

Sustainable Energy Authority of Ireland

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

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1. 2019 national projections: key insights

1.1. Energy and climate-related 2020 targets

- Different levels of achievement are anticipated by 2020 for renewable energy targets for transport, electricity and heat.
 - The transport sector will likely meet the EU mandated 2020 target of 10% (when multipliers for sustainable biofuels are included).
 - A small gap of less than three percentage points is anticipated for the electricity target of 40% by 2020.
 - The gap for the heat target is larger and could be three to four percentage points short of the 2020 target of 12%.
- When these are taken together, it is expected that Ireland will fall short of its mandatory European target for an overall 16% renewable energy share by 2020, with overall achievement approximately 13% (see *Figure 1*). This shortfall will require Ireland to purchase statistical transfers, as per the *Renewable Energy Directive 2009/28/EU*.
- Compared to other European countries Ireland was 22nd out of the EU-28 for overall renewable energy share and 26th out of the EU-28 for progress towards overall 2020 renewable energy target.¹
 - In the electricity sector Ireland was 13th out of the EU-28 for RES-E, which is a reasonable ranking especially when the readily-available renewable electricity resources are compared across countries.
 - In transport Ireland was seventh out of the EU-28 for RES-T. Increased action to reduce the oil dependency in the sector, including by sourcing sustainable biofuels and effecting modal shift, is needed.
 - In terms of heat, Ireland is 27th out of the EU-28 for RES-H. Given the geographically dispersed, largely low temperature nature of heat demands in Ireland this sector is a major challenge. District heating offers significant potential here.
- On the current trajectory, Ireland's energy efficiency achievement in 2020 is likely to be 16%, compared to the binding 20% energy savings target.
- Non-ETS emissions are anticipated to be between 0% and 1% below 2005 levels by 2020 compared to the target of 20% below, which was mandated in the EU *Effort Sharing Decision (Decision No 406/2009/EC)*. The emissions target shortfall will also require compliance purchasing.

¹ Based on the Eurostat harmonised approach to calculating and reporting renewable energy shares across the EU using the SHARES tool and the latest available data for 2016.

1.2. An initial assessment of 2030 ambition

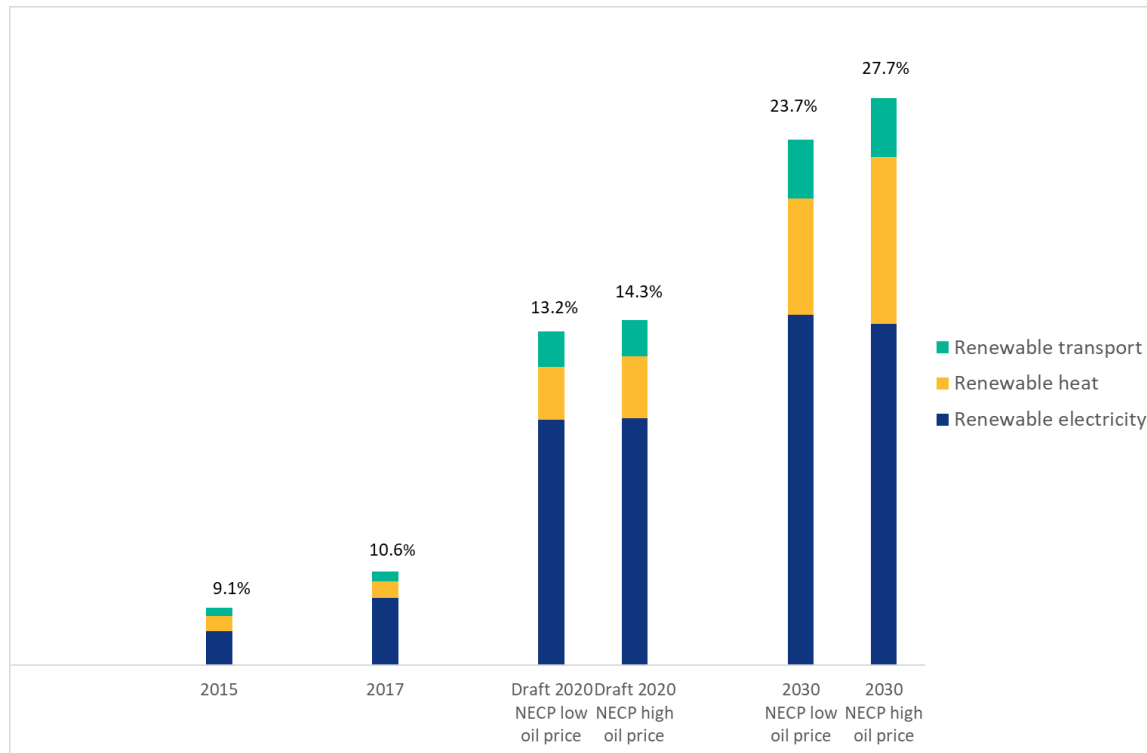
The anticipated level of target achievement in 2030 has also been assessed. These modelled outcomes are based on the suite of existing policies and measures, plus the ambition included in the *National Development Plan* (NDP).² They do not include the additional impact of the (yet to be released) *All of Government Climate Action Plan*. Anticipated levels of achievement in 2030 on that basis are:

- An overall renewable energy share of at least 24%;
- Circa 25% renewable transport (RES-T);
- 18-26% renewable heat (RES-H);
- At least 55% renewable electricity (RES-E); and
- At least 25% savings from energy efficiency.

Increasing the number and intensity of policies and measures in support of sustainable energy will increase these levels of ambition. The Minister for Communications, Climate Action and Environment will soon present an *All of Government Climate Action Plan* that will accelerate the pace of delivery of climate and energy policy. A revised set of 2030 anticipated outturn estimates will be presented in the final *National Energy and Climate Plan* (NECP), due in December 2019. This will map a detailed pathway to achievement of Ireland's 2030 climate targets.

In March 2019 a Joint Houses of the Oireachtas report on climate change, *Climate change: a cross-party consensus for action*, noted that all parties of the Oireachtas and the independent Climate Change Advisory Council recognise the State's response to climate change has been insufficient to date. However, the report itself offers the political mandate to address the situation. It includes comprehensive recommendations and resolves to hold Government and public bodies to account for the delivery of climate actions.

Figure 1: Scenario comparison of progress towards the overall renewable energy share



Note: for all the figures in this report only the *With Additional Measures* (WAM) NECP scenarios are included. These illustrate anticipated target achievement for existing and planned policies and measures to 2020 and 2030.³

² *National Development Plan 2018–2027* (January, 2019) Department of Public Expenditure and Reform.

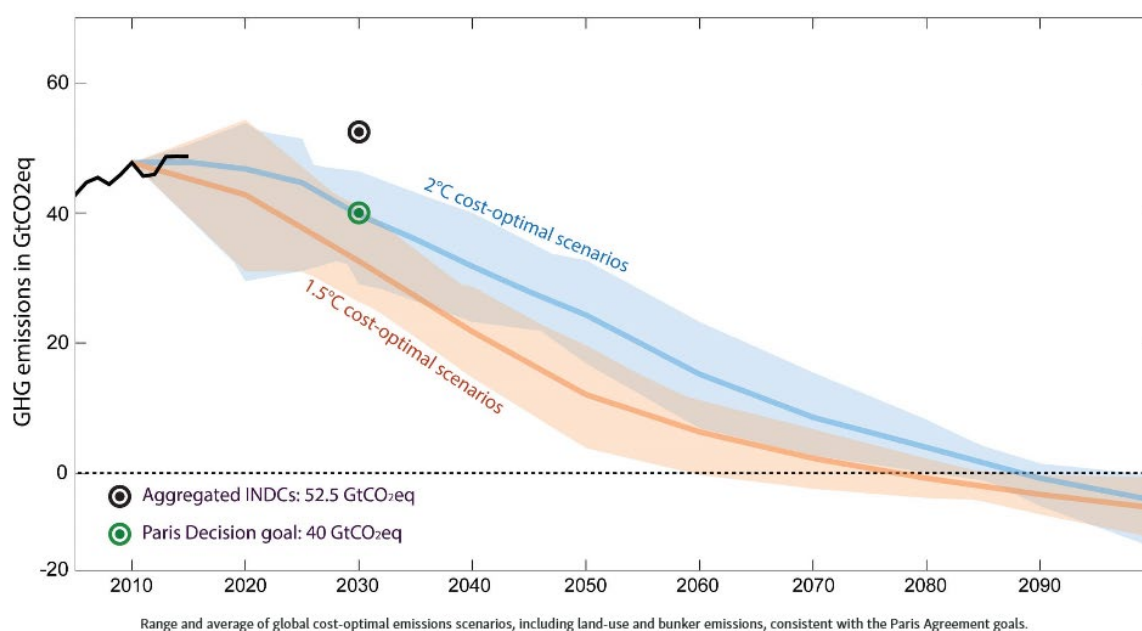
³ The NECP high oil price and NECP low oil price scenarios are called NECP 2 and 4 respectively in the draft NECP.

2. Climate change context

Climate change is now recognised as the biggest threat to life on earth, and it is now urgent that we take immediate action to reduce anthropogenic emissions of greenhouse gases to limit its damaging effects. In September 2018 the G7 noted that *“Today the effects of climate change are no longer a distant threat – they are real and present”*.⁴ Four of the hottest years on record occurred post-2010.⁵ At the United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP) 24, held in December 2018, it was highlighted that *“there is no doubt about the urgency of the situation, and the priority that tackling climate change needs to have for the international community”*, that *“the reality is proving to be worse than scientists had foreseen”* and *“climate change is running faster than we are”*.⁶

Climate change is the result of increasing global average temperatures, commonly referred to as global warming. Increasing concentrations of greenhouse gases in the atmosphere from anthropogenic activities are the main cause of global warming above pre-industrial levels. The most recent coordinated global effort to limit the impact of climate change is set out by the legally binding *Paris Agreement*, which aims to limit global warming to well below 2°C above pre-industrial levels and states that there should be net zero emissions globally by the second half of the century.^{7,8} The (not legally binding) global ambition is to limit the global warming increase to 1.5 °C, since this would substantially reduce the risks and effects of climate change. Ireland contributes to the mitigation aspects of the *Paris Agreement* via the Nationally Determined Contributions (NDCs) tabled by the European Union on behalf of Member States, which commits to a 40% reduction in EU-wide emissions by 2030 compared to 1990.⁹

Figure 2: NDCs short-term estimates and long-term greenhouse gas emissions targets



Source: *Paris-equity-check.org – A multidimensional equity and warming assessments of national climate pledges (Robiou du Pont et al., 2017)*.

⁴ G7 (Group of 7, namely; Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States), public engagement paper – Working together on climate change, oceans and clean energy.

⁵ State of the Climate: Global Climate Report for August 2018. NOAA, 2018.

⁶ UN Secretary-General António Guterres speech at the World Economic Forum. UNFCCC, 2019.

⁷ Adopted by 195 Parties to the UNFCCC in December 2015 and ratified by the European Union (EU) and Irish Government, triggering entry into force on 4 November 2016.

⁸ Paris Agreement. UNFCCC, 2015.

⁹ Intended Nationally Determined Contribution of the EU and its Member States. EU, 2015.

As shown in *Figure 2*, current aggregated Intended Nationally Determined Contributions (INDCs) are insufficient for the achievement of *Paris Agreement* goals.¹⁰ This points to the need for immediate and wider-ranging international action on climate change.

The role of sustainable energy in tackling the climate change challenge is significant. As noted by the G7 *“Responding to these threats requires a global transition from the energy that has powered our societies for generations to clean, renewable sources”*. The EU is pursuing its climate targets through a combination of financial support and regulation. Key targets are set out in the *2020 and 2030 climate and energy packages*.¹¹

This report highlights the direction of travel on energy-related emissions in Ireland. The insights are based on projections of energy supply and demand and an assessment of the impact of current and planned energy efficiency and renewable energy policies and measures on future energy and emissions trends.

¹⁰ Prior to the Paris Agreement countries submitted Intended Nationally Determined Contributions (INDCs), since the December 2015 agreement these are now referred to as Nationally Determined Contributions (NDCs)

¹¹ The 2020 Clean Energy Package details are available from: https://ec.europa.eu/clima/policies/strategies/2020_en. The 2030 Clean Energy Package details are available from; https://ec.europa.eu/clima/policies/strategies/2030_en

3. SEAI national energy projections modelling process

Under the *Sustainable Energy Act 2002*, SEAI has a statutory role in compiling and disseminating national projections of energy production and use. SEAI has published energy demand and supply projections for the Republic of Ireland since 2006 in collaboration with the Economic and Social Research Institute. These projections are used to inform the debate on future energy trends and to assist the government in taking corrective measures. The Environmental Protection Agency combines the results of the SEAI energy projections with agricultural and waste sector emissions for the basis of its annual greenhouse gas emissions projections.

The energy projections produced by SEAI are underpinned by an understanding of recent relationships between energy use, economic growth, energy prices, and energy policies. These relationships provide the basis for projecting how energy use may develop into the future, following changes in fossil fuel prices, economic growth and energy policy. The SEAI National Energy Modelling Framework is designed to accommodate policy granularity, enabling explicit modelling of the impact of the incentives and opportunities created by specific policy instruments. Furthermore, the detailed and well-grounded simulation of consumer decision making in the modelling process leverages the unique experience, data and insights that SEAI has in policy delivery.

Under the most recent EU *Energy and Climate Package* governance, energy and emissions reporting are being consolidated into annual NECPs. With the support of SEAI, a draft NECP was published by the Department of Communications, Climate Action and Environment (DCCAE) in December 2018 and a finalised plan is due for submission in December 2019. SEAI annual National Energy Projections will inform the projections presented in that plan.

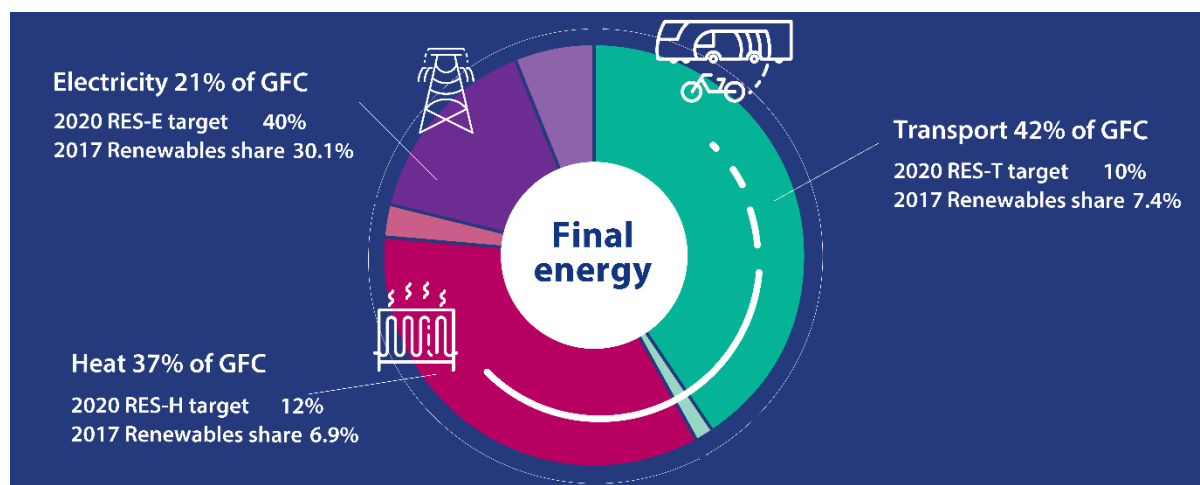
3.1. Energy and emissions targets

The European 2020 renewable and energy efficiency targets were agreed in 2007, at a time of strong economic growth for Ireland, in a high global oil price environment with associated concerns around peak oil. Ireland has binding targets of 16% of gross final energy use and 10% of energy use in the transport sector from renewable sources by 2020.¹² To achieve Ireland's overall renewable energy target, national sub-targets were also set in the end-use sectors of heat (RES-H = 12%) and electricity (RES-E = 40%), as presented in *Figure 3* The pathways to achieving these targets was originally set out in the *National Renewable Energy Action Plan*.¹³

¹² A mandatory target agreed under the EU Renewable Energy Directive 2009/28/EC.

¹³ National Renewable Energy Action Plan, Ireland. Submitted to the European Commission under Article 4 of Directive 2009/28/EC. Department of Communications, Energy and Natural Resources, 2010.

Figure 3: Energy demand by mode with shares of renewables and 2020 targets



Source: SEAI, 2018a.

The *Draft National Energy and Climate Plan*, published in December 2018, established 2030 levels of achievement at the national level on renewable energy of at least 24%, as well as an energy efficiency improvement of approximately 25%.¹⁴ A finalised NECP plan must be submitted to the EU by December 2019. The levels of ambition included in the draft NECP will be increased in the final report to reflect the recent acceleration in national ambitions and new policies and measures.

Renewable energy targets are based on a percentage of end-use demand.¹⁵ Energy end-use demand can be broadly categorised into three distinct modes of energy use, namely electricity, transport and heat. There are renewable energy targets for each mode of energy use, as well as an overarching renewable energy target. There are also distinct energy efficiency and greenhouse gas emissions targets.

Energy efficiency can influence the total energy demand, thus changing the absolute amount of renewable energy to achieve a given target share of renewable energy. For target achievement it is necessary to progress the renewable energy shares and energy efficiency as much as possible in all energy modes.

For improved energy efficiency, a target has been set to reduce energy demand by 20% of the historic average energy use during the period 2000–2005 through energy-efficiency measures by 2020. The current suite of measures is described in detail in Ireland's *National Energy Efficiency Action Plan* and annual reports.¹⁶ The overall EU energy-efficiency 2030 target is to achieve a 32.5% improvement on average historic energy use around the year 2005. Ireland's stated ambition is a contribution of a 25% improvement in energy efficiency relative to 2001–2005 levels by 2030, or 39,377 GWh of savings. This level of ambition will be reviewed prior to the finalisation of Ireland's NECP.

Greenhouse gas emissions are long-lived, and their impact on global warming is usually measured in hundreds of years. Thus, the main concerns for global warming are cumulative emissions and the atmospheric concentrations of greenhouse gases. To mitigate climate change, atmospheric greenhouse gas concentrations from anthropogenic activities must be reduced, and early actions are an imperative given the cumulative nature of emissions.

¹⁴ Draft National Energy and Climate Plan. Department of Communications, Energy and Natural Resources (DCCAE), 2018a.

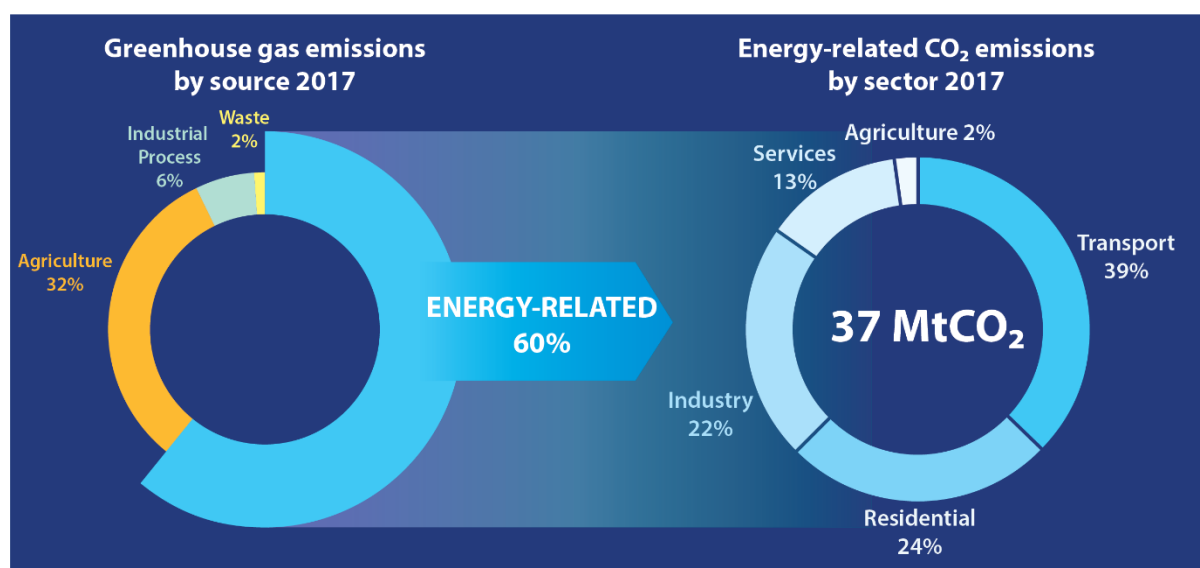
¹⁵ Gross final consumption (GFC) comprising all sector energy use and all electricity generated.

¹⁶ National Energy Efficiency Action Plan for Ireland #4 (2017–2020). DCCAE, 2017.

Of Ireland's total greenhouse gas emissions, currently approximately two-thirds (63% in 2017) are energy related, as can be seen in *Figure 4*. The remaining 37% are non-energy-related emissions from the agricultural and waste sectors. Projections for non-energy-related emissions combined with those from energy use in Ireland are reported by the Environmental Protection Agency in their annual *National Emissions Projections*.¹⁷

Of the total energy-related emissions, the majority (56% in 2017) are from the non-Emissions Trading System (ETS) sector (which covers transport, residential and low energy intensive commercial energy users), with the rest (44%) coming from the EU ETS sector, which incorporates electricity generation, energy-intensive industries and aviation.

Figure 4: Greenhouse gas emissions by sector in 2017



Source: EPA, 2018.

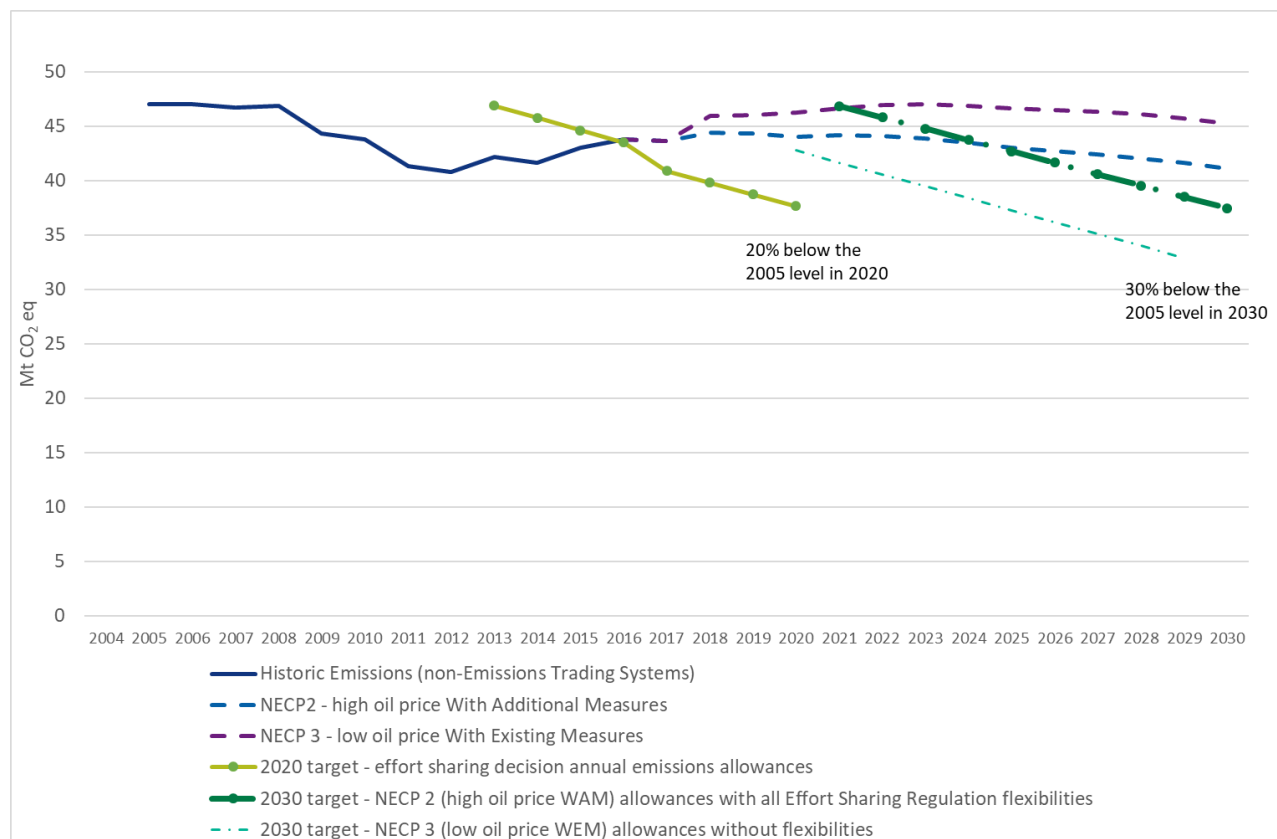
Ireland must achieve a 20% reduction on 2005 levels across all non-ETS emissions by 2020 under the EU *Effort Sharing Decision (Decision No 406/2009/EC)*. A revised *Effort Sharing Regulation (2018/841/EU)* was adopted in May 2018 determining that non-ETS sectors must reduce emissions by 30% by 2030 compared to 2005. Importantly, the regulation includes binding annual greenhouse gas emission reductions by Member States from 2021 to 2030, thus resulting in a carbon budget for the non-ETS sectors to 2030. Existing flexibilities under the 2009 *Effort Sharing Decision* (for example, banking, borrowing and buying and selling between Member States) are retained and two new flexibilities added (the use of ETS allowances and credit from action undertaken in the Land Use, Land Use Change and Forestry sector) to allow for a fair and cost-efficient achievement of the targets.

For non-ETS emissions targets, non-energy related agriculture and waste disposal emissions are included.¹⁸ The non-ETS sector targets, binding annual limits and projected greenhouse gas emissions are shown in *Figure 5*. Agriculture and transport dominate non-ETS sector emissions accounting for an estimated 75% of emissions in 2020 and 2030 with current policies and measures. Reducing emissions in these sectors is clearly critical to achieving Ireland's short and long-term emission reduction targets.

¹⁷ National Emissions Projections. EPA, 2018.

¹⁸ Agriculture sector emissions arise from enteric fermentation, manure management and nitrogen and urea application to soils. Fuel combustion from agriculture/forestry/fishing is included within the definition of the agriculture category. The data underpinning the agriculture projections include projected animal numbers, crop areas and nitrogen fertiliser application to soils as supplied by Teagasc to the Environmental Protection Agency in April 2018. Projections are based on an updated analysis undertaken by Teagasc of the projected national herd population, crop areas and fertilizer use, which takes into account Food Wise 2025 policy targets and reflects recent trends in agricultural production.

Figure 5: Ireland non-ETS emissions (historical and projected) including non-energy related agriculture and wastes emissions



Source: supplied by EPA for the Draft National Energy and Climate Plan (DCCAE, 2018a).

Note: The 2021 to 2030 annual emissions allocations are affected by the start point which will be based on an average of 2016 to 2018 emissions. As these emissions aren't settled yet, estimation of the allowances depends on which projection scenario is chosen.

In this graph both the high oil price scenario with additional policy measures (NECP2 - with annualised flexibilities associated with full exploitation of the Emissions Trading Scheme and land use and land use change and forestry sector flexibilities detailed in the Effort Sharing Regulation) and the low oil price scenario with existing policy measures only scenario (NECP3 without flexibilities) are used to highlight the range of possibilities.

4. Sector focus: transport

The transport sector is currently the largest energy-using sector and is the sector most reliant on imported fossil fuels in the form of petroleum products and biofuels. Personal transport energy demand dominates and is heavily influenced by consumer preferences, while freight and aviation transport energy demand is strongly influenced by the level of commercial activity in the economy.

Currently, all transport fuel contains on average around 4.1% (by energy content) biofuel blended with fossil-based petrol or diesel. Biofuel uptake in Ireland is driven primarily through the Biofuel Obligation Scheme, an obligation on fuel suppliers to blend an increasing percentage of biofuel with their fuel. The scheme was first introduced in 2010, and with multiple increases to the blend rate it has been very successful in increasing the share of renewable energy use in transport. This supply side measure has the advantage of not requiring engagement with individual consumers. A statutory instrument for an increase in the biofuel blend to 12.359% by volume in January 2020 has been published.

However, there is a risk that increased demand for biofuels, especially those derived from food and feed crop feed stocks could ultimately lead to a phenomenon known as 'indirect land use change. To address concerns about this, the European Commission published a directive in September 2015, containing amendments to the *Renewable Energy Directive 2009/28/EU*. All biofuels supplied in Ireland are required under *Directive 2015/1513/EU* to deliver at least 60% greenhouse gas savings relative to fossil fuel alternatives.

Further, a limiting factor in biofuels blending is the so-called 'blend wall', which is a lack of compatibility with existing vehicle designs and current fuel distribution infrastructures. Current restrictions are 10% (by volume) level for ethanol in gasoline, and 7% (by volume for Fatty Acid Methyl Ester biodiesel) in diesel. It is possible to derive fuels from renewable sources that are chemically identical to diesel, so-called "drop-in fuels" such as hydrotreated vegetable oil. This could facilitate deeper levels of renewables in transport in the medium term.

The *National Policy Framework Alternative Fuels Infrastructure for Transport in Ireland* aims to support a transition away from fossil fuels over the next two decades, moving predominantly to electricity for passenger cars, commuter rail and taxis by 2030.¹⁹ Biofuels will continue to play a key role over the coming years, along with some electrification, as can be seen in *Figure 6*. Natural gas will provide an interim alternative solution for larger vehicles (freight and buses), where significant reductions in carbon dioxide (CO₂) could be expected from integrating biomethane with compressed natural gas and liquified natural gas. Liquified natural gas and methanol are likely to increase their penetration as fuels in the shipping sector. Hydrogen is not expected to deliver mass-market uptake over this term as the costs of the refuelling infrastructure and associated vehicles are likely to remain prohibitive until the middle of the next decade.

Electric vehicles, despite their high efficiency, will only make a relatively small contribution to the overall RES-T 2020 target. Nonetheless, they play an important role in the diversification and decarbonisation of the transport fleet as well as improving air quality and noise reduction in urban areas. There has been a notable acceleration in the number of models of electric vehicles available in Ireland in 2018 and 2019, and a strong increase in consumer demand. The *National Development Plan 2018–2027* stated Irish Government policy of no new non-zero emission vehicles to be sold in Ireland post 2030 and no National Car Test (NCT) Cert will be issued for non-zero emission cars post 2045.²⁰

Supporting low carbon technologies and greater uptake of alternative fuels will be but one element of decarbonising transport. The mitigation measures in transport will need to be wide-ranging, with a focus on complementary policymaking, smarter travel and modal shift initiatives (including significant efforts to encourage cycling, walking and public transport use), coupled with fiscal and taxation incentives to target behavioural change.

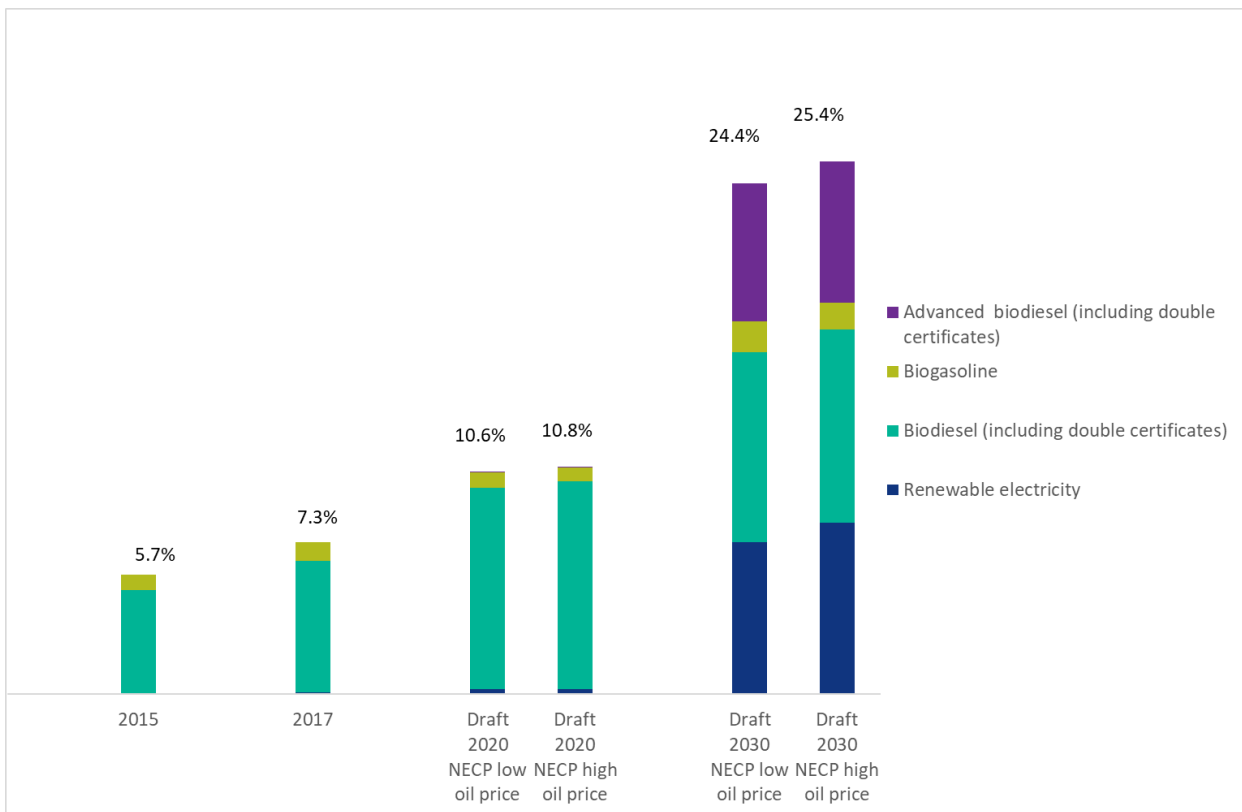
¹⁹ National Policy Framework Alternative Fuels Infrastructure for Transport in Ireland. Department of Transport, Tourism and Sport, 2017.

²⁰ National Development Plan 2018–2027. Irish Government, 2018.

Additional policy actions that could help to close the gap to the renewable transport target include:

- Health campaigns that target a shift in personal transport mode. For example encouraging increased daily exercise and linking less energy and emissions to a reduction in local air pollutants and noise.
- Capitalising on advances in ICT and national strengths in this field by developing vehicle sharing (both passenger and vehicle sharing) and further links to public transport.
- A further increase to the Biofuels Obligation Scheme to reach a RES-T of 14% by 2030, and incorporating compliance with more stringent sustainability criteria related to the source of biofuels.

Figure 2: Scenario comparison of progress towards renewable transport targets



5. Sector focus: electricity

Ireland has had considerable success in increasing the share of renewables in electricity generation and there is a need to continue to achieve in this sector to take full advantage of the country's abundant renewable energy resources. Renewable electricity from variable renewable sources such as wind, ocean and solar also reduces the overall quantity of primary fuel input required. Unlike fuels that are combusted to release energy, such renewable sources do not lose energy in the conversion process to final energy.

The *National Development Plan 2018–2027* states that by 2030, peat and coal will no longer have a role in electricity generation in Ireland. The use of peat will be progressively eliminated by 2030 by converting peat power plants to more sustainable low-carbon technologies. Notwithstanding the social and security of supply concerns, swifter decarbonising of the electricity grid could be achieved by removal of peat and coal from electricity generation as soon as possible.

The SEAI *BioHEAT* model has highlighted that significantly less biomass would be available for use in the heat sector if there is co-firing of biomass with peat for electricity generation (for example by large industries shifting from oil to biomass for heat), increasing prices and thus reducing the incentive for business to shift to renewable heat.

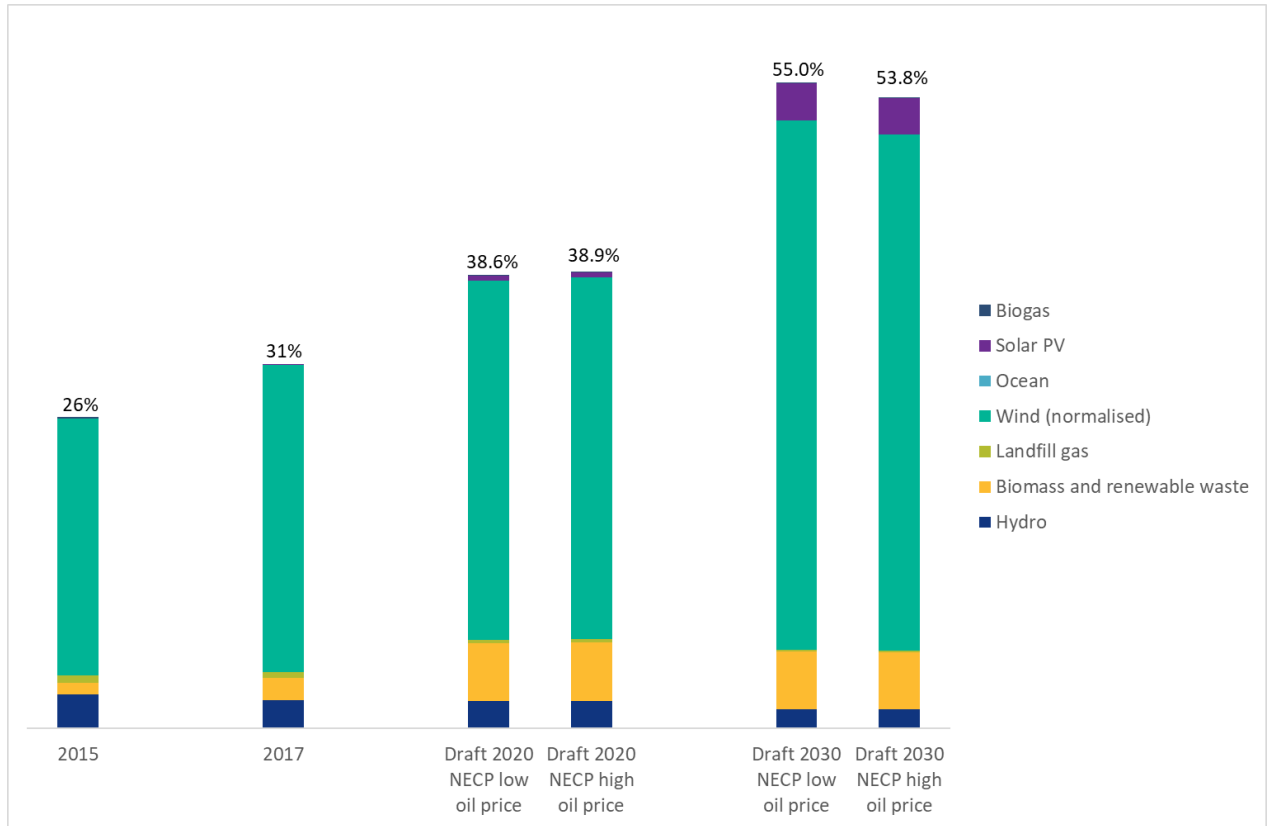
The latest EirGrid *Generation Capacity Statement* predicts very strong electricity demand growth in the short-term (3%–5% per year).²¹ Primarily driven by an expansion of the data centre and large industrial energy users sector, where growth of over 20% per year to 2025 is anticipated in the EirGrid median scenario.

It is evident from *Figure 7* that the significant progress in renewable electricity deployment will need to continue, with an increased deployment rate of all renewable electricity technologies. The Renewable Energy Support scheme aims to increase the deployment rate, support up to 4,500 megawatts of additional renewable electricity by 2030 and diversify the renewable electricity portfolio. In March 2019 the Minister of Communications, Climate Action and Environment committed to raise the amount of electricity generated from renewable sources to 70% by 2030. Policy measures that could help to meet the Government increased ambition include:

- Expediting the adoption of clear, and timebound, licensing and consenting procedures for offshore renewable energy development.
- Addressing technical grid challenges to incorporating very high levels of asynchronous renewables, for example via EirGrid's Delivering a Secure, Sustainable Electricity System (DS3) programme.
- Creating a clear, and timely, grid connection access and concession regime for offshore and new onshore renewable energy development, with due regard for methods by which the State can most cost effectively reduce or manage risk.
- Creating markets for grid services such as energy storage and other services supporting high levels of renewables on-grid.
- Supporting onshore wind farms reaching end of life, by providing clarity for re-powering investment decisions intertwined with new wind guidelines.
- Assisting the timely delivery of increased interconnection.
- Establishing corporate power purchase agreements mechanisms with mandated minimum renewable energy purchases or self-generation for large electricity demand users to leverage private investments in renewable electricity.
- Encouraging prosumers by consideration of communication methods, market mechanisms, market rules, frameworks and setting a price for export to the grid from point source generation, in line with the ambitions outlined in the Clean Energy Package.
- Developing community energy and small-scale renewable generation projects to enable a shift to a more distributed generation system with demand response capabilities.

²¹ Generation capacity statement 2018–2027. EirGrid & SONI, 2018.

Figure 3: Scenario comparison of renewable electricity progress



6. Sector focus: heat

Progress on renewable heat is crucial to meet the overall renewable energy targets. Yet, it is difficult to make progress on renewable energy use in the heat sector due to the diversity of the sector and dispersed actors.²² To meet the carbon reduction ambitions, both heat demand and supply side options will need to be targeted. Demand side options require consumer engagement and decisions. Supply side options require mobilisation of new technologies, supply chains and regulatory or market frameworks.

To date, the most significant contribution towards the renewable heat target has come from the industrial sector, with more modest contributions from the household and services sectors. Industry sub-sectors such as: 'wood and wood products', and 'food and beverage' use production residues as renewable sources of energy. This reflects the low cost of bioenergy by using production by-products for heat in these sectors.

Deployment of modern renewable heat such as efficient biomass boilers and solar thermal systems has been supported by grants in the past. Solar thermal continues to be supported for households through SEAI home energy grants and grants for heat pump technology have recently been introduced.

Since 2011 domestic building regulations have included a minimum threshold requirement for renewable energy supply for new residential buildings that can be met via renewable heat technologies. A similar requirement for buildings other than dwellings was introduced in the 2017 revision to non-domestic building regulations.

The roll out of the Government's support scheme for renewable heat is currently underway.²³ The scheme will focus on heat users in the commercial, industrial, agricultural, district heating, public sector and other non-domestic heat users.²⁴ The scheme is designed to increase the energy generated from sustainable renewable sources in the heat sector by around three percentage points. The support scheme for renewable heat is a hybrid scheme comprising investment aid (grant) for heat pumps and operational aid (ongoing quarterly payments for 15 years) for biomass and anaerobic digester based boilers and combined heat and power units. The scheme is currently open to applications for investment aid for heat pumps, and the operational aid segment is at the advanced planning stage subject to European Commission State Aid approval.

As already mentioned, greater use of biomass in electricity generation could increase prices for certain biomass sources, thus reducing the incentive for business to shift to renewable heat. However, biomass prices relative to fossil fuels and likely carbon tax increases could help to drive the update of renewable heat. This can be seen in *Figure 8*, where there is a stark difference in progress between the low and high oil price scenario renewable heat shares.

The updated *Renewable Energy Directive 2018/2001/EU (RED II)* includes revised and more stringent sustainability criteria. To be sustainable, bioenergy must avoid negative impacts to land, food security, water resources, biodiversity and livelihoods. Further, crucially, it must also save CO₂.²⁵ Ireland is in a position to supply sustainable biomass to the energy sector, but only if suitable sources of biomass are used. A recent SEAI publication considers environmental, economic and social sustainability indicators, as well as the RED II sustainability criteria, to identify possible sustainability risks and assist with developing appropriate policy for supporting bioenergy.²⁶

²² In the context of renewable energy, the terms 'heat energy' and 'thermal energy' are often used interchangeably and they refer to energy used for heating and cooling.

²³ Support Scheme for Renewable Heat. DCCA, 2018b.

²⁴ Not included in the Emissions Trading Scheme.

²⁵ Because the CO₂ released when biomass is combusted for energy had already been absorbed from the atmosphere, overall the net CO₂ impact is neutral. But the growing processing and transportation of biomass fuel can also cause emissions and irresponsible use of biomass fuel can have negative outcomes for emissions.

²⁶ Sustainability Criteria Options and Impacts for Irish Bioenergy Resources. SEAI, 2018b. Available from: <https://www.seai.ie/sustainable-solutions/renewable-energy/bioenergy/sustainability-criteria-o/>

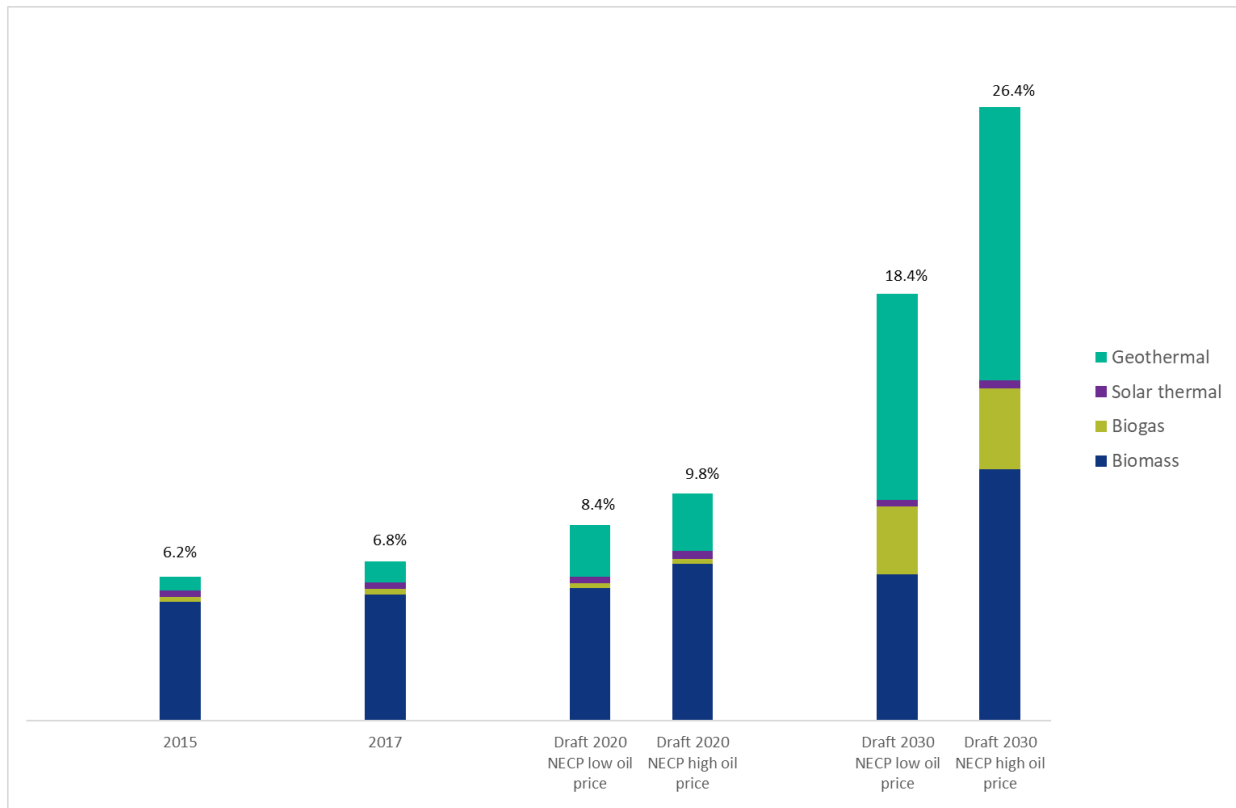
At the end of 2017 the renewable heat share was 6.8%.²⁷ Even with an additional three percentage points increase from the support scheme for renewable heat, renewable heat is likely to fall short of the Government target of 12% by 2020.²⁸ Increased ambition in RES-H is included in RED II Article 23 with a specified target of growth of 1.3% per annum from 2021. Policy actions that could close the gap to the renewable heat targets include those listed below (many have been included in the Government's National Development Plan and will likely be further developed in upcoming plans):

- Establishing district heating networks in urban areas, especially if the source of heat is currently wasted, such as heat from power stations or data centres.
- Establishing appropriate regulatory and policy frameworks that can facilitate the development of heat networks.
- Developing a national strategy for waste heat recovery from industrial processes.
- Targeting supports for changing out oil-fired boilers to heat pumps, along with the provision of roof solar, in at least 170,000 homes.
- Early targeting of local authority and housing agency stock to increase supply chain competency, capacity and confidence in retrofit.
- Considering targeted regulation and incentives to address the 'split incentive' challenge to retrofitting rented property in both the commercial and residential sector.
- Adding more biomass CHP installations deployed with the support of the existing Renewable Energy Feed-In Tariff (REFIT) scheme for biomass CHP.
- Supporting the adoption of renewable heat for process and space heating through the sharing of best practice and provision of mentoring supports to business for the development, assessment and delivery of successful renewable heat projects.
- Establishing a biomass fuel sustainability scheme for Ireland.
- Considering the options to decarbonise the fossil gas grid.
- Exploring the potential for hydrogen substitution and use in the gas grid.

²⁷ Latest available data until the 2018 energy balance is finalised in October 2019.

²⁸ Due to delays in the rollout of the support scheme for renewable heat it is unlikely the full impact of the scheme will contribute to 2020 renewable heat targets. The scheme funding is €5 million for 2019 and at full implementation the annual expenditure is expected to be in the order of €30 million.

Figure 4: Scenario comparison of progress towards renewable heat targets



7. Energy efficiency

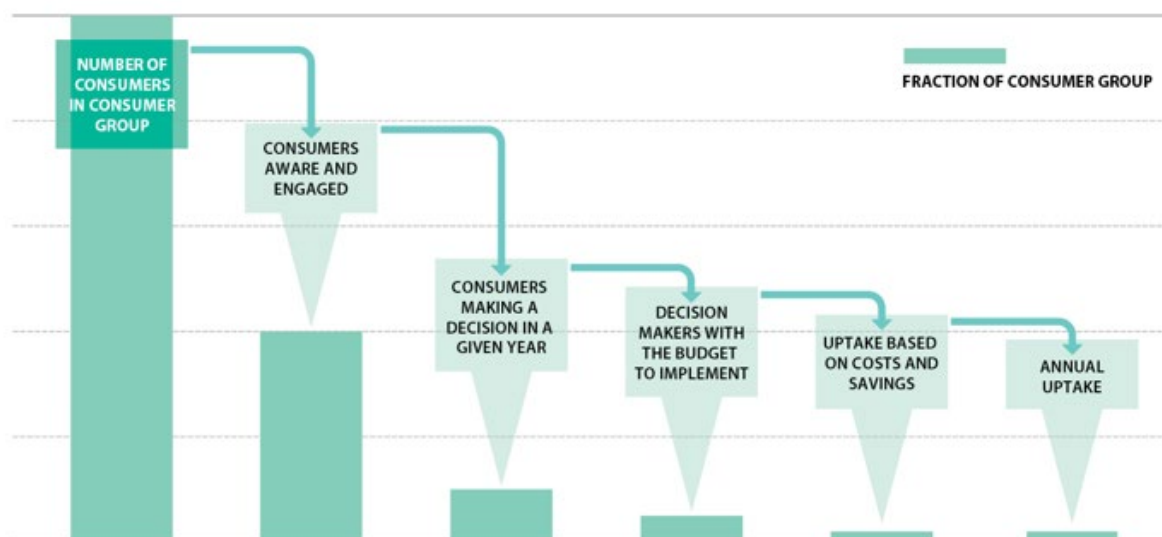
Energy efficiency comprises a myriad of individual measures realised through technological, behavioural or economic changes. Energy efficiency contributes to meeting several energy and climate goals. All three goals of energy policy, namely, energy security, competitiveness and protection of the environment through reduced greenhouse gas emissions can be progressed through energy-efficiency measures.

In addition, less energy demand due to efficiency measures lowers the effort required to achieve the renewable energy targets (for example, a reduced number of installed wind turbines or biomass boilers would be required). There are economic and social benefits of energy efficiency, including direct savings, lower fuel costs, more controlled investment in supply, and there is increasing evidence for improved health and well-being.²⁹

An energy efficiency improvement of 16% relative to the 2001–2005 baseline is anticipated by 2020 in the latest projections, falling short of the 20% target for 2020.³⁰ Delayed action on energy efficiency ends up locking in inefficiencies that mean much stronger action needs to be taken in the future.³¹ Therefore an intensification of efforts and additional investment are required.

However, like the heat sector, due to the disparate nature of the actors required to improve energy efficiency, there are challenges around achieving progress. Furthermore, consumer behaviour, preferences and financial constraints or priorities lead to significant barriers curtailing investment in energy efficiency, as presented in *Figure 9*. However, consumer uptake can be improved through measures such as regulation, information campaigns, promoting energy efficiency services and energy audits. In addition, financial support, loans, energy performance contracts and tax incentives could further boost uptake.

Figure 5: Barriers to consumer uptake



Source: Clancy et al., 2018.

²⁹ Capturing the multiple benefits of energy efficiency. IEA (International Energy Agency), 2015.

³⁰ Including both supply and demand side savings.

³¹ Energy Efficiency Market Report. IEA, 2018.

It is known that the full spectrum of policy packages to improve energy efficiency has not been implemented yet in Ireland.³² There is also room to expand the energy-efficiency policy coverage, especially beyond the heat sector, where the majority of energy-efficiency related policy measures have been implemented to date. A range of immediate policy actions that would lead to increase energy-efficiency improvements include:

- Provision of energy finance through zero- or low-interest loans for energy-efficiency investments by householders and businesses.
- Incorporating behaviourally informed interventions into the design of policy measures.³³
- Consideration of employee incentive, pay-as-you-save and taxation incentivisation methods as alternative means of catalysing retrofit activity.
- Facilitating an effective energy service company market in Ireland.
- Establishing minimum energy standards for commercial property leasing.
- Regulation to ensure the adoption of cost-effective efficient technologies (cost optimal) or mandate near-zero energy buildings.
- Roll-out of enforcement of regulations for energy performance.
- Evaluating and redesigning grants and financial supports for SMEs, specifically considering cash-flow needs and behaviours in the sector.
- Providing households and businesses with free or low-cost independent energy audits.

³² Unlocking the Energy Efficiency Opportunity. SEAI, 2015.

³³ Changing Energy Behaviour – What Works. SEAI, 2018b.

8. Greenhouse gas emissions

There are two separate approaches used to promote emissions reductions at EU level. A ‘cap and trade’ system for GHG trading within Europe (2003/87/EC), also referred to as the Emissions Trading Scheme, was established in 2005. Installations covered by the scheme include electricity-generating power stations, large-scale industrial plants and the aviation sector.

For sectors outside the scheme, the EU *Effort Sharing Decision* establishes a binding greenhouse gas emissions target for all EU Member States relative to a 2005 baseline.³⁴ Ireland’s target for 2020 is for a 20% reduction in non-ETS emissions compared to 2005. Latest trends estimated by the EPA indicate Ireland’s non-ETS emissions are projected to be 1% below 2005 levels in 2020 under the With Additional Measures (WAM) scenarios.

There are also binding annual emissions limits for the period 2013–2020 to ensure a gradual move towards the 2020 target, as presented in *Figure 4*. The cumulative exceedances of those annual emissions allocations are detailed in *Table 1*. Under the current *Effort Sharing Decision* there is the flexibility to bank annual savings below the annual emissions limits, or borrow, buy and sell emissions credits between Member States.

For 2030, Ireland’s target has been set at 30% below 2005 levels of non-ETS emissions. For 2030, non-ETS emissions are projected to be marginally worse than 2020 at 0.5% below 2005 levels for the WAM scenarios.³⁵ The *Effort Sharing Regulation 2018/842/EU* to 2030 maintains existing effort-sharing flexibilities and provides two new flexibilities (use of ETS allowances and credit from action undertaken in the Land Use, Land Use Change and Forestry sector) to allow for a fair and cost-efficient achievement of the targets. The cumulative exceedances of 2021–2030 annual emissions allocations in 2030, allowing for maximum flexibilities, is expected to be 7 MtCO₂ in the WAM high oil price scenario and 40 MtCO₂ in the WAM low oil price scenario (also included in *Table 1*).

Table 1: Cumulative non-ETS emissions EU *Effort Sharing Decision* targets

	NECP1 With Existing Measures (WEM) (High oil price)	NECP2 With Additional Measures (WAM) (High oil price)	NECP3 With Existing Measures (WEM) (Low oil price)	NECP4 With Additional Measures (WAM) (Low oil price)
2020	10.4	9.2	15.8	14.7
2030	22.0	7.0	55.8	40.1

Source: supplied by EPA for the Draft National Energy and Climate Plan (DCCAE, 2018a).

Note: Scenario descriptions provided in the appendix.

Current projections for the agricultural sector suggest there will not be a reduction in greenhouse gas emissions from that sector (EPA, 2018). This leads to very challenging trajectories for the non-ETS energy sectors. Patently an immediate acceleration of emissions reductions is required to put Ireland on the long-term trajectory of emissions reductions required.

³⁴ The non-ETS sector covers energy-related emissions in the residential, transport, agriculture and waste sectors, as well as small businesses/industry. It also comprises non-energy-related agriculture and waste disposal emissions.

³⁵ The With Additional Measures scenario includes all implemented and adopted policies as well as planned policies that have financial support or are under discussion and have a realistic chance of being adopted and implemented in future.

9. Closing the gaps to targets

The existing package of policies and measures is being further developed by Government in order to close the gap to achievement of energy and emissions reductions targets for 2030. Given the cumulative nature of emissions, an immediate acceleration of emissions reductions is required to put Ireland on the committed long-term trajectory. This includes meeting Ireland's commitment to the *Paris Agreement* on climate change and an aggregate reduction of at least 80% CO₂ emissions (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors. Increased ambition and delivery targets supporting a sustainable energy transition are anticipated to be included in the upcoming *All of Government Climate Action Plan* being produced by DCCA.

Achieving the level of ambition set for 2020 and 2030 will be dependent on:

- Increased deployment rates of sustainable energy technologies and practices across the entire economy.
- The development of a national training and skills strategy to support growth of the clean energy technology sector.
- Support for changes in business models, nascent clean energy technology supply chains and the addressing of existing market failures.
- Early resolution of planning and regulatory barriers, including continued public engagement, and the development of appropriate market structures – especially for electrification of heat and transport supported with high levels of renewable electricity.
- Significant mobilisation of private investment in renewable energy and energy efficiency – additional spend on efficiency is known to achieve multiple benefits including warmer, healthier and more cost effective buildings.
- The acceleration of innovation and technology adoption, especially in the area of electricity demand response, grid flexibility and storage.
- The exploitation of advances in ICT and national strengths in this field to advance renewables and energy efficiency, particularly in relation to passenger mobility solutions.
- Aggressively adopting the 'avoid, shift and improve' transport energy policy principles – this involves managing mobility demand to avoid trips or a shift to the most efficient modes, plus improving the energy efficiency of vehicles as well as reducing the carbon intensity of fuels.
- Taking in the ethical cost of carbon consideration in all aspects of public and private enterprise planning, involving the enforcement of the polluter pays principle by including the negative external costs associated with emissions such as healthcare or environmental reparation costs.
- An approach to carbon neutrality in the agriculture and land-use sector, including forestry, that does not compromise capacity for sustainable food production.
- The promotion of an environmentally aware and concerned citizen and community ideology to combat climate change, including recognition of the impact of diet and consumerism on climate change.

9.1. Summary of progress towards targets

Table 2: Scenario progress towards 2020 targets

	2018 Provisional Progress estimates	NECP1 <i>With Existing Measures (WEM) (High oil price)</i>	NECP2 <i>With Additional Measures (WAM) (High oil price)</i>	Shares adjusted scenario**	NECP3 <i>With Existing Measures (WEM) (Low oil price)</i>	NECP4 <i>With Additional Measures (WAM) (Low oil price)</i>
	2020	2020		2020	2020	
Energy Efficiency* %	12.1	13.6	14.2		13.7	14.4
RES-E %	33	38.5	38.9		38.2	38.6
RES-H %	6.8	8.8	9.8		8.0	8.4
RES-T % (regulation)	4.1 (7.1)	4.1 (7.7)	5.6 (10.8)		4.1 (7.5)	5.6 (10.6)
Overall RES %	11.3	13.3	14.3	12.7	12.3	13.2
Total GHG Emissions Mt CO2eq		61.6	60.6		64.2	63.3
ETS		17.0	16.6		17.3	17.1
Non-ETS		44.6	44.0		46.8	46.2

Note: Scenario descriptions provided in the appendix.

* The energy efficiency progress includes demand-side savings only. Supply side savings accounted for separately, and when included an energy efficiency improvement of 16% on a 2001 -2005 baseline by 2020 is anticipated, as per the fourth National Energy Efficiency Action Plan.

**The shares adjusted scenario assumes the 2020 renewable energy shares from NECP 2 but maintains the sectoral shares of demand across heat, transport and electricity in the short term to reflect the historic trend. It is informed by 2018 provisional energy balance data. An inherent assumption is demand growth greater than the high oil price scenarios but less than the low oil price scenarios.

Table 3: Scenario progress towards 2030 targets

	NECP1 <i>With Existing Measures (WEM)</i> (High oil price)	NECP2 <i>With Additional Measures (WAM)</i> (High oil price)	NECP3 <i>With Existing Measures (WEM)</i> (Low oil price)	NECP4 <i>With Additional Measures (WAM)</i> (Low oil price)
	2030	2030	2030	2030
Energy Efficiency %	18.7	24.7	18.9	25.1
RES-E %	41.2	53.8	39.6	55.0
RES-H %	19.2	26.4	12.9	18.4
RES-T % <i>(regulation)</i>	4.0 (10.4)	9.3 (25.4)	4.0 (9.7)	9.3 (24.4)
<i>Overall RES %</i>	19.2	28.0	15.8	23.7
Total GHG Emissions Mt CO ₂ eq	64.6	55.2	66.8	59.7
<i>ETS</i>	20.6	14.1	18.4	14.4
<i>Non-ETS</i>	44.0	41.1	48.4	45.3

Note: Scenario descriptions provided in the appendix.

Appendix: scenario policy assumptions

Two policy scenarios were modelled (each run using both high and low fossil fuel price projections):

- **With Existing Measures (NECP1 & NECP3);** policies implemented and adopted by the end of the latest inventory year, that is 31 December 2017.
- **With Additional Measures (NECP2 & NECP4);** implemented and adopted policies as well as planned policies.

	NECP1 <i>With Existing Measures (WEM)</i> (High oil price)	NECP2 <i>With Additional Measures (WAM)</i> (High oil price)	NECP3 <i>With Existing Measures (WEM)</i> (Low oil price)	NECP4 <i>With Additional Measures (WAM)</i> (Low oil price)
Prices	EU <i>Energy Reference Scenario</i> (2016) Prices (constant 2013 values).	EU <i>Energy Reference Scenario</i> (2016) Prices (constant 2013 values).	BEIS 2017 low fossil fuel prices.	BEIS 2017 low fossil fuel prices.
Policies and measures (PAMs)	Includes policies in place prior to the end of 2017.	Includes anticipated impact of all <i>NDP</i> announced and active or additional PAMs.	Includes policies in place prior to the end of 2017.	Includes anticipated impact of all <i>NDP</i> announced and active or additional PAMs.
Biofuel blend assumptions	Statutory target remains at current level of 8.696% (commonly referred to as 8% by volume: 8%/92% = 8.696%) until 2030. Advanced biofuel target and food-based constraint assumed to be met.	Statutory target at 11.111% from 1 January 2019 and 12.360% from 1 January 2020. Blending levels to reach E10 and B12 by 2030 with statutory blend increasing incrementally. The increases shall be in line with the overall RES trajectory set out in the Governance Regulation. The starting level for the purposes of calculating the trajectory is assumed to be the level achieved in 2020 under the 'WEM' scenario and the 2030 level is assumed based on achieving E10 and B12.	Statutory target remains at current level of 8.696% (commonly referred to as 8% by volume – 8%/92% = 8.696%) until 2030. Advanced biofuel target and food-based constraint assumed to be met.	Statutory target at 11.111% from 1 January 2019 and 12.360% from 1 January 2020. Blending levels to reach E10 and B12 by 2030 with statutory blend increasing incrementally. The increases shall be in line with the overall RES trajectory set out in the Governance Regulation. The starting level for the purposes of calculating the trajectory is assumed to be the level achieved in 2020 under the 'WEM' scenario and the 2030 level is assumed based on achieving E10 and B12.
Low carbon heating assumptions	Support scheme for renewable heat based on one-year funding. Heat pumps in new domestic and commercial buildings driven by building regulations.	Support scheme for renewable heat based on five years of funding to achieve 1.6TWh RES-H; biomethane injection of 1.6TWh by 2030 achieved by incentive and/or obligation; additional district heating of 0.12TWh growing linearly from 2023 to 2028.	Support scheme for renewable heat based on one-year funding. Heat pumps in new domestic and commercial buildings driven by building regulations.	Support scheme for renewable heat based on five years of funding to achieve 1.6TWh RES-H; biomethane injection of 1.6TWh by 2030 achieved by incentive and/or obligation; additional district heating of 0.12TWh growing linearly from 2023 to 2028.

		Heat pumps in new domestic and commercial buildings driven by building regulations; 170,000 heat pumps in existing residential buildings.		Heat pumps in new domestic and commercial buildings driven by building regulations 170,000 heat pumps in existing residential buildings.
Electricity generation	<ul style="list-style-type: none"> • Lough Ree and West Offaly stations to co-fire with biomass after the PSO for those stations expires at the end of 2019. • Moneypoint to close at the end of 2030. • Wind increases at 140MW per annum. • Offshore wind is introduced from 2028. • Solar PV growth similar to EirGrid GCS. • SNSP at 65% throughout. • 40% RES-E achieved in 2030 and maintained. 	<ul style="list-style-type: none"> • Lough Ree and West Offaly stations to co-fire with biomass after the PSO for those stations expires at the end of 2019, at a higher rate than for the baseline. • Moneypoint to close at the end of 2025. • Wind grows on a linear trajectory • Offshore wind is introduced from 2023. • Solar PV grows to 1.5GW installed capacity by 2030. • SNSP increases from 65% to 75% in from 2026. • 5MW ocean energy demonstration projects from 2023. • Additional interconnection added in 2025 and 2026. • ~55% RES-E achieved in 2030 and maintained. 	<ul style="list-style-type: none"> • Lough Ree and West Offaly stations to co-fire with biomass after the PSO for those stations expires at the end of 2019. • Moneypoint to close at the end of 2030. • Wind increases at 140MW per annum. • Offshore wind is introduced from 2028. • Solar PV growth similar to EirGrid GCS. • SNSP at 65% throughout. • 40% RES-E achieved in 2030 and maintained. 	<ul style="list-style-type: none"> • Lough Ree and West Offaly stations to co-fire with biomass after the PSO for those stations expires at the end of 2019, at a higher rate than for the baseline. • Moneypoint to close at the end of 2025. • Wind grows on a linear trajectory. • Offshore wind is introduced from 2023. • Solar PV grows to 1.5GW installed capacity by 2030. • SNSP increases from 65% to 75% in from 2026. • 5MW ocean energy demonstration projects from 2023. • Additional interconnection added in 2025 and 2026. • ~55% RES-E achieved in 2030 and maintained.
Electric vehicles	~250,000 electric vehicles on the road by 2030 (¾ BEV, ¼ PHEV).	~500,000 electric vehicles on the road by 2030 (¾ BEV, ¼ PHEV). No new non-zero emissions vehicles sold post-2030.	~250,000 electric vehicles on the road by 2030 (¾ BEV, ¼ PHEV).	~500,000 electric vehicles on the road by 2030 (¾ BEV, ¼ PHEV). No new non-zero emissions vehicles sold post-2030.
Energy Efficiency (NB: Includes demand-side savings only. Supply side savings accounted for separately.)	Most national energy efficiency programmes assumed to continue delivering their 2017 achieved level of savings until the end of 2021. No further activity under these schemes assumed from 2022 onwards. Achieved 2017 savings under EEOS are assumed to be maintained until 2030. No further savings after that.	Most national energy efficiency programmes assumed to continue delivering their 2017 achieved level of savings across the entire forecast horizon. Achieved 2017 savings under EEOS are assumed to be maintained until 2030. No further savings after that.	Most national energy efficiency programmes assumed to continue delivering their 2017 achieved level of savings until the end of 2021. No further activity under these schemes assumed from 2022 onwards. Achieved 2017 savings under EEOS are assumed to be maintained until 2030. No further savings after that.	Most national energy efficiency programmes assumed to continue delivering their 2017 achieved level of savings across the entire forecast horizon. Achieved 2017 savings under EEOS are assumed to be maintained until 2030. No further savings after that.

	Impact of the 2019 domestic building regulations and 2018 non-domestic building regulations included over entire forecast horizon.	Impact of the 2019 domestic building regulations and 2018 non-domestic building regulations included over entire forecast horizon.	Impact of the 2019 domestic building regulations and 2018 non-domestic building regulations included over entire forecast horizon.	Impact of the 2019 domestic building regulations and 2018 non-domestic building regulations included over entire forecast horizon.
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