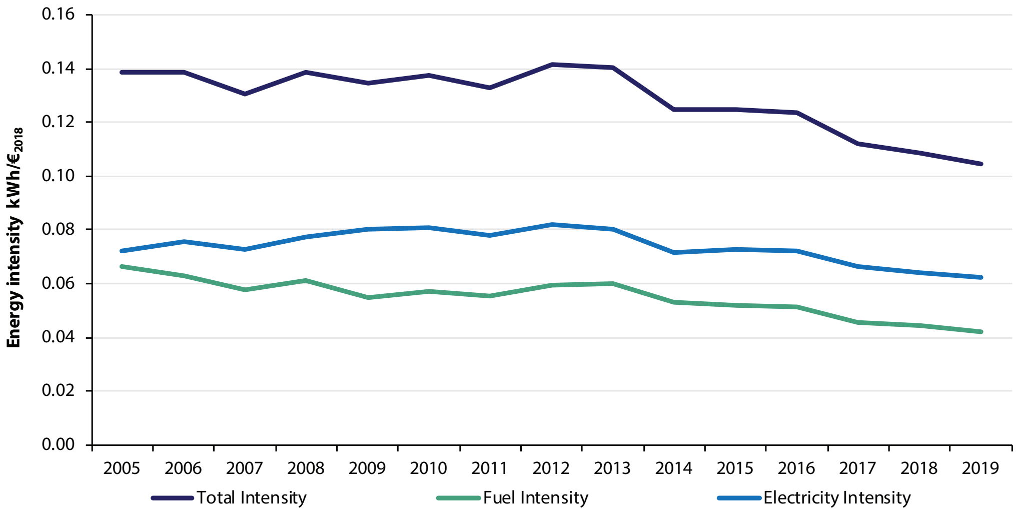
7.4.1 Energy intensity of the commercial and public services sector

The energy intensity of the services sector is generally measured in relation to the value added generated by services activities. As shown in *Figure 72*, this intensity is flatter than that of industry. The overall energy intensity of the services sector was 25% lower in 2019 than it was in 2005, principally because of the rapid growth in the value added in the sector.

There has been a general downward trend in services' energy intensity since 2005. Energy intensity in services fell by 4% in 2019.

Electricity intensity has been falling since 2005, with the exception of 2008. In 2019, electricity intensity decreased by 3.2% compared with 2018 and was 14% below the 2005 level.

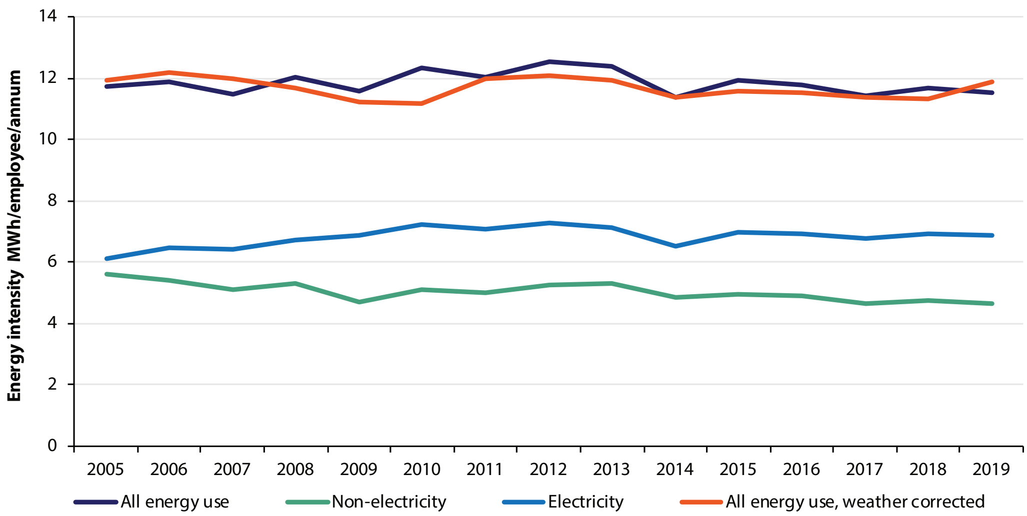
Figure 72: Energy intensity of the commercial and public services sector



Source: SEAI

Two other indicators in this sector are energy use per unit of floor area and per employee. The consumption of oil and gas is mainly for space-heating purposes and is likely to be more related to the floor area heated, rather than to the number of people occupying a building at a given time. Due to an absence of data on floor area in the services sector, it is not currently possible to calculate the consumption per unit of floor area.

Figure 73: Energy per employee in the commercial and public services sector



Source: SEAI

Electricity use per employee is used as an indicator of energy use in the services sector because, usually, there is a correlation between electricity use and the number of employees. In *Figure 73,* it can be seen that electricity per employee fell between 2008 and 2011 but has been relatively stable since then, and fell by just 0.5% in 2019.

Non-electric energy use per employee fell by 2.4% in 2019, and stood at 17% below 2005 levels. If corrections are made for the effects of weather, then non-electric energy use per employee increased by 5.3% in 2019 when compared with 2018 (see *Table 36*).

Table 36: Growth rates and quantities of energy per employee in commercial and public services

	Overall Growth %	Average Annual Growth %				Quantity (kWh)	
	2005 – 2019	'05 – '19	'10 – '15	'15 – '19	2019	2005	2019
Total kWh/employee	-1.9	-0.1	-0.7	-0.9	-1.2	11,731	11,506
Fuel kWh/employee	-17.2	-1.3	-0.6	-1.7	-2.4	5,605	4,643
Electricity kWh/employee	12.0	0.8	-0.7	-0.4	-0.5	6,126	6,863
Weather Corrected							
Total kWh/employee	-0.4	0.0	0.7	0.7	4.7	11,924	11,873
Fuel kWh/employee	-16.9	-1.3	1.7	0.4	5.3	5,752	4,781
Electricity kWh/employee	14.9	1.0	0.0	0.9	4.2	6,171	7,091

7.4.2 Public sector developments

The public sector consists of approximately 4,400 separate public bodies, about 4,000 of which are individual schools. The other 400 comprise, inter alia, Government departments, non-commercial State bodies, State-owned companies and local authorities. Each 'public body' is a stand-alone organisation and can range in size from very small (e.g. a small rural school or a five-person agency) to very large (e.g the Health Service Executive or An Garda Síochána). The vast majority of energy is consumed by the 100 largest organisations.

Public services[69] energy consumption comprises two main classes of energy consumer:

- Public sector buildings (offices, hospitals, clinics, nursing homes, schools, prisons, barracks, Garda stations, etc.), which primarily consume electricity, natural gas and oil-based fuels in addition to smaller amounts of renewable and solid fuels;
- Public sector utilities, which primarily consume electricity, for example wastewater treatment plants, water treatment facilities, pumping stations, and street lighting (~400,000 units).

The Fourth National Energy Efficiency Action Plan (NEEAP) and the European Union (Energy Efficiency) Regulations 2014 (SI 426 of 2014) set out several obligations on public bodies with respect to their 'exemplary role' for energy efficiency. The NEEAP sets a 33% efficiency target for the sector by 2020. This is equivalent to 279 ktoe (4,581 GWh based on 2018 data).

Since 1 January 2011, public sector bodies have been required to report to Government annually on their energy use and the actions they have taken to reduce consumption. SEAI and the Department of Communications, Climate Action and Environment have developed an energy monitoring and reporting system[70] to satisfy the reporting requirements of both SI 426 of 2014 and the NEEAP. Since 2013, all public sector organisations have been obliged to use this system to report their annual energy consumption to SEAI. The system includes a national public sector energy database, which includes all public sector electricity and natural gas meter numbers. Over time, the monitoring and reporting system will build a comprehensive bottom-up picture of energy consumption in the sector through the population of the national public sector energy database.

In 2019 SEAI published the *Annual Report 2018 on Public Sector Energy Efficiency Performance*[71]. It noted that 345 public sector bodies and 3,680 schools completed reports on energy and these represented 96% of total public sector energy consumption. The total energy consumption in 2018 of these bodies was 10,178 GWh (primary energy), which consisted of 4,992 GWh of electricity, 3,124 GWh of thermal energy and 2,132 GWh of transport energy. This cost the State €668 million in 2018. The report also noted that these bodies have achieved annual primary energy savings of 3,751 GWh, or a 27% improvement on business as usual, yielding a cost saving of €246 million. The public sector has a target of 33% energy efficiency improvement by 2020.

Public sector bodies have achieved annual primary energy savings of 3,751 GWh in 2018, or a 27% improvement on business as usual, yielding a cost saving of €246 million. The public sector has a target of 33% energy efficiency improvement by 2020.

8 Energy statistics revisions and corrections

Some changes, revisions and corrections to the historic energy balance data were implemented during 2019. The most significant of these are listed below:

Energy Sources

Coal: Anthracite + Manufactured Ovoids

- Import estimates were revised to align with data from the CSO Trade Statistics from 2012, resulting in an increase in residential consumption.

Oil: Refinery Feedstocks

New fuel in the Energy Balance. IEA/Eurostat Definition;

> These are processed oils destined for further processing (e.g. straight run fuel oil or vacuum gas oil) excluding blending. With further processing, it will be transformed into one or more components and/or finished products. This definition also covers returns from the petrochemical industry to the refining industry (e.g. pyrolysis gasoline, C4 fractions, gasoil and fuel oil fractions).

Oil: Naphtha

This is now spelled correctly in the spreadsheet (was Naphta)

Natural Gas

Consumption in transport moved from Road Light Goods Vehicle to Road Freight

Renewables: Biomass & Renewable Waste

Split into two columns

- Biomass
  - Wood and wood waste
  - Tallow
  - Meat and bone meal
- Renewable Waste
  - Renewable portion of solid recovered fuel
  - Renewable portion of low carbon fuel
  - Renewable portion of tire derived fuel
  - Renewable waste used for electricity generation

Renewables: Liquid Biofuel

Split into two columns

- Biodiesel
- Bioethanol

Renewables: Solar

Split into two columns

- Solar Photovoltaic
- Solar Thermal

Renewables: Geothermal

Heading renamed to Ambient Heat

Energy Balance Fuel Summary Table

The table below shows all fuels in the Energy Balance, their column position in the format of the Energy Balance published in 2019, and their column in the new Energy Balance published in 2020. New columns are shown with darker shading.

Fuel	Previous Column	New Column	Notes
Coal	C	C	
Bituminous Coal	D	D	
Anthracite + Manufactured Ovoids	E	E	
Coke	F	F	
Lignite\Brown Coal Briquettes	G	G	
Peat	H	H	
Milled Peat	I	I	
Sod Peat	J	J	
Briquettes	K	K	
Oil	L	L	
Crude	M	M	
Refinery Feedstocks	n/a	N	New column
Refinery Gas	N	O	
Gasoline	O	P	
Kerosene	P	Q	
Jet Kerosene	Q	R	
Fueloil	R	S	
LPG	S	T	
Gasoil/Diesel/DERV	T	U	
Petroleum Coke	U	V	
Naphta	V	W	Changed to correct spelling: Naphtha
Bitumen	W	X	
White Spirit	X	Y	
Lubricants	Y	Z	
Natural Gas	Z	AA	
Renewables	AA	AB	
Hydro	AB	AC	
Wind	AC	AD	
Biomass & Renewable Waste	AD	AE & AF	Split into two columns - Biomass and Renewable Waste
Landfill Gas	AE	AG	
Biogas	AF	AH	
Liquid Biofuel	AG	AI + AJ	Split into two columns - Biodiesel and Bioethanol
Solar	AH	AK & AL	Split into two columns - Solar Photovoltaic and Solar Thermal
Geothermal	AI	AM	Renamed to Ambient Heat
Non-Renewable Waste	AJ	AN	
Electricity	AK	AO	
Heat	AL	AP	
TOTAL	AM	AQ	

Data Flows

Transformation

Transformation Output: Combined Heat and Power Plants – Electricity

- Renamed to Combined Heat and Power Plants

Transformation Output: Combined Heat and Power Plants – Heat

- Removed

Transformation Output: Public Thermal Power Plants

- Transformation output had been reported under some combustible fuels but not for others.
- There were also inconsistencies in how the electricity generated from these fuels was included in the Electricity column. From 1990 to 2009 it was transferred over under Exchanges and Transfers: Electricity. From 2010 the output was included under total Electricity Transformation Output and not under Exchange and Transfers. (Please note that electricity generated from Hydro, Wind and Solar remains under Exchanges and Transfers: Electricity as before)
- Transformation output from combustible fuels is now only reported in the Electricity column for consistency and to align with the Eurostat Energy Balance format.
- 1996 to 2019
  - Output from Landfill gas removed from Landfill gas. Included in Electricity.
- 2007 to 2019
  - Output from Biomass removed from Biomass. Included in Electricity.
- 2012 to 2019
  - Output from Non-Renewable Waste removed from Non-Renewable Waste. Included in Electricity.

Transformation Output: Combined Heat and Power Plants

- As above
- 2003 to 2019
  - Output from Biogas removed from Biogas. Included in Electricity.
- 2004 to 2019
  - Output from Biomass removed from Biomass. Included in Electricity.

Total Final Consumption

- New data flows sourced from the CSO Business Energy Use Survey will be included in the final Energy Balance.
- The new flows are listed below, with the relevant NACE codes and descriptions included.

Industry

- Construction
  - 41 Construction of buildings
  - 42 Civil engineering
  - 43 Specialised construction activities

Commercial Services

- Wholesale, Retail, and Vehicle Repair
  - 45 Wholesale and retail trade and repair of motor vehicles and motorcycles
  - 46 Wholesale trade, except of motor vehicles and motorcycles
  - 47 Retail trade, except of motor vehicles and motorcycles
- Transportation and Storage
  - 49 Land transport and transport via pipelines
  - 50 Water transport
  - 51 Air transport
  - 52 Warehousing and support activities for transportation
  - 53 Postal and courier activities
- Accommodation and Food Services

  - 55 Accommodation
  - 56 Food and beverage service activities
- Information and Communication
  - 58 Publishing activities
  - 59 Motion picture, video and television programme production, sound recording and music publishing activities
  - 60 Programming and broadcasting activities
  - 61 Telecommunications
  - 62 Computer programming, consultancy and related activities
  - 63 Information service activities
- Financial, Insurance and Real Estate Activities
  - 64 Financial service activities, except insurance and pension funding
  - 65 Insurance, reinsurance and pension funding, except compulsory social security
  - 66 Activities auxiliary to financial services and insurance activities
  - 68 Real estate activities
- Other Services Sectors

Public Services

- Water Supply, Sewerage, and Waste Management
  - 36 Water collection, treatment and supply
  - 37 Sewerage
  - 38 Waste collection, treatment and disposal activities; materials recovery
  - 39 Remediation activities and other waste management services
- Public Administration
  - 84 Public administration and defence; compulsory social security
- Education
  - 85 Education
- Health, Residential Care and Social Work Activities
  - 86 Human health activities
  - 87 Residential care activities
  - 88 Social work activities without accommodation

The table below shows all data flows in the Energy Balance, their row number in the format of the Energy Balance published in 2019, and their row number in the new Energy Balance published in 2020. Changes shown in darker shading.

Energy Flow	Previous Column	New Column	Notes
Indigenous Production	2	2	
Imports	3	3	
Exports	4	4	
Mar. Bunkers	5	5	
Stock Change	6	6	
Primary Energy Supply (incl non-energy)	**7**	**7**	
Primary Energy Requirement (excl. non-energy)	**8**	**8**	
Transformation Input	**9**	**9**	
Public Thermal Power Plants	10	10	
Combined Heat and Power Plants	11	11	
Pumped Storage Consumption	12	12	
Briquetting Plants	13	13	
Oil Refineries & other energy sector	14	14	
Transformation Output	**15**	**15**	
Public Thermal Power Plants	16	16	
Combined Heat and Power Plants - Electricity	17	17	Renamed to Combined Heat and Power Plants
Combined Heat and Power Plants - Heat	18	n/a	Deleted
Pumped Storage Generation	19	18	
Briquetting Plants	20	19	
Oil Refineries	21	20	
Exchanges and transfers	**22**	**21**	
Electricity	23	22	
Heat	24	23	
Other	25	24	
Own Use and Distribution Losses	**26**	**25**	
Available Final Energy Consumption	**27**	**26**	
Non-Energy Consumption	**28**	**27**	
Final non-Energy Consumption (Feedstocks)	29	28	
Total Final Energy Consumption	**30**	**29**	
Industry*	**31**	**30**	
Non-Energy Mining	32	31	
Food & beverages	33	32	
Textiles and textile products	34	33	
Wood and wood products	35	34	
Pulp, paper, publishing and printing	36	35	
Chemicals & man-made fibres	37	36	
Rubber and plastic products	38	37	
Other non-metallic mineral products	39	38	
Basic metals and fabricated metal products	40	39	
Machinery and equipment n.e.c.	41	40	
Electrical and optical equipment	42	41	
Transport equipment manufacture	43	42	
Other manufacturing	44	43	
Construction	n/a	44	New
Transport	**45**	**45**	
Road Freight	46	46	
Road Light Goods Vehicle	47	47	
Road Private Car	48	48	
Public Passenger Services	49	49	
Rail	50	50	
Domestic Aviation	51	51	
International Aviation	52	52	
Fuel Tourism	53	53	
Navigation	54	54	
Unspecified	55	55	
Residential	**56**	**56**	

Commercial/Public Services	**57**	**57**	
Commercial Services	**58**	**58**	
Wholesale, Retail, and Vehicle Repair	n/a	59	New
Transportation and Storage	n/a	60	New
Accommodation and Food Services	n/a	61	New
Information and Communication	n/a	62	New
Financial, Insurance and Real Estate Activities	n/a	63	New
Other Services Sectors	n/a	64	New
Public Services	**59**	**65**	
Water Supply, Sewerage, and Waste Management	n/a	66	New
Public Administration	n/a	67	New
Education	n/a	68	New
Health, Residential Care and Social Work Activities	n/a	69	New
Agricultural	**60**	**70**	
Fisheries	**61**	**71**	
Statistical Difference	62	72	

Glossary of abbreviations

Abbreviation	Explanation
CCGT	Combined cycle gas turbine
CHP	Combined heat and power
CO_2	Carbon dioxide
CSO	Central Statistics Office
EPA	Environmental Protection Agency
ETS	EU Emission Trading Scheme
EU-15	The first 15 Member States of the European Union
GDP	Gross domestic product
GHG	Greenhouse gas
GNI*	Modified gross national income
GNP	Gross national product
goe	gramme of oil equivalent
ICT	Information and communications technology
IEA	International Energy Agency
IP	Intellectual property
IPCC	Intergovernmental Panel on Climate Change
ktoe	kilotonne of oil equivalent
NCT	National Car Testing service
NEDC	New European Driving Cycle
NEEAP	National energy efficiency action plan
NREAP	National renewable energy action plan
OECD	Organization for Economic Co-operation and Development
PV	Photovoltaic
R&D	Research and development
RES	Renewable energy share
RES-E	Renewable energy share in electricity
RES-H	Renewable energy share in heat
RES-T	Renewable energy share in transport
SEAI	Sustainable Energy Authority of Ireland
TFC	Total final energy consumption
TPER	Total primary energy requirement
UNFCCC	United Nations Framework Convention on Climate Change
VOC	Volatile organic compounds
WLTP	Worldwide Harmonised Light Vehicle Test

Glossary of terms

Carbon dioxide (CO_2): A compound of carbon and oxygen formed when carbon is burned. Carbon dioxide is one of the main greenhouse gases. Units used in this report are t CO_2 – tonnes of CO_2, kt CO_2 – kilo-tonnes of CO_2 (10^3 tonnes) and Mt CO_2 – mega-tonnes of CO_2 (10^6 tonnes).

Carbon intensity (gCO_2/kWh): This is the amount of CO_2 that will be released per kWh of energy of a given fuel. For most fossil fuels the value of this is almost constant, but in the case of electricity it will depend on the fuel mix used to generate the electricity and also on the efficiency of the technology employed.

Weather correction: Annual variations in weather affect the space heating requirements of occupied buildings. Weather correction involves adjusting the energy used for space heating by benchmarking the climate in a particular year with that of a long-term average measured in terms of number of degree days.

Combined heat and power (CHP) plants: Combined heat and power (CHP) refers to plants which are designed to produce both heat and electricity, for own use only or third-party owned and selling electricity and heat on site as well as exporting electricity to the grid.

Energy intensity: The amount of energy used per unit of activity. Examples of activity used in this report are gross domestic product (GDP), value added, number of households, employees, etc. Where possible, the monetary values used are in constant prices.

Gross and net calorific value (GCV and NCV): The gross calorific value (GCV) gives the maximum theoretical heat release during combustion, including the heat of condensation of the water vapour produced during combustion. This water is produced by the combustion of the hydrogen in the fuel, or in some cases from the evaporation of water already present in the fuel. The net calorific value (NCV) excludes this heat of condensation because it cannot be recovered in conventional boilers. For natural gas, the difference between GCV and NCV is about 10%, for oil it is approximately 5%.

Gross domestic product (GDP): The gross domestic product represents the total output of the economy over a period.

Gross electrical consumption: Gross electricity production is measured at the terminals of all alternator sets in a station; it therefore includes the energy taken by station auxiliaries and losses in transformers that are considered integral parts of the station. The difference between gross and net production is the amount of own use of electricity in the generation plants.

Gross final consumption: Directive 2008/28/EC defines gross final consumption of energy as the energy commodities delivered for energy purposes to industry, transport, households, services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production, and including losses of electricity and heat in distribution.

Gross inland energy consumption: Sometimes abbreviated as gross inland consumption, is the total energy demand of a country or region. It represents the quantity of energy necessary to satisfy inland consumption of the geographical entity under consideration.

Heating degree days: 'Degree days' is the measure or index used to take account of the severity of the weather when looking at energy use in terms of heating (or cooling) 'load' on a building. A degree day is an expression of how cold (or warm) it is outside, relative to a day on which little or no heating (or cooling) would be required. It is thus a measure of the cumulative temperature deficit (or surplus) of the outdoor temperature relative to a neutral target temperature (base temperature) at which no heating or cooling would be required.

Modified gross national income (GNI*): Modified gross national income (or GNI*) was introduced by the CSO in 2017 to assess the level of activity in the Irish economy excluding the effects of globalisation that disproportionately affect the Irish economic results. GNI* is defined as GNI less the effects of the profits of re-domiciled companies and the depreciation of intellectual property products and aircraft leasing companies.

Nominal and real values: Nominal value refers to the current value expressed in money terms in a given year, whereas real value adjusts nominal value to remove effects of price changes and inflation to give the constant value over time indexed to a reference year.

Total final consumption: This is the energy used by the final consuming sectors of industry, transport, residential, services, agriculture and fisheries. It excludes the energy sector: electricity generation, oil refining, etc.

Total primary energy requirement: This is the total requirement for all uses of energy, including energy used to transform one energy form to another (e.g. burning fossil fuel to generate electricity) and energy used by the final consumer.

Value added: Value added is an economic measure of output. The value added of industry, for instance, is the additional value created by the production process through the application of labour and capital. It is defined as the value of industry's output of goods and services less the value of the intermediate consumptions of goods (raw materials, fuel, etc.) and services.

Wastes(non-renewable): The non-renewable portion of wastes used as an energy source.

Energy conversion factors

To:	toe	MWh	GJ
From:	Multiply by		
toe	1	**11.63**	**41.868**
MWh	0.086	**1**	**3.6**
GJ	0.02388	**0.2778**	**1**

Energy units

joule (J): Joule is the international (S.I.) unit of energy.

kilowatt hour (kWh): The conventional unit of energy that electricity is measured by and charged for commercially.

tonne of oil equivalent (toe): This is a conventional standardised unit of energy. One tonne of oil equivalent is defined as having a net calorific value of 41.868 GJ. A related unit is the kilogram of oil equivalent (kgoe), where 1 kgoe = 10^{-3} toe.

Decimal prefixes

deca (da)	10^{1}	deci (d)	10^{-1}
hecto (h)	10^{2}	centi (c)	10^{-2}
kilo (k)	10^{3}	milli (m)	10^{-3}
mega (M)	10^{6}	micro (μ)	10^{-6}
giga (G)	10^{9}	nano (n)	10^{-9}
tera (T)	10^{12}	pico (p)	10^{-12}
peta (P)	10^{15}	femto (f)	10^{-15}
exa (E)	10^{18}	atto (a)	10^{-18}

Calorific values

Fuel	Net Calorific Value toe/t	Net Calorific Value MJ/t
Crude Oil	1.0226	42,814
Gasoline (Petrol)	1.0650	44,589
Kerosene	1.0556	44,196
Jet Kerosene	1.0533	44,100
Gasoil/Diesel	1.0344	43,308
Residual Fuel Oil (Heavy Oil)	0.9849	41,236
Milled Peat	0.1860	7,787
Sod Peat	0.3130	13,105
Peat Briquettes	0.4430	18,548
Coal	0.6650	27,842
Liquefied Petroleum Gas (LPG)	1.1263	47,156
Petroleum Coke	0.7663	32,084

	Conversion Factor	Conversion Factor
Electricity	86 toe/GWh	3.6 TJ/GWh

Emission factors

	t CO_2/TJ (NCV)	g CO_2/kWh (NCV)
Liquid Fuels		
Motor Spirit (Gasoline)	70.0	251.9
Jet Kerosene	71.4	257.0
Other Kerosene	71.4	257.0
Gas/Diesel Oil	73.3	263.9
Residual Oil	76.0	273.6
LPG	63.7	229.3
Naphtha	73.3	264.0
Petroleum Coke	92.9	334.5
Solid Fuels and Derivatives		
Coal	94.6	340. 6
Milled Peat	116.7	420.0
Sod Peat	104.0	374.4
Peat Briquettes	98.9	355.9
Gas		
Natural Gas	56.9	204.7
Electricity		
(2019)	90.1	324.6

Sources

Applus+ (National Car Test)

Central Statistics Office

Department of the Environment, Climate and Communications

Department of Housing, Local Government, and Heritage

Department of Transport

EirGrid

Environmental Protection Agency

ESB Networks

European Commission DG TREN

EU-funded ODYSSEE Project

Eurostat

Gas Networks Ireland

International Energy Agency

Met Éireann

National Grid UK

Revenue Commissioners

Road Safety Authority (Vehicle Registration Unit)

US Energy Information Administration

Vehicle Certification Agency UK

Bibliography

Central Statistics Office (2017), *Census 2016 Profile 1 – Housing in Ireland*. Available from: http://www.cso.ie/en/csolatestnews/presspages/2017/census2016profile1-housinginireland/

Central Statistics Office (2020), *National Income and Expenditure 2019*. Available from: https://www.cso.ie/en/statistics/nationalaccounts/nationalincomeandexpenditureannualresults/

Central Statistics Office (2020), *Road Freight Transport Survey Quarter 4 and Year 2019*. Available from: https://www.cso.ie/en/statistics/transport/roadfreighttransportsurvey/

EirGrid (2019), *All Island Generation Capacity Statement 2020 – 2029*. Available from: https://www.eirgridgroup.com/site-files/library/EirGrid/All-Island-Generation-Capacity-Statement-2020-2029.pdf

EirGrid (2020), *TSO Connected Renewables - Annual Installed Capacities*. Available from: http://www.eirgridgroup.com/site-files/library/EirGrid/TSO-Connected-Renewable-Generation.pdf

ESB Networks (2020), *Distribution Connected-Energised Wind*. Available from: https://www.esbnetworks.ie/docs/default-source/publications/dso-connected-energised-wind-generators-q3-2020.pdf?sfvrsn=379506f0_30

European Environment Agency (2020), *Monitoring CO_2 emissions from new passenger cars and vans in 2018*. Available from: https://www.eea.europa.eu//publications/co2-emissions-from-cars-and-vans-2018

European Union (2003), *Directive 2003/30/EC of the European Parliament and of the Council on the promotion of the use of biofuels or other renewable fuels for transport*. Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:123:0042:0046:EN:PDF

European Union (2003), *Directive 2003/87/EC of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC*. Available from: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003L0087&from=EN

European Union (2006), *Directive 2006/32/EC of the European Parliament and of the Council on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC*. Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:114:0064:0064:EN:PDF

European Union (2007), *Council Decision 2007/394/EC amending Council Directive 90/377/EEC with regard to the methodology to be applied for the collection of gas and electricity prices charged to industrial end-users*. Available from: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007D0394&from=EN

European Union (2009), *Decision No 406/2009/EC of the European Parliament and of the Council on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020*. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009D0406&from=EN

European Union (2009), *Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and subsequently repealing Directives 2001/77/EC and 2003/30/EC*. Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF

Eurostat (2020), *Energy, transport and environment statistics – 2020 edition*. Available from: https://ec.europa.eu/eurostat/web/products-statistical-books/-/KS-DK-20-001

Gas Networks Ireland (2020), *Network development plan 2019*. Available from: https://www.cru.ie/wp-content/uploads/2020/08/CRU20101-GNI-draft-Ten-year-Network-Development-Plan-2019.pdf

National Oil Reserves Agency (2011), *Energy (Biofuel Obligation and Miscellaneous Provisions) Act 2010*. Available from: http://www.nora.ie/regulationslegislation/biofuels-obligation-scheme.152.html

National Oil Reserves Agency (2020), *Biofuel Obligation Scheme Annual Report 2019*. Available from: https://www.nora.ie/_fileupload/457-20X0088%20-%20BOS%20Annual%20Report%20for%202019%20for%20publication.pdf

OECD/IEA/Eurostat (2005), *Energy Statistics Manual*, Paris: OECD/International Energy Agency. Available from: https://www.iea.org/training/toolsandresources/energystatisticsmanual/

Sustaniable Energy Authority of Ireland (2019), *Combined Heat and Power in Ireland – 2019 Update*. Available from: https://www.seai.ie/publications/CHP-Update-2019.pdf.

Sustaniable Energy Authority of Ireland (2020), *Energy Security in Ireland – 2020 Report*. Available from: https://www.seai.ie/publications/Energy-Security-in-Ireland-2020-.pdf

Sustaniable Energy Authority of Ireland (2020), *Renewable Electricity in Ireland – 2020 Update*. Available from: https://www.seai.ie/publications/2020-Renewable-Energy-in-Ireland-Report.pdf

Bibliography (continued)

Sustaniable Energy Authority of Ireland (2020), *Annual Report 2019 on Public Sector Energy Efficiency Performance*. Available from: https://www.seai.ie/business-and-public-sector/public-sector/monitoring-and-reporting/public-sector-results/

Sustaniable Energy Authority of Ireland (2020), *Electricity & Gas Prices in Ireland – 2nd Semester 2019*. Available from: https://www.seai.ie/publications/Price-Directive-2nd-Semester-2019.pdf.

Sustaniable Energy Authority of Ireland (2018), *Energy in the Residential Sector 2018 Report*. Available from: https://www.seai.ie/publications/Energy-in-the-Residential-Sector-2018-Final.pdf

Vehicle Registration Unit (various years), *Irish Bulletin of Vehicle and Driver Statistics*. Available from: https://www.gov.ie/en/publication/0f943b-irish-bulletin-of-vehicle-and-driver-statistics-2019/.

Energy balance 2019

kilotonnes of oil equivalent (ktoe)	Coal	Peat	Oil	Natural Gas	Renewables	Non-Renew/Waste	Electricity	Total
Indigenous Production	0	391	0	2,147	1,461	145		4,144
Imports	216	0	9,052	2,424	176		187	12,055
Exports	8	6	1,571	0	7		132	1,723
Mar. Bunkers	0	0	142		0			142
Stock Change	172	244	93	0	-2			508
Primary Energy Supply (incl. non-energy)	**380**	**629**	**7,432**	**4,571**	**1,629**	**145**	**55**	**14,842**
Primary Energy Requirement (excl. non-energy)	**380**	**629**	**7,193**	**4,571**	**1,629**	**145**	**55**	**14,604**
Transformation Input	**152**	**492**	**2,912**	**2,565**	**213**	**89**	**53**	**6,475**
Public Thermal Power Plants	152	430	78	2,262	201	89		3,212
Combined Heat and Power Plants	0	5	1	259	12			276
Pumped Storage Consumption							41	41
Briquetting Plants	0	57	0		0			57
Oil Refineries and other energy sector	0	0	2,833	44	0		12	2,889
Transformation Output	**0**	**54**	**2,847**	**0**	**0**	**0**	**1,721**	**4,622**
Public Thermal Power Plants	0	0	0		0		1,521	1,521
Combined Heat and Power Plants	0	0	0		0		179	179
Pumped Storage Generation							21	21
Briquetting Plants		54	0		0			54
Oil Refineries		0	2,847		0			2,847
Exchanges and Transfers	**17**	**0**	**-52**	**0**	**-940**	**0**	**940**	**-35**
Electricity					-940		940	0
Heat								0
Other	17		-52		0			-35
Own Use and Distribution Losses	**0**	**8**	**81**	**66**	**0**		**254**	**409**
Available Final Energy Consumption	**246**	**183**	**7,234**	**1,940**	**476**	**57**	**2,409**	**12,545**
Non-Energy Consumption	**0**	**0**	**238**	**0**	**0**	**0**	**0**	**238**
Final Non-Energy Consumption	0	0	238	0	0			238
Total Final Energy Consumption	**255**	**183**	**7,014**	**1,973**	**488**	**57**	**2,444**	**12,414**
Industry	**79**	**0**	**371**	**958**	**188**	**57**	**642**	**2,295**
Non-Energy Mining	0	0	21	9	0		19	49
Food, Beverages and Tobacco	0	0	68	271	25		153	517
Textiles and Textile Products	0	0	4	20	0		5	29
Wood and Wood Products	0	0	3	3	121		27	154
Pulp, Paper, Publishing and Printing	0	0	1	5	0		11	16
Chemicals and Man-Made Fibres	0	0	20	131	0		108	259
Rubber and Plastic Products	0	0	4	2	0		21	28
Other Non-Metallic Mineral Products	79	0	160	21	42	57	56	414
Basic Metals and Fabricated Metal Products	0	0	11	417	0		51	479
Machinery and Equipment n.e.c.	0	0	4	8	0		19	31
Electrical and Optical Equipment	0	0	4	19	0		82	105
Transport Equipment Manufacture	0	0	1	0	0		2	4
Other Manufacturing	0	0	12	31	0		61	104
Construction	0	0	56	21	0		27	104
Transport	**0**	**0**	**5,015**	**17**	**188**	**0**	**7**	**5,228**
Road Freight	0	0	746	0	40			787
Light Goods Vehicles	0	0	257		14			271
Road Private Car	0	0	1,978		94		2	2,075
Public Passenger Services	0	0	130		7			137
Rail	0	0	40		0		4	44
Domestic Aviation	0	0	6		0			6
International Aviation	0	0	1,110		0			1,110
Fuel Tourism	0	0	232		12			245
Navigation	0	0	89		0			89
Unspecified	0	0	426	17	20			463
Residential	**175**	**183**	**1,164**	**591**	**73**		**699**	**2,886**
Commercial/Public Services	**1**	**0**	**265**	**406**	**39**	**0**	**1,050**	**1,760**
Commercial Services	0	0	125	210	23		705	1,064
Public Services	0	0	140	196	15		345	697
Agricultural	**0**	**0**	**175**	**0**	**0**		**47**	**222**
Fisheries	**0**	**0**	**24**		**0**			**24**
Statistical Difference	-9	0	-18	-33	-11	0	-35	-107

Note: This is the short version of the energy balance. A more detailed expanded balance showing detailed sub-fuel data is available on the SEAI website at https://www.seai.ie/data-and-insights/seai-statistics/key-publications/national-energy-balance/

SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Rialtas na hÉireann
Government of Ireland

Sustainable Energy Authority of Ireland
Three Park Place
Hatch Street Upper
Dublin 2
Ireland
D02 FX65

e info@seai.ie
w www.seai.ie
t +353 1 808 2100

@seai_ie