CLIMATE CHANGE ADVISORY COUNCIL

# Annual Review 2018


# Annual Review 2018

July 2018

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Climate Change Advisory Council
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## Climate Change Advisory Council

The Climate Change Advisory Council is an independent advisory body tasked with assessing and advising on how Ireland can achieve the transition to a low-carbon, climate-resilient and environmentally sustainable economy.

The Climate Change Advisory Council was established on 18 January 2016 under the Climate Action and Low Carbon Development Act 2015.

**Climate Change Advisory Council Members:**

Prof. John FitzGerald (Chair)
Prof. Alan Barrett (ESRI)
Prof. Gerry Boyle (Teagasc)
Laura Burke (EPA)
Prof. Peter Clinch
Prof. Frank Convery
Joseph Curtin
Prof. Anna Davies
Prof. Ottmar Edenhofer
Jim Gannon (SEAI)
Prof. Alan Matthews

## Climate Change Advisory Council – Adaptation Committee

At its meeting on 6 April 2016, the Climate Change Advisory Council established an Adaptation Committee to consider matters relating to climate change adaptation.

**Adaptation Committee Members:**

Prof. John FitzGerald (Chair)
Mark Adamson
Prof. Gerry Boyle (Teagasc)
Laura Burke (EPA)
Prof. Robert Devoy
Jim Gannon (SEAI)
Ciarán Hayes
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# Executive Summary

The Climate Change Advisory Council is an independent advisory body tasked with reviewing national climate policy, progress on the achievement of the national transition objective and progress towards international targets. As set out in the Climate Action and Low Carbon Development Act 2015, a key task of the Council is to conduct an annual review of progress made over the previous year in reducing greenhouse gas emissions and furthering the transition to a low-carbon, climate-resilient and sustainable economy and society by 2050.

## Key Messages

- Irish greenhouse gas emissions are rising rather than falling. Ireland is completely off course in terms of achieving its 2020 and 2030 emissions reduction targets. Without urgent action that leads to tangible and substantial reductions in greenhouse gas emissions, Ireland is unlikely to deliver on national, EU and international obligations and will drift further from a pathway that is consistent with transition to a low-carbon economy and society.

- The Council welcomes the National Planning Framework and the National Development Plan as potentially significant contributions to transition; however, their robust implementation and monitoring will be key to achieving progress in the transition to a low-carbon, climate-resilient and sustainable economy and society.

- The Council welcomes the commitment to end the burning of coal at Moneypoint by 2025. However, the Council is concerned that planned support for biomass co-fired with peat has the effect of supporting the continued burning of peat for electricity generation, thus contributing to higher emissions. There is an urgent need to bring coherence to this aspect of energy policy and climate change policy by closing peat-fired generation as soon as possible.

- The Council recommends that the carbon tax be raised to €30 per tonne in Budget 2019 as an essential component of achieving decarbonisation, rising to €80 per tonne by 2030.

- The current carbon price level in the EU Emissions Trading System is insufficient to achieve climate targets and objectives, including the decarbonisation of electricity generation. Analysis suggests that the best way to achieve the ending of the burning of coal at Moneypoint by 2025 would be to introduce a carbon price floor in Ireland alongside other European countries. The government should actively work with other European countries towards this goal.

## Greenhouse Gas Emissions and Projections

Ireland's greenhouse gas emissions for 2016, and projections of emissions to 2035, are disturbing. Ireland's greenhouse gas emissions increased again in 2016. Instead of achieving the required reduction of 1 million tonnes per year in carbon dioxide emissions, consistent with the National Policy Position, Ireland is currently increasing emissions at a rate of 2 million tonnes per year. An increase in greenhouse gas emissions is evident across all sectors, with the largest increases in energy industries, up 0.7 million tonnes of carbon dioxide equivalent, followed by transport and agriculture both up 0.5 million tonnes of carbon dioxide equivalent.

Projections indicate strong growth in emissions nationally and across transport and the built environment in the coming decades, driven by strong economic growth and an associated increase

in energy demand. Fossil fuels continue to play the dominant role in meeting future energy demand. Increased output in agriculture also leads to increased emissions, despite efficiency gains.

## Progress Against Targets

Emissions in 2016 were 62 million tonnes of carbon dioxide equivalent. For the first time, emissions exceeded the annual limit under the EU Effort Sharing Decision. Ireland will miss its 2020 EU Effort Sharing Decision cumulative emissions reduction target by 16 million tonnes of carbon dioxide equivalent. Without new policies and measures, Ireland is also predicted to miss its 2030 EU Effort Sharing Regulation cumulative emissions reduction target by 92 million tonnes excluding the use of allowed flexibilities. This will take us further away from achieving our national transition objective for 2050. If the flexibilities are fully utilised, the gap reduces to 47 million tonnes. However, this would imply cost and effort which should be planned for.

The observed and projected increase in agricultural emissions, and ongoing carbon losses from land use (including from peat extraction), undermine our ability to achieve the national transition objective and our EU targets for 2020 and 2030. This is of great concern to the Council.

While Ireland can comply with EU policy and regulation for 2020 and 2030 by purchasing emissions allowances, this use of public funds - with no environmental benefit - would leave Ireland with a bigger and more expensive task to meet its future targets to 2030 and beyond. In contrast, measures to improve land-use management could help Ireland to comply with its 2030 targets and have potential environmental benefits.

Ireland is not on a pathway to achieve a low-carbon, climate-resilient and sustainable economy and society by 2050. Major new initiatives are required if Ireland is to meet its objectives on climate change.

## Recommendations

The Government has not provided a pathway for the decarbonisation of the economy and society by 2050. Scenario analysis should be undertaken to provide a 'map' for policymakers and an appropriate benchmark against which to measure the effectiveness of different policies. Without such a map, we cannot know how Ireland will transition to a low-carbon economy and society. It has never been more urgent or apparent that this gap in our understanding is addressed if Ireland is to meet the policy objectives for 2030 and 2050.

To support the implementation of the National Mitigation Plan, monitoring and evaluation of progress on actions and commitments in a transparent manner is crucial. Understanding the successes and failures of past policies is crucial to designing a cost-efficient path to decarbonising the economy. Monitoring and evaluation is also important for public participation and citizens' engagement such as through the National Dialogue on Climate Action.

The National Planning Framework has the capacity to address key long-term drivers of greenhouse gas emissions in Ireland. The National Development Plan also contains welcome commitments on climate action and key planned investments that can support the low-carbon transition. The Council welcomes these as important enhancements of institutions and governance for such a transition. However, implementation will need to be robust to achieve their objectives and their impact on emissions and transition has not been estimated. Monitoring and evaluation will be essential to check progress.

The current level of the carbon tax in Ireland and the prevailing carbon price in the EU Emissions Trading System are insufficient to achieve climate targets and objectives. The Council recommends increasing the carbon tax in Ireland to €30 per tonne in Budget 2019 rising to €80 per tonne by 2030. The Council also recommends that the excise tax on diesel should be raised to that on petrol. This will bring environmental and health benefits. Any increase in carbon taxation should be accompanied by measures to address energy poverty and reduce the negative impacts of carbon taxation on poorer households.

Having considered the environmental and competitiveness impacts and the impact on government budgets, Council analysis suggests that the best way to achieve the ending of the burning of coal at Moneypoint by 2025 would be to introduce a carbon price floor in Ireland alongside other European countries. The Government should work actively with other European countries on the adoption of a regional carbon price floor for electricity generation.

The Public Service Obligation support for peat will end in 2019, making peat-fired electricity generation commercially unviable. In the absence of a new subsidy, this would end peat-fired electricity generation in Ireland. However, proposed support for biomass co-fired with peat would subsidise continued peat-fired electricity generation. This would be an environmentally harmful subsidy resulting in substantially higher emissions of greenhouse gases at significant direct cost to the nation.

Specific advice and recommendations for action in the electricity generation, built environment, transport, agriculture and land use sectors to reduce emissions and adapt to climate change are provided within this report.

## Climate Resilience

Climate change is already having an impact in Ireland. Recent extreme weather events revealed the vulnerability of many communities, services and utilities to disruption and highlight the need to prepare for, and invest in, becoming more resilient to current and future climate.

Adaptation will require partnership between government, the public and the private sector. The National Adaptation Framework is a significant advance in the institutional support for adaptation and resilience in Ireland. The Framework offers a platform for shared understanding in Ireland of the potential impacts of climate change, so that actions have common purpose across all regions and all sectors.

## Future Council Focus

The Council will turn its focus to agriculture and transport over the next 12 months and will then follow with work on heating and the built environment.

## Conclusion

Ireland is completely off course in terms of its commitments to addressing the challenge of climate change. The National Development Plan and National Planning Framework can help, but much more is needed. There are policies and measures that can put us back on course. Robust carbon pricing will support action by individuals and businesses while raising revenue that can support the transition to a low-carbon, climate-resilient and sustainable economy and society.

## Contents

# 1. Introduction

Each year the Climate Change Advisory Council is charged with reviewing Ireland's performance regarding the achievement of the national transition objective and compliance with existing European Union (EU) and international obligations related to climate action. The Annual Review 2018 is the second annual review carried out by the Council and describes the results of this review. It documents Ireland's progress in the previous year in achieving reductions in greenhouse gas emissions and in furthering the transition to a low-carbon, climate-resilient and environmentally sustainable economy.

The Annual Review 2018 follows the structure of the first annual review in accordance with the requirements of the Climate Action and Low Carbon Development Act 2015[1] with the addition of some new elements. There are three changes of significance in structure and content from the Annual Review 2017. The first is the addition of Chapter 7: Progress towards a Climate Resilient Ireland, which addresses the adaptation and resilience component of the national transition objective. The second is the refocusing of Chapter 6: Achieving the National Transition Objective in a Cost-effective Manner. This reflects the statement of principles, as outlined in the Annual Review 2017, that the Council will employ to consider a cost-effective approach to the national transition objective. The Annual Review 2018 applies those principles in considering the cost-effectiveness of highlighted policies and measures across sectors and at a national level. Finally, 'Carbon Pricing' is this year's topic of the Special Focus in Chapter 8.

Chapters 2, 3 and 4 concentrate on setting the scene for meeting the national transition objective. Data and projections are presented and Ireland's performance against international and national climate objectives is assessed. Chapter 2 presents an overview of Ireland's 1990 to 2016 greenhouse gas emissions inventory data and draws attention to changes that occurred between 2015 and 2016. Chapter 3 presents an overview of Ireland's most recent greenhouse gas emissions projections for the period 2017 to 2035. Chapter 4 describes Ireland's performance against our EU 2020 emissions reduction target in 2016, our cumulative targets from 2013 to 2020 and 2030, and an assessment of performance towards our own national transition objective to 2050.

Chapters 5 and 6 focus on progress made in furthering the transition to a low-carbon and climate-resilient economy and society by 2050 at a sectoral and cross-sectoral level. Chapter 5 presents updated potential indicators for transition. Chapter 6 considers existing and recent developments in policies and measures across the sectors and at a national level. Advice is provided on how to achieve a cost-effective approach.

Chapter 7 considers how progress on adaptation to the impacts of climate change and transition to a resilient society can be assessed in terms of the integration of adaptation into policy development and planning. It also explores the need for indicators to measure and evaluate the implementation of adaptation actions and their effectiveness. The chapter also presents an overview of some lessons learned from recent events that provide insight into vulnerabilities to current and future climate.

Finally, 'Carbon Pricing' is this year's Special Focus topic in Chapter 8. It considers in more technical detail the implementation of carbon pricing in Ireland via the carbon tax and the EU Emissions Trading System carbon price. Advice and recommendations regarding further development or evolution of these instruments is then offered.

Chapter 9 documents the activities of the Council in 2017.

## 2. A Summary of the National Greenhouse Gas Emissions Inventory

### Key Messages

- Emissions of greenhouse gases increased by 3.6%, or 2.1 million tonnes of carbon dioxide equivalent, in 2016, returning greenhouse gas emissions to 2009 levels.
- Increases in greenhouse gas emissions were recorded in all sectors in 2016.
- Economic growth has been the main driver of the growth in emissions in recent years. Ireland's economy and emissions have not undergone the level of decoupling required to put us on a pathway to a low-carbon transition and meet the required EU targets.

The Climate Action and Low Carbon Development Act 2015 tasked the Council, as part of its Annual Review, to provide a summary of the findings as set out in the national greenhouse gas emissions inventory. Ireland's greenhouse gas emissions inventory in 2016 as prepared by the Environmental Protection Agency (EPA) is provided below. The inventory is the quantitative basis for the Council's review of progress made in achieving reductions in greenhouse gas emissions to enable the achievement of the national transition objective.

### 2.1 Ireland's Greenhouse Gas Emissions Inventory

The annual greenhouse gas emissions inventory is central to the development of national climate change mitigation policy. It reflects the effectiveness of measures taken to achieve policy goals. Each year the EPA prepares and publishes Ireland's official greenhouse gas emissions inventory. The inventory is reported to the EU and the United Nations Framework Convention on Climate Change (UNFCCC) and is subject to in-depth international review. The current inventory, which provides data from 1990 to 2016, was submitted to the EU on 13 March 2018 and to the UNFCCC on 13 April 2018.

Ireland's greenhouse gas emissions increased by 3.6%, or 2.1 million tonnes of carbon dioxide equivalent, from 59.4 million tonnes of carbon dioxide equivalent in 2015 to 61.5 million tonnes of carbon dioxide equivalent in 2016 (see Figure 2.1).[2] This is the second year in succession that emissions have increased. In the period 2006 to 2016 some of the most significant reductions in emissions were recorded in three years during the financial recession. These reductions were largely the result of the downturn in Ireland's economy over the period 2009 to 2011. Between 2006 and 2016 the most significant increases were in the last two years. Data for 2016 shows a continued increase in emissions, demonstrating that the growth of Ireland's economy and emissions of greenhouse gases remain coupled.

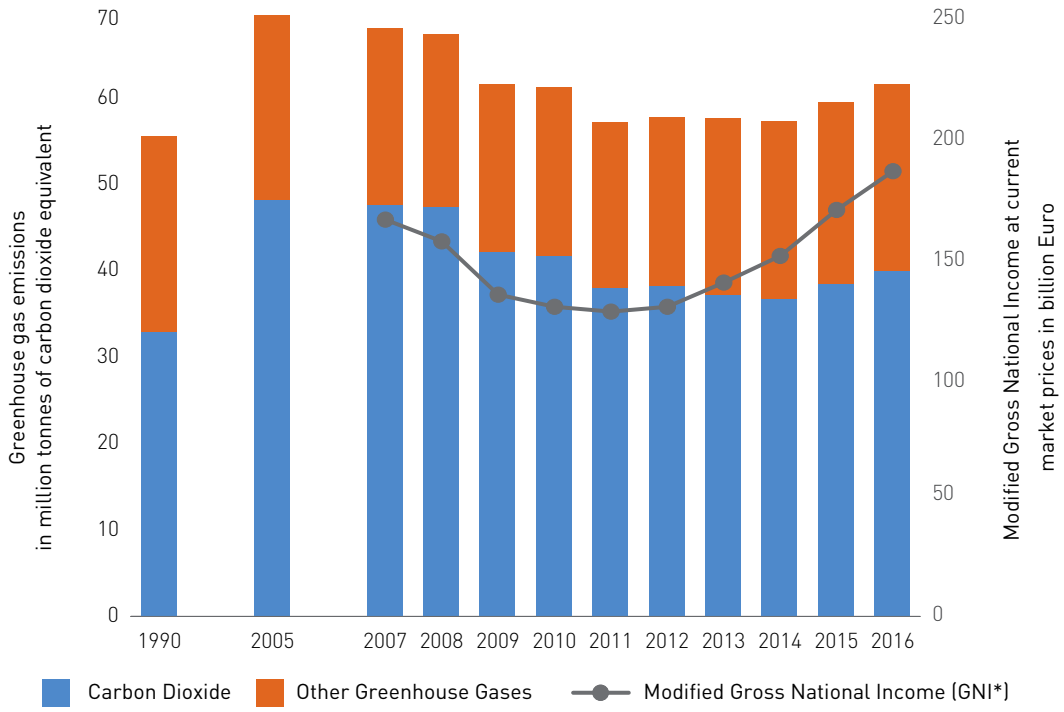


**Figure 2.1:** *Greenhouse gas emissions for base years 1990 (National Policy Position[3]) and 2005 (EU 2020 targets) and the decade 2007 to 2016 showing carbon dioxide (in blue) and other greenhouse gases (in orange) in units of million tonnes of carbon dioxide equivalent (Mt $CO_2$ e). Modified gross national income (GNI*) at current market prices (grey line) in billions of euros is also shown (right-hand scale).* **Data sources:** *EPA National Emissions Inventory 2018[2] and Central Statistics Office, National Accounts 2018.[4]*

## 2.2 Sectoral Greenhouse Gas Emissions

The EPA provides inventory data broken down into 10 sectors. A summary of data for greenhouse gas emissions from these sectors in 2016 is listed in Table 2.1. Changes in sectoral greenhouse gas emissions and how each of those sectors contributed to the overall increase in 2016 is shown in Figure 2.2. Increases in greenhouse gas emissions are evident across all sectors, with the largest absolute increase in energy industries at 0.7 million tonnes of carbon dioxide equivalent, followed by agriculture and transport at 0.5 million tonnes of carbon dioxide equivalent each. Increases in greenhouse gas emissions were recorded in all the main sectors.

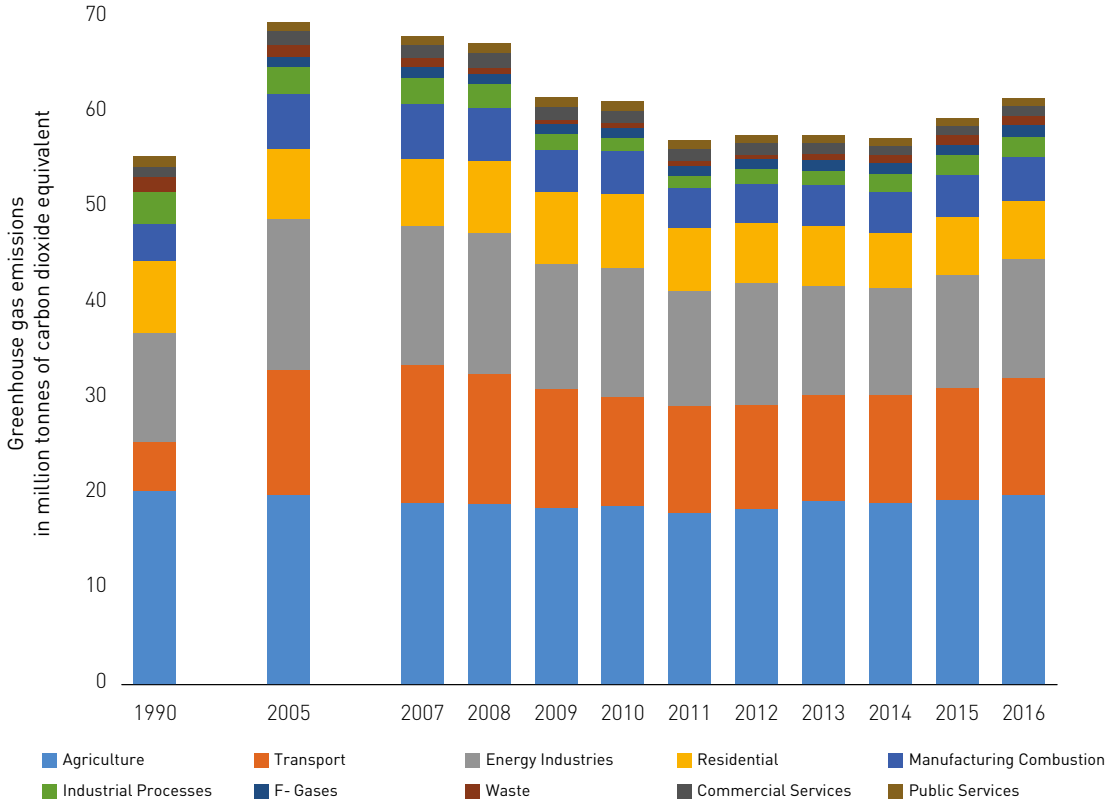


**Figure 2.2:** *Greenhouse gas emissions for base years 1990 (National Policy Position[3]) and 2005 (EU 2020 targets) and the last decade, 2007 to 2016, presented by sector in units of million tonnes of carbon dioxide equivalent.* **Data source:** *EPA National Emissions Inventory 2018.*[2] *F-gases, fluorinated greenhouse gases.*

**Table 2.1:** *Greenhouse gas emissions for base years 1990 (National Policy Position) and 2005 (EU 2020 targets), and for 2013, 2014, 2015 and 2016, broken down by sector and detailing the change in emissions in 2016, relative to 1990, 2005 and 2015.* **Data source:** *EPA National Emissions Inventory 2018*[2]

| Sector (% of total greenhouse gas emissions in 2016) | Greenhouse gas emissions inventory | | | | | | Change in 2016 relative to 1990 | | Change in 2016 relative to 2005 | | Change in 2016 relative to 2015 | | Key drivers relative to 2015 as identified in the EPA National Emissions Inventory 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2005 | 2013 | 2014 | 2015 | 2016 | | | | | | | |
| | Mt $CO_2$ e | | | | | | Absolute Mt $CO_2$ e | % | Absolute Mt $CO_2$ e | % | Absolute Mt $CO_2$ e | % | |
| Agriculture (32.3%) | 20.3 | 19.9 | 19.3 | 19.0 | 19.3 | 19.9 | –0.5 | –2.4 | 0.001 | 0.005 | 0.5 | 2.7 | Increased dairy cow numbers, increased milk production |
| Transport (20.0%) | 5.1 | 13.1 | 11.1 | 11.3 | 11.8 | 12.3 | 7.2 | 139.3 | –0.8 | –6.3 | 0.5 | 4.1 | Increased passenger diesel cars, decline in biofuels |
| Energy Industries (20.4%) | 11.4 | 15.9 | 11.5 | 11.2 | 11.8 | 12.6 | 1.1 | 9.8 | –3.4 | –21.1 | 0.7 | 6.0 | Increased gas for electricity generation and reductions in renewable generation |
| Residential (9.8%) | 7.5 | 7.3 | 6.4 | 5.7 | 6.0 | 6.0 | –1.5 | –19.6 | –1.2 | –16.9 | 0.01 | 0.1 | Fewer warm days, increase in gas and kerosene use |
| Manufacturing Combustion (7.4%) | 4.0 | 5.9 | 4.2 | 4.3 | 4.5 | 4.6 | 0.6 | 15.0 | –1.3 | –22.4 | 0.1 | 1.6 | Increase in emissions from food, drink and cement sectors |
| Industrial Processes (3.5%) | 3.3 | 2.8 | 1.5 | 1.8 | 2.0 | 2.1 | –1.1 | –34.3 | –0.6 | –22.2 | 0.1 | 7.1 | Increased cement production |
| F-Gases (2.1%) | 0.0 | 1.0 | 1.1 | 1.2 | 1.1 | 1.3 | 1.2 | 3497 | 0.3 | 24.3 | 0.1 | 11.0 | Increased hydrofluorocarbon emissions from use as refrigerant |
| Waste (1.6%) | 1.5 | 1.3 | 0.7 | 0.9 | 0.9 | 1.0 | –0.6 | –38.1 | -0.3 | –25.8 | 0.01 | 0.9 | Increased methane emissions from landfill |
| Commercial Services (1.6%) | 1.1 | 1.5 | 1.1 | 1.0 | 1.0 | 1.0 | –0.1 | –8.2 | –0.5 | –32.6 | 0.02 | 2.5 | Increased gas use offset by increased biomass/biogas use |
| Public Services (1.4%) | 1.2 | 1.0 | 0.9 | 0.8 | 0.9 | 0.9 | –0.3 | –24.8 | –0.1 | –8.3 | 0.02 | 2.7 | Increased gas use offset by increased biomass/biogas use |
| Total | 55.5 | 69.5 | 57.6 | 57.3 | 59.4 | 61.5 | 6.1 | 10.9 | –8.0 | –11.5 | 2.1 | 3.6 | |

## 2.3 Assessing the Relationship Between Carbon Dioxide and Economic Growth

The Intergovernmental Panel on Climate Change (IPCC) and the European Environment Agency (EEA) use the Kaya identity to provide insights into the broader macroeconomic drivers of carbon dioxide emissions.[5,6] The Kaya identity asserts that there is a strong relationship between carbon dioxide emissions and several independent factors within an economy, namely population, income and energy use. When comparing one period with another, the Kaya identity can be used to 'decompose' the change in carbon dioxide emissions into the macroeconomic forces driving those changes.[7] It aims to bring clarity to the assessment of the macroeconomic drivers of emissions.

The Kaya identity can be described as:

$$CO_2 \text{ emissions} = \text{Population} \times (\text{GDP/Population}) \times (\text{Energy/GDP}) \times (CO_2/\text{Energy})$$

This method relates changes in population growth, income per capita (gross domestic product (GDP)/population), intensity of energy consumption per unit income (energy/GDP) and carbon intensity of energy consumption ($CO_2$/energy) to emissions of carbon dioxide.

A decomposition of Ireland's carbon emissions from 2015 to 2016 by real GDP† is presented in Figure 2.3. Emissions reductions achieved through improvements in the carbon intensity of energy and in the energy intensity of GDP are small relative to the continued and robust growth in GDP per capita and increase in population. If economic growth continues, significant and robust improvements in other driving forces will be necessary to achieve a low-carbon transition. Further understanding of the driving forces behind this trend is necessary to monitor progress and consider policies that will bring appropriate levels of emissions reductions.

**Box 2.1:** *Decoupling explained*

### Decoupling economic growth and emissions of greenhouse gases

The Organisation for Economic Co-operation and Development (OECD) describes decoupling as *breaking the link* between economic goods and environmental bads.[8] Over time, economic output becomes less and less dependent on environmental resources and has less of an impact on the environment as pollution from these activities is reduced. In theory, this allows the economy to continue to grow without running out of finite resources or damaging the environment beyond repair.

In the case of climate change and emissions of greenhouse gases to the atmosphere, the atmosphere is a finite resource. To keep global warming to well below 2°C in line with the Paris Agreement, there is a limited amount of greenhouse gases that can be emitted to the atmosphere. How do we continue to grow our economy and stay well below 2°C?

There are two types of decoupling: relative decoupling, in which total emissions of greenhouse gases increase but more slowly than the increase in economic activity, and absolute decoupling, in which total emissions of greenhouse gases decline while economic activity continues to increase. An economy has decoupled in absolute terms when economic growth can be sustained without having a negative effect on the environment.[9]

† The constant or 'real' GDP is linked and referenced to 2015 as the reference year for prices and thus adjusts for inflation.

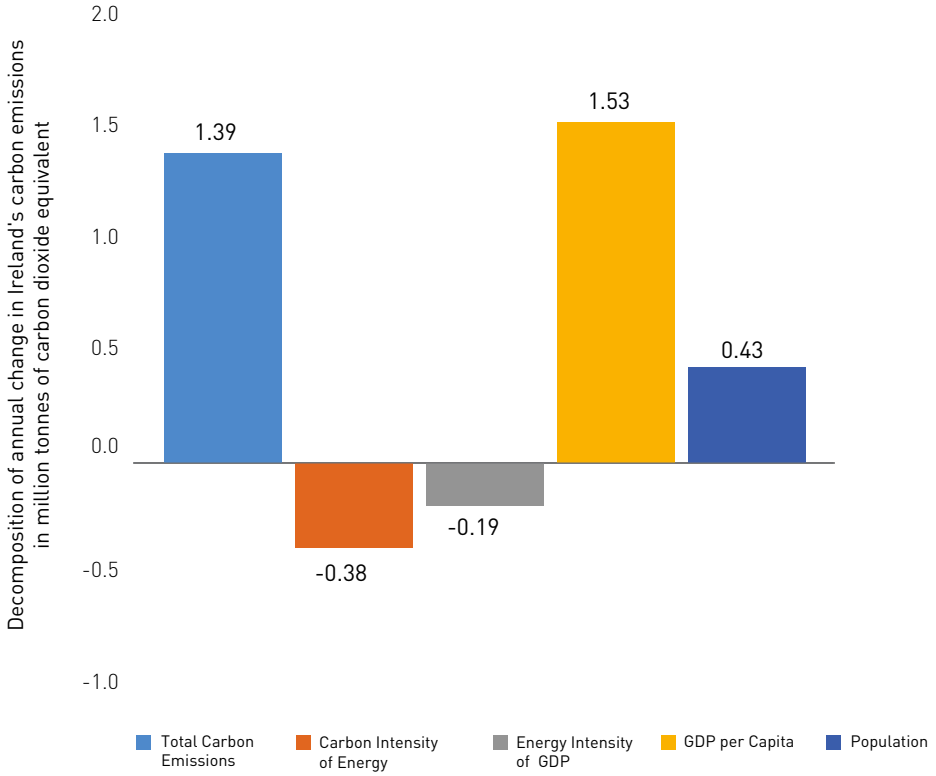


**Figure 2.3:** *Kaya identity decomposition† of annual change in Ireland's carbon emissions‡ in 2016.*
**Source:** *O'Mahony, Zhou, Sweeney (2018) Understanding the driving forces of carbon emission in Ireland.* [10]

† Based on real GDP data at constant prices data from Central Statistics Office (CSO).
‡ Energy-related carbon emissions based on Total Primary Energy Requirement (TPER) data from SEAI.

# 3. A Summary of Future Greenhouse Gas Emissions

## Key Messages

- Projections indicate strong growth in emissions nationally and across key sectors in the coming decades underpinned by strong economic growth and an associated increase in energy demand.
- Peat and coal continue to be key contributors to emissions from electricity generation and a key component of future trends in the energy industry sector.
- Of significant concern are additional planned policies and measures that are projected to increase emissions compared with current policies and measures. This is unprecedented.
- Planned support for biomass co-firing with peat has the effect of supporting continued burning of peat for electricity generation, contributing to higher emissions.

The Climate Action and Low Carbon Development Act 2015[1] tasked the Council as part of its Annual Review to provide a summary of the most recent projections of greenhouse gas emissions. In this chapter, Ireland's future greenhouse gas emissions as prepared by the EPA are provided below.[2] Official projections of greenhouse gas emissions based on policies and measures applied to these sectors are provided for the period 2017 to 2030.

## 3.1 Ireland's Greenhouse Gas Emissions Projections

Every year, the EPA releases greenhouse gas emissions projections for Ireland. Every second year, these projections are submitted to the EU in accordance with reporting requirements. These biennial projections are reported to the EU, as part of the Monitoring Mechanism Regulation, and to the UNFCCC every four years. As with the greenhouse gas inventory, the projections are subject to in-depth international review. The current set of projections were submitted to the EU on 22 May 2018.

The projections are based on two scenarios from 2017 to 2035, known officially as, 'with existing measures' and 'with additional measures'.† The 'with existing measures' scenario assumes that no additional policies and measures, beyond those approved and implemented, in other words, those already in place, by the end of 2016, are considered. The 'with additional measures' scenario assumes the implementation of policies and measures in the 'with existing measures' scenario and further implementation of planned policies and measures from 2020. These include renewable and energy efficiency measures as described in the National Energy Efficiency Action Plan and the National Renewable Energy Action Plan. The projected emissions depend on achieving the assumed level of deployment. The outcomes of these scenarios identify a significant shortfall in achieving Ireland's energy efficiency targets and renewable energy targets for electricity, transport and heat to 2020.

† It should be noted that in some sectors projections under 'with existing measures' and 'with additional measures' use identical policies and that measures are implemented to the same degree in both. In these sectors, there is no difference between the scenarios. The sectors in which identical policies and measures are implemented to the same degree are F-gases and waste. The industrial processes sector has similar numbers for both scenarios but not identical levels of implementation.

Greenhouse gas emissions projections are prepared using data from several key sources. The energy forecast is provided by the Sustainable Energy Authority of Ireland (SEAI). This information was prepared with the Economic and Social Research Institute (ESRI) and University College Cork (UCC). The ESRI uses macroeconomic projections produced by the Core Structural Model of the Irish Economy (COSMO) model.[11] Projections of global economic activity are based on the National Institute's Global Econometric Model (NiGEM) from the National Institute of Economic and Social Research in the UK.[12] Agricultural forecasts are provided by Teagasc. These include data on animal numbers, crop areas and fertiliser use.

Ireland's target under the Effort Sharing Decision is a 20% reduction in greenhouse gas emissions by 2020, relative to 2005 levels. The EPA's emissions projections indicate that, by 2020, a slight reduction of less than 1% of the target will be achieved. Projections indicate strong growth in emissions nationally and across key sectors in the coming decade. This is largely underpinned by strong economic growth and relatively low oil prices. The main increases are seen in agriculture and transport, which dominate the Effort Sharing Decision emissions and account for 75% of these emissions. The gap between 'with existing measures' and 'with additional measures' narrows in the period to 2020, indicating that mitigation options in the short term are largely fixed. After 2019 the scenarios diverge. This, rather unusually, sees the 'with additional measures' scenario with higher projected emissions from 2020 to 2025 (see Figure 3.1). In 2026 the scenarios diverge again with higher emission in the 'with existing measures' scenario once again. This is the result of policies related to electricity generation.

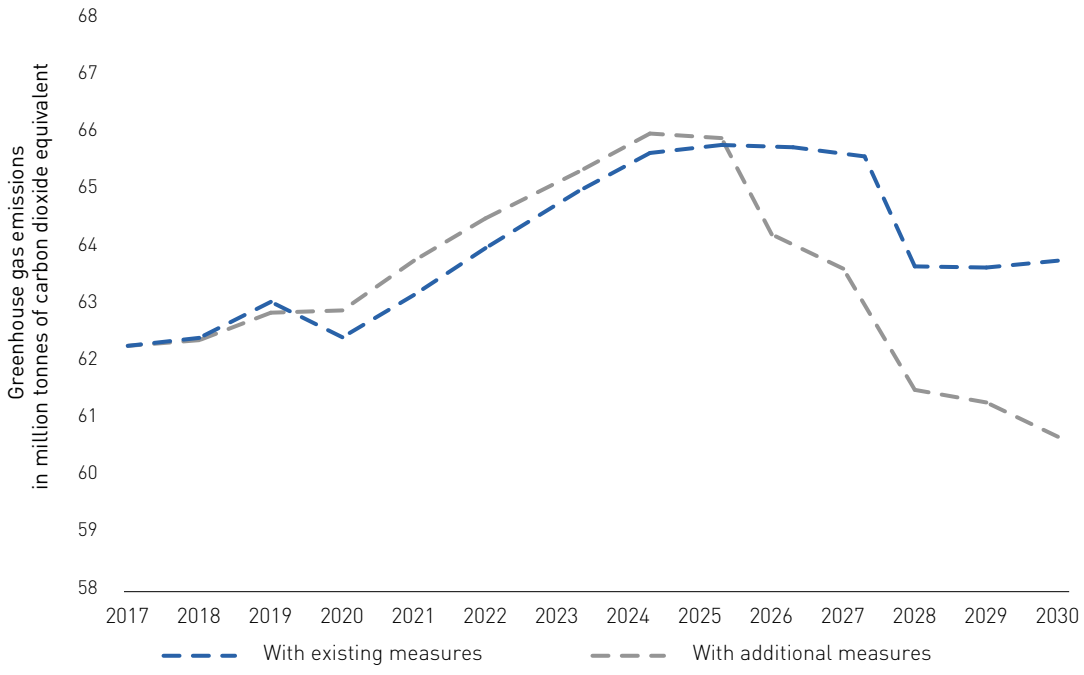


**Figure 3.1:** *Greenhouse gas emissions projections for 2017 to 2030 under the 'with existing measures' (blue dashed line) and 'with additional measures' (grey dashed line) in units of million tonnes of carbon dioxide equivalent.* **Data source:** *EPA Ireland's Greenhouse Gas Emissions Projections 2017-2035.*[15]

**Box 3.1:** *Impact of policies 2017 to 2030*

### Impact of policies on emissions projections: electricity generation

Projected emissions for the 'with existing measures' and 'with additional measures' scenarios are similar until 2019 and then begin to diverge. The narrow gap between the two scenarios to 2019 indicates that in the short term, mitigation options are largely fixed. The divergence, rather unusually, sees the 'with additional measures' scenario with higher projected emissions. This is the result of assumptions related to electricity generation. The 'with existing measures' scenario reflects the ending of support for peat-fired electricity generation after 2019. This results in a significant decline in peat used in electricity generation after 2019. Under the 'with additional measures' scenario peat-fired electricity generation receives indirect support through Renewable Energy Feed in Tariff III,[13] which supports biomass that is co-fired with peat after 2019.

From 2026 the 'with existing measures' scenario returns to having the higher projected emissions as the accelerated phase-out of coal in electricity generation and the introduction of commercial interconnection after 2025 are assumed as part of the 'with additional measures' scenario.

The impact of the Renewable Energy Feed in Tariff III support for co-firing peat and biomass in electricity generation is that it reduces the availability of biomass for use in the industrial processes sector under the 'with additional measures' scenario. The increase in price for biomass for heat in industrial processes results in increased emissions from fossil fuels compared with the 'with existing measures' scenario.

The most recent EPA emission projections do not consider the impact of policies and measures that are part of the recently announced National Development Plan or the full impact of policies and measures included in the National Mitigation Plan.[14] It is anticipated that the additional impact of the policies and measures included in these plans will be provided to the EPA by the relevant government departments and agencies and included in next year's emission projections.[15]

## 3.2 Future Sectoral Greenhouse Gas Emissions

The EPA provides projections broken down into sectors like those in the inventories. A summary of the projected emissions of greenhouse gases from these sectors for 2020 and 2030 is shown in Table 3.1. In 2020, the transport and agriculture sectors account for 55.5%, or 34.9 million tonnes of carbon dioxide equivalent, of total emissions and dominate emissions in the Effort Sharing Decision sector under the 'with additional measures' scenario.[15]

Emissions from transport are projected to increase by 17% to 18%, or between 2.1 and 2.5 million tonnes of carbon dioxide equivalent, by 2020, relative to 2016 levels based on the two projected scenarios. Overall growth in transport emissions reflects strong growth in diesel fuel consumption in private cars and freight to 2025. Agricultural emissions are projected to increase by between 3.3% and 4.4%, or between 0.7 and 1.3 million tonnes of carbon dioxide equivalent, by 2020, relative to 2016 levels, as a result of increased milk production. Emissions projections from this sector already reflect developments in the cattle population following the elimination of the milk quota system and provide an updated outlook for the sector. Other sectors that predict increases in emissions include residential, manufacturing combustion and industrial processes.

Emissions reductions of 18.5% to 11.7%, or 2.3 to 1.5 million tonnes of carbon dioxide equivalent, relative to 2016, are projected in the energy industries sector by 2020 under the 'with additional measures' scenario. Emissions decreases are also predicted for F-gases, for waste and in the commercial and public service sectors. Projections for both 'with existing measures' and 'with additional measures', broken down by sector, are shown in Table 3.1 and Figure 3.2.

**Table 3.1:** *Projections of total greenhouse gas emissions by sector from 2016 to 2020 and 2030 under the 'with additional measures' scenario.* **Data sources:** *EPA National Emissions Inventory 2018*[2] *and Ireland's Greenhouse Gas Emissions Projections 2017–2035*[15]

| Sector (% of total greenhouse gas emissions in 2016) | Greenhouse gas emission inventory | | | | Greenhouse gas emission projections for 'with additional measures' | | | | | | Key assumptions as identified in Ireland's Greenhouse Gas Emissions Projections 2017 to 2035 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2005 | 2015 | 2016 | 2020 | 2030 | Change in 2020 relative to 2016 | | Change in 2030 relative to 2016 | | |
| | Mt $CO_2$ e | | | | Mt $CO_2$ e | | Absolute Mt $CO_2$ e | % | Absolute Mt $CO_2$ e | % | |
| Agriculture (32.3%) | 20.3 | 19.9 | 19.3 | 19.9 | 20.5 | 20.9 | 0.7 | 3.3 | 1.1 | 5.5 | Increase in dairy cow herd and nitrogen use |
| Transport (20.0%) | 5.1 | 13.1 | 11.8 | 12.3 | 14.4 | 14.3 | 2.1 | 17.1 | 2.0 | 16.6 | Increase in diesel use in cars and freight |
| Energy Industries (20.4%) | 11.4 | 15.9 | 11.8 | 12.6 | 11.1 | 7.5 | –1.5 | –11.7 | –5.1 | –40.4 | Increase in renewables |
| Residential (9.8%) | 7.5 | 7.3 | 6.0 | 6.0 | 6.5 | 6.5 | 0.5 | 8.1 | 0.4 | 6.8 | Increase in renewables in heating, increase in energy efficiency |
| Manufacturing Combustion (7.4%) | 4.0 | 5.9 | 4.5 | 4.6 | 4.7 | 5.1 | 0.2 | 3.7 | 0.5 | 11.2 | Increase in renewables in heating, increase in energy efficiency |
| Industrial Processes (3.5%) | 3.3 | 2.8 | 2.0 | 2.1 | 2.4 | 3.3 | 0.3 | 13.4 | 1.1 | 52.3 | Increase in cement and lime production |
| F-Gases (2.1%) | 0.04 | 1.0 | 1.1 | 1.3 | 1.0 | 0.8 | –0.3 | –23.6 | –0.5 | –40.4 | Saving associated with the impact of Directive 2006/40/EC[†] |
| Waste (1.6%) | 1.5 | 1.3 | 0.9 | 1.0 | 0.6 | 0.4 | –0.4 | –39.7 | –0.5 | –53.3 | Decline in methane emissions from landfill |
| Commercial Services & Public Services (3.2%) | 2.2 | 2.4 | 1.8 | 1.9 | 1.7 | 1.9 | –0.2 | –9.6 | 0.1 | 4.3 | Increase in energy efficiency |
| Total | 55.5 | 69.5 | 59.4 | 61.5 | 62.9 | 60.7 | 1.4 | 2.2 | –0.8 | –1.4 | |

[†]Directive 2006/40/EC relating to emissions from air-conditioning systems in motor vehicles and amending Council Directive 70/15/EEC.

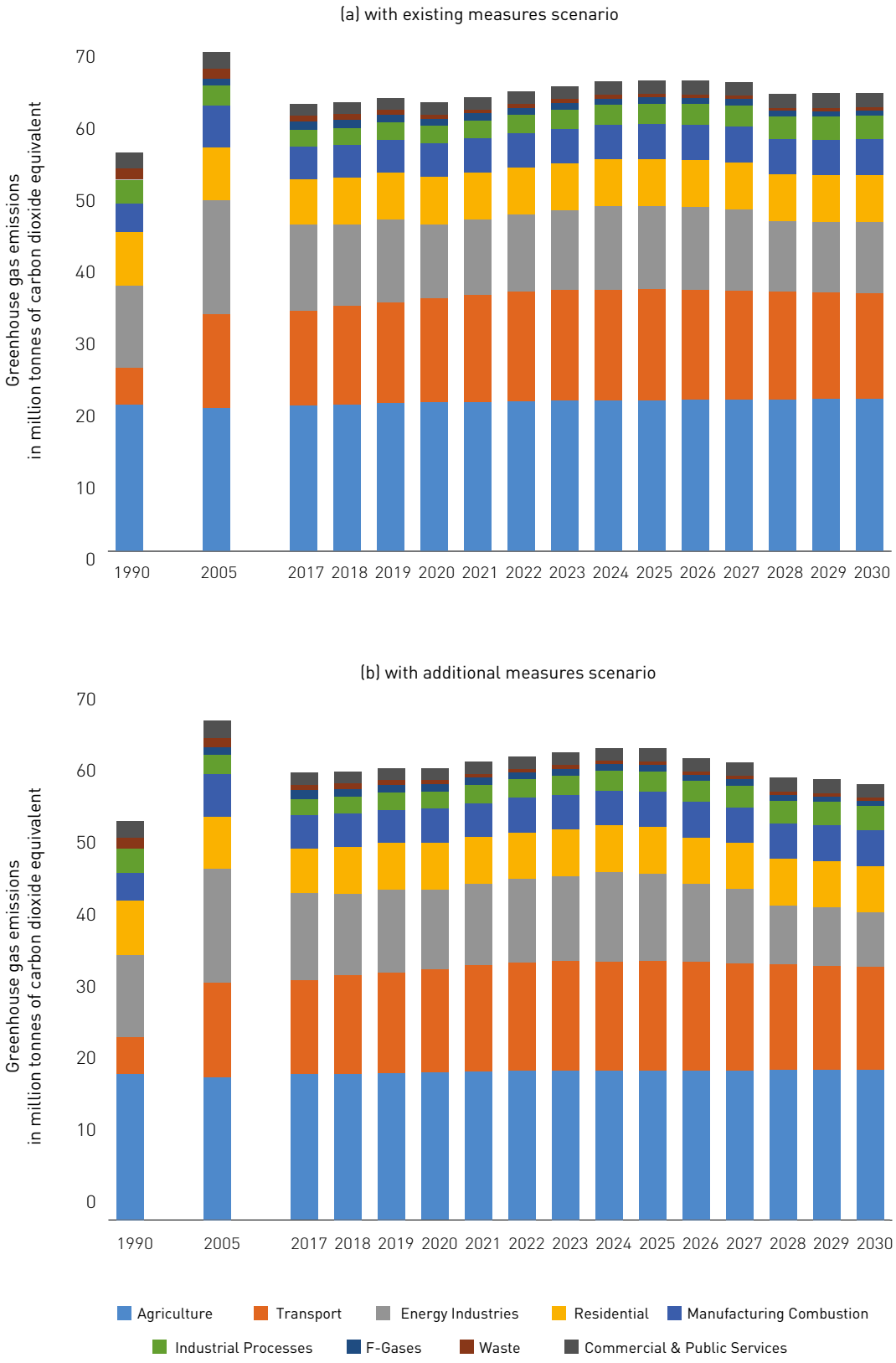


**Figure 3.2:** *Greenhouse gas emissions for (a) with existing measures and (b) with additional measures scenarios, base years 1990 (National Policy Position[3]) and 2005 (EU 2020 targets), 2016 data and projections to 2020 and 2030, broken down by sector in units of million tonnes of carbon dioxide equivalent.* **Data sources:** *EPA National Emissions Inventory 2018*[2] *and Ireland's Greenhouse Gas Emissions Projections 2017–2035.*[15]

# 4. Performance Against Existing Obligations of the State

## Key Messages

- Instead of achieving the necessary 1 million tonnes per annum reduction in carbon dioxide emissions in line with our own National Policy Position, Ireland is currently increasing emissions at a rate of 2.1 million tonnes per annum.
- Ireland's target under the Effort Sharing Decision is a 20% reduction in greenhouse gas emissions by 2020, relative to 2005 levels. Projections indicate that, by 2020, a slight reduction of less than 1% will be achieved.
- Cumulative emissions of greenhouse gases to 2020 will see Ireland exceed its EU Effort Sharing Decision target (338 million tonnes) by approximately 16 million tonnes of carbon dioxide equivalent.
- Cumulative emissions of greenhouse gases to 2030 will see Ireland exceed its EU Effort Sharing Regulation targets (380 million tonnes) by approximately 92 million tonnes of carbon dioxide equivalent.
- Using full flexibilities from the EU Emissions Trading System and land use, land-use change and forestry (LULUCF), for which the rules are not yet fully developed, Ireland would still exceed its 2030 targets by around 47 million tonnes of carbon dioxide equivalent.

The Climate Action and Low Carbon Development Act 2015[1] tasked the Council, as part of its Annual Review, to provide advice and recommendations in relation to compliance with the existing obligations of the state under the law of the EU or international agreements. Ireland's performance in relation to reducing greenhouse gas emissions in accordance with national, EU and international targets is considered in the text below.

## 4.1 Climate and Energy Package 2020

The Climate and Energy Package 2020 is a collection of directives and decisions to ensure that the EU meets its climate and energy targets for the year 2020. The package has three key objectives: (1) to cut greenhouse gas emissions by 20%, relative to 1990; (2) to produce 20% of EU energy from renewables; and (3) to improve energy efficiency by 20% by 2020. There are two areas that relate directly to the objective to reduce emissions of greenhouse gases, namely the Emissions Trading System[16] and the Effort Sharing Decision.[17] Under the Emissions Trading System, the EU aims to reduce emissions from large industrial and institutional facilities, especially electricity generation. The Emissions Trading System covers 45% of the EU's greenhouse gas emissions and aims to reduce these emissions to 20% below 2005 levels by 2020. The EU, as a whole, is well on track to achieve this target. The Effort Sharing Decision covers emissions that are not covered in the Emissions Trading System. Each Member State has binding targets for reducing emissions in the non-Emissions Trading System sector between 2013 and 2020.

### 4.1.1 Emissions Trading System and Effort Sharing Decision

The increase in Ireland's greenhouse gas emissions from 2015 to 2016 is observed in both the Emissions Trading System and Effort Sharing Decision sectors (see Figure 4.1). Emissions of greenhouse gases under the Emissions Trading System increased by 5.4%, or 0.9 million tonnes of carbon dioxide equivalent, from 2015 to 2016. Emissions from sectors covered by the Effort Sharing Decision increased in total by 2.8%, or 1.2 million tonnes of carbon dioxide equivalent. In Ireland, the Emissions Trading System covers 29%, or 17.7 million tonnes of carbon dioxide equivalent, of Ireland's total greenhouse gas emissions in 2016, while the majority, 71%, or 43.8 million tonnes of carbon dioxide equivalent, is covered by the Effort Sharing Decision. The European Commission, which manages the Emissions Trading System, has key responsibility for ensuring a reduction in emissions through the Emissions Trading System sector. The Irish Government has primary responsibility for achieving the targets in the non-Emissions Trading System sector.


**Figure 4.1:** *Greenhouse gas emissions for the Emissions Trading System (in dark green) and the Effort Sharing Decision (in yellow) over the period 2007 to 2016 and in the base year 2005 of EU climate and energy 2020 targets in units of million tonnes of carbon dioxide equivalent.* **Data source:** *EPA National Emissions Inventory 2018.*[2]

### 4.1.2 Effort Sharing Decision: Targets to 2020

Under the EU Effort Sharing Decision, Ireland has both annual targets and a cumulative target for reductions in greenhouse gas emissions from 2013 to 2020. Emissions in 2016 were above the annual limit under the EU Effort Sharing Decision. Ireland's annual limit for 2016 is 43.5 million tonnes of carbon dioxide equivalent. This limit was exceeded by 0.3 million tonnes of carbon dioxide equivalent. Emissions in the years 2013, 2014 and 2015 were below the annual targets (see Figure 4.2). Emissions savings accrued in these years may contribute to meeting future annual targets to 2020 and the cumulative target from 2013 to 2020.

Projections for both 'with existing measures' and 'with additional measures' scenarios indicate that emissions will exceed the annual targets from 2016 onwards (see Figure 4.2 and Table 4.1). Over the period 2013 to 2020, greenhouse gas emissions are projected to exceed annual limits by a cumulative total of between 16.3 and 17.0 million tonnes of carbon dioxide equivalent. This takes into consideration emissions savings accrued from 2013 to 2015. These projections indicate that, despite existing and planned additional policies and measures, greenhouse gas emissions continue to increase, suggesting that our targets may be missed by a substantial margin.

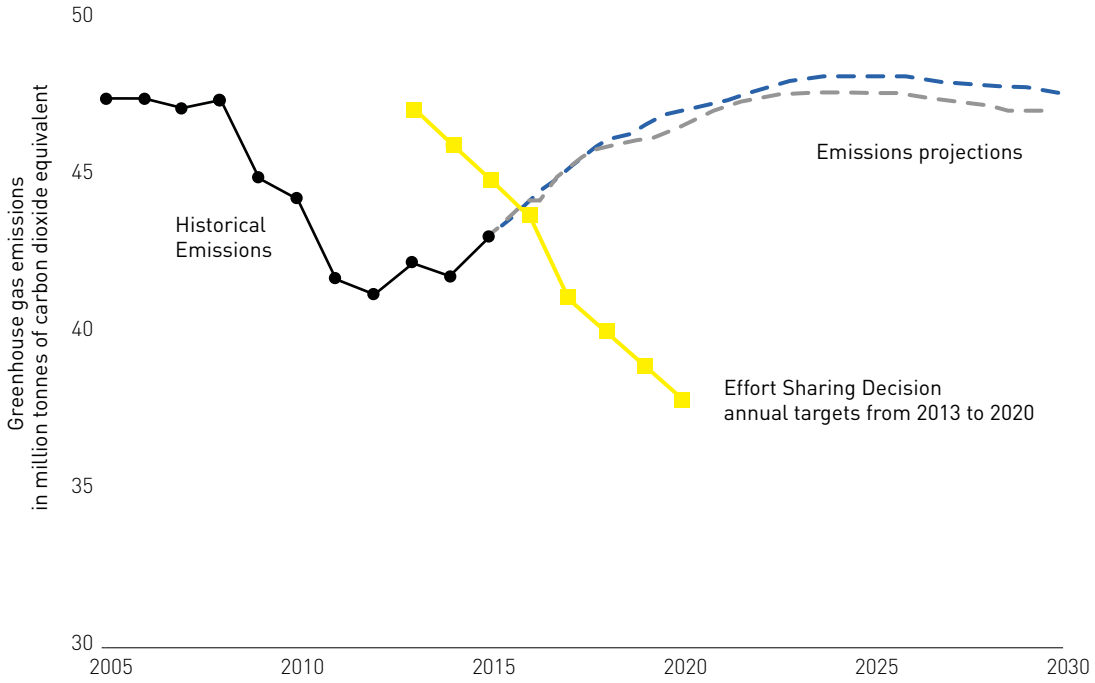


**Figure 4.2:** *Ireland's greenhouse gas emissions under the EU Effort Sharing Decision (black line) from 2005 to 2016. Annual targets (yellow line) as included under the Effort Sharing Decision for the period 2013 to 2020, without use of flexibilities, and emissions projections for 'with existing measures' (dashed blue line) and 'with additional measures' (dashed grey line) are presented here in units of million tonnes of carbon dioxide equivalent.* **Data sources**: *EPA National Emissions Inventory 2018,*[2] *Ireland's Greenhouse Gas Emissions Projections 2017–2035*[15] *and European Commission Decision (EU) 2017/1471 2017.*[18]

**Table 4.1:** *Actual (black italics) and projected (blue and grey text) greenhouse gas emissions, covered under the EU Effort Sharing Decision targets, relative to annual totals and total cumulative emissions targets.* **Data source:** *EPA National Emissions Inventory 2018,*[2] *Ireland's Greenhouse Gas Emissions Projections 2016–2035*[15] *and European Commission Decision (EU) 2017/1471 2017*[18]

| Year | Limits Mt $CO_2$ e | Emissions Mt $CO_2$ e | | Distance to target Mt $CO_2$ e | |
|---|---|---|---|---|---|
| | | Actual | | Actual | |
| | | With existing measures | With additional measures | With existing measures | With additional measures |
| 2013 | 46.9 | *42.3* | | *4.6* | |
| 2014 | 45.8 | *41.8* | | *3.9* | |
| 2015 | 44.6 | *43.1* | | *1.6* | |
| 2016 | 43.5 | *43.8* | | *-0.3* | |
| Cumulative (2013–2016) | 180.8 | 170.7 | | 10.1 | |
| 2017 | 40.9 | 45.1 | 45.1 | –4.2 | –4.2 |
| 2018 | 39.8 | 45.9 | 45.8 | –6.1 | –6.0 |
| 2019 | 38.7 | 46.4 | 46.1 | –7.6 | –7.4 |
| 2020 | 37.7 | 46.8 | 46.5 | –9.2 | –8.8 |
| Remaining (2017–2020) | 157.1 | 184.2 | 183.5 | — | — |
| **Total** | **337.9** | **354.9** | **354.2** | **–17.0** | **–16.3** |

Mt $CO_2$ e, million tonnes of carbon dioxide equivalent.

### 4.1.3 EU Effort Sharing Regulation 2030

The Effort Sharing Regulation,[19] the successor to the Effort Sharing Decision, is part of the suite of EU climate policies and the EU Energy Union strategy. It was adopted on 14 May 2018. The objective of the Effort Sharing Regulation is to reduce EU-wide emissions in the non-Emissions Trading System sector by 30% by 2030, relative to 2005 levels. It sets annual national limits on Member States' emissions of greenhouse gases in the non-Emissions Trading System sector for the period 2021 to 2030. The agreed national target for Ireland is 30% by 2030, relative to 2005 levels (see Figure 4.3 and Table 4.2).

As with the Effort Sharing Decision, emissions savings accrued in one year can be carried over to meet annual limits in subsequent years. Member States can transfer or buy annual emission allocations (AEAs) to and from other Member States. In addition to the existing flexibilities, the Effort Sharing Regulation offers two new flexibilities. The first is a one-off flexibility that allows Member States to achieve their targets using Emissions Trading System allowances that would otherwise be auctioned. The second flexibility acknowledges the difficulty of achieving emissions reductions in agriculture and allows the use of removals within the land use sector to achieve the target. If Ireland used both these flexibilities, the national target would become a 20.5% reduction by 2030 relative to 2005 levels. Annual limits for Ireland are presented in Figure 4.3.

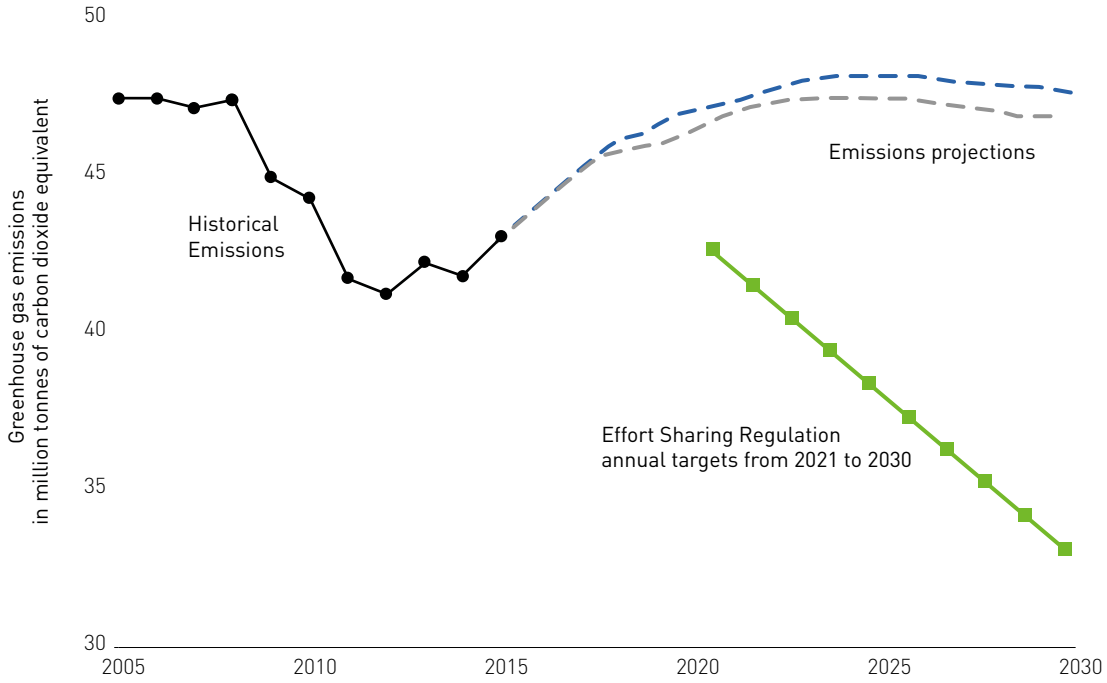


**Figure 4.3:** *Ireland's greenhouse gas emissions under the Effort Sharing Regulation (black line) from 2005 to 2016. Annual targets as included under the Effort Sharing Regulation (green line) for the period 2021 to 2030 and emissions projections for 'with existing measures' (dashed blue line) and 'with additional measures' (dashed grey line) are presented here in units of million tonnes of carbon dioxide equivalent.* **Data sources:** *EPA National Emissions Inventory 2018,*[2] *Ireland's Greenhouse Gas Emissions Projections 2017–2035*[15] *and Effort Sharing Regulation 2016*[19].

Projections for both 'with existing measures' and 'with additional measures' scenarios indicate that, over the period 2021 to 2030, greenhouse gas emissions are projected to exceed annual limits by a cumulative total of between 92.2 and 97.3 million tonnes of carbon dioxide equivalent. Making full use of both total Emission Trading Scheme flexibilities and total land use, land-use change and forestry flexibilities, greenhouse gas emissions in Ireland are still projected to exceed annual limits by a cumulative total of between 46.6 and 51.7 million tonnes of carbon dioxide equivalent. The projections indicate that, despite existing and planned additional policies and measures, greenhouse gas emissions continue to increase, suggesting that Ireland is completely off course to achieve low-carbon transition.

### 4.1.4 Use of Flexibilities

Ireland may use the purchase of emission allowances to comply with its EU Effort Sharing Decision targets to 2020 and Effort Sharing Regulation targets to 2030. The Council has previously expressed concern over Ireland's fiscal exposure to requirements for the purchasing of compliance with EU climate targets.[20] This option also represents a use of public funds to meet targets that would produce no local benefits or national investment in the low-carbon transition.

Purchase of compliance does not avoid the costs of emissions reductions but rather delays the cost to the post-2030 period when further emissions reductions are required. It also increases the challenge of achieving our national transition objective for 2050. The purchase of compliance should be considered only when it is cost-effective, that is, where the current marginal abatement cost is greater than the sum of the current price of carbon (unit compliance cost), the future marginal abatement cost and the potential value of co-benefits of action in the current period.†

† In other words, where there are no abatement or mitigation options costing less than the price of carbon ($P_C$) plus the marginal abatement costs in the future period ($MAC_{t+1}$) plus the value of co-benefits or $\nwarrow P_C + MAC_{t+1}$ + co-benefits.

In the case of the EU Effort Sharing Regulation, there are three flexibility mechanisms: (1) the option to trade EU emissions allowances with other Member States; (2) the option to transfer EU emissions allowances from the EU Emissions Trading System; and (3) the option to use EU emissions allowances associated with land use, land-use change and forestry. If Ireland makes use of its total flexibility from the Emissions Trading System, amounting to 18.8 million tonnes of carbon dioxide equivalent, and the land use, land-use change and forestry flexibility, amounting to 26.8 million tonnes, net exceedance of 2030 targets will be reduced to between 46.6 and 51.7 million tonnes (see Table 4.2).

If Ireland is to purchase emissions allowances to comply with its EU targets, its primary focus should be on allowances associated with land use, land-use change and forestry. These allowances, achieved predominantly through afforestation, augment removals through the existing terrestrial carbon sink and have tangible environmental benefits if the afforestation is carried out and managed in an environmentally sustainable manner. The secondary focus should relate to the other allowances mentioned above (1 and 2). If options 1 and 2 are considered, the concerns that the Council has previously expressed regarding the use of public funds to purchase compliance will need to be considered. This is less of a concern in relation to complying with targets through land use measures, whereby environmental benefits in Ireland could be achieved.

The Council previously recommended that a study examining a range of scenarios to determine the optimal use of compliance purchasing and the necessary additional policy measures that are needed to move Ireland on to a sustainable growth path be undertaken by the Department for Public Expenditure and Reform. This should be done in consultation with the Department of Communications, Climate Action and Environment and with the Department of Finance. The Council has yet to see the results of this work.

**Table 4.2:** *Projected (blue and grey text) greenhouse gas emissions, covered under the EU Effort Sharing Regulation targets, relative to annual totals and total cumulative emissions targets.* **Data sources:** *EPA National Emissions Inventory 2018,*[2] *Ireland's Greenhouse Gas Emissions Projections 2017–2035*[15] *and European Commission Decision (EU) 2017/1471 2017*[18]

| Year | Limits | Emissions | | Distance to target | |
|---|---|---|---|---|---|
| | Mt $CO_2$ e | Mt $CO_2$ e | | Mt $CO_2$ e | |
| | | With existing measures | With additional measures | With existing measures | With additional measures |
| 2021 | 43.1 | 47.2 | 47.0 | –4.1 | –3.9 |
| 2022 | 42.0 | 47.6 | 47.3 | –5.6 | –5.3 |
| 2023 | 40.9 | 47.9 | 47.5 | –7.0 | –6.6 |
| 2024 | 39.7 | 48.0 | 47.5 | –8.3 | –7.8 |
| 2025 | 38.6 | 48.1 | 47.6 | –9.5 | –9.0 |
| 2026 | 37.4 | 47.9 | 47.4 | –10.5 | –9.9 |
| 2027 | 36.3 | 47.8 | 47.2 | –11.5 | –10.9 |
| 2028 | 35.2 | 47.7 | 47.1 | –12.6 | –11.9 |
| 2029 | 34.0 | 47.6 | 46.9 | –13.6 | –12.9 |
| 2030 | 32.9 | 47.5 | 46.8 | –14.6 | –13.9 |
| **Total** | **380.2** | **477.5** | **472.3** | **–97.3** | **–92.2** |
| Total LULUCF flexibility | –26.8 | — | — | — | — |
| Total ETS flexibility | –18.8 | — | — | — | — |
| Net exceedance | — | — | — | **51.7** | 46.6 |

ETS, Emissions Trading System; LULUCF, land use, land-use change and forestry; Mt $CO_2$ e, million tonnes of carbon dioxide equivalent.

## 4.2 International Agreements

Ireland is a Party to the UNFCCC and has ratified both the Kyoto Protocol and the Paris Agreement under the Convention. The Kyoto Protocol, agreed in 1997, sets legally binding emission limitation and reduction targets relative to levels of greenhouse gas emissions in 1990. As a Member State of the EU, Ireland participates in meeting the EU Emission Reduction Target. There are two distinct commitment periods, namely from 2008 to 2012 and from 2013 to 2020. The EU met its 2012 binding greenhouse gas emissions reduction target and is on track to meet its binding greenhouse gas emissions reduction targets to 2020.

The Paris Agreement was adopted in 2015 and entered into force in 2016. The Paris Agreement requires countries to submit nationally determined contributions, which, for developed countries, include emissions reduction targets to 2025 or 2030. As a Member State of the EU, Ireland's contribution to the Paris Agreement is captured in the EU's nationally determined contribution. The EU contribution to the Paris Agreement reflects the EU-wide ambition and targets as set out in section 4.1.

## 4.3 National Policy Position

Ireland's national transition objective, as defined in the National Policy Position[3] and Climate Action and Low Carbon Development Act 2015,[1] is to transition to a low-carbon, climate-resilient and environmentally sustainable economy by 2050. In terms of mitigation, it is broken down into two components. The first aims to reduce emissions of carbon dioxide in three key sectors – electricity generation, the built environment and transport – by 80% by 2050, relative to 1990 levels. The second is related to agriculture, land use and forestry. It identifies 'an approach to carbon neutrality' without compromising sustainable food production as its primary objective.

The level of ambition expressed in relation to mitigation in the National Policy Position is broadly in line with European and international objectives. The National Policy Position brings focus to carbon dioxide emissions from fossil fuel sources. This recognises the importance of reducing carbon dioxide emissions that will continue to warm the planet long into the future. The targets under the National Policy Position are not legally binding.

### 4.3.1 Emissions of Carbon Dioxide

In 2016, greenhouse gas emissions increased by 3.6%, or 2.1 million tonnes of carbon dioxide equivalent, relative to 2015, while emissions of carbon dioxide increased by 3.9%, or 1.5 million tonnes of carbon dioxide equivalent. Although emissions of carbon dioxide peaked at 48 million tonnes of carbon dioxide equivalent in 2005, they have not yet dropped below 1990 levels. Current levels are approximately 21.4%, or 7.1 million tonnes of carbon dioxide equivalent, higher than in 1990. While some years have seen reductions, these have, for the most part, been associated with the financial recession. Annual carbon dioxide emissions reductions of the order of 2.5%, or 1 million tonnes of carbon dioxide equivalent, per year, relative to 2016, will be required to achieve an at least 80% reduction in carbon dioxide emissions by 2050. This would bring Ireland on to a pathway that is consistent with the low-carbon transition, as described in the National Policy Position (see Figure 4.4).

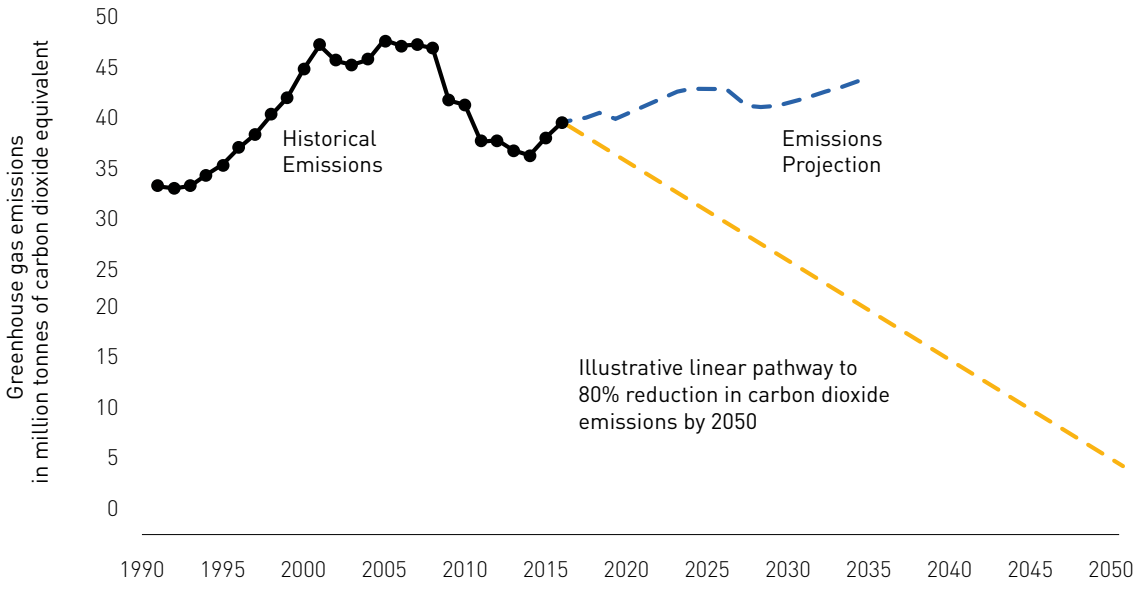


**Figure 4.4:** *Emissions of carbon dioxide in Ireland from 1990 to 2016 (solid black line) and projections from 2017 to 2035 (blue dashed line). An illustrative linear pathway for achievement of the low-carbon transition to 2050 (orange dashed line) is shown here in units of million tonnes of carbon dioxide equivalent.* **Data sources:** *EPA National Emissions Inventory 2018*[2] *and Ireland's Greenhouse Gas Emissions Projections 2017–2035.*[15]

### 4.3.2 Agriculture and Land Use, Land-use Change and Forestry

The National Policy Position addresses emissions sources from agriculture and removals from the terrestrial sink together, reconciling sources and sinks through an objective 'towards an approach to carbon neutrality'. In 2016, greenhouse gas emissions removals by sinks in the land use, land-use change and forestry sector decreased slightly by 2.5%, or 0.1 million tonnes of carbon dioxide equivalent, relative to 2015. Greenhouse gas emissions in 2016 from agricultural sources increased by 2.8%, or 0.5 million tonnes of carbon dioxide equivalent, relative to 2015. There is currently no definition of 'an approach to carbon neutrality' or any indication of a pathway for achieving this element of the low-carbon transition to 2050. Decreasing removals and increasing emissions moves Ireland further away from the objective of the National Policy Position.

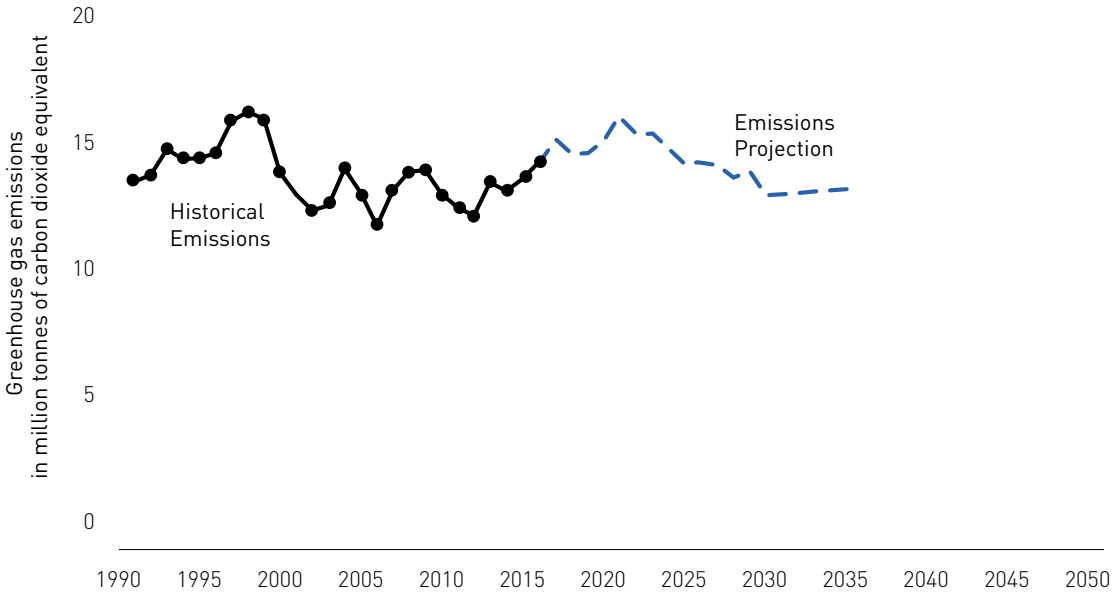


**Figure 4.5:** *Net emissions of greenhouse gases from agriculture sources and removals from terrestrial sinks in Ireland from 1990 to 2016 (solid black line) and projections from 2017 to 2035 (blue dashed line). Units are million tonnes of carbon dioxide equivalent.* **Data sources:** *EPA National Emissions Inventory 2018* [2] *and Ireland's Greenhouse Gas Emissions Projections 2017–2035.*[15]

**Box 4.1:** *Projections for land use, land use change and forestry*

### Land-use change projections

Projections of land-use change are based on macroeconomic drivers and policy measures that lead to conversion of land to other uses. They include national forestry policy, leading to afforestation; energy policy, leading to the decline in the use of peat; and decisions related to the management of foresty and peatlands. Other land management decisions are more difficult to project and monitor, for example the intensification of production on grasslands, or the use of winter cover crops to enhance carbon and nutrient uptake. These management practices can affect the carbon cycle and, in the long term, lead to changes in biomass and soil carbon stored within the landscape. Aligning the analysis of land use projections with the projections of emissions for the wider economy would improve the assessment of linkages between sectors. For example, it would be important to reflect the demand for land use change driven by the energy sector's increased demand for land-based renewable resources.

For the second commitment period of the Kyoto Protocol, Ireland has elected to include grazing land management and cropland management as voluntary elements of our accounting. This is in addition to the mandatory requirements for afforestation, reforestation, deforestation, and forest land management. In the EU Climate and Energy Package there is no mechanism for activities within land use to be counted towards Ireland's EU Effort Sharing Decision 2020 targets. Under the EU Effort Sharing Regulation to 2030 there is some flexibility for Ireland to access net removals from the land use sector as a contribution to our 2030 targets. It may be possible to elect and include wetland drainage and rewetting activities as part of our contribution to our 2030 targets.

## 4.4 Advice and Recommendations

The Council reiterates that Ireland is currently completely off course in relation to its EU targets to 2020 and 2030 and in relation to the National Policy Position. Without urgent action that leads to tangible reductions in greenhouse gas emissions, Ireland is unlikely to deliver on international, EU and national obligations and will drift further from a pathway that is consistent with a transition to a low-carbon economy and society.

The Council recommends the development of a strategy that focuses on energy efficiency and moving towards renewables and that avoids perverse incentives that increase emissions of greenhouse gases. The multiple benefits of reducing emissions should also be considered within such a strategy.

The Council previously recognised that the National Mitigation Plan does not put Ireland on a pathway to a low-carbon transition. The National Mitigation Plan has since been complemented by the National Development Plan. It is unclear to what extent the policies and measures in the National Development Plan will impact on greenhouse gas emissions, as they have not yet been incorporated in to the national emissions projections. The Council recommends that the anticipated National Energy and Climate Plan incorporates new policies and measures that are (1) coherent regarding reducing energy use and at the same time reducing emissions of greenhouse gases and (2) consistent with putting Ireland on a pathway to a low-carbon economy and society.

If Ireland is to employ flexibilities to comply with its 2030 EU targets, its primary focus should be mitigation in the land use, land-use change and forestry sector. This would augment removals through the existing terrestrial carbon sink, contribute towards the national transition objective and have tangible environmental benefits. Purchase or transfer of allowances should only be considered as a secondary flexibility measure. If purchase or transfer of allowances are considered as part of Ireland's compliance strategy, the concerns that the Council has previously expressed, regarding the cost-effectiveness of this approach in the absence of tangible local or environmental benefits, will need to be considered.

There is still no definition of 'an approach to carbon neutrality' for the agriculture and land sector. The National Mitigation Plan identified this as a matter of priority for the research programmes led by the EPA and Department of Agriculture, Food and the Marine. Without a definition, it is difficult to assess the performance of this sector and more importantly to develop a strategy in this area. Such a strategy would need to detail how to augment Ireland's emissions removals through terrestrial sinks and bring agricultural production into balance and on to a sustainable low-carbon pathway.

# 5. Progress Made in Furthering Transition

## Key Messages

- The National Planning Framework has the capacity to address key drivers of greenhouse gas emissions in Ireland. Robust implementation will be key.
- The National Development Plan contains welcome commitments on climate action and key planned investments to support the low-carbon transition.
- Carbon intensity in the electricity sector has increased in the last two years with broader implications for decarbonisation. Planned electrification in the heat and transport sectors requires low- to zero-carbon electricity.
- Energy efficiency in the built environment sector is not progressing quickly enough. More houses need to be reached and deeper retrofits achieved with a switch to low-carbon energy sources.
- Despite some progress in the Dublin region, nationally there has been little progress towards the long-term low-carbon transition in the transport sector. This is of significant concern to the Council.
- The observed increase in agriculture emissions and ongoing carbon losses from land use (including from peat extraction) undermines our ability to achieve the national transition objective. This is of significant concern to the Council.

The Climate Action and Low Carbon Development Act 2015[1] tasked the Council, as part of its Annual Review, to assess progress made in furthering transition to a low-carbon, climate-resilient and environmentally sustainable economy.

This is the second Annual Review by the Council. This year we review progress made across the sectors and progress in public participation, institutions and governance, before presenting a potential range of indicators for transition in the sectors. The indicators offer one perspective on progress made in furthering transition by looking at data reflecting progress in behavioural, technical, structural and infrastructural changes that are key to long-term achievement of the national transition objective.

## 5.1 Progress Across the Sectors

### 5.1.1 Electricity Generation

Emissions from electricity generation in 2016 increased by about 6.0%, or 0.7 million tonnes of carbon dioxide equivalent, relative to 2015 levels. Electricity consumption in Ireland increased by 2.0% to 26 terawatt hours (TWh) between 2015 and 2016. The contribution of renewable electricity to gross electricity consumption increased from 25.3% in 2015 to 27.2% in 2016 (see Table 5.1). This resulted in avoiding 3.1 million tonnes of carbon dioxide equivalent emissions and the cost of importing the equivalent amount of fossil fuels. Around 400 megawatts (MW) of wind was installed in 2016, the highest annual increase to date. This resulted in wind being the second largest source of electricity generation in Ireland, gas being the largest.

While the emissions intensity of electricity generation (grams of carbon dioxide per kilowatt hour) has fallen by around 46% since 1990, it has started to increase again since 2014. From 2015 to 2016 emissions intensity increased from 468 to 483 grams of carbon dioxide per kilowatt hour (g $CO_2$ /kWh; see Table 5.1). The increase in the carbon intensity of emissions and in absolute emissions from this sector in 2016 was largely caused by the increased use of gas in electricity generation and a switch from net imports of electricity to net exports. It should be noted that there was a slight decrease in emissions from burning peat and coal in electricity generation, from 7.0 to 6.8 million tonnes of carbon dioxide equivalent between 2015 and 2016 (see Table 5.1). Ongoing use of peat and coal for electricity generation in Ireland will continue to keep the carbon intensity of this sector well above the EU average.

While the share of renewable electricity generation is increasing, particularly wind, this year's data once again demonstrate that the pace of decarbonisation of electricity generation is not compatible with a low-carbon transition to 2050. The Emissions Trading System needs to deliver a carbon price signal strong enough to drive down emissions from electricity generation. This will be discussed in more detail in Chapter 8.

Increasing renewable electricity generation leads to the decarbonisation of electricity generation. Renewable electricity generation needs to be realised at all scales to ensure that the pace of instalment is in line with our national objectives to 2050. While the amount of wind installed in 2016 is the highest to date, opposition to the deployment of renewables and the accompanying infrastructure is a major concern. Good planning guidelines, which give greater clarity to stakeholders, local authorities, the energy sector and the wider community have demonstrated increased deployment in other countries.[21] Good community engagement that fosters a collaborative approach has been shown to increase the social acceptability of wind. Engaging the public in the decision-making processes from the beginning, addressing public concerns and incorporating suggestions from the public all act to allay public concern regarding these developments.[22] Two documents of note here are the new planning guidelines around wind and other renewables and the new Renewable Electricity Support Scheme, both of which are currently under development. The development of battery storage and increased interconnection with Northern Ireland and, in future, the continent is needed to create greater capacity for the grid to incorporate renewables, especially wind and solar, and to increase energy security (see Chapter 6 for additional information).

The new draft Renewable Energy Support Scheme investigates ways to support the development of renewables and to ensure that people and communities living adjacent to proposed installations are consulted and involved in the process. There are also plans, currently under development at SEAI, to increase individual and community engagement through distributed micro-generation of electricity. This is a step in the right direction when it comes to effectively engaging with communities on these issues. All of these activities are crucial in increasing the pace of the installation of renewables.

To decarbonise heating and transport – an essential extension to decarbonising electricity generation – these activities need to be put on to a pathway that is consistent with achieving a low-carbon economy by 2050. Currently 14.6% or 97,963 and 15.4% or 103,162 of homes reported in the Building Energy Rating (BER) statistics[23] use electricity as their main space and water heating, respectively. In terms of transport there are currently about 4000 electric vehicles on the road in Ireland. Compared with the total number of private vehicles on the road in 2016,

2,038,268 vehicles, this is only 0.002%.[24] It is obvious that there needs to be a significant increase in activity in these areas to allow the decarbonisation of heating and transport, on top of the work that is being done to decarbonise electricity generation.

### 5.1.2 Built Environment

The built environment sector includes residential, commercial and public buildings with emissions primarily due to energy demand for space and water heating, and 'manufacturing combustion'. 'Manufacturing combustion' is the use of energy (historically from burning fuels) in manufacturing processes. It includes emissions from cement production and from the food and drink sector among others. Consumption of electricity is not included in the built environment sector emissions. There has been some progress on transition in the built environment in recent years. Emissions from this sector stayed steady at 12.5 million tonnes carbon dioxide equivalent with a small increase of approximately 0.1 million tonnes carbon dioxide equivalent from 2015 to 2016. Residential emissions also stayed relatively steady from 2015 to 2016 at approximately 6 million tonnes carbon dioxide equivalent. However, the latest European data analysed by SEAI show that, in 2015, the average Irish dwelling emitted 58% more energy-related carbon dioxide than the average EU dwelling, while the energy demand of the average Irish dwelling was just 7% above the EU average. This reflects a high dependency on fossil fuels – coal, peat and oil – for heating and minimal deployment of renewable heating and district heating. New building regulations in the residential and commercial sectors have led to significant improvements in the efficiency of new building stock and will improve uptake of renewables.

More than 375,000 homes have benefited from SEAI's Better Energy Home and Better Energy Warmer Homes grants since 2000.[25] The impact of these grants on emissions is not yet clear. SEAI is taking steps to improve the monitoring of such outcomes in existing and future programmes. However, as originally designed, these retrofit programmes were not intended to bring the buildings involved to the 'nearly-zero energy building' (NZEB) standards required for new buildings. Consequently, many of these homes would require additional investment to achieve the longer term transition objective.

Despite the above progress, EU and Building Energy Rating statistics and the 2016 Census all demonstrate the need for urgent action. The Building Energy Rating database shows that 24% of rated houses achieve poor energy efficiency ratings of E, F and G, unchanged since last year's review despite over 60,000 new ratings in the data set since the last report. This contrasts with annual energy data, as in Table 5.1, that show a decreasing trend in residential solid fuel use over the same period. Households dependent on burning solid fuel are more likely to experience energy poverty.

The floor area of new residential buildings is increasing, with a 15% increase in average floor area across all homes from 2000 to 2016[25]. While the Building Energy Rating (BER) of newer builds is improving, increased floor areas mean that absolute energy demand decreases may not be proportionate. The choice of fuel for residual energy demand therefore remains key. Over 42% of dwellings in the Building Energy Ratings data set use solid fuel or heating oil as their main space heating fuel. Of the 118,574 dwellings that achieve an A or B rating, 24% use oil or solid fuel as their main space heating fuel.[26] This is not the optimal long-term solution.

It is notable that some private businesses have begun to offer biofuel on a competitive retail basis to private and commercial customers. This innovation by the private sector is welcome and an important sign of transition. It will be crucial to the long-term transition that customers and government can be confident of the environmental credentials of those fuels.

There are fewer publicly available data on the fuel use and efficiency of commercial and public buildings. Emissions from the commercial and public services sector saw a small increase of approximately 47 thousand tonnes carbon dioxide equivalent from 2015 to 2016 or about 2.6%. For public buildings, Table 5.1 shows that energy demand has remained relatively steady with a less than 0.5% change from 2015 to 2016. However we need to start seeing decreased energy demand. Over 48,000 non-domestic buildings have undergone a Building Energy Rating audit, representing an increase of over 3000 since the 2017 Annual Review.[27] Summary statistics on these data are published by the Central Statistics Office (CSO) and SEAI. Overall, as Table 5.1 shows in 2016, 13.8% of commercial buildings achieved an A or B rating compared with 14.0% in 2015. This perhaps shows that the data is reflecting a broader cross section of premises but nevertheless points to the scale of the retrofit task faced by the commercial sector. The data show that schools and colleges still have the highest proportion of A and B ratings (50%, unchanged since last review). Nursing residential homes and hostels also have a high proportion of A and B ratings (46%, unchanged since last review), while restaurants and public houses have the lowest proportion of A and B ratings (7%, unchanged since last review). Workshops and maintenance depots have the highest proportion of F and G ratings (31%, unchanged since last review). A new technical guidance document for the Building Regulations on Conservation of Fuel and Energy – Buildings other than Dwellings was published in late 2017 to come into effect on 1 January 2019,[28] with the aim of establishing a 'near zero emission building' performance for new non-dwelling buildings. This should represent a significant improvement on existing standards, which had not been updated since 2008.

### 5.1.3 Transport

The transport sector is not contributing towards the 2020 targets and there has been little progress towards the long-term low-carbon transition. The relationship between income (as measured by modified gross national income at current prices[†],[29]) and transport emissions has weakened in recent years but remains close. Emissions fell during the recession in line with falling economic activity but, since 2012, the overall picture in transport is that emissions are again increasing significantly with greenhouse gas emissions at their highest level since 2010. According to the EPA, this is the fourth successive year of increases in transport emissions following five consecutive years of decreases since 2007.[2] If this increasing trend continued, transport emissions would return to their 2007 peak by 2022.

† At time of publication, statistics for modified gross national income (GNI*) at constant prices was not available. This would give a better reflection of the real relationship between income levels and transport emissions.

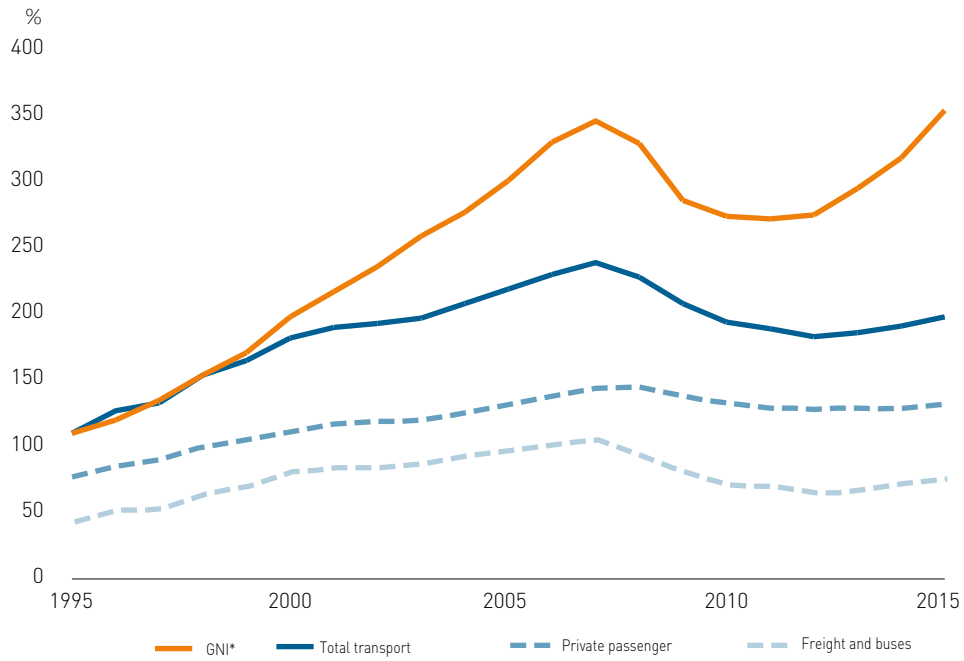


**Figure 5.1:** *Modified gross national income (GNI*) from 1995 to 2015 (solid orange line), emissions of greenhouse gases from total transport in Ireland (solid blue line), from private passenger transport (dashed blue line), and from freight and bus transport (dashed light blue line). Percentages calculated relative to base year 1995.*
**Data sources:** *EPA National Emissions Inventory 2018* [2] *and Central Statistics Office 2018.* [29]

## Passenger Transport

Key sectoral indicators are pointing in the wrong direction at a national level. As well as economic growth and higher levels of activity, urban sprawl and spatial planning decisions have caused high levels of emissions and congestion on roads that lead to major centres of employment. The National Travel Survey 2016 found that, at a national level, journey distances and durations are increasing. Almost three-quarters or 74.3% of all journeys were made by car, a less than 1% difference between the 2013 and 2014 survey results. Only about 5 to 6% were car passenger journeys, meaning most car journeys were single occupant.[30] Ireland's estimated emissions from cars, at 1.6 tonnes of carbon dioxide per capita, are the fifth highest among EU Member States. The Census 2016 found that nationally 65.6% of those commuting to work travelled by car. The same data showed just under half of commuters working in Dublin travelled by car.[31] The impact of the reliance on private vehicle transport on greenhouse gas emissions is compounded by increasing journey lengths (in time and distance) and fuel or technology choice. As shown in Table 5.1, the distance travelled by private vehicle per capita again rose by over 3% between 2015 and 2016. The Central Statistics Office new vehicle registration data show that in 2016, only 0.5% of new passenger cars were zero emissions capable, including plug-in hybrid and all-electric cars. Although this has risen to 0.7% in 2017, the rate of uptake would need to increase dramatically to bring passenger transport on to a sustainable pathway nationally.

**Box 5.1:** *Zero emissions capable vehicles*

### Zero emissions capable vehicles

The National Mitigation Plan does not provide a definition for zero emissions capable vehicles. International examples tend to include tail pipe emissions of both greenhouse gases and other air pollutants in the definition.[32,33] There are broadly three types of zero emissions capable vehicles: (1) electric and fuel cell vehicles; (2) plug-in hybrids; and (3) internal combustion engines using renewable fuels.[34]

1. Electric vehicles are commonly charged from the national grid. Fuel cell vehicles have electric motors powered by hydrogen. Although commonly known as zero emissions vehicles, the actual emissions balance of electric and fuel cell vehicles depends on the emissions associated with the generation of electricity or the production of hydrogen powering the vehicle. As the emissions intensity of electricity in Ireland is greater than zero, it is not yet true that these vehicles are truly zero emissions. Therefore, we use the term 'zero emissions capable' as a collective term to include electric vehicles with other potentially zero emissions vehicles. It should be noted that electric vehicles have zero emissions under the Effort Sharing Regulation emissions, as the emissions associated with electric vehicles are typically covered by the EU Emissions Trading System.
2. Plug-in hybrid vehicles can take a charge from the national grid and travel a limited distance in electric mode. On longer journeys, they switch to fossil fuel engines, with tail pipe emissions typical of internal combustion engines. However, with routine charging, zero emissions operation should be possible for most typical journeys.
3. Internal combustion engine vehicles using renewable fuels are nearly identical to conventional vehicles, with only modest change to the engine configuration to adapt it to different fuel quality and energy density. They are greenhouse gas zero emissions only insofar as the production of the fuel is net zero emissions. They do not have the co-benefits of reducing tail pipe emissions of other air pollutants.

The National Travel Survey 2016 also shows that there was little change overall from 2013 to 2016 in the shares of the sustainable modes of transport (walking, cycling and public transport) have together stayed at approximately 22%. However, a growth in cycling can be seen even at the national level. The survey shows that bus use at the national level fluctuated around 4% over the same period.

There have been encouraging developments in Dublin. The recent *Canal Cordon Report 2017* provides some insight into changes in the behaviour of commuters entering city centre areas between the Royal Canal and the Grand Canal.[35] The total number of people crossing in to Dublin city centre during the morning commute period has returned to levels seen in 2006 before the recession, at approximately 211,400 in 2017. However, there has been a shift in the modes of transport used, most notably an increase in walking and cycling, and a decline in car use over the same period (2006 to 2017) while the percentage share of bus and rail travel has seen little change. At an aggregate level people are changing to the active modes of walking and cycling from car use rather than transferring from public transport. In the period from 2006 to 2017, the total use of sustainable modes of travel into the city, that is, bus, train, Luas, walking and

cycling together, has increased from 61% to 70%, with a 3% increase between 2016 and 2017. The National Travel Survey 2016 shows that journey distances in Dublin have decreased over the period 2013 to 2016, suggesting that either people are living closer to their work and services such as shopping and leisure or that individuals are making fewer journeys. This could be an encouraging trend.

#### Freight

Emissions from road freight transport increased again from 2015 to 2016 by 7.5% (297.7 thousand tonnes carbon dioxide equivalent). However, in the same period, vehicle kilometres rose by 19.7%, tonne kilometres rose by 17.5% and tonnes carried rose by 20.0%.[36] This points to some improvement in freight efficiency. As the 2017 Annual Review noted, rail freight transport is a minor share of total freight and has experienced a steady decline in recent decades. While freight activity increased across most sectors from 2015 to 2016, delivery of goods to road works or building sites saw the biggest increase of 52.7% bringing it from 8.8% of total tonne kilometres in 2015 to 12.7% in 2016. Delivery of goods and materials to retail outlets and wholesalers and to factories saw increases of 25.0%, 20.0% and 41.0% respectively. Import/export traffic holds the largest share of total tonne kilometres at 20.6% in 2016 but saw only a 1.8% increase in tonne kilometres from 2015 to 2016. In 2015, Irish exports and imports combined to an amount over twice the size of the Irish GDP (216%). Only Hong Kong (401%), Luxembourg (391%), Singapore (326%) and Malta (278%) recorded higher levels of trade openness.[37] Economic activity is dependent on the movement of freight. The strategy for achieving significant emissions reductions in the long term needs to be about improving logistics efficiencies and fuel switching. Improved engine performance and efficiencies will be important in the short to medium term.

### 5.1.4 Agriculture and Land Use

In the absence of a definition of neutrality within the agriculture and land use sector, it is not possible to provide a detailed assessment of progress towards the national policy objective. Nevertheless, given the observed increase in agriculture emissions and ongoing carbon losses from land use, the sector is not on a trajectory to achieve the national transition objective.

#### Agriculture

Annual agriculture emissions increased by 2.7% in 2016, and increased by 4.5% relative to 2014. Emissions are projected to increase further. This has largely been driven by the industry taking advantage of market opportunities arising from the removal of quotas on dairy production, in line with Food Wise 2025.[38]

Animal numbers, animal types and farm management are fundamental drivers of emissions within the sector. In addition, much of our agricultural land is managed to produce fodder for the animals, leading to emissions associated with nutrient management and the use of nitrogen fertilisers. The number of dairy animals has seen a significant increase in recent years, with an annual increase in 2016 of 79,000 animals (6.2%) and a total increase of 270,000 animals since 2011 (25.1%). Non-dairy cattle saw an annual increase in numbers in 2016 of 168,000 animals (3.9%). The trend in non-dairy cattle in recent years is not as evident in the dairy sector, but has still recorded an increase of 475,000 animals since 2011 (8.9%). Although there is evidence of improvements in efficiency of production, these have not been sufficient to avoid an increase in absolute emissions.

Challenges exist in providing analysis and indicators of progress towards transition within the agriculture and land sector. Many of the actions undertaken to mitigate emissions and improve efficiency cannot be readily reflected in national estimates of emissions and removals. Measures and policies identified in the National Mitigation Plan focus on improving production efficiency and land management. Quantifying these potential emissions reductions is essential for assessing their effectiveness.

### Land Use

All land uses should be included in mitigation options. Policies and practices to maintain and enhance carbon stocks are needed as part of the overall achievement of an approach to neutrality.

The role of forest land is clear. National policy on forestry is largely consistent with enhancing the national carbon stocks as well as sustainable resource management. In the period 2006 to 2015, the average annual rate of increase in forest was 5,820 hectares per year. In 2016, forest area increased by 6,290 hectares. This rate of increase in forest area is less than that required to achieve the long-term objective of 18% national coverage by mid-century.

The European Commission published legislative proposals for the reform of the Common Agricultural Policy post 2020 on 1 June 2018. This proposed reform is an opportunity to enable more effective supports and incentives for agriculture to maintain and enhance carbon stocks within the rural landscape including in biomass and soils. This should be consistent with other environmental objectives, including enhancing the nature value of agricultural land and improving water and air quality. Current estimates of the change in carbon stocks on agricultural soils indicate a large net source of emissions due to the drainage of peat for use as grazing lands.

Activities on non-agricultural peatlands continue to represent a major source of greenhouse gas emissions, with a steady increase in drained organic soils reported (see Table 5.1). The increase is largely driven by ongoing peat extraction for domestic heating, electricity generation and horticultural use and drainage to enable grassland and forestry activities. The reported increase in drained areas has occurred despite successful rewetting and restoration activities on specific sites. Policies and incentives to enable the improved management of organic soils across all land use types are required. A large proportion of the land managed for peat extraction is in state ownership. The state can provide leadership in improved management of these resources.

There is a clear need for an appropriate national land use policy to help move land management to a more sustainable pathway. This must also address emerging demands from the bio-economy and renewable energy, as well as more conventional demands on land, such as agriculture, forestry, built environment, habitat and ecosystem services. The Council considers that the development of a comprehensive land-use strategy, including all land use types, is essential.

## 5.2 Public Participation

Public participation is key to a successful and smooth transition. There have been significant developments towards furthering public participation in Ireland in recent months.

The National Dialogue on Climate Action is a Government of Ireland initiative through the Department of Communications, Climate Action and Environment, and it was included in the National Mitigation Plan published in July 2017. The primary goal of the National Dialogue on Climate Action is to ensure an inclusive process of engagement and consensus building across society towards enabling the transition to a low-carbon and climate-resilient future.

The first Regional Gathering of the National Dialogue on Climate Action was held on 23 June 2018 in Athlone. This first gathering will use outcomes to inform and design the National Dialogue on Climate Action programme going forward.

The Citizens' Assembly[39] was tasked with considering 'How the State can make Ireland a leader in tackling climate change' and discussed this topic at meetings in September and November 2017. The Assembly vote indicated overwhelming support in Ireland to take a leadership role in addressing climate change. The Citizens' Assembly report of the same name has produced several key recommendations.[40] All of the recommendations overwhelmingly support the state to act to combat climate change. The Citizens' Assembly wants to see a transition away from private fossil fuel vehicles and improvements to infrastructure surrounding zero emissions transport. The Citizens' Assembly believes that a move away from non-renewable sources of energy is necessary and believes that community-owned and -sold renewable electricity is the best approach. Agriculture and agricultural practices were also a focus in its recommendations, with diversification of land use and greenhouse gas emission taxation being priorities. These recommendations were presented to the Oireachtas for consideration on 18 April 2018 (see section 5.3).

Public opinion can be a strong driver of public participation levels. The European Commission tests public opinion using Eurobarometer surveys, which consist of 1000 face-to-face interviews in each Member State on various topics. Surveys based on attitudes surrounding climate change were conducted most recently in the years 2015 and 2017.[41,42] Results from the Eurobarometer surveys show a 20% decrease in the perceived threat of climate change in Ireland (88% to 68%). The results of the survey show Irish respondents reporting decreased active contributions in combatting climate change, for example they were less conscious in 2017 of energy efficiency when buying new household appliances than in 2015. However, Irish respondents indicated feelings of more personal responsibility for tackling climate change than their EU counterparts. They feel multiple actors also have responsibility including the government and the EU, as well as business and industry. Looking to the future, Irish respondents deemed government targets for 2030 on renewable energy and energy efficiency very important. Overall, the results of the survey indicate decreased engagement with climate change action at a personal level. The high-profile media coverage of the Paris Agreement negotiations in 2015 may have led to strong results in the 2015 survey. It is unfortunate that the 2015 level of engagement was not maintained, as is evident by the 2017 results.

More regular testing of Irish public attitudes and opinions on climate change and response could be useful to inform research and underpin strategies promoting increased public participation. It will also be important to monitor and evaluate the impact and effectiveness of public participation and citizen engagement measures such as the National Dialogue. This will help inform future approaches for continued improvement.

## 5.3 Institutions and Governance

The Minister for Communications, Climate Action and Environment, Denis Naughten, gave the second Annual Transition Statement to Seanad Éireann on 29 November 2017 and to Dáil Éireann on 7 December 2017. The statement acknowledged that Ireland would not achieve its 2020 emissions reduction target set in the 2009 EU Effort Sharing Decision. The statement also included some updates on the implementation of the first National Mitigation Plan under the Climate Action and Low Carbon Development Act 2015,[1] which was published on 17 July 2017.

The Council looks forward to the 2018 Annual Transition Statement in which the government has committed to providing an update on the National Mitigation Plan steering group and an update on progress in the implementation of the specific actions committed in the National Mitigation Plan.

In early July 2018, the Oireachtas established the Joint Committee on Climate Action to consider the report of the Citizens' Assembly (discussed in section 5.2 above) along with the further implementation of the National Mitigation Plan, the state of play on sectoral adaptation plans and the development of the National Energy and Climate Plan.

### 5.3.1 National Planning Framework

The National Planning Framework is a high-level strategic plan by the government to shape the future growth and development of Ireland until the year 2040. It aims to guide public and private investment. An objective of the Framework is to plan for the jobs and homes required by an anticipated population increase of 1 million by 2040, creating opportunities and enhancing quality of life while protecting the environment. The Planning and Development (Amendment) Bill 2016 provides a legislative basis for the National Planning Framework. It also sets out a monitoring process in relation to its implementation and a statutory requirement for regular reviews and updates and establishes an independent Office of the Planning Regulator. The framework also builds on the existing legislative basis for the regional assemblies' regional spatial and economic strategies.

The Framework identifies 'macro-spatial' growth as the preferred approach, with regional parity between the East and Midlands Regional Authority (EMRA) and the North Western Regional Assembly (NWRA) and Southern Regional Assembly (SRA) combined. A regional concentration towards the five cities and potential for some regionally important larger settlements is a key result. Choices on prioritisation of specific towns or districts are to be devolved to the regions and then to local government operating within the regional spatial and economic strategy (RSES). The aim of the Framework is to direct development away from business-as-usual patterns of sprawl, low-density and expensive scattering of services, concentrated on a growing Dublin catchment, towards smarter growth. A focus towards contained growth and reduced sprawl by targeting infill lands, including brownfield sites, is an important part of the approach. A significant support to the Framework is the National Development Plan (see section 5.3.2 below) which aims to underpin the Framework with the required infrastructure and spending commitments. Existing statutory arrangements for the coordination of transport planning (by the National Transport Authority, NTA) with spatial planning will be extended to all five metropolitan areas.

A new National Regeneration and Development Agency will be established with a clear government mandate to work with local authorities, relevant Departments and agencies and the Office of Public Works (OPW). A new standardised methodology will be put in place for zoning of land in regional, metropolitan or local plans.

The National Policy Position on Climate Change[3] is adopted as a key driver in the Framework that will shape investment choices over the coming decades. The Framework states the intention that the future planning and development of communities at local level will be refocused to tackle Ireland's higher than average carbon intensity per capita. Sustainable mobility is a key part of the Framework, with the goal that by 2040 our cities and towns will enjoy a cleaner, quieter environment free of combustion engine-driven transport systems.

In considering energy production, the focus is mainly on renewable energy, and the potential role of rural areas to contribute here is highlighted. Offshore wind energy, including floating turbine technologies, receive focus with an acknowledgement of potential requirements for the reinforcement of the existing transmission network. A potentially positive development, since the publication of the Energy White Paper 2015,[43] is that development of indigenous oil and gas reserves is not mentioned in the document.

### 5.3.2 National Development Plan

The National Development Plan sets out the almost €116 billion that will underpin the National Planning Framework and drive its implementation over the next 10 years. €91 billion in exchequer funding for public capital investment has been allocated and will be supplemented with substantial investment by commercial state-owned enterprises. The Plan also contains policy commitments regarding the direction of future investment. Four new funds, together worth €4 billion over the course of the plan, will allocate funding based on a competitive bidding process. This includes €500 million for a Climate Action Fund under the DCCAE. The indicative resource allocation for 'Transition to a Low-Carbon and Climate-Resilient Society' is €21.8 billion. Other allocations, for example, €8.6 billion for 'Sustainable Mobility' or potentially the National Broadband Plan will also have an impact on climate objectives.

The National Development Plan contains more of the specific commitments and detail that the Council had sought in the National Mitigation Plan. They include the commitment that, by 2030, peat and coal will no longer have a role in electricity generation in Ireland, a commitment to invest in energy efficiency with upgrades to homes to achieve a minimum Building Energy Rating of B increasing by 50% from 2021, and a commitment that no new non-zero emissions vehicles will be sold in Ireland post 2030. The Council welcomes the publication of the National Development Plan and the commitments contained therein.

### 5.3.3 Sustainable Development Goals

Under the 2030 Agenda for Sustainable Development, countries are encouraged to incorporate the Sustainable Development Goals (SDGs) into planning and policy and develop their own national responses or plans to address the goals. The 17 Sustainable Development Goals cover the social, economic and environmental requirements for a sustainable future, with goal 13 'Take urgent action to combat climate change and its impacts' making specific reference to addressing climate change.

In April 2018, the Minister for Communications, Climate Action and Environment launched the Sustainable Development Goals National Implementation Plan. This Plan outlines 19 actions to be completed in 2018 to 2020 and is a whole-of-government initiative that sets out arrangements for interdepartmental coordination, stakeholder engagement and periodic progress reporting at national and global levels.[44]

## 5.4 Climate Justice

Climate justice links human rights and development to achieve a human-centred approach, safeguarding the rights of the most vulnerable and sharing the burdens and benefits of climate change and its resolution equitably and fairly. Climate justice is informed by science, responds to science and acknowledges the need for equitable stewardship of the world's resources.[45] There are two dimensions to climate justice in the Irish context: (1) achieving climate justice in the domestic sphere; and (2) contributing to climate justice internationally.

### 5.4.1 Climate Justice within Ireland

Transition to a low-carbon society and economy will affect different segments of the society and economy in different ways. Climate justice in the domestic context is about ensuring that negative impacts of the low-carbon transition, particularly on vulnerable people and communities, is reduced or addressed through other measures, while the advantages of transition are shared fairly. The impacts of climate change on vulnerable groups within Ireland are also areas of concern that have not been sufficiently analysed to date. This aspect is discussed further in Chapter 7.

Fiscal instruments such as carbon taxes are routinely analysed and assessed for their impact on different sectors of society. The distributional impacts of the carbon tax are discussed in Chapters 6 and 8. However, the impact of other policies and measures on vulnerable people and communities is less routinely assessed. During the low-carbon transition, some activities may become uneconomic with consequences for employees and local communities. Individuals and communities dependent on high-carbon activities or assets should be supported in finding new employment and new economic value in the low-carbon economy. Revenue from carbon pricing measures could fund such support. The distribution of the benefits of transition also needs to be considered. Where incentives or supports are offered for changes in behaviour or investment in different technologies, for example electric vehicles, home upgrades, public transport, cycling to work, it is important to ensure that these incentives or supports also reach poorer and more vulnerable communities. Careful targeting of measures and, in some cases, additional supports may be required to achieve this broad deployment. These efforts are required to ensure that vulnerable people and communities are part of the transition and experience the associated benefits such as energy cost savings, improved air quality, warmer homes and greater access to services.

### 5.4.2 Contribution to Climate Justice Internationally

Ireland's per capita emissions, 8.5 tonnes of carbon dioxide[†] per person, are among highest in the world.[46] In contrast, developing countries, acknowledged as the most severely impacted by climate change, have contributed the fewest emissions, especially when examined on a per capita basis. One aspect of climate justice is reducing our own contribution to climate change through the reduction of our greenhouse gas emissions on both production and consumption bases. A second aspect is to help developing countries in their response to climate change. Climate finance is the main vehicle for delivery of such support. Ireland has signed up for international commitments in this regard. Under the UNFCCC, Ireland as a developed country is committed to jointly mobilising with other developed countries US$100 billion per annum by 2020 for climate action in developing countries with the possibility to mobilise such resources from public, private and alternative sources.

International climate finance reported by Ireland increased from approximately €36 million in 2015 to over €52 million in 2016. In both years, the reported climate finance was entirely public grant-based finance. A significant majority of Ireland's international climate finance is directed towards adaptation – at 67% in 2015 and 74% in 2016. Most of the finance is directed towards support to the least developed countries. While project-level information provided by Ireland on disbursed climate finance is very good (in 2015 'Adaptation Watch' graded Ireland as second among

† This is the per capita emissions of carbon dioxide only. This number will be higher if all greenhouse gas emissions are included (see Table 5.1).

developed countries in the transparency of its adaptation climate finance information[47]), the data on total climate finance disbursed by Ireland each year is not readily accessible. Information on the reported total should be made available on a government website.

## 5.5 Indicators of Transition

In its proposals for an Energy Union Governance Regulation, the European Commission identifies the carbon dioxide and greenhouse gas intensity of gross domestic product (GDP) as an indicator of transition.[48] These indicators are included in Table 5.1, but on their own they present an incomplete picture. To assess progress in transition, it is important to understand whether practices and technology deployment are changing or whether we are experiencing continued lock-in of high-carbon technologies and practices. Table 5.1 presents one perspective on the state of transition across the sectors in Ireland. This is not an exhaustive list of indicators. Other indicators can also be informative.

Measuring progress in transition represents a movement away from historical comparisons of emissions against previous performance. Incremental improvements may no longer be enough. Instead, assessing progress in transition means comparing where we are with where we need to be. Unfortunately, our desired endpoint is not always clear. For example, in the long term, petrol and diesel cars in the private car fleet need to be phased out. Similarly, we know that electricity generation needs to decarbonise and that energy coming from coal and peat needs to be phased out rapidly. However, while we may expect that the distance travelled by private vehicle per capita should decrease, with an increase in public transport, cycling and walking, it is not clear how the indicator might reflect decarbonisation when the vehicle stock transitions to a low- or zero-emissions or autonomous fleet. These uncertainties point to the need for a broader basket of indicators to be employed in measuring a low-carbon transition that will cut across all sectors in our economy and society.

Some additional indicators have been added since the first Annual Review in 2017, based on further consideration of the most pertinent and informative indicators for Ireland.

**Table 5.1:** *Possible indicators of transition across sectors (see Appendix 2 for data sources)*

| Name | 2010 | 2014 | 2015 | 2016 | Unit |
|---|---|---|---|---|---|
| GHG intensity of the economy | 0.5 | 0.4 | 0.3 | 0.3 | kt $CO_2$ e/€M GNI* |
| GHG per capita | 13.5 | 12.4 | 12.8 | 13.0 | t $CO_2$ e/population |
| $CO_2$ intensity of the economy | 0.3 | 0.2 | 0.2 | 0.2 | kt $CO_2$/€M GNI* |
| $CO_2$ per capita | 9.2 | 8.0 | 8.2 | 8.4 | t $CO_2$/population |
| Economy-wide efficiency | €2,330 | €2,846 | €3,213 | €3,410 | GVA /t $CO_2$ e €/t $CO_2$ e |
| Total primary energy requirement | 171,042 | 153,970 | 161,529 | 167,623 | Megawatt hour (MWh) |
| Emissions from peat and coal fired electricity generation | 5,737 | 6,349 | 7,051 | 6,840 | kt $CO_2$ |
| $CO_2$ intensity of electricity | 529 | 456 | 468 | 483 | g $CO_2$/kilowatt hour (kWh) |
| % renewable of gross electricity consumption | 14.6 | 22.9 | 25.3 | 27.2 | % |
| % renewable heat | 4.5 | 6.6 | 6.6 | 6.8 | % |
| % residential energy from solid fuel (peat and coal) | 15.5 | 16.5 | 15.2 | 13.9 | % |
| A and B Building Energy Rating (BER)-rated residential dwellings | – | – | 13.5 | 15.6 | % of BER data set |
| A and B BER-rated commercial buildings | – | – | 14.0 | 13.8 | % of non-dwelling BER data set, excluding hospitals, health, community, nursing homes, schools and colleges |
| Energy efficiency gains in public bodies | – | – | 21.0 | 20.0 | % improvement from business as usual |
| Energy consumption of public bodies | – | – | 9,343 | 9,375 | Gigawatt hours (GWh) |
| % renewable transport | 2.4 | 3.1 | 3.3 | 3.0 | % |
| Distance by private vehicles | 31,734 | 31,457 | 34,609 | 36,689 | Million kilometres |
| Distance by private vehicles per capita | 6,967 | 6,824 | 7,466 | 7,741 | Kilometres |
| Distance by goods vehicles | 6,870 | 6,999 | 7,290 | 7,750 | Million kilometres |

| Name | 2010 | 2014 | 2015 | 2016 | Unit |
|---|---|---|---|---|---|
| Distance by public service vehicles | 1,242 | 1,242 | 1,287 | 1,323 | Million kilometres |
| Private car new vehicles' fuel type | 81,122 (95.5%) | 91,157 (98.7%) | 119,066 (98.3%) | 138,778 (97.8%) | Number of new petrol and diesel vehicles (as % of all new) |
| New goods vehicles' fuel type | 10,490 (99.8%) | 16,243 (99.9%) | 22,926 (99.9%) | 28,039 (100%) | Number of new petrol and diesel vehicles (as % of all new) |
| Forestry cover | 731,576 | 754,565 | 760,270 | 766,564 | Hectares |
| Dairy cattle | 1,039 | 1,177 | 1,268 | 1,347 | Thousands |
| Non-dairy cattle | 5,516 | 5,663 | 5,658 | 5,827 | Thousands |
| Sheep | 4,328 | 5,019 | 4,870 | 4,770 | Thousands |
| Total area of drained organic soils | 905,653 | 935,011 | 943,983 | 950,354 | Hectares |
| Farming efficiency | €92 | €121 | €125 | €137 | GVA/t $CO_2$ e €/t $CO_2$ e |
| Dairy production efficiency | 0.9 | 0.9 | 0.8 | 0.9 | kg $CO_2$ e/kg milk |
| Beef production efficiency | 14.2 | 12.5 | 12.5 | 12.4 | kg $CO_2$ e/kg beef |
| International total climate-specific finance | – | €33,674,000 | €36,003,000 | €52,696,000 | Euros |

GHG, greenhouse gas; GVA, gross value added at current market prices; GNI*, modified gross national income at current market prices.

## 5.6 Advice and Recommendations

The Irish economy is not on a pathway towards low-carbon transition. The 2017 National Mitigation Plan contained insufficient measures to put Ireland on this pathway. The National Planning Framework and the National Development Plan announced in 2018 will assist in transitioning towards a low-carbon economy and society; however, their impact on emissions and transition has not been estimated. The government needs to outline, in a comprehensive manner, the pathway Ireland will follow to achieve the national transition objective.

The National Planning Framework has the capacity to address key drivers of greenhouse gas emissions in Ireland. The National Development Plan contains welcome commitments on climate action and key planned investments that can support the low-carbon transition. The Council welcomes these as an important enhancement of institutions and governance for low-carbon transition. However, implementation will need to be robust to achieve the objectives.

More regular testing of Irish public attitudes and opinions on climate change and responses could be useful to inform research and underpin strategies promoting increased public participation. It will also be important to monitor and evaluate the impact and effectiveness of public participation and citizen engagement measures such as the National Dialogue. This will help to inform future approaches for continued improvement.

Carbon intensity in the electricity sector has increased in the last two years with broader implications for decarbonisation nationally. Planned electrification in the heat and transport sectors requires low- to zero-carbon electricity. Opposition to the deployment of renewables and the accompanying infrastructure is a major concern in increasing Ireland's capacity for renewables. Good planning guidelines and community engagement are key in increasing the social acceptability of wind. Further policies and measures and the development of robust planning guidelines are required in this sector to achieve progress.

Energy efficiency in the built environment sector, crucial to decarbonisation, is not progressing fast enough. More houses need to be reached and deeper retrofits achieved. Many high-performing buildings still rely on fossil fuels for their remaining energy demand. Increased progress in both energy efficiency upgrades and switching to renewable energy sources will be important to achieve true low-carbon transition in this sector.

The transport sector is not contributing towards the 2020 targets and there has been little progress towards a low-carbon transition. Progress in the Dublin region in recent years shows the potential for improving the share of public transport, walking and cycling in overall transport activity, particularly in urban areas, but innovative thinking may be required to address freight and rural transport emissions.

The observed increase in agriculture emissions and on-going carbon losses from peat extraction and land drainage undermines our ability achieve the national transition objective towards neutrality. Further implementation of policies and measures is required to achieve progress in this area.

# 6. Achieving the National Transition Objective in a Cost-Effective Manner

## Key Messages

- The success of the National Planning Framework will be determined by the extent to which other plans, policies and measures follow through and maintain consistency with the aims and objectives contained within the Framework.
- The implementation of the National Development Plan is contingent on resources and therefore prioritisation is essential. Sufficient funding and institutional capacity will be required to deliver on all the commitments made.
- To support implementation of the National Mitigation Plan, monitoring and evaluation of progress on actions and commitments is crucial. This information must be made available in a timely and transparent manner.
- A robust carbon price can support low-carbon transition across the sectors at a lower cost to government than the extensive provision of subsidies. Revenue from a carbon tax should support low-income households.
- The Council recommends a carbon tax of €30 per tonne in 2019 rising to €80 per tonne by 2030.
- The commitment to increase the annual rate of energy efficiency home upgrades by 50% is ambitious and necessary. This could be enhanced by a robust carbon price. Integrating behavioural insights to deployment plans will be important to success.
- The participation of the private sector in driving and funding mitigation action is important to successful transition. This participation could be enhanced by a robust carbon price.

The Council is mandated under the Climate Action and Low Carbon Development Act 2015[1] to provide advice on cost-effective approaches to achieve the transition objective. This chapter addresses that mandate. While Chapter 5 sets out the state of play in terms of emissions, trends, technology and behaviour, and what needs to change to achieve transition, this chapter explores how government and other actors bring about the required change and explores the cost-effectiveness of this approach.

It is important not to lose sight of the overall motivation for climate action and the potential benefits that may arise from mitigation actions.[†] The overall projected costs of mitigation do not approach the potential costs of uncontrolled climate change. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) found that:

> Without additional mitigation efforts beyond those in place today, and even with adaptation, warming by the end of the 21st century will lead to high to very high risk of severe, widespread and irreversible impacts globally (high confidence). Mitigation involves some level of co-benefits

† Adaptation and the transition to climate resilience are addressed in Chapter 7.

> and of risks due to adverse side effects, but these risks do not involve the same possibility of severe, widespread and irreversible impacts as risks from climate change, increasing the benefits from near-term mitigation efforts.[49]

The International Renewable Energy Agency (IRENA) found that the cost savings of the long-term transition away from fossil fuels towards energy efficiency and renewable energy would far outweigh the costs of transition due to benefits associated with reduced air pollution, better health and lower environmental damage.[50] The 2015 Lancet Commission on Health and Climate Change concluded that 'a comprehensive response to climate change could be the greatest global health opportunity of the 21st century'.[51] The 2017 Annual Review found, in assessing the most cost-effective manner to achieve reductions in greenhouse gas emissions, co-benefits, such as improved air quality, reduced congestion and reduced nitrate pollution, to be important factors to inform decision making. Economic opportunities from efficiency gains and the green economy should also be considered.

## 6.1 Assessing a Cost-Effective Approach

It is the Council's intention to monitor and review implementation and performance of the National Mitigation Plan each year, as it is the primary statutory instrument supporting national transition. The first National Mitigation Plan under the Climate Action and Low Carbon Development Act 2015[1] was published on 17 July 2017. The National Mitigation Plan contains 106 actions; however, the Council was concerned at the lack of specific detail or commitment on new policies and measures. The Council would like to see the actions linked to expected outcomes or impacts to allow effective monitoring of implementation and progress.

Based on the 2017 Annual Review, the Council considers eight different factors that can assist in achieving a cost-effective approach and how these might be employed to achieve cost-effective transition, sectorally and cross-sectorally:

- effective implementation
- monitoring the impact and effectiveness of measures
- development and use of an up-to-date marginal abatement cost curve as one part of the evidence base
- pursuit of co-benefits to increase effectiveness
- integration of behavioural and societal responses in the design of policies and measures
- avoidance of contradictory or conflicting policy
- enabling and encouraging innovative responses.

Mobilising alternative resources and reducing costs to government where appropriate is an important principle that the Council gives due consideration to in the development of advice and recommendations on policies and measures.

Having considered the application of these factors to highlighted existing and committed policies and measures, the Council has developed advice and recommendations to address gaps to

achieve transition and to improve the cost-effectiveness of transition. This is not a comprehensive analysis of all policies relevant to greenhouse gas emissions and drivers but aims to consider the significant developments in the past year and the most important policies and measures already in place.

## 6.2 Availability of Evidence

The Council has noted the gaps in provision of data or estimates of the cost and effectiveness of measures included in the National Mitigation plan and in the Annual Transition Statement. The Council also notes that evidence and analysis underpinning the National Development Plan has not been published. The publication of such data and analysis is crucial to inform the public discourse on taking forward the low-carbon, climate-resilient transition to 2050. This can greatly enhance public acceptance of measures and consequently improve the effectiveness of implementation.

Teagasc has recently published a second iteration of the Teagasc Marginal Greenhouse Gas Abatement Cost Curve for Irish Agriculture.[52] This represents an update to the original report published in 2012. The new marginal abatement cost curve is calculated from a systems perspective, allowing representation of cost savings from synergies between measures, rather than on the basis of individual cost and effectiveness of individual measures. The publication of this analysis will greatly contribute to the understanding of the role of different agricultural measures in meeting greenhouse gas emission and abatement targets. As yet, there has been no update to the National Marginal Abatement Cost Curve published by SEAI in 2009,[53] nor has an official marginal abatement cost curve for the wider energy sector been published. Further development of sectoral marginal abatement cost curves could be useful to inform policy.

## 6.3 National Plans and Processes

### 6.3.1 National Planning Framework

The Council welcomes the Framework's adoption of the National Policy Position on Climate Change[3] as a key driver. This integration of climate change in planning at the highest levels of government is crucial to driving transition across the economy. The Framework lacks detail, which is understandable given the breadth of issues it addresses. However, the high-level engagement on climate change needs to be carried through to all levels of government (policymakers, regulators and agencies at national, regional and local levels) so that the costs and benefits of climate change are factored into all decision making and responses are integrated in a more specific, measurable and operational manner. The associated National Development Plan (discussed in section 6.3.2 below) includes some more detail on climate-relevant elements and their implementation.

The Framework, with its focus on spatial planning and long-term vision to 2040, has the capacity to address key drivers of transport emissions, the dislocation between places of residence and places of work, and the carbon efficiency of goods networks. The success of the Framework will be determined by the extent to which other plans, policies and measures follow through and maintain consistency with the aims and objectives contained therein. A robust legislative backing will be required to ensure the ongoing relevance and success of the Framework.

### 6.3.2 National Development Plan

The ambition in the National Development Plan, described in Chapter 5, is welcome. Ambition now needs to be turned into delivery with monitoring of results. Regarding mitigation, the National Development Plan (2018) contains more of the specific commitments and detail that the Council had hoped for in the National Mitigation Plan, published in 2017, on electricity generation, the built environment and transport. Some highlights of the National Development Plan with respect to climate change include:

- investment in energy efficiency with upgrades to homes increasing from 30,000 to 45,000 per annum from 2021 to achieve a minimum Building Energy Rating of B
- new Renewable Electricity Support Scheme to support up to 4500 megawatts of additional renewable electricity by 2030
- conversion of Moneypoint electricity generation plant to end the burning of coal by 2025
- conversion of peat power plants to more sustainable low-carbon technologies by 2030
- at least 500,000 electric vehicles on the road by 2030 and additional charging infrastructure to cater for planned growth
- enhanced electricity interconnection
- no new non-zero emission (capable) vehicles to be sold in Ireland post 2030
- town-scale pilots of food and agriculture waste to gas in agricultural catchments for local gas networks' supply and biogas production
- establishment of 'climate-smart countryside' projects to establish the feasibility of the home and farm becoming net exporters of electricity, including through small-scale renewable technologies.

These are discussed under the sectoral headings below. Some important details are still missing, such as the strategy for the replacement of Moneypoint and peat-fired electricity generation. With the statement that, by 2030, peat and coal will no longer have a role in electricity generation, co-firing of peat with biomass would be ruled out for the long term, but the plan for the interim period is not encouraging. As noted in Chapter 3, support for co-firing of peat with biomass will lead to increases in greenhouse gas emissions. Provisions for action in agriculture are made but detail is lacking.

The implementation of the National Development Plan is contingent on resources. Sufficient funding and institutional capacity will be required to deliver on all the commitments made. If resources are constrained, the National Development Plan as published offers no guidance as to how different elements in the Plan should be prioritised. The analysis underpinning the National Development Plan has not been published. The National Development Plan was published too late for the impact of policies and measures contained within the Plan to be included in the 2018 National Emissions Projections published by the EPA. It is anticipated that additional impacts will be included in the 2019 National Emissions Projections. It is not yet known the extent to which commitments made will affect the projection of emissions to 2030. It is therefore difficult to

comment on the cost-effectiveness of the proposed investments. Analysis supporting the National Development Plan should be published to enhance transparency and inform the prioritisation of measures.

Many elements of the National Development Plan will depend on private sector funding. The Council considers that the mobilisation and use of other sources of funding to support transition is appropriate and necessary. The participation of the private sector in driving and funding mitigation action is important to successful transition and helps to reduce cost to government, contributing to the potential for reduction in taxes. Strategies and instruments will be required to mobilise and engage the private sector in meeting climate challenges. It will be crucial to have clarity on how private sector investment will be mobilised in support of the National Development Plan. A robust carbon price would play a role in mobilising private finance. Innovative financial instruments could also play a role. For example, in 2017, the French treasury, Agence France Trésor, launched its first green bonds, the Green OAT, to the value of €7 billion to finance domestic mitigation, adaptation and other environmental actions.[54]

The National Development Plan, as a plan for investment, focuses on achieving change through direct investment in action or investing in change through subsidies and incentives. It is important not to lose sight of the potential role that disincentives such as legislation, costs (such as carbon pricing) or penalties can play in achieving emissions reductions, often at a low cost.

### 6.3.3 Budget

The annual budgetary process represents a key opportunity to support climate action and to consider the broader impacts of government fiscal policy on greenhouse gas emissions, climate resilience and the low-carbon transition. The Council was disappointed about the lost opportunity in Budget 2018 to enhance fiscal instruments, such as the carbon tax and fuel excise duties, despite considerable evidence in their favour. The Council also noted the lack of analysis of climate and greenhouse gas emission impacts supporting budgetary decisions across sectors.

The Council recommends that measures with significant environmental impacts should be included in a cross-sectoral assessment of the climate and environmental impact of the Budget. The cost-effectiveness of such interventions should also be assessed in terms of the likely cost per tonne of carbon dioxide avoided. Such analysis would increase transparency and support better decision making in line with the National Policy Position on climate change and the Paris Agreement.

The Council is also concerned about fiscal exposure to the need for purchasing for compliance with EU climate change and energy targets. A strategic approach is required such that compliance purchasing is limited to where it is the most cost-effective approach. The Council recommends that the Department for Public Expenditure and Reform should undertake, in consultation with the Department of Communications, Climate Action and Environment and the Department of Finance, a study examining a range of scenarios to determine the optimal use of compliance purchasing and the necessary additional policy measures that are needed to move Ireland onto a sustainable growth path.

### 6.3.4 The National Mitigation Plan

The first National Mitigation Plan under the Climate Action and Low Carbon Development Act 2015[1] was published on 17 July 2017 as a 'living document'. It is the Council's intention to monitor

and review the implementation of the National Mitigation Plan each year, as it is the primary statutory instrument supporting national transition.

The National Mitigation Plan contains 106 actions. The Council has identified that 29 of these actions were due for delivery in 2017. Some of these actions have been delivered, for example the rollout of the EXEED programme for grants to business for energy upgrades.[55] Some actions do not appear to have been delivered yet, for example the finalisation of the the Bioenergy Plan in 2017, where only the draft plan and consultation have been published. For many actions, it is not clear what progress has been made. To support robust implementation of the National Mitigation Plan, it is crucial that information is made available in a transparent manner on the progress in implementation to date of actions and commitments within the Plan. The actions should be linked to expected outcomes or impacts to allow effective planning for further efforts required to close the emissions gap.

Since its publication, developments such as the Renewable Heat Incentive, the National Planning Framework and the National Development Plan have added to the array of measures in place to address climate change. As a living document, the National Mitigation Plan should be regularly and transparently updated to reflect newly committed policies and measures and to re-estimate the distance to target for 2020, 2030 and beyond.

## 6.4 Cross-Sectoral Measures

A Climate Action Fund with a planned value of €500 million was announced in the National Development Plan to leverage investment by public and private bodies in climate action measures. The effort to leverage private funding would be a very welcome complement to public funding sources. The National Mitigation Plan included an action to prepare a report for government on options for non-exchequer sources of financing for climate measures in advance of Budget 2019. With the breadth and scale of activity required to achieve transition to a low-carbon, climate-resilient economy and society, it is crucial that the private sector is engaged in the response to climate change.

### 6.4.1 Carbon Price

Regarding cost-effective approaches, economists have long seen carbon pricing instruments as the best approach to achieving cost-effective greenhouse gas mitigation. As discussed in the Council's Periodic Review Report 2017, typically in response to increased costs due to carbon pricing measures, polluters will reduce overall emissions in the cheapest way. This means that overall environmental goals can be achieved in the most flexible and least-cost way to society. Carbon prices also guide research and development activity to focus on innovations that help to avoid or reduce emissions over time. It is important that individuals, households, business and industry are given a clear signal from government on the future development of carbon prices so they can plan accordingly.

From a governmental perspective, carbon pricing, whether implemented via an appropriate carbon tax or via an appropriate emissions trading carbon price, can reduce the cost to the exchequer of changing polluter behaviour. Rather than government offering or paying for incentives to polluters to reduce their pollution, the polluter pays a price for polluting with the revenue going to government or else, in the case of carbon pricing due to emissions trading, to more efficient producers in the sector. If the carbon price is insufficient to influence polluter behaviour, the government must turn to other incentives or measures, with associated costs,

to change behaviour. An appropriate carbon price level can reduce the call on public funding support to influence and change individual and business behaviour and thus may indirectly benefit the wider economy. As with all policies, it is important to consider the impacts on poor and vulnerable communities or groups. Appropriate use of carbon tax revenues can more than address regressive impacts and bring benefits through measures to reduce energy poverty and improve the incomes of those households and individuals most affected by increasing carbon taxes.

Chapter 8 finds that the current carbon tax in Ireland and the market price of carbon in the EU Emissions Trading System, when compared against internationally recommended levels, are insufficient to incentivise the change in individual and polluter behaviour required for the low-carbon transition. A robust carbon price can support low-carbon transition across the sectors at a lower cost to government than the extensive provision of subsidies. The Council recommends a carbon tax of €30 per tonne of carbon dioxide in 2019 rising to €80 per tonne by 2030. The Council recommends that any increase in carbon taxation should be accompanied by measures to address energy poverty and reduce the negative impacts of carbon taxation on poorer households.

Analysis suggests that the best way to achieve the ending of the burning of coal at Moneypoint by 2025 would be to introduce a carbon price floor in Ireland alongside other European countries. Real emissions reductions can be achieved while raising important revenues for government. Competitiveness impacts, estimated to be limited, would be reduced if other countries took similar measures. The Council therefore recommends that government should work with other European countries on the adoption of a carbon price floor for the electricity sector.

### 6.4.2 Research

The EPA has a statutory role in coordinating environmental research in Ireland. Towards achieving this objective the EPA has established the Climate Research Coordination Group.The group includes climate research funding agencies and government stakeholders.

The National Mitigation Plan requires the Climate Research Coordination Group to report annually on its activities and to provide an assessment and synthesis of key findings from the research programmes and related research activities every five years. The Group intends to publish the first annual report on 2018 research activities in the first half of 2019. It also intends to publish a more comprehensive assessment and synthesis report of climate research in Ireland by 2021.

## 6.5 Sectoral Measures

### 6.5.1 Electricity Generation

In the last year, there have been several developments in relation to policy surrounding this sector. These developments will be documented below and have been drawn from a variety of sources, including high-level statements from the Minister, the National Development Plan, the National Planning Framework and the Budget 2018. So far, there is no assessment of the level of emissions reductions that might be expected from these developments. The Annual Transition Statement 2018 did not identify any new policies or measures in relation to this sector. While there are welcome developments in this area, some will need further work to move from aspiration to implementation.

### Peat and Coal Phase-Out

In March 2018, Minister Naughten TD announced that Ireland would join the Powering Past Coal Alliance, a global initiative that brings together a wide range of governments, businesses and organisations taking action to accelerate clean growth and climate protection through the rapid phase-out of traditional coal power.[56,57] This announcement is supported by the National Development Plan, which makes a commitment to end the burning of coal in Moneypoint by 2025 and identify options for its conversion to low-carbon generation. The conversion is likely to require a significant investment of around €1 billion. Peat-fired electricity generation is committed to end by 2030. These announcements are in line with a commitment by the ESB to reduce the carbon intensity of its emissions to below 200 grams of carbon dioxide per kilo Watt hour (g $CO_2$/kWh) by 2030, meaning that there will be no peat or coal in its generation portfolio by 2030. However, projections under the 'with additional measures' scenario show an increase in emissions associated with electricity generation until 2030, largely associated with indirect support to peat through a Public Service Obligation (PSO) levy to support electricity generation from biomass co-fired with peat.

### Infrastructure

The National Development Plan recognises the role of investment in renewable energy, ongoing capacity renewal and new technology in decarbonising electricity generation. It signals that investment in renewables must be accompanied by (1) energy efficiency measures that reduce demand, (2) diversification of energy sources, (3) greater interconnection to international energy networks, (4) electricity storage, and (5) the roll-out and utilisation of smart meters. Complementing the investment in renewables in this manner will increase capacity to electrify heat and transport in the future.

Specific proposals related to infrastructure include investment by the commercial state sector to ensure that in the long term Ireland's electricity network infrastructure is sustainable, secure, competitive and compatible with the projected levels of renewable energy through the ongoing reinforcement of the existing power grid. Enhanced electricity interconnection including the proposed Celtic Interconnector (increased capacity of 700 megawatts) to France and further interconnection to the UK will enhance energy security and diversify energy sources available to the network. Developments are also proposed in relation to the gas infrastructure, specifically to support regional and rural development and the low-carbon transition.

### Renewables

The National Planning Framework also supports the shift towards renewable electricity generation highlighting the importance of the forthcoming Renewable Electricity Policy and Development Framework, the development of Wind Energy Guidelines and the Renewable Energy Development Plan. It also signals the roll-out of the National Smart Energy Metering programme to commence in 2019 as key to a low-carbon development. The development of the new Renewable Electricity Support Scheme (RESS), which will ensure that community and the citizen are at the centre of the zero-carbon energy transition, will support up to 4500 megawatts of additional renewable electricity by 2030. Recent research from the ESRI demonstrates that the PSO support to renewable electricity generation has delivered a reduction in wholesale electricity prices, lowering household energy bills.[58]

The government has also shown support for the continued development of offshore renewable energy by allocating budget funding to the test site infrastructure in 2018.

### 6.5.2 Built Environment

There have been significant developments in policies and measures addressing emissions and drivers in industry, households and the public sector built environment since the 2017 Annual Review. The developments below have been drawn from Budget 2018, the Annual Transition Statement by the Minister in December 2017 and the National Development Plan 2018, among other sources. This is not a comprehensive analysis of all policies relevant to the built environment but aims to consider the significant developments and the most important policies and measures already in place.

#### Industry

A commitment to launch a support scheme for renewable heat was announced in 2017 with an allocation of €6.8 million to fund the initial phase included in Budget 2018.[59] A renewable heat incentive scheme had been included as a proposal for consideration in the 2017 National Mitigation Plan. This is the first support scheme directed at renewable heat sources in Ireland and is aimed entirely at the industrial and commercial sector. The scheme is designed to increase the energy generated from renewable sources in the heat sector by approximately three percentage points. This will assist in meeting EU targets for renewable heat but is unlikely to deliver in time to help to meet 2020 targets. The expected greenhouse gas emissions savings from the incentive have not been estimated, though it can be expected to add to mitigation efforts. The estimated impact of the support scheme should be included in future iterations of the National Emissions Projections by the EPA to enable better understanding of how it might contribute to closing the emissions gap to our 2030 target.

There are two strands to the renewable heat support scheme: (1) a price support mechanism for fossil fuel heating systems switching to biomass and anaerobic digestion sources; and (2) installation grants for the installation of renewable heating systems such as air, ground and water source heat pumps. To ensure that anticipated deployment levels are achieved it will be important to ensure that supply chains for renewable fuels, conversion of heating systems and installation of renewable energy based systems are secure. This may include ensuring the availability of appropriate apprenticeship and trade training opportunities. Where biofuel heating systems are supported, eligibility criteria for technologies and feedstocks should consider potential air quality impacts to avoid unnecessary costs to society. The sustainability criteria for biofuel feedstock should include consideration of life-cycle direct and indirect emissions.

Fuel switching to renewable heat should be accompanied by energy efficiency measures. It is therefore welcome that Budget 2018 allocated a further €14 million to support energy efficiency in the commercial and industrial sector. It is unclear whether this is directed at the building fabric or at efficiency of production processes. Again, it is unclear what emissions savings and economic dividends will be achieved. The National Development Plan contained a commitment to upgrade at least one-third of total commercial premises to a Building Energy Rating of B. Given the high number of F and G rated commercial buildings, €14 million will not be enough. It will therefore be important to have a long-term plan for upgrading the commercial building stock. This plan should consider how to promote efficiency upgrades in the long term without reliance on fiscal support.

### Households

There have been some advances in committed policies and measures to address residential sector emissions since the publication of the National Mitigation Plan in 2017. The National Development Plan, published in February 2018, included significant commitments for energy efficiency both in terms of policies and in terms of resources allocated. This includes a commitment to investment in energy efficiency, with upgrades to homes increasing from 30,000 to 45,000 per annum from 2021 with the aim of achieving a minimum Building Energy Rating of B. This is a welcome step forward in long-term transition management. As discussed in section 5.1.2, a minimum rating of B may not be sufficient for the low-carbon transition to 2050, if the main fuel used for space or water heating in B-rated houses is a fossil fuel. The commitment from SEAI that there will no longer be any Better Energy Homes grant funding for oil or gas boiler replacements is therefore particularly important, as is the extension of government support to heat pumps and roof-top solar panels.

The commitment to increase the annual rate of energy efficiency home upgrades by 50% is ambitious and necessary. Achieving this increased deployment rate will require sufficient and appropriately targeted incentives and supports. Behavioural factors will be crucial to achieve these rates. The SEAI, responsible for delivering the increased deployment rate, recently established a behavioural economics unit to develop improved targeting of households to encourage uptake. Making decisions on retrofit easier, such as clear standards and advice on the appropriate technologies for a given task and house type, improves uptake rates. Trusted intermediaries can play a key role. A robust supply chain of appropriately qualified building contractors and tradespeople, such as plumbers and electricians, who can provide the appropriate advice and guidance to households should be actively developed to avoid constraints to deployment. Reducing the 'hassle' factor in choosing to retrofit your home for efficiency or renewable energy is another key factor to increasing uptake. Additional steps such as a need to seek planning permission, which includes the necessity to advertise in a local paper, or the need to deal with multiple companies, contractors or specialists on a single job, can discourage many people from taking the plunge, offering another potential role for intermediaries.

Publication of data on uptake rates, achieved efficiency gains, and so on, will allow academic and other independent researchers to contribute to increased understanding of factors affecting the uptake and effectiveness of measures and thereby contribute to development of solutions. Publishing such data will also lead to improved public understanding of the performance of measures and therefore better prioritisation of future government support. Budget 2018 allocated €84 million to support residential energy efficiency programmes. The National Development Plan projects exchequer investment of €4 billion in the period 2018 to 2030, along with taxation and regulatory measures, which it anticipates would see a step-change in the energy performance in the residential sector.

It is important that this and future support is targeted to ensure that support for upgrades is directed towards those most in need of those supports, those who cannot make changes without support, fuel-poor households, on so on. More affluent households could be encouraged through an adequate carbon price to invest in upgrades with little if any cost to government, whereas poorer households may lack the access to resources for such investments. The Better Energy Warmer Homes scheme and the Warmth and Wellbeing Pilot scheme target homes of the elderly, children suffering from chronic respiratory conditions and the vulnerable. Efforts to support these and other vulnerable groups in the low-carbon transition should continue.

SEAI estimates that a sum of over €35 billion will be required over 35 years to make the existing housing stock low carbon by 2050.[60] The National Development Plan projects exchequer investment of €4 billion in the period 2018 to 2030, along with taxation and regulatory measures, which it anticipates would see a step-change in the energy performance in the residential sector. A deep retrofit pilot programme, led by SEAI, was initiated in 2017. The programme was included in the National Mitigation Plan 2017 and was estimated to have a direct exchequer cost of €21.2 million from 2017 to 2019. The aim of the pilot is to determine the costs, benefits and effective strategies for achieving the highest standards for the existing building stock. Measuring costs, impacts and outcomes is a key part of the programme. The learning from this pilot programme will be crucial in informing Ireland's transition pathway and how best to allocate budgeted support. It is important that the outcomes and analysis from the programme are published so that learning can be more widely shared.

#### Public Sector

The public sector built environment is an important enabler to achieving transition, not just with regard to reducing its own direct emissions but also because of the potential for the public sector to act as a leader and demonstrator of best practice. The National Development Plan includes a commitment to support deep energy retrofit of schools built before 2008. This is very welcome, as the visibility of schools in the community is very high and therefore has the potential to greatly increase understanding of the retrofit process and its benefits. These investments should be accompanied by an active sharing of information in those communities about the steps being undertaken.

### 6.5.3 Transport

The National Development Plan contains significant planned investments for transport across road and rail, while the National Planning Framework aims to more effectively manage the drivers for transport demand, such as urban sprawl and scattered rural development. These can have significant impacts on transport emissions in the medium to long term.

The National Planning Framework aims to achieve sustainable mobility but also enhanced regional accessibility. Effective implementation of the National Planning Framework to reduce transport demand, facilitate the provision of public transport services and make walking and cycling viable transport options for a greater proportion of the population would support climate objectives. The Framework's aim of reducing urban sprawl and balancing regional development should have the effect of reducing the distances between homes and workplaces. The aim to sustainably pursue development within existing urban areas and towns can increase population density, thus making the provision of public transport more economic. While the National Development Plan contains significant investment in sustainable mobility with an €8.6 billion allocation, it also pursues enhanced regional accessibility (€7.3 billion allocation) mostly through investment in the road network. While this ratio reflects a significant advance on support for sustainable mobility compared with the last development plan,[61] it is important to note that expenditure on bus corridors, cycle lanes and paths falls under the sustainable mobility allocation. To achieve cost-effectiveness in the low-carbon transition it is important that contradictory or conflicting policies and investments are avoided. The Department of Transport, Tourism and Sport is undertaking a strategic infrastructure plan, Planning Land Use and Transport Outlook (PLUTO) 2040, to assess the future needs for land transport in Ireland, based on National Planning Framework population projections. Investment in the road network is not necessarily in conflict with the low-carbon

transition, as zero emission capable vehicles also benefit from a good road network. However, such investments should be carefully planned to support the low-carbon transition, for example by integrating the provision of space for the sustainable modes of transport, such as walking, cycling and public transport, and planning or investment for alternative fuelling and charging points.

The government has also shown renewed ambition for deploying electric vehicles in the National Development Plan. This includes a commitment to have at least 500,000 electric vehicles on the road by 2030 and additional charging infrastructure to cater for planned growth. No cars that are not zero emission capable will be sold in Ireland post 2030 and National Car Test certification will only be issued for zero emission capable cars post 2045. Supporting measures in Budget 2018 such as exemptions from benefit in kind tax, SEAI grants for installation of home charging points and funding for charging infrastructure underpin the commitments. Development and investment in charging infrastructure needs to expand in advance of increased deployment rates to support electric vehicles as an attractive prospect for car buyers. Charging infrastructure needs to be integrated into local and regional spatial planning, dwelling and non-dwelling building regulations, and planning of the electricity transmission and distribution network. The additional electricity demand on the grid in urban and suburban areas will be significant.

It is possible for the public sector to act as leaders and exemplars in the deployment of electric vehicles. New vehicle registration data show that in 2016, only 0.7% of new public service vehicles were either hybrid or zero emission capable. This rose to 1.8% in 2017 (see Table 5.1). Acceleration of the rate of investment in low-emissions public service vehicles would increase the visibility and acceptance of low-emissions technologies by the general public. In this regard the public sector and commercial fleet trials that allow public bodies and businesses to trial electric vehicles (EVs) and steps taken to facilitate public procurement of electric vehicles announced in Budget 2018 are very important. Similarly the new Electric Vehicle Taxi Grant and supporting measures announced in Budget 2018 to stimulate high-visibility uptake will also increase the public's exposure to electric vehicles and support their uptake by the general public.

Public transport investment was one of the most high-profile areas of the National Development Plan with plans and investments announced for the Metro Link Dublin, elements of the Dublin Area Rapid Transit (DART) expansion and investment in BusConnects in Dublin, Cork and Galway. BusConnects is a programme of upgrading the bus service through a more accessible network and increased provision of bus corridors across main city routes. The five city regions are also planned to benefit from sustainable transport projects over the period to 2027 to provide additional sustainable travel options to complement increased capacity and faster higher quality public transport in the cities, including traffic management, bus priority and walking and cycling routes. Public transport investment will also include park and ride facilities, a national train control centre, rail and bus station improvement, and ticketing systems. The technology and fuels underpinning public transport provision are also addressed with a planned transition to low-emissions vehicles, including electric buses, for the urban public bus fleet with no diesel-only buses purchased from 1 July 2019.

It is intended that new town bus services will be provided in certain large towns to enable their development and growth and to provide a public transport option for residents and visitors. For the inter-urban rail network the identified priority is to protect the investment already made in the national railway system by funding maintenance and safety projects needed to maintain safety and service levels. New diesel electric trains are expected to be delivered in 2022.

Investment in public transport is needed if it is to absorb more passengers. Public transport capacity has decreased in recent years. Annual operated vehicle seat kilometres, used by the National Transport Authority as a measure of public transport capacity, fell by almost 5% in Dublin Bus and by 12% in Iarnród Éireann from 2010 to 2016. Bus Éireann saw a small increase in annual operated vehicle seat kilometres of just 1.3% from 2010 to 2016, despite a population increase of 3.9% over the same period.[62] The average age of the fleet at Dublin Bus and Bus Éireann also increased. The fact that both services saw an overall increase in passenger numbers from 2010 to 2016 demonstrates that great efficiencies have been gained but public transport use remains below 2007 levels.[63] The Luas was the only service to see a significant expansion of 20% in annual operated vehicle seat kilometres from 2010 to 2016. In 2016, Luas capacity in terms of operated vehicle seat kilometres was almost one-third of that provided by Dublin Bus. Research by the European Commission highlights that, based on their measurement, access to public transport is relatively low in Dublin compared with other European cities.[64] Access to public transport in other Irish cities, towns and rural areas is unlikely to be better. Low population density is a factor in increasing the costs of public transport provision in Ireland, but the costs of the service need to be assessed against the benefits of decreased congestion, social inclusion, road safety and low-carbon transition.

Increased rates of cycling seen at a national level, mostly in the Dublin region, have been the most positive development in sustainable transport in recent years. Walking and cycling are often portrayed as the most sustainable transport modes, having the benefits of exercise and health as well as zero carbon emissions. However, a significant practical and behavioural barrier to walking and cycling, even where distances are short, is the real or perceived safety concerns. Dedicating road space to cyclists and pedestrians, preferably segregated from traffic can greatly reduce safety concerns. The Annual Transition Statement 2017 stated a commitment to investment of over €100 million to a multi-annual urban cycling and walking programme. Town and rural areas should not be neglected. A greenways strategy is expected to be published in 2018. The Department of Transport, Tourism and Sport, together with local authority engineers, should explore strategies for improving the safety of walking and cycling on all road categories.

The Irish economy is particularly dependent on the movement of freight. Chapter 5 identified that logistical efficiencies and engine efficiencies in the short term and fuel switching in the medium to long term are the means to reduce emissions in this sector. The National Development Plan included a plan to expand the refuelling network for alternatively fuelled freight vehicles to address emissions. This is welcome but not sufficient. Technological potentials, energy source supply chains and business models, driver behaviour and logistics management trends all need to be considered in this sector. The Department of Transport, Tourism and Sport, together with the Department of Communications, Climate Action and Environment should develop a strategy for low-carbon transition in the freight sector to reflect the complexities and economic importance of the sector.

### 6.5.4 Agriculture and Land Use

The agriculture and land use sector is not on a trajectory to achieving the National Policy Objective. A number of initiatives have been identified that may enable the rural economy to contribute significantly to renewable energy generation. However, the observed and projected expansion of livestock and dairy production in Ireland increases the challenges to achieving emission reduction targets in 2020 and 2030.

The National Mitigation Plan highlights the potential role of the rural economy in the development of a diverse portfolio of renewable energy infrastructure. Several research and piloting initiatives were noted, including:

- town-scale pilots of using food and agricultural waste in agricultural catchments for local gas networks supply and biogas production
- climate-smart countryside pilot projects to establish the feasibility of the home and farm becoming net exporters of electricity through the adaptation of smart metering, smart grids and small-scale renewable technologies, for example solar, heat pumps and wind.

Budget 2018 included a measure that assured farmers that development of solar facilities at an appropriate scale would not impact on designation of these agricultural lands, and they would continue to be eligible for farm payments. In addition, the potential for utility-scale solar photovoltaic energy generation is attracting significant attention from investors. Successful development will diversify economic opportunities in the rural economy. There will be some competition for land use, but this is unlikely to be at a scale that would impact the availability of agricultural land nationally. The planning and development guidelines for utility-scale solar facilities have not been finalised. This should be addressed as a matter of priority, to avoid inappropriate development, to ensure benefits accrue to local communities, and to enable the rapid roll-out of a diversified generation infrastructure.

Ireland's Rural Development Programme 2014-2020 will provide support of €3.4 billion for climate change objectives. The annual EU and government supports to the agri-environment schemes, forestry, biofuels and the beef data genomics programme are presented in Table 6.1. Although much of the spending under these headings is not directly aimed at climate mitigation or adaptation, co-benefits are often realised. For example, support for new hedgerow planting is primarily aimed at addressing biodiversity and heritage issues. However new hedgerows are also effective at carbon sequestration to biomass and soils. An evaluation of the Green, Low-Carbon, Agri-Environment Scheme (GLAS) published in 2016 found a very limited number of studies that monitored and analysed the scheme with respect to its impact on climate mitigation and adaptation.[65,66] The review also presented a template for the development of monitoring and modelling capacity to enable necessary evaluation of the Green, Low-Carbon, Agri-Environment Scheme going forward.[67] On the basis of this review, robust indicators of the impacts of measures supported under the scheme can be developed.

**Table 6.1:** *Supports provided to enable environmentally sustainable agriculture, forestry and biofuels*

| Activity | Spending (million euros) | |
|---|---|---|
| | 2015 | 2016 |
| Rural Environment Protection Scheme | 131 | 148 |
| Forestry and Bio-fuels | 104.2 | 103.8 |
| Beef Data Genomics Programme | 34.7 | 62 |

A number of programmes provide supports and incentives to farmers and other landowners to enable beneficial environmental outcomes and sustainable management practices.

The Beef Data and Genomics Programme (BDGP) was launched in May 2015, with the aim to deliver accelerated genetic improvement in the quality of the beef herd and, as a result, lead to associated climate benefits. Measures included completion of the Carbon Navigator, genetic profiling of the herd, and actions over time to improve the genetic merit of the herd through selective replacement with animals with lower greenhouse gas emissions. Over 23,000 participants have signed up to a six-year contract to implement measures under the programme.[68] The 2017 evaluation of Rural Development Programme found that participation in the Beef Data and Genomics Programme is beginning to improve herd fertility, but it remains at an early stage of development. It is too early in the reporting phase of the Rural Development Programme to analyse whether actions under the Carbon Navigator, such as a longer grazing season, have been implemented.

A total of 53,174 farmers have been approved for entry into the Green, Low-Carbon, Agri-Environment Scheme, surpassing the target participant rate of 50,000 by 2018. The scheme supports actions on 943,332 hectares of farmland, approximately 32% of all agricultural land in Ireland. The 2017 evaluation of the Rural Development Programme reports lower greenhouse gas emissions per hectare on Green, Low-Carbon, Agri-Environment Scheme farms compared with non-participants. However, the dairy sector participation is relatively poor, and therefore the comparison may overestimate the impact of the scheme.

Bord Bia's Origin Green programme is a high-profile initiative that provides supports to farm, manufacturing, retail and food service sectors to adopt best practice. Knowledge transfer through the Carbon Navigator and other emissions assessment tools is a core feature of the programme, with voluntary actions and targets for participants. Origin Green also includes regular audits and data collection. Participating farms account for 90% of beef production and 70% of dairy production. The 2016 report outlines significant potential for emissions reduction within beef (7%) and dairy (14%), based on successful achievement of the individual improvement targets by the cohort of participating farmers.[69] Demonstrating progress in achieving this potential emissions reduction will be important as Origin Green develops.

The EPA-led Smart Farming initiative complements Origin Green, but has a broader environmental scope.[32] The EPA has collaborated with key agriculture stakeholders, including the Irish Farming Association, the Department of Agriculture, Food and Marine, Teagasc, SEAI and third-level institutions. The aim of the initiative is to enable farmers to adopt sustainable farming practices, including greenhouse gas mitigation measures, through knowledge transfer, while also achieving significant cost co-benefits and improving farm environmental and economic sustainability. In its 2017 report, the Smart Farming programme estimated a 10% average potential greenhouse gas emissions reduction on participating farms. Realising and

verifying these potential emissions reductions through data analysis and monitoring is required. Data on the uptake of these practices and real-world impact on carbon stocks are needed to ensure they are reflected in national reporting of emissions and removals.

The Annual Transition Statement 2017 did not identify new measures further to the National Mitigation Plan. The timing of policy development and implementation is closely aligned with the roll-out of the Common Agricultural Policy and other EU mechanisms and supports for agricultural development.

The primary goal of Ireland's forest policy is to enable the development of an economically viable and environmentally sustainable forestry industry.[70] It aims to expand the national forest to meet the raw resource demands of several key sectors including timber for construction, as well as biomass for renewable energy. It also aims to increase the store of carbon within the forests, initially through afforestation. However, ultimately the national forest will achieve a level of maturity whereby the carbon stock is maintained as a sustainable balance between harvesting and replanting and regeneration. Forestry policy has an ambitious target to increase national forest cover from the current 11% to 18% by 2046. This requires a sustained net increase in forest area of approximately 15,000 hectares per year. Significant additional effort is required over the medium term to realise this policy ambition.

The National Peatlands Strategy sets down a vision, values and principles that will guide government policy in relation to all peatlands.[71] These are to be applied through their incorporation into the more detailed sectoral plans, policies and actions adopted and undertaken for each policy area. The strategy applies to all peatlands, including peat soils, and covers 1.47 million hectares. The strategy is aimed at peatland owners, users and the broader community that benefits from the services that peatlands provide.

The National Planning Framework states the intention to prepare a medium to longer term national land-use plan for peatlands in state ownership to manage their most appropriate future use, building on the existing National Peatlands Strategy and other national policy related to peatlands conservation and management.

## 6.6 Advice and Recommendations

The Council was disappointed about the lost opportunity in Budget 2018 to enhance fiscal instruments, such as the carbon tax and fuel excise duties, despite considerable evidence in their favour. A robust carbon price can support low-carbon transition across the sectors at a lower cost to government than extensive provision of subsidies. Revenue from a carbon tax could support low income households. The Council recommends a carbon tax of €30 per tonne in 2019 rising to €80 per tonne by 2030. Equalisation of petrol and diesel excise duties would also be important to reflect their overall environmental impacts across greenhouse gas emissions and air pollutants.

The Council considers the mobilisation and use of other sources of funding to support transition to be appropriate and necessary. The participation of the private sector in driving and funding mitigation action is important to successful transition. Strategies and instruments will be required to mobilise and engage the private sector in meeting climate challenges. It will be crucial to have clarity on how private sector investment will be mobilised by government in support of the National Development Plan. Robust carbon pricing could play an important role.

The commitment to increase the annual rate of energy efficiency home upgrades by 50% is ambitious and necessary. Making decisions on retrofit easier, such as having clear standards and advice on the appropriate technologies for a given task and house type, improves uptake rates. Trusted intermediaries can play a key role. A reliable supply chain of appropriately qualified building contractors and tradespeople, such as plumbers and electricians who can provide the appropriate advice and guidance to households, should be actively developed to avoid constraints to deployment.

A commitment to launch a support scheme for renewable heat, announced in 2017, is a welcome development to address emissions and low-carbon transition in the commercial and industrial sectors. To ensure that anticipated deployment levels are achieved it will be important to ensure that supply chains for renewable fuels, conversion of heating systems and installation of renewable energy-based systems are secure. This could be undermined by planned support for co-firing of biomass with peat in electricity generation. Fuel switching to renewable heat should be accompanied by energy efficiency measures. It will be important to have a long-term plan for upgrading the commercial building stock, which has a high share of low-performing buildings. This plan should consider how to promote efficiency upgrades in the long term without reliance on fiscal support. Robust carbon pricing could play a role.

The success of the National Planning Framework will be determined by the extent to which other plans, policies and measures follow through and maintain consistency with the aims and objectives contained therein. Strong legislative backing will be required to ensure the ongoing relevance and success of the Framework.

The implementation of the National Development Plan is contingent on resources. Sufficient funding and institutional capacity will be required to deliver on all the commitments made. If resources are constrained, it will be important to have clarity and transparency on how different elements in the plan should be prioritised. Prioritisation should take into account a revised shadow price of carbon.

To support comprehensive implementation of the National Mitigation Plan, it is crucial that information is made available in a timely and transparent manner on the progress in implementation to date of actions and commitments within the National Mitigation Plan. The actions should be linked to expected outcomes or impacts to allow effective planning for further efforts required to close the emissions gap.

The Council welcomes the government commitment to end the burning of coal at Moneypoint by 2025. The commitment that, by 2030, peat and coal will no longer have a role in electricity generation in Ireland is also welcome. The Council is very concerned by the plans for the continued support for peat indirectly through a subsidy for biomass co-fired with peat. Support for electricity generation from co-firing of peat with biomass is projected to lead to an increase in greenhouse gas emissions up to 2030 and will not assist in meeting climate change targets. Peat is a high-carbon fuel whether burned alone or co-fired with biomass. Government resources should not support measures that lead to increases in emissions.

Emissions from freight are growing but hard to address. The Department of Transport, Tourism and Sport, together with the Department of Communications, Climate Action and Environment should develop a strategy for low-carbon transition in the freight sector that reflects the complexities of the sector such as technological potentials, energy source supply chains and business models, driver behaviour and logistics management, as well as the economic importance of the sector.

The agriculture and land sector must adopt all reasonable cost-effective measures to reduce emissions and enhance removals within the sector. There remains a need to define the carbon neutrality objective for the sector. Measures such as GLAS and Origin Green should aim for measurable environmental benefits, including measurable greenhouse gas emissions reductions. The recently published analysis by Teagasc on a marginal abatement cost curve identifies measures that should be employed to reduce emissions.[52]

The Council will turn its focus to agriculture and transport in the autumn and winter of this year. This will be followed by work on the heating and built environment sectors in the coming year.

# 7. Progress Towards a Climate-Resilient Ireland

## Key Messages

- Recent extreme events highlight challenges across many sectors and communities and signal the need to prepare for, invest in and become resilient to climate change.
- The National Adaptation Framework is a significant advance in the institutional support for adaptation and resilience in Ireland. Progress on sectoral and local authority adaptation plans is the next priority.
- Delivering effective adaptation requires a strong partnership between government, the public and the private sector. Government must enable and empower action by others and show leadership through its own actions.
- Significant work is required on risk assessment, identifying options for effective action, implementation, monitoring and evaluation. To ensure integrated and coherent outcomes, collaboration across all regions and all sectors is required.

The Climate Action and Low Carbon Development Act 2015[1] requires the Council to conduct an annual review of progress made 'furthering transition to a low-carbon, climate-resilient' economy. The National Policy Position highlights the importance of an integrated approach involving all stakeholders to ensure that appropriate adaptation measures are implemented. This includes investment plans to reduce negative impacts of climate change at sectoral and local levels. In this chapter, the Council outlines a set of basic principles to assess progress on adaptation.

## 7.1 Outline of Observed and Projected Climate Change for Ireland

To prepare for the impacts of climate change, we need to first understand our historical and current climate, along with our weather and its variability. This forms the basis for understanding what our future climate may be. The projected impacts of climate change often seem distant from everyday life. The need to plan and invest in actions to address impacts therefore receives less priority. When projected climate impacts are framed within our personal or historical experience it can make the need for action more tangible and immediate. Improving resilience to existing climate and extremes in weather will put us on a pathway towards a climate-resilient Ireland.

### Observed Climate Change since the Pre-Industrial era (~1850 to present)

Ireland possesses a wealth of knowledge and experience to draw on to understand our vulnerability to climate variability. Ireland has some of the longest weather records in the world, with continuous recording at some sites available from the early 1800s.

There is unequivocal evidence of changes in climate in Ireland since the pre-industrial era. Ireland has experienced warming of approximately 0.8°C from 1900 to 2010, which is consistent with global trends. This is less than the warming experienced across the rest of Europe, which is around 1.5°C above the pre-industrial level.[72] Ireland's lower rate of warming results from the influence of the Atlantic on our climate. Recent analysis provides evidence of an increase in the variability of temperatures in Ireland, with a notable increase in the probability of high temperature episodes[73,74] (see Box 7.1).

There is also evidence that Ireland has experienced changes in precipitation (rain and snow) patterns and intensity. Ireland has monthly rainfall records back to 1711 based on observations and weather diaries[74] (see Box 7.1). The full historical record shows that there is considerable year-to-year and decade-to-decade variability in rainfall totals. However, three points are noteworthy:

- Recent decades have been the wettest in more than 300 years.
- There is a clear trend towards wetter winters and drier summers.
- These changes are not always evident in the shorter records (30 years) that are typically used for analysis. This emphasises the importance of long-term records for tracking change and informing adaptation planning.[74]

Recent analysis shows that in the past Ireland has experienced episodes of multi-year drought.[75] However, the period since 1980 has been relatively drought-free. Both historical patterns of climate variability and projections of regional climate change suggest that there will be significant risk of multi-year drought.

### Future Climate Change

Projections of climate change in Ireland have been broadly consistent since global and regional modelling work began in the late 1990s. Global and regional climate models provide insight into climate change to the periods around 2050 and further out to around 2100. For Ireland, although underlying warming trends will continue in the period to the 2050s, natural climate variability will dominate. That is, climate events will be broadly consistent with those observed in the historical record, although the frequency of those events will change. The change will be subtle at first, but will become steadily more pronounced. The severity of impacts after 2050 will strongly depend on the effectiveness of global action to reduce greenhouse gas emissions.

It is important to remember that Ireland's weather will continue to be variable. Ireland will continue to experience relative extremes of cold and heat, drought and precipitation, and wind. However, Ireland will experience winters that are generally wetter and summers that are generally drier. Winters will warm faster than summers, leading to fewer frost days. Rainfall episodes will be more intense, leading to greater rates of surface run-off and higher risk of flooding. There is also the possibility that, although average wind speed may decrease, the intensity of individual storms may increase. Investment in climate research has given us improved understanding of the underlying physical processes and better climate model resolution, which has provided these valuable insights.[76,77,78,79]

**Box 7.1:** *Past and future climate change in the context of memorable seasonal extremes*

## Past and future climate change in the context of memorable seasonal extremes

Climate change is often regarded as temporally, geographically or socially distant from people's everyday lives. Direct personal experience of climate-related weather events may act as a strong 'signal' or focusing event that makes the otherwise abstract nature of climate change more tangible and triggers more substantive public engagement and policy response. A useful approach is to ground climate change projections in the context of recent extreme events, still vivid in the public mind. Such an approach also offers insights into what climate change may mean for Irish society, the vulnerabilities that exist and the challenges of adaptation.

During the period 1900 to 2014, the hottest and the driest summer in Ireland was 1995. That summer saw increased mortality, especially among the elderly and infirm. Rainfall deficits and water shortages adversely impacted the agricultural sector. Water shortages were also a common occurrence, with record low water levels on the Shannon impacting tourism, while water supplies for major cities like Dublin were severely tested. Using weather observations, research has shown that experiencing a summer as hot as 1995 has become 50 times more likely over the last century, while the chances of a summer as dry as 1995 occurring have doubled.

With current global emissions trends, climate model projections for the end of this century suggest that our hottest summer historically may be viewed as an unusually cool summer in the future. By 2100, summers similar to 1995 will be much cooler than the new average, with summers at least as hot as 1995 occurring almost 90% of the time. The same climate models suggest that summers as dry as 1995 may become 10 times more frequent by the end of the century.

The two wettest winters on record since 1900 are the winters of 2015 to 2016 and 1994 to 1995. Both winters were associated with widespread flooding. From historical observations, the likelihood of a winter as wet as 1994 to 1995 has doubled over the last century. Climate model projections suggest that similar wet winters may become eight times more frequent by the end of the century. Together with the population growth expected in Ireland over the coming decades and the already high flood exposure, such change would make flooding a much more familiar experience for Irish society.[80]

## 7.2 Principles and Concepts

The Council has adopted the definition of adaptation which is provided in the Climate Action and Low Carbon Development Act 2015.[1] Adaptation 'means any adjustment to:

- any system designed or operated by human beings, including an economic, agricultural or technological system, or
- any naturally occurring system, including an ecosystem,

that is intended to counteract the effects (whether actual or anticipated) of climatic stimuli, prevent or moderate environmental damage resulting from climate change or confer environmental benefits.'

### 7.2.1 Prevention, Planning and Shared Responsibility

Prevention is a key element of adaptation, particularly in the context of planning new development, new infrastructure and sustainable land use. For example, it would be preferable to avoid development in areas currently at risk of flooding or likely to be prone to flooding in the future, rather than making costly flood management investments in the future. Decisions to develop in areas of identifiable climate risk need to be informed by an awareness of potential future cost and risk implications. Some development and zoning decisions in the past have not reflected environmental and climate constraints, leading to predictable adverse consequences. Guidelines and regulatory structures and processes exist to inform decision making and are important tools to ensure appropriate development at all levels.

In planning for adaptation, it is important to consider the potential for multiple benefits that can be realised through adaptation measures. For example, measures could also contribute to achievement of the Sustainable Development Goals,[81] align with the Sendai Framework (which addresses disaster risk reduction),[82] and help to achieve other national policies, along with regional and local development goals.

Government has an important function in guiding and regulating the actions of individuals, communities and enterprises to promote and enable adaptation actions. This can be done through the provision of climate information and the implementation of appropriate legislation in planning and development. Adaptation is not solely the responsibility of government, it is a shared responsibility across all sectors of society. Ultimately, behaviour and investments by the private sector and citizens shape our resilience to climate change. Private actors therefore bear primary responsibility for the protection of their well-being and property, and their adaptation investment will be very important at local and individual level. Awareness of the need for adaptation remains poor, with corresponding low levels of willingness to engage. Some responsibility must be delegated at a community and government level to ensure coherent, efficient and effective implementation of the adaptation response, with the greatest societal benefit.

Climate change has the potential to have a disproportionate impact on vulnerable and marginalised communities and individuals. Multiple factors tend to lead to under-representation of these sectors of society and their concerns within decision making at all levels. Additionally, resources for local, independent actions are severely constrained with a high dependence on state supports for implementation of both adaptation and mitigation measures.

In the preparation and communication of adaptation planning, clarity should be provided on the assessment of risk, exposure, vulnerability, resilience and adaptive capacity, and the decision-making framework under which options are considered. This should include criteria for prioritisation, implementation, monitoring and evaluation. These would set the stage for consideration of the types of options to develop and the need for a robust and credible portfolio of measures.

### 7.2.2 Indicators

It is important to recognise that adaptation is a process of continuous learning and improvement. To enable learning, indicators are required throughout the policy development process for the purposes of monitoring and evaluation.[51]

Appropriate indicators enable the critical assessment and review of adaptation actions, including their implementation, and the early identification of emerging issues. In broad terms, there are two types of indicators: impact indicators and response indicators. However, standard approaches for indicators are not fully developed with useful examples of country-specific classifications and definitions.[83] Systems need to be established to ensure that data are collected at the appropriate level to produce relevant and credible indicators.

*Impact indicators:* these include weather observations that quantify climate change and inform the assessment of risks such as temperature, precipitation and wind, and trends in impacts such as sea level rise, river flow and flooding. A report on the status of national systems to monitor essential climate variables found that it is important that Irish observation systems are maintained to enable continuous monitoring of these indicators.[84] Socio-economic indicators of impact are also important. In broad terms these reflect the exposure to, and ability to cope with, current impacts and changing impacts caused by climate change. Examples from other countries include the number of properties projected to be affected by flooding; energy generation and supply lost due to climate and weather events; the number of work days lost due to flooding/ severe weather; and the number and duration of delays in transport due to severe weather. In developing Ireland-specific indicators, it is important that the indicators reflect the impact of actions and progress in adaptation and are measurable without excessive burden.

*Response indicators:* these reflect the status and pace of implementation of adaptation actions and their effectiveness. Examples from the UK's Monitoring and Evaluation reports[85] include assessment of the number of electricity substations with site-level protection measures in place or in planning; actual and planned investment in resilience in water supply and treatment; and planned investment in transport infrastructures to improve resilience. These could also include measures related to adaptive capacity.

The key issue is that indicators must be fit for purpose, directly relevant to the adaptation objectives, and preferably based on existing or readily available data that is updated on a regular basis.

### 7.2.3 Types of Adaptation

The literature identifies three broad types of adaptation: soft, green and grey, as well as combinations of these.

- Grey adaptation measures involve investment in specific engineering solutions, such as coastal and river flood defences.

- Green, or nature-based measures, are inspired and supported by nature, and aim to manage and enhance ecosystems to provide protection or resilience. Examples include the restoration of wetlands to manage flood risk, or urban shading to decrease the potential for overheating and to enhance ventilation.

- Soft adaptation measures focus on changing behaviour to improve individual, community and wider societal response to climate change as well as addressing the risks and facilitating implementation, including capacity building, for example improved early warning systems and communications to encourage appropriate actions during an extreme event and increasing the knowledge and skills of individuals and organisations to engage in and implement adaptation.

In developing adaptation plans, the criteria by which progress will be monitored and evaluated is important. This directly relates to the set of indicators developed to enable the evaluation of progress in the implementation of adaptation plans and measures, and the evaluation of their effectiveness.

There is a need for the integration of responses across sectors leading to coherent and complementary spatial and cross-sectoral adaptation response. There is also a need to recognise that risks, opportunities and responses exhibit dependencies and interdependencies that require an integrated and collaborative approach.

Governance structures, both horizontal and vertical, are important in ensuring consistency between policy and local action. In providing an enabling environment, it is important that these structures support the prioritisation of actions, especially in situations with multiple stakeholders and differing objectives and concerns.

## 7.3 Review of Progress

This section presents a commentary on significant policy developments in 2017 and the first quarter of 2018.

### 7.3.1 Institutions and Governance

The first National Adaptation Framework was published on 19 January 2018. The Council welcomes this important development in adaptation policy. A key component of the framework is the role of the National Adaptation Steering Group in ensuring coherence across sectors and at different levels of government, from local to national levels. This is of critical importance given the local scale at which decisions are taken regarding the implementation of actions and measures and the interdependencies between localities and communities. The framework should provide an enabling environment for local action and for collaboration and coordination of local-scale decisions. The Council welcomes the guidance in the National Adaptation Framework that all options advanced in sectoral and local authority adaptation plans will be actionable and are reflected in their key priorities within the annual budgetary and estimates processes.

To enable appropriate analysis and review of the implementation and efficacy of the National Adaptation Framework, operation of the steering group will need to be transparent and open. This also applies to the National Mitigation Plan Steering Group, within which the adaptation steering group resides.

The 2017 Annual Transition Statement focused on mitigation but has three short sections that address progress on adaptation. The statement looked forward to the publication of the

National Adaptation Framework, the National Climate Dialogue and progress on sectoral and local authority adaptation plans. It is anticipated that the 2018 Annual Transition Statement will provide more detailed reporting and analysis of the implementation of the National Adaptation Framework.

#### Local Authorities

Under the Climate Action and Low Carbon Development Act 2015,[1] local authorities are mandated to develop adaptation plans. Four regional climate action offices have been established with the support of the government. These will increase capacity at regional and local levels to address climate change and should enable a coherent approach in the assessment of adaptation needs and responses and allow the meaningful coordination of adaptation actions across regions.

#### Adaptation Preparedness in Ireland

In 2015, the European Commission undertook a preliminary inventory of Member State preparedness for climate change impacts and adaption action, examining the preparedness of institutions.[86] Results from Ireland showed that several substantial advances have been made; however, more effort is required if vulnerability is to be addressed and resilience is to be built up. The European Environment Agency assessment was undertaken prior to recent important policy developments including publication of the National Adaptation Framework, the establishment of regional climate action offices and progress on sectoral and local adaptation plans.

Recent research undertook an updated and more detailed analysis of Ireland's preparedness, and preliminary findings and recommendations were presented to the Council's Adaptation Committee.[87] The study found that the key components of an enabling environment for climate resilience are in place. These should aid sectoral- and local-level planning; however, barriers remain that may hamper adaptation action and implementation. The key to overcoming the barriers to adaptation and realising possible opportunities lies with the institutions and processes, including the local authority regional climate action offices, the National Adaptation Framework and the National Dialogue on Climate Action.

### 7.3.2 Support and Information Systems

The Council intends to review progress on the provision of supports for adaptation planning and implementation from the research community and through the provision of information such as Climate Ireland (see below), as well as progress on capacity building and awareness-raising more generally.[88]

In the National Mitigation Plan and National Adaptation Framework, the EPA is charged with the role of coordinating climate research across state-funded bodies. The EPA will produce an annual report of current research activity in Ireland, with the first report expected in early 2019. In addition, the EPA will produce a regular assessment report that will review the findings of scientific research literature relevant to Ireland on a five-year cycle. The Council looks forward to the publication of these reports.

Climate Ireland is a web-based platform primarily focused on providing climate information to sector and local authorities to assist them in the development of climate action plans. Climate Ireland was developed with research funding provided by the EPA and is currently in pilot mode with funding from the Department of Communications, Climate Action and Environment. The Council recommends that the provision of information resources be further developed and consolidated, with appropriate funding, governance and technical advisory structures.

The Council is concerned that the barriers to adaptation are not fully addressed in current adaptation planning. This extends beyond the provision of information to other forms of support. There is a need for appropriate engagement with stakeholders in the adaptation planning process at an early stage. This includes a need for awareness raising, capacity building and skills development among a diverse range of stakeholders and communities. The National Dialogue on Climate Action, developed as an action in the National Mitigation Plan, may be a useful mechanism to engage stakeholders and to identify and address barriers to adaptation at local, regional and national levels.

### 7.3.3 Progress in Sectors

The Climate Action and Low Carbon Development Act 2015[1] requires adaptation plans from sectors and local authorities. Current understanding is that adaptation plans will have a deadline for publication of September 2019. The National Adaptation Framework is not explicit about the number of sectoral adaptation plans that will be produced. However, it does identify 12 sectors under four thematic areas, and the government departments to lead on the preparation of the sector adaptation plans.

A number of non-statutory sectoral adaptation plans were published in 2017 under the National Climate Change Adaptation Framework 2012. It is worth noting that, in the development of some of these plans, it was determined that full strategic environmental assessment was not required, as the plans did not include actions with direct impact. This 'screening out' may need to be revisited for the statutory plans.

In the development of sectoral and local authority adaptation plans, it may be useful to assess the extent to which current climate variability has impacted operations and maintenance of assets and infrastructure. For example, extreme events may have resulted in demands on resources and response systems that were beyond the original designed thresholds of buildings or infrastructures (roads or water systems). The adaptation plans should also elaborate on changes already introduced in response to anticipated climate change, including modified operational or strategic processes, modified processes within contingency planning, or existing measures and planning for other purposes such as emergency planning or land-use planning.

#### Cross-Sectoral Progress

The Council provided comments and advice on previous non-statutory sectoral adaptation plans that are still relevant. To date, sectoral adaptation plans have tended to adopt a narrow focus and lacked cross-sector analysis including engagement with a broader range of stakeholders including end-users. They have also lacked analysis of links, synergies, co-benefits and trade-offs with mitigation and other policy objectives such as clean air and health. Strategic Environment Assessment is a useful mechanism to ensure some of this broader analysis is conducted for the plans.

The non-statutory adaptation plans showed an apparent focus on immediate risks, while maintaining and protecting current infrastructures systems. They lacked forward planning to consider how sectors and regions may develop and the potential for changing risks in the transition to a sustainable low-carbon economy and society.

The National Planning Framework highlights climate action as a priority concern. Both the National Planning Framework and the National Development Plan acknowledge adaptation and

support significant investment to address flooding. However, the risks associated with other climate hazards are not identified or explored. For example, there are known risks to public health due to heat stress, especially to vulnerable communities and individuals. Other countries have invested in the provision of 'cool spaces' in public buildings, such as schools and libraries, with air conditioning, which open to the public in hot weather.

### Theme: Critical Infrastructure

Under the Critical Infrastructure theme, the Framework identifies three sectors: electricity and gas networks; and communications networks, both led by the Department of Communications, Climate Action and Environment; and transport infrastructure, led by the Department of Transport Tourism and Sport. Two of these sectors published non-statutory adaptation plans.

#### Electricity and Gas Networks

In 2017 the Department of Communications, Climate Action and Environment produced an adaptation plan for this sector. The plan is robust in terms of management of the risk associated with projected climate risk to existing and planned infrastructure. However, the plan does not contain a detailed analysis of the risks posed to energy supply networks and changing demand profiles during a rapid transition to renewables and other low-carbon sources. The potential role of domestic-generation, local-generation and utility-scale energy storage in building resilience in the network is not considered.

#### Transport Infrastructure

The first non-statutory adaptation plan for the transport sector, *Developing Resilience to Climate Change in the Irish Transport Sector*, was published on 29 November 2017.[89] The plan outlines climate research and analysis on the likely impacts of climate change for transport, including more frequent storm events, rising sea levels and increased flooding. The plan also highlights the ongoing work in climate change adaptation within the transport sector and other sectors.

The Council recognised the early stage of development of adaption planning within the sector. Additional development is required with respect to detailed risk assessment, linkages between mitigation and adaptation as the transport infrastructure transitions to a low-carbon system, and linkages to spatial planning as envisaged in the National Planning Framework and the National Development Plan.

Further development of the monitoring and evaluation of implementation and the effectiveness of adaptation measures is also required.

### Theme: Public Health

The Department of Health is identified as the lead for development of the adaptation plans under this theme. To date, a public health adaptation plan has not been published.

A recent review in the medical journal *The Lancet* highlighted climate change issues globally for public health and the need for both mitigation and adaptation.[90] Beyond the more immediate health impacts including injury and disease, the review highlights national and local mental health emergency response capacity to climate-related extreme events; the extent to which climate change is considered within national mental health strategies; and the social and psychological effect of uninsured economic losses that result from extreme weather events.

Food security is intrinsically a public health issue. One of the foundation objectives of the EU's Common Agricultural Policy has been to provide food security for Europe with long-term environmental, economic and socially sustainable food production and distribution systems. Ireland is food secure, but we are not food independent, relying on international trade for many food staples. Disruptions to trade and transport systems can have impacts on short-term food supplies. Analysis of the potential impacts of climate change across Europe indicate significant impact on food production. Ireland needs to consider these impacts in developing domestic and EU policy for adaptation to ensure food security.

It is important that development of the adaptation plan for public health considers the cross-sectoral and cross-theme linkages.

### Theme: Natural and Cultural Capital

The National Adaptation Framework identifies five sectors under this theme. The Department of Agriculture, Food and the Marine is the lead for development of adaptation plans for the seafood, agriculture and forestry sectors. The Department of Culture, Heritage and the Gaeltacht is assigned the lead for developing plans for the biodiversity and for the built and archaeological heritage sectors.

#### Agriculture, Forestry and Seafood

In 2017, the Department of Agriculture, Food and the Marine published a non-statutory adaptation plan for the agriculture and forestry sector under the National Climate Change Adaptation Framework 2012. A Strategic Environmental Assessment was also undertaken for this plan. The plan notes the strong links between the options for mitigation in the sector and the need for adaptation and includes consideration of the other major policy objectives for the sector. Although the National Policy Position on neutrality within the agriculture and land use sector is cited, the adaptation plan only considered agricultural and forest lands. The Council has recommended previously that an all land uses approach is required to ensure an appropriate approach to neutrality.

The adaptation plan is strongly focused on current activities within the sector and the potential impact on agricultural production. The general trend towards the intensification of agricultural activities requiring higher fodder production may not be a sustainable model. With climate change, the production and maintenance of sufficient fodder reserves may become more challenging, leaving highly stocked farm enterprises needing to import fodder at additional cost. The adaptation plan considered plant and animal health; however, human health and safety was largely only considered in the context of workers in the forestry sector. There is a need for additional consideration of the physical and psychological impacts on farmers' health, both directly in terms of exposure to adverse weather and indirectly caused by stress.

Future iterations of adaptation plans should consider the implications of large-scale deployment of renewable energy on agricultural lands and the conversion of land for energy crop production.

Clarity is required on the scope of the adaptation plan for the seafood sector as envisaged under the National Adaptation Framework.

#### Biodiversity

The Department of Culture, Heritage and the Gaeltacht is tasked with development of a statutory adaptation plan for biodiversity. To date an adaptation plan for biodiversity has not been published.

Phenological research, including the study of the timing of natural events – such as the emergence of plants and insects or the arrival of migrating birds – has shown changes in the seasonal patterns of life in the natural world in Ireland.[91] There is also evidence of changing climate conditions impacting on the distribution of native and invasive species.[92] The impacts of climate change on economically important plant and animal species, such as impacts on growing season, distribution of pollinators, pests and diseases, need also to be considered in the context of adaptation in other sectors within the Natural and Cultural Capital theme.

#### Built and Archaeological Heritage

The Department of Culture, Heritage and the Gaeltacht is tasked with the development of a statutory adaptation plan for the built and archaeological heritage. To date an adaptation plan for this sector has not been published. Clarity is required on the scope of the adaptation plan for this sector as envisaged under the National Adaptation Framework.

### Theme: Water Resource and Flood Risk Management

The National Adaptation Framework identified three sectors under this theme. The Office of Public Works is identified as the lead authority to develop an adaptation plan for flood risk management. The development of adaptation plans for water quality and for water service infrastructure will be led by the Department of Housing, Planning and Local Government.

#### Flood Risk Management

The Office of Public Works has been active in the integration of climate change into the development of flood risk management. In 2015, it published a Flood Risk Management Climate Change Sectoral Adaptation Plan, prepared under the remit of the National Climate Change Adaptation Framework, 2012. More recently, the Office of Public Works has concluded an intensive process of assessment and planning to identify priority areas for flood defence development. The flood risk management plans produced through the process are supported by comprehensive analysis and research, including the assessment and mapping of current and potential future flood extents and risk, including potential damage to residential and business properties, utilities and social infrastructure. The approach in presenting more than the economic impacts is welcome and may serve as a template for analyses in other sectors. Box 7.1 presents the approach in more detail.

It is important that monitoring systems and evaluation indicators are integrated into the implementation plans to enable assessment and review of progress.

**Box 7.1:** *Flood risk management plans*

## Flood risk management plans

In May 2018, the Office of Public Works published the 29 flood risk management plans for the country. The plans identify priority areas for investment in flood defence systems. The plans were subject to Strategic Environmental Assessment and Appropriate Assessment, as required, as well as public engagement and consultation. The government has signalled its commitment to the plans through the National Development Plan which includes a planned investment of nearly €1 billion in a 10-year programme of flood relief measures, of which €260 million has been announced for priority developments.

The plan is the supported by detailed observation, mapping, research and analysis, under the Catchment Flood Risk Assessment and Management Programme. Included in the analysis was an assessment of historical flooding events, of current risk and of the risk for two potential future scenarios taking climate change into account.

The depth of analysis can be illustrated with an example from the flood risk management plan for Limerick, bearing in mind that a similar analysis was undertaken for 300 vulnerable areas across the country.

| **LIMERICK**<br>**Type of risk** | **Flood risk for design AEP (%) Event** | | |
|---|---|---|---|
| | **10% AEP** | **1% AEP** | **0.1% AEP** |
| **Current scenario (present day)** | | | |
| Event damage | €3,776,223 | €83,149,259 | €497,504,513 |
| No. residential properties at risk | 89 | 1122 | 1856 |
| No. business properties at risk | 6 | 248 | 485 |
| No. utilities at risk | 0 | 0 | 2 |
| No. major transport assets at risk | 27 | 49 | 85 |
| No. highly vulnerable properties at risk | 0 | 4 | 6 |
| No. of social infrastructure assets at risk | 2 | 6 | 14 |
| No. environmental assets at risk | 4 | 4 | 6 |
| No. potential pollution sources at risk | - | - | - |
| **Mid-range future scenario** | | | |
| Event damage | €116,873,727 | €389,586,114 | €936,942,688 |
| No. residential properties at risk | 1662 | 2447 | 4190 |
| No. business properties at risk | 207 | 468 | 745 |
| No. utilities at risk | 0 | 1 | 2 |
| No. major transport assets at risk | 31 | 56 | 85 |
| No. highly vulnerable properties at risk | 0 | 4 | 6 |
| No. of social infrastructure assets at risk | 2 | 8 | 14 |
| No. environmental assets at risk | 4 | 4 | 6 |
| No. potential pollution sources at risk | 0 | 0 | 1 |

| LIMERICK<br>Type of risk | Flood risk for design AEP (%) Event | | |
|---|---|---|---|
| | 10% AEP | 1% AEP | 0.1% AEP |
| **High-end future scenario** | | | |
| Event damage | €358,259,000 | €1,035,710,958 | €1.752,867,802 |
| No. residential properties at risk | 1757 | 2636 | 5047 |
| No. business properties at risk | 239 | 510 | 766 |
| No. utilities at risk | 0 | 2 | 2 |
| No. major transport assets at risk | 40 | 69 | 85 |
| No. highly vulnerable properties at risk | 1 | 6 | 6 |
| No. of social infrastructure assets at risk | 3 | 12 | 14 |
| No. environmental assets at risk | 5 | 6 | 6 |
| No. potential pollution sources at risk | 1 | 1 | 4 |
| AEP, annual exceedance probability. | | | |

The table presents the flood risk in Limerick to 10-year (10%), 100-year (1%) and 1000-year (0.1%) flood events based on current climate conditions; a medium-range climate change scenario with 50-cm sea level rise and a 20% increase in peak flow in the Shannon; and a high-end climate scenario with a 100-cm sea level rise and 30% increase in peak flow.

The analysis clearly illustrates the potential increased risk to property, businesses and infrastructure due to coastal and river flooding in the area. However, the analysis considers only the existing natural and built environment in the area, it does not consider any projected development in the area, which might arise due to changing demographics, economic growth, etc. It would be useful if future iterations of the plans considered these.

A similar approach may be useful for other sectors. For example, local health services might consider mapping their infrastructure relative to vulnerable people and the impact on service provision in the events of various climate extremes.

### 7.3.4 Public Awareness and Participation

Over the course of two weekends in 2017, the Citizens' Assembly deliberated on the question of 'How the State can make Ireland a leader in tackling climate change?' The final report on these deliberations was published and submitted to the Houses of the Oireachtas on the 18 April 2018. Two of the specific questions balloted upon related to adaptation, and strongly indicated a desire for active engagement with the public on adaptation and robust analysis and assessment to enable resilience. The Council looks forward to the government's response to the recommendations of the Assembly.

## 7.4 Review of Specific Events in 2017/2018

Ireland has experienced several notable weather and climate events in the past year. Although these are not directly attributed to climate change, they have shown strengths and weaknesses in Ireland's capacity to respond to and recover from extreme events.

In this section the Council provides an overview of the lessons learned and policy implications of specific events in 2017 and early 2018 related to impacts and adaptation. It is not intended to

provide analysis of the meteorological or climatic conditions driving these events, or to attribute the events to climate change.

As certain weather conditions become less common (such as snow or storm events), they may become more disruptive if shared knowledge on how to cope with them is not captured and maintained. In this context, the need to improve and enhance resilience to a broader range of climate risks is perhaps the most challenging aspect of adaptation. It is important to consider the implications of these events for how Ireland will manage and respond to these situations in the future but also where they point to challenges and a need for change.

Recent events provide an opportunity to consider how, as individuals and as a community, people can reduce vulnerability and increase resilience, including, where appropriate, engaging in discussions related to rebuilding with resilience in the recovery phase, especially where projections of climate change indicate increased risk. This should also include the need to enhance the relevance and effectiveness of communications in providing warnings and post-event learning to enable appropriate long-term responses and actions to improve resilience.

The events highlight an ongoing need to develop effective communication and to inform and educate sectors, businesses and the public on appropriate responses to warnings and extremes. To enable learning, a timely and wide-ranging review and assessment of the circumstances, successes and failures of systems should be undertaken. This would be especially valuable for decision making in the recovery and rebuilding phases, as well as the prevention phase, and should engage all stakeholders.

### Storms Ophelia and Brian

Storm Ophelia formed as a hurricane in the Atlantic in early October 2017. On 16 October 2017, ex-Hurricane Ophelia reached Ireland bringing widespread disruption and damage to many parts. It was an unprecedented weather event for Ireland with record-breaking wind speeds measured by Met Éireann, and a red-level severe weather warning for the entire country. Storm Brian, which was a more typical mid-Atlantic storm system, moved in from the west before the end of the same week, hampering recovery in certain areas of the country. Four deaths were reported associated with the storms.

The storms caused a cascading failure of critical infrastructures and systems in some areas. There was some confusion within the public as to the appropriate response to alerts.

Some questions arise about the resilience of current energy networks, especially the electricity grid. Storm Ophelia impacted more than 385,000 households and some businesses suffered disruption to power. Of note was the scale of the impact on other utilities, such as water supply and wastewater treatment, in a cascade of system failures, with 109,000 people without water at the peak of the storm.

Despite the damage and disruption, recovery was swift, with practically all roads reopened within 24 hours of the storm, water supply restored within four days and all electricity customers reconnected within eight days.

Motivated in part by the impacts of the storms, ESB Networks, in cooperation with others, has initiated a pilot study in the Dingle area that will test emerging technologies to enhance the resilience of the electricity supply to isolated communities. This industry-led innovative approach is a welcome development.

### The Beast from the East and Storm Emma: Orange and Red Alerts

In late February 2018, a large arctic air mass with anticyclonic structure from the east (the Beast from the East) collided with warmer moist air associated with Atlantic storm systems (Storm Emma), resulting in heavy snow falls across Ireland with significant accumulations and drifts in some areas.

The red warning alerts issued on 28 February and 2 March encouraged the public to avoid all unnecessary travel. The warning on 2 March strongly encouraged the public to ensure that they were safely indoors by 16:00. This specific language is credited with enabling emergency and road maintenance vehicles easy access on all major routes and a rapid deployment of snow clearance equipment. It is notable that, with similar conditions in the UK, emergency and other services were reportedly severely hampered by abandoned and marooned vehicles across the road network.

Water supply in the Greater Dublin Area suffered a predictable and somewhat discouraging disruption in the period immediately following the cold snap. Unusually high losses from the network led to low water levels in the main reservoirs. This prompted curtailment of water supply in the evening and overnight across large parts of the city. This points to significant underlying concerns with respect to the resilience of water supply to the city and to poor understanding by and communication with the general public with respect to appropriate responses to cold weather.

### Recent Flooding Events

Flooding is a recurrent risk in many areas of the country. The Office of Public Works is mandated to coordinate the long-term management of flood risk and has recently published an extensive plan of action for communities at significant risk from flooding.

In August 2017 a notable pluvial or 'flash' flood occurred in Donegal, in which very intense rainfall over several hours led to run-off exceeding the capacity of local waterways and drainage systems, leading to rapid flooding and severe damage to local roads and bridges, as well of flooding of properties and a hospital.

Climate change projections warn that intense rainfall events are likely to occur more often across the country. Episodes of this type are very challenging to forecast, which puts greater pressure on warning and communications systems in the first instance and on emergency responders to mobilise resources to address a rapidly evolving situation.

Burnfoot village in Donegal, Galway City and Mountmellick were subject to severe flooding in late 2017 and were assessed as part of the Catchment Flood Risk Assessment and Management Programme. The causes and extents of recent flooding events will be taken into account as the flood relief measures proposed in the flood risk management plans for these communities are taken forward to detailed design and planning.

Storm Eleanor, in early 2018, raised regional yellow and orange alerts. It caused rapid flooding following overtopping of flood defences in Galway city. A 'perfect storm' of adverse conditions with respect to high tides, storm surge, high winds and high river flow caused flooding in city streets. Constraints on local resources due to the holiday period may have hampered communications with those directly impacted.

### Fodder Shortages

The winter of 2017/2018 proved to be a challenging season for agriculture in Ireland.

A prolonged period of rainfall and relatively low soil temperatures led to poor growing conditions and trafficability with restricted access to pastures across many parts of the country. Many farm enterprises experienced difficulties sourcing sufficient animal fodder during the resulting extended animal housing period.

Constraints on fodder supply began to emerge in the north-west by December 2017. Movement of fodder from other parts of the country to these areas was reported. However, a late spring and ongoing saturated soil conditions meant that all parts of the country ran short of fodder by early April 2018.

It is important to consider the recovery period following a specific event of this type. Most farm enterprises maintain a reserve of fodder that can be built up over several years. Favourable growing conditions can replenish much of the fodder reserve within 12 months. However, the probability of unfavourable conditions and longer periods of recovery cannot be discounted.

Although the intensity of the most recent fodder shortage was notable, similar problems occurred in 1998/1999 and 2012/2013, with other regional weather-related issues reported in other years. This includes in 2015/2016 when poor conditions led to crop failures in Donegal and major flooding led to the implementation of the Emergency Welfare Scheme, the Emergency Fodder Supply Scheme and the Emergency Flood Damage Relief Scheme in affected areas. The frequency of disruptions and adverse impacts on agricultural activities, production and income is indicative of low levels of resilience within the sector to current climate variability. Projections of climate change indicate that it is likely that adverse conditions will occur with greater frequency and intensity. The current trend towards intensification of farming in Ireland may not be resilient to current and projected climate change without improved strategic capacity to advise on sustainable animal stocking rates and fodder budgeting at farm, regional and national scales.

## 7.5 Advice and Recommendations

The Council welcomes the planned investment in flood management systems under the National Development Plan, and it commends the Office of Public Works in its robust and comprehensive analysis of flood risk across the country. However, there has been a lack of consideration in the National Development Plan of other climate hazards to the same level of detail. The assessment approach adopted by the Office of Public Works may serve as a template and can be adapted for other sectors and hazards.

Prevention is generally more cost-effective than recovery, repair and protection. The Council recommends that decision makers make best use of existing processes and regulatory instruments to avoid inappropriate new development in areas of known or potential future risk.

Public awareness of climate risk and the need for adaptation is poor, which reduces willingness to act at all levels. This deficit needs to be addressed as ultimately behaviour and investments by the private sector, individuals and households will shape vulnerability and resilience to climate change. Government should share responsibility and manage major investments. However its primary function will be in guiding and regulating the actions of individuals, communities and the enterprises to enable adaptation actions.

In raising awareness and in more detailed analysis undertaken to development adaptation plans, it is important to include understanding the costs, benefits, trade-offs and co-benefits of actions and the role of adaptation in achieving the 2050 vision.

# 8. Special Focus: Carbon Pricing

## Key Messages

- The current level of the carbon tax in Ireland and the prevailing price in the EU Emissions Trading System are insufficient to achieve climate targets and objectives.
- The Council recommends increasing the carbon tax in Ireland to €30 per tonne of carbon dioxide in Budget 2019, rising to €80 per tonne by 2030.
- The Council recommends that any increase in carbon taxation should be accompanied by measures to address energy poverty and reduce the negative impacts of carbon taxation on poorer households.
- Analysis suggests that the best way to achieve the end of the burning of coal at Moneypoint by 2025 would be to introduce a carbon price floor in Ireland alongside other European countries. Any competitiveness impacts would be reduced if other countries took similar measures.
- The Council recommends that government should work with other European countries on the adoption of a carbon price floor for the electricity sector.

The term 'carbon pricing' is short-hand for putting a value on greenhouse gas emissions that aims to reflect, to some degree, the costs to society of climate change from those emissions. The Periodic Review Report 2017 described how carbon pricing ensures that some of the costs of climate change from greenhouse gas emissions are taken into account in the decisions of producers and consumers.[93] Typically, in response to increased costs, polluters decide to reduce costs by reducing overall emissions in the cheapest way. In this way, the overall environmental goal can be achieved in the most flexible and least-cost way to society. In its First Report the Council emphasised the importance of an effective price signal for carbon emissions.[94]

There are three main tools for carbon pricing: carbon taxes, emissions trading systems, and shadow pricing.[†] Ireland uses all three tools as levers to encourage changes in consumer behaviour, government decision making, and new investment and innovation within business sectors. Ireland collects a carbon tax and applies a 'shadow' carbon price in cost–benefit analysis of public investments and expenditures. Ireland also participates in the EU Emissions Trading System, which covered about 29% of emissions in Ireland in 2016.

The National Mitigation Plan 2017 contained a commitment, led by the Department of Public Expenditure and Reform, to undertake a review of guidance on public expenditure appraisal and evaluation.[14] This is to ensure their suitability to capture key costs and benefits of climate measures, including a review of the designated shadow price of carbon. The Council welcomed this commitment as a key component to inform decision making by government and looks forward to considering the outcome of the review upon its publication. This chapter focuses on carbon pricing as a cost-effective tool to achieve climate goals.

† For an explanation and discussion of the shadow pricing of carbon, please see Appendix 4 of the Climate Change Advisory Council's 2017 Periodic Review.

## 8.1 Carbon Tax

A carbon tax sets a 'real-world' price on the adverse environmental impact of greenhouse gas emissions by imposing a tax rate on greenhouse gas emissions or, more commonly, on the carbon content of fossil fuels. With the existence of a carbon tax:

- Individuals and households are incentivised to reduce their carbon emissions through reduced burning of fossil fuels. Investment in energy efficiency, alternative low-carbon heating systems or other emissions-saving strategies are therefore encouraged.
- Business and industry are incentivised to reduce their own demand for fossil fuels and to provide low- and zero-carbon options to consumers. Research and innovation are therefore encouraged and costs of low-carbon options reduced.
- The government can use revenue from carbon taxation to fund expenditure, including addressing negative impacts of the carbon tax on those with low incomes and supporting the low-carbon transition. If carbon tax revenue is used to support the lowering of income tax rates, the economy could receive the 'double dividend' of increased economic growth alongside reduced greenhouse gas emissions.[95]

> In the National Mitigation Plan, the Department of Finance committed to an action to 'commission further analysis to inform the policy direction of the [carbon] tax with an examination of the mitigation and distributive impacts of the carbon tax as implemented and an assessment of its possible future price evolution'.

### 8.1.1 Carbon Tax in Ireland

Ireland introduced a carbon tax in the 2010 Budget. Since then, it has generated over €2 billion in revenue for the Irish government. The Irish carbon tax applies to carbon dioxide emissions associated with both liquid and solid fossil fuels including petrol and diesel, coal, peat briquettes, heating oil and gas. The tax is imposed at point of sale, and directly impacts the consumer. In the 2017 Periodic Review Report, the Council recommended that 'a clear signal from Government on the further development of the carbon tax is required' as an essential signal for reducing emissions in the long term. An increase in the carbon tax would better reflect the costs of carbon dioxide emissions to society and, as noted in Chapter 6, would increase the incentives to householders and businesses to invest in energy efficiency and transition to low-carbon energy sources.

The impacts and effectiveness of carbon taxation are well researched in Ireland and globally. The Organisation for Economic Cooperation and Development recently released a report *Effective Carbon Rates; Pricing $CO_2$ through Taxes and Emissions Trading Systems*, which includes a carbon pricing gap indicator for the surveyed countries. The pricing gap is assessed against a rate of €30 per tonne, which the Organisation for Economic Cooperation and Development considers a 'low-end estimate of the cost of carbon'.

Unfortunately, Budget 2018 did not take the opportunity to adjust the carbon tax level or to signal its future direction. Work by the High-Level Commission on Carbon Prices, supported by the World Bank,[†] concluded that 'the explicit carbon-price level consistent with achieving the

† The High-Level Commission on Carbon Prices is an initiative of the Carbon Pricing Leadership Coalition, a voluntary partnership of national and sub-national governments, businesses, and civil society organisations launched by the World Bank Group.

Paris temperature target is at least US$40–80 per tonne of carbon dioxide (t $CO_2$) by 2020 and US$50–100/t $CO_2$ by 2030, provided a supportive policy environment is in place.[96] The carbon tax in Ireland is currently set at €20 per tonne. This is significantly below the international estimates of the appropriate carbon pricing levels, and it is insufficient to encourage the level of innovation and behavioural change required to achieve transition objectives.

The Council recommends increasing the carbon tax in Ireland, in line with the recommendations of the World Bank High-Level Commission on Carbon Prices, to a rate of €30 per tonne of carbon dioxide in 2019 rising to €80 per tonne by 2030. The increase in tax from €20 to €30 per tonne would add approximately €1.20 to the existing price of a 40-kg bag of coal or €0.26 to a bale of briquettes in 2019. The distributional impacts of carbon taxation are a concern and need to be addressed.

There have been numerous studies of carbon taxation in Ireland and the distribution of its impacts across different segments of society.[97,98,99] The general consensus across this academic research is that carbon taxation can disproportionately impact poorer households and individuals more than richer households and individuals. In 2016, the carbon tax raised €434 million in revenue for the government.[100] Appropriate use of carbon tax revenues can more than address negative impacts and bring benefits to energy-poor households. These households are more likely to rely on solid fuels for heat and should be supported in upgrading their dwellings. Multiple co-benefits include warmer, healthier homes, reduced heat energy demand, and transition to low-carbon energy sources. Measures could take two forms: (1) funding for credit-constrained poorer households to make their homes energy efficient and low carbon; or (2) an increase in welfare payments. The Council recommends that any increase in carbon taxation should be accompanied by measures to address energy poverty and reduce the negative impacts of carbon taxation on poorer households.

## 8.2 Carbon Pricing through the EU Emissions Trading System

Currently a carbon price signal is delivered to the electricity sector and other large emitting industries in Ireland via the EU Emissions Trading System.[†] The prevailing carbon price in the EU Emissions Trading System had been commonly accepted as offering a carbon price too low to incentivise significant emissions reductions or low-carbon transition. In June 2016, the Council wrote to Minister Naughten TD to recommend that the Irish government support reform of the EU Emissions Trading System to make it an effective tool for decarbonisation.[101] The Council in particular recommended the introduction of a minimum price for EU Allowances (EUAs), commonly referred to as carbon price floor for the EU Emissions Trading System. In 2018 the EU agreed changes to the System but did not agree a carbon price floor.

The revised EU Emissions Trading System Directive [(EU) 2018/410] entered into force in April 2018. The revised directive addresses a new target to achieve 43% greenhouse gas emissions reductions below 2005 levels across the EU Emissions Trading System sector by 2030. Furthermore, to address concerns regarding robust carbon pricing and carbon leakage, reform elements were also agreed. Some key changes in the revised directive include: [102,103,104]

- The annual emission reduction will be 2.2 % from 2021.

† The functioning of an emissions trading system and how it delivers a carbon price and emissions reductions are explained in an annex of the 2017 Periodic Review Report.

- The number of (surplus) allowances to be taken off the market and placed in the Market Stability Reserve will be doubled temporarily until the end of 2023.†
- A new mechanism to limit the validity of (or cancel) allowances in the Market Stability Reserve above a certain level will become operational in 2023 (for Amendment to Article 1 of Decision (EU) 2015/1814 on the Market Stability Reserve).†
- The share of allowances to be auctioned will be 57%. The sectors at highest risk of relocating their production outside the EU will receive full free allocation. The free allocation rate for sectors less exposed to carbon leakage will amount to 30%. A gradual phase-out of that free allocation for the less exposed sectors will start after 2026, with the exception of the district heating sector.
- In the event of closure of electricity generation capacity in their territories due to additional national measures, Member States may cancel allowances up to an amount corresponding to the average verified emissions of the installation concerned over a period of five years preceding the closure [Article 12(4)].

A number of studies indicate that these changes to the EU Emissions Trading System will still produce a surplus of allowances until 2030, resulting in a carbon price much lower than is appropriate if Europe and Ireland are to achieve their 2050 objectives.[105,106,107]

In its first Periodic Review Report (2017) the Council noted the conclusion of the World Bank's High-Level Commission on Carbon Prices (reiterated in section 8.1.1 above). A 2018 World Bank report on the state and trends of carbon pricing found that further rises in carbon prices are needed to stimulate emissions reductions in line with the Paris Agreement.[108] They are not alone. Other prominent groups have also made recommendations or calculations of appropriate carbon pricing levels that exceed existing carbon price levels. The European Council for the Academies of Applied Sciences, Technologies and Engineering noted in 2014 that, in Europe, 'for 2015, the socially optimal $CO_2$ price paths … range from about 10 to 20€/t $CO_2$, and for 2020 the optimal price range across models spans from 20 to 70€/t $CO_2$. [109] Commission analysis for the 2030 Climate and Energy Framework suggested that, to meet a 43% emission reduction target in the ETS by 2030 cost-effectively, a carbon price of €40 t $CO_2$ e would be required.[110] The higher the carbon price, the more low-carbon technologies or options become competitive. The agreed reforms to the EU Emissions Trading System Phase 4 have already had a significant effect on the price of carbon, stabilising it between €14 and €16 per tonne of carbon dioxide equivalent in May 2018.[111,112] Clearly, this still does not approach the levels suggested by the academic literature and international organisations as necessary to achieve climate change targets.

### 8.2.1 Using Carbon Pricing to Achieve Electricity Sector Objectives

In its Annual Review 2017, the Council noted that the pace of decarbonisation in the electricity generation sector is not currently compatible with a low-carbon transition to 2050. Since then, the National Development Plan, published in early 2018, includes a commitment to end the burning of coal at Moneypoint electricity generation station by 2025 and a commitment that, by 2030, peat and coal will no longer have a role in electricity generation in Ireland. The commitment on Moneypoint is welcome, but it is not yet clear what instrument or mechanism will be used

† The performance and impact of the Market Stability Reserve is subject to regular review beginning in 2021 and every five years thereafter, which may undermine confidence in the expected impact of these provisions.

to achieve this. Regulation is one option, but robust carbon pricing could also be effective. The Council wants to see these commitments achieved in the most cost-effective manner available.

Ending the use of peat in electricity generation should be uncomplicated. At present, peat-fired electricity generation is a viable commercial activity only because of a subsidy for production financed by the Public Service Obligation levied on electricity bills. Ending this environmentally harmful subsidy and other environmentally harmful indirect subsidies to peat (such as support for co-firing biomass with peat, as discussed in previous chapters) would probably see an end to the role of peat in electricity generation in Ireland. The money saved by ending the subsidy could be used to assist peat workers and associated communities in finding new opportunities in the low-carbon economy.

There are three main options for ending the use of coal in electricity generation in Ireland: (1) increase the subsidy to renewables; (2) stop the burning of coal at Moneypoint by regulatory action; or (3) rely on a carbon price. The choice of instrument should be informed by consideration of the direct cost of the instrument, the competitiveness impacts and the climate change impact. The climate change impact or the overall change in greenhouse gas emissions within the electricity generation sector at an EU level is determined by interaction with the EU Emissions Trading System. In normal circumstances, the closure of an emitting installation frees up EU emission allowances, which can be purchased by other installations in other countries or industries to cover increased emissions in those other sectors or countries. This is known as the waterbed effect: like pressing on a waterbed, emissions are moved from one area to another but the total volume or cap on emissions is unchanged, meaning no overall reduction in emissions at an EU level. But the 2018 revised Emissions Trading System Directive changes this picture.

The 2018 revised Emissions Trading System Directive, has two key additional clauses that negate or puncture the waterbed effect described above, allowing absolute emissions reductions to be achieved at an EU level. The amendment to Article 1 of Decision (EU) 2015/1814 on the Market Stability Reserve, bringing about cancellation of a share of allowances held in the Market Stability Reserve from 2023, means that the overall volume of allowances (the cap on emissions) can be reduced. However, research so far suggests that the effect of the Market Stability Reserve cancellation clause will diminish as we approach 2030.[113,114] The rules are complex and subject to political review, so the environmental outcome is difficult to predict. A second clause, Article 12(4) in the revised Emissions Trading System Directive offers more certainty in the medium to long term. Under this clause governments can choose to cancel allowances that would have been needed for installations, such as Moneypoint, that close-down due to 'additional national measures'.

Implementing the government's commitment in the National Development Plan to end the role of coal and peat in the generation of electricity by 2030 would be considered 'an additional national measure' that would fall under Article 12(4) of the Emissions Trading System Directive described in section 8.2 above, allowing the government to cancel allowances.[†] This cancellation ensures additional emissions reductions to those planned for under the existing emission reduction target for the EU Emissions Trading System sector. Given uncertainty over the environmental impact of the Market Stability Reserve, the Council recommends that the government employ Article 12(4) of the Directive to ensure real emission reduction impact is achieved at an EU level from the

† The government can cancel allowances from the total quantity of allowances to be auctioned by it, up to an amount corresponding to the average verified emissions of the installation concerned over a period of five years preceding the closure.

closure of peat- and coal-fired electricity generation capacity in Ireland.

The cost to government and the Irish economy of ending of the burning of coal at Moneypoint depends on the instrument chosen to achieve this commitment. If regulation is used by government, the effect would be to increase the cost of electricity (until such time as the costs of renewable energies are competitive with gas). The cost increase would be driven by the absence of cheap coal. The consequent higher market price for electricity would improve the profit margins for gas. Renewable generators, though receiving a higher market price for electricity, would see a reduction in government support meaning that net gains would be limited.† In summary, a regulatory measure would mean an increased cost of electricity to business and consumers that would increase profits for gas generators and potentially reduce costs to government through reduced need for support to renewable energy.

If a decision is taken to 'squeeze out' coal-fired generation through increased subsidisation to renewable energy, the costs would probably be much higher, requiring a much higher Public Service Obligation for all consumers. Alternatively, the commitment could be achieved through a sufficiently robust carbon price. The rest of the chapter explores this latter option in greater detail.

The prevailing carbon price in the EU Emissions Trading System is generally not thought to be sufficient to achieve decarbonisation (see discussion in section 8.2 above). Deane et al. (2018) found that a carbon price of €35 per tonne of $CO_2$e in 2030‡ would not be sufficient to end the burning of coal at Moneypoint.[115] Therefore, further measures would be required to achieve a sufficiently robust carbon price to end the use of coal in electricity generation in Ireland.

### 8.2.2 A Carbon Price Floor

In the light of low expectations for the EU Emissions Trading System carbon price, some EU Member States are considering national measures to support the carbon price signal in their respective Emissions Trading System sectors. Britain has implemented a carbon price floor across its Emissions Trading System industries since 2013. In 2013, the British carbon floor price was set at £9/t$CO_2$e and rose to £18/t$CO_2$e in 2015 where it has since been held fixed with no plans for further increase.§ The British carbon floor price has been credited as the main driver for the rapid reduction of coal-fired power generation in the UK.[116] In 2017, the Dutch government coalition agreement included plans for the introduction of a carbon floor price for the power generation sector of €18/t$CO_2$e from 2020 rising to €43/t$CO_2$e by 2030.[117] The French government has also announced its plans to continue to pursue a carbon floor price in the electricity sector,[118] while some Scandinavian countries expressed their determination to pursue national measures if the EU Emissions Trading System did not sufficiently drive low-carbon transition.[119] In March 2018, the Government of France hosted a conference in Brussels, bringing together officials from France, Germany, Britain, Finland, the Netherlands and Sweden and called on other EU nations to adopt a regional carbon price floor for power generators to promote a shift away from coal to more climate-friendly fuels.[120] Therefore, the question of a carbon price floor in an Irish context

† Support to renewables is delivered through a Renewable Energy Feed in Tariff that operates by providing a guaranteed minimum price to generators for 15 years. The government pays generators the difference between the market price for electricity and the minimum price, whereby the minimum price is still the larger of the two.

‡ This scenario follows projections of the Emissions Trading System price for 2020 and 2030 based on the European Commission's EU Reference Scenario.

§ According to Newbery et al., 2018 (endnote 107), as of May 2018, the total carbon price arising from the EU ETS plus the British carbon price floor mechanism was around €33 / t $CO_2$.

should be revisited to explore whether there is a case for a carbon price floor in Ireland when other EU Member States implement the same policy.

### Irish Interest in a Carbon Price Floor

- Research for the Department of Communications, Climate Action and Environment shows that pathways to decarbonisation in the non-Emissions Trading System sector rely to a significant degree on electrification of heat and transport services.[121] While electrification can bring with it some improved carbon efficiency, decarbonisation of the electricity sector is required to make this a viable long-term national decarbonisation strategy.

- A carbon price floor could offer certainty to business, and could shift the financial burden for supporting low-carbon investment from government (such as via subsidies, grants) to the market (via allowance costs).

- A carbon price floor would generate revenue for government as long as the market price for carbon is less than the designated carbon price floor. The government collects the difference between the carbon price floor and the market price. This revenue could be used to support the low-carbon transition. Options include supports for affected communities to transition to the low-carbon economy or support for poorer households to undertake energy efficiency measures.

- Increased interconnection and links to other neighbouring European electricity markets can bring benefits to Irish electricity consumers and support long-term decarbonisation. Such links would be facilitated by consistent climate and carbon pricing policies.

A key concern for Ireland would be the extent to which a carbon price floor might impact on Irish economic competitiveness. An important component of this is the extent to which a carbon price floor would affect Irish electricity prices and how this would compare with the evolving electricity price in competitor countries. It is important to remember that the competitiveness effects need to be compared with the effect of a regulated closure of Moneypoint on Irish electricity prices, which is now government policy. Another point of interest is the level of revenue that might be raised by government through the implementation of a carbon price floor. If implemented in a similar manner to the UK carbon price floor, the government would impose a levy on electricity generation installations under the EU Emissions Trading System that equals the difference between the carbon price floor and the prevailing EU Emissions Trading System allowance price. Finally, it is of interest to understand what alternative electricity source might meet the gap in supply formerly filled by coal and peat.

To inform its advice on a carbon price floor for Ireland, the Council considered Deane et al. (2018), which is summarised here. The full analysis is available on the Council website.[115] The analysis simulates the full EU interconnected electricity market at hourly resolution considering both variable renewable and thermal (coal, oil, gas) generation plants for the years 2020 and 2030 under varying carbon price floor assumptions for the EU Member States. Three scenarios were considered:

- a reference scenario, which assumes a unified Emissions Trading System price, of €18/t $CO_2$e in 2020 and €35/t $CO_2$e in 2030, across all Member States†

† This scenario follows projections of the Emissions Trading System price for 2020 and 2030 based on the European Commission's EU reference scenario.

- a small group scenario, which assumes a carbon price floor (CPF) is applied in Ireland, Belgium, Denmark, Finland, France, Luxembourg, Netherlands, Norway, Sweden and the UK at a rate of €35/t $CO_2$e in 2020 and €50/t $CO_2$e in 2030
- a large group scenario, in which a carbon price floor is applied in all the small group countries and Germany.

In the small and large group scenarios, EU Member States not applying a price floor continue to apply the market carbon price, which remains at the reference level (€18/t $CO_2$e in 2020 and €35/t $CO_2$e in 2030).

In general, the implementation of a carbon price floor will increase wholesale electricity prices in countries where it is applied and will also impact neighbouring countries through interconnection. Impacts are generally more pronounced in 2020 than 2030, as higher levels of interconnection in 2030 smooth out imbalanced power flows. The impact of a carbon price floor will vary depending on several factors including the make-up of the electricity generation portfolio in a country and the level of electricity interconnection. Countries with more thermal generation, especially coal, and less renewable electricity generation, are more exposed to increases in the carbon price. Likewise, a country with limited interconnection options is also more likely to be impacted by a wholesale electricity price increase. A €10 per tonne increase in the Emissions Trading System carbon price generally adds €4 per megawatt hour to gas fired generation costs and €10 to coal fired plants' costs.† Countries that export more electricity will generally experience higher prices than countries that import.

*Environmental impact:* Overall, in countries implementing a carbon price floor, electricity production and greenhouse gas emissions decrease. Countries outside the group implementing a carbon price floor see an increase in electricity production due to higher exports and consequent increases in emissions. However, the analysis suggests that there would be a small net reduction in EU emissions from electricity generation, partly due to electricity transmission constraints.

However, this result takes no account of the impact of the potential cancellation of allowances by countries implimenting a carbon price floor, under Article 12(4). Such a cancellation would mean that the increased emissions in non-participating countries would drive up the EU Emissions Trading System price, leaving it higher than it would have been in the absence of action by participating countries. Under a carbon price floor, in 2020 emissions from electricity generation in Ireland would decrease marginally (1–3% compared to the reference scenario). In 2030, emissions from electricity generation in Ireland under the carbon price floor would decrease substantially by 46–48% compared with the reference scenario. By 2030, the running hours of Moneypoint would decrease substantially, potentially leading to closure,‡ and Ireland would see increased import of electricity from France.

*Price impact*: Overall the decision by a group of countries to implement a carbon price floor affects the consumer costs of electricity similarly in both implementing and non-implementing countries, with non-implementing countries seeing a smaller increase in costs. Implementing countries would see an increase in the consumer costs of electricity of 0.09% of GDP compared with the reference scenario, increasing to 0.13% of GDP if Germany is included in implementing

† In EU Member States where either of these is the marginal plant, the price increase is passed through to the wholesale price of electricity.

‡ The model cannot reflect changes in the assumed reference generation portfolio. Therefore closure and/or new entry of generating capacity, which might be expected to follow from significant market changes, do not appear in the results.

countries. Similarly, non-implementing countries see an increase in consumer costs of electricity of between 0.08 and 0.14% of GDP compared with the reference scenario, depending on whether Germany decides to implement the carbon price floor. These estimates do not allow for the possible effects of the policy on the prices of fossil fuel generation in non-participating countries due to a higher EU Emissions Trading System price resulting from the cancellation of allowances.

For Ireland, implementing a carbon price floor would lead to an increase in the consumer costs of electricity of 0.07–0.08% of GDP compared with the reference. The increase in the wholesale price of electricity is higher in Ireland than other implementing countries if Germany does not implement a carbon price floor. However, with Germany implementing a carbon price floor, key Irish trading partners such as Germany and the Netherlands have similar increases in the wholesale price of electricity, with the UK, Sweden, Belgium and Finland close behind. The overall addition to consumers' costs in Ireland is estimated at up to €270 million in 2020 and up to €230 million in 2030. This compares with the existing Public Service Obligation levy on electricity bills of €470 million in 2018 and an expected €260 million for 2019.[122] It is important to remember that, due to the constraints of the model, changes in the generation capacity portfolio that might be expected in the context of significant market and policy changes are not included in the analysis. Such changes in the generation capacity portfolio, such as the private sector investing more in renewable generation, might be expected to lower costs compared with the results of the analysis, but we cannot predict the extent to which this would apply.

Also, as with the closure of Moneypoint by regulatory action, the resulting higher wholesale price for electricity would benefit renewable generators. In turn this would result in some reduction in the costs of the Renewable Energy Feed in Tariff subsidy. This would reduce the Public Service Obligation levy needed to support renewables, partly offsetting the effect on consumers' bills of the higher price.

*Government revenue*: Implementation of the carbon price floor would yield revenue to the governments of those implementing countries. The government revenue is calculated as the difference between the prevailing (reference scenario) market price of carbon and the assumed carbon price floor (€17 in 2020 and just €15 in 2030 due to an increase in the underlying market price of carbon) multiplied by remaining emissions in the electricity sector of the implementing countries. Results of the analysis show significant revenue raised of between €2.4 to €8 billion across the implementing countries in 2020, depending on whether Germany implements a carbon price floor. In 2030, results show revenues of between €2 and €6 billion. The results for Ireland show revenue of around €130 million in 2020, falling to around €60 million by 2030, reflecting the significant drop in emissions.

*Conclusions on the carbon price floor:* It is important to consider the extent to which Irish economic competitiveness is impacted by relative changes in the wholesale price of electricity. The results of the analysis show significant decreases in emissions in Ireland by 2030, and some reduction in overall EU electricity sector emissions even before considering the cancellation of EU emissions allowances under Article 12(4) of the EU Emissions Trading System Directive. The results show that the competitiveness impacts of implementing a carbon price floor in Ireland alongside other European countries would be limited. The overall cost would be significantly less than the cost of the current Public Service Obligation for 2017 to 2018. The competitiveness effects would also depend on whether or not Germany participated in the policy.

A carbon price floor would reduce the need for publicly funded support of renewable energy. Government revenue raised by a carbon floor price could then be used to support transition of the generation capacity portfolio to help reduce price impacts or to support poorer households or vulnerable businesses cope with increased electricity costs (as discussed in section 5.4.1). Overall, the analysis suggests that the best way to achieve the ending of the burning of coal at Moneypoint by 2025 would be to introduce a carbon price floor in Ireland alongside other European countries.

It is important to recall that the results of this analysis pertain to comparison of scenarios in which Moneypoint is allowed to continue operation. At the time of writing, similarly detailed analysis was not yet available to explore the impacts on emissions and the consumer cost of electricity in the event that burning of coal at Moneypoint was ended by regulatory intervention. The Council recommends that such analysis inform decision making on the introduction of a carbon price floor in Ireland. The Council further recommends that Ireland actively participates in discussions by a group of EU Member States on implementation of a regional carbon floor price, as it is obvious that the more countries that undertake measures to significantly reduce emissions in the electricity sector through introducing a carbon price floor, the lower will be the competitiveness impacts for Ireland.

## 9. Activities of the Council

As required under Section 12(f) of the Climate Action and Low Carbon Development Act 2015,[1] the activities of the Council in 2017 are listed here.

| Date | Purpose | Attendees |
|---|---|---|
| 25/01/2017 | Climate Change Advisory Council Adaptation Committee Meeting | Prof. John FitzGerald (Chair), Mark Adamson (OPW), Laura Burke (EPA), Prof. Robert Devoy (UCC), Jim Gannon (SEAI), Ciarán Hayes (CCMA), Dr Ina Kelly (HSE), Eoin Moran (Met Éireann), Dr Conor Murphy (Maynooth University), Roger Street (UKCIP) |
| | | Climate Change Advisory Council Secretariat |
| | | Consultations with: Commission for Energy Regulation; Louth County Council; Galway County Council; Codema; Marine Institute; Department of Agriculture, Food and the Marine; Department of Transport |
| 22/02/2017 | Climate Change Advisory Council Meeting | Prof. John FitzGerald (Chair), Prof. Alan Barrett (ESRI), Prof. Gerry Boyle (Teagasc), Laura Burke (EPA), Prof. Peter Clinch, Prof. Frank Convery, Joseph Curtin, Prof. Anna Davies, Prof. Ottmar Edenhofer, Jim Gannon (SEAI), Prof. Alan Matthews |
| | | Climate Change Advisory Council Secretariat |
| | | Consultations with: ERI UCC; Department of Finance |
| 26/04/2017 | Climate Change Advisory Council Meeting | Prof. John FitzGerald (Chair), Prof. Alan Barrett (ESRI), Prof. Gerry Boyle (Teagasc), Laura Burke (EPA), Joseph Curtin, Prof. Anna Davies, Prof. Ottmar Edenhofer, Jim Gannon (SEAI), Prof. Alan Matthews |
| | | Climate Change Advisory Council Secretariat |
| | | Consultations with: EPA; Department of Public Expenditure and Reform; Department of Housing, Planning and Local Government; Department of Communications, Climate Action and Environment |
| 24/05/2017 | Climate Change Advisory Council Adaptation Committee Meeting | Prof. John FitzGerald (Chair), Mark Adamson (OPW), Laura Burke (EPA), Jim Gannon (SEAI), Dr Ina Kelly (HSE), Eoin Moran (Met Éireann), Dr Conor Murphy (Maynooth University) |
| | | Climate Change Advisory Council Secretariat |
| | | Consultations with: Irish Centre for High-End Computing; OPW |
| 26/07/2017 | Launch of Periodic Review Report 2017 | Prof. John FitzGerald (Chair), Laura Burke (EPA) |
| | | Climate Change Advisory Council Secretariat |
| 06/09/2017 | Climate Change Advisory Council Meeting | Prof. John FitzGerald (Chair), Prof. Alan Barrett (ESRI), Prof. Gerry Boyle (Teagasc), Laura Burke (EPA), Joseph Curtin, Prof. Anna Davies, Prof. Ottmar Edenhofer, Jim Gannon (SEAI), Prof. Alan Matthews |
| | | Climate Change Advisory Council Secretariat |
| | | Consultations with: National Transport Authority |

| Date | Purpose | Attendees |
|---|---|---|
| 27/09/2017 | Climate Change Advisory Council Adaptation Committee Meeting | Prof. John FitzGerald (Chair), Prof. Gerry Boyle (Teagasc), Laura Burke (EPA), Prof. Robert Devoy (UCC), Ciarán Hayes (CCMA), Dr Ina Kelly (HSE), Eoin Moran (Met Éireann) |
| | | Climate Change Advisory Council Secretariat |
| | | Consultations with: Department of Communications, Climate Action and Environment; Department of Agriculture, Food and the Marine; European Environment Agency |
| 19/10/2017 | Climate Change Advisory Council Meeting | Prof. John FitzGerald (Chair), Laura Burke (EPA), Prof. Peter Clinch, Joseph Curtin, Prof. Anna Davies, Jim Gannon (SEAI), Prof. Alan Matthews |
| | | Climate Change Advisory Council Secretariat |
| | | Consultations with: Department of Communications, Climate Action and Environment; EPA |
| 05/12/2017 | Launch of Annual Review 2017 | Prof. John FitzGerald (Chair), Prof. Alan Barrett (ESRI), Joseph Curtin, Jim Gannon (SEAI) |
| | | Climate Change Advisory Council Secretariat |
| 13/12/2017 | Climate Change Advisory Council Meeting | Prof. John FitzGerald (Chair), Prof. Alan Barrett (ESRI), Prof. Gerry Boyle (Teagasc), Laura Burke (EPA), Prof. Peter Clinch, Joseph Curtin, Prof. Anna Davies, Prof. Ottmar Edenhofer, Jim Gannon (SEAI), Prof. Alan Matthews |
| | | Climate Change Advisory Council Secretariat |
| | | Consultations with: Klimarådet |

CCMA, County and City Management Association; ERI UCC, Environmental Research Institute, University College Cork; ESRI, Economic and Social Research Institute; HSE, Health Service Executive; OPW, Office of Public Works; UKCIP, UK Climate Impacts Programme.

| Activities of the Climate Change Advisory Council 2017 | | | |
|---|---|---|---|
| **Date** | **Organisation** | **Subject** | **Attendees** |
| 09/01/2017 | Teagasc | Work of the Climate Change Advisory Council | Prof. John FitzGerald |
| 02/02/2017 | Department of Finance | Introducing the Climate Change Advisory Council and functions of the Department of Finance | Climate Secretariat |
| 14/02/2017 | University College Cork | Meeting with UCC to discuss Energy Modelling | Prof. John FitzGerald, Climate Secretariat |
| 14/02/2017 | University College Cork | UCC Climate CoLab 2017 Seminar Series – The Climate Change Advisory Council – ongoing work and recent findings | Prof. John FitzGerald |
| 24/02/2017 | Department of Communications, Climate Action and Environment | Discussion on National Mitigation Plan | Prof. John FitzGerald, Climate Secretariat |
| 11/04/2017 | Department of Housing | Introducing the Climate Change Advisory Council and discussing the National Planning Framework Consultation | Climate Secretariat |
| 11/04/2017 | Department of Public Expenditure and Reform | Introducing the Climate Change Advisory Council and functions of the Department of Public Expenditure and Reform | Climate Secretariat |
| 13/04/2017 | National Transport Authority (NTA) | Briefing on NTA issues for transport in the next national plan and discussed the implications of NTA's policies for climate change | Prof. John FitzGerald |
| 21/04/2017 | Department of Communications, Climate Action and Environment | Discuss sectoral mitigation plan for electricity generation | Climate Secretariat |
| 24/04/2017 | Department of Communications, Climate Action and Environment | Discuss sectoral mitigation plan for built environment | Climate Secretariat |
| 25/04/2017 | Department of Agriculture | Discuss sectoral plan for agriculture and forestry | Climate Secretariat |
| 25/04/2017 | Department of Transport | Discuss sectoral plan for transport | Climate Secretariat |
| 25/04/2017 | Department of Jobs, Enterprise and Innovation | Introducing the Climate Change Advisory Council and discuss the role of Department of Jobs, Enterprise and Innovation in climate change | Climate Secretariat |

| Activities of the Climate Change Advisory Council 2017 | | | |
|---|---|---|---|
| **Date** | **Organisation** | **Subject** | **Attendees** |
| 03/05/2017 | Department of Communications, Climate Action and Environment | Meeting with Minister Denis Naughten | Prof. John FitzGerald |
| 04/05/2017 | Department of Taoiseach | Presentation on Climate Change and the Climate Change Advisory Council | Prof. John FitzGerald, Climate Secretariat |
| 06/06/2017 | Ervia | The latest work of Ervia in carbon capture and storage | Prof. John FitzGerald, Climate Secretariat |
| 13/06/2017 | Energy Ireland | Energy Ireland Conference 2017 | Prof. John FitzGerald |
| 27/06/2017 | SEAI | Discuss latest work of SEAI | Climate Secretariat |
| 28/06/2017 | National Economic Dialogue | Attend National Economic Dialogue | Prof. John FtizGerald |
| 03/07/2017 | ESPON | Interview regarding Europe-wide project investigating the impact governance has on the transition to a local carbon economy | Prof. John FitzGerald |
| 10/07/2017 | Department of Communications, Climate Action and Environment | Meeting with Department of Communications, Climate Action and Environment | Prof. John FitzGerald, Climate Secretariat |
| 21/07/2017 | Macgill Summer School | A new long-term vision and plan is required | Prof. John FitzGerald |
| 01/08/2017 | Climote | Opportunities for cutting carbon | Prof. John FitzGerald |
| 14/08/2017 | SEAI | Discuss content for Annual Review 2017 | Climate Secretariat |
| 25/09/2017 | National Dialogue on Climate Action | Introductory discussion with Chair of National Dialogue on Climate Action | Prof. John FitzGerald |
| 26/09/2017 | DG Climate Action/ ICF Consulting | Ex-post evaluations on selected policy measures supporting emissions reductions in Member States | Prof. John FitzGerald |
| 28/09/2017 | Environment Ireland | Present 'A strategy for meeting Ireland's climate change challenge' | Prof. John FitzGerald |
| 05/10/2017 | Meeting with DG Climate Action | Discuss Ireland's Country Report | Prof. John FitzGerald, Climate Secretariat |
| 09/10/2017 | Department of Communications, Climate Action and Environment | Discuss maters arising out of Climate Change Advisory Council meeting | Prof. John FitzGerald, Climate Secretariat |
| 09/10/2017 | College Proteins | Research | Prof. John FitzGerald |
| 13/10/2017 | Devenish | Discussion and evening reception | Prof. John FitzGerald |

| **Activities of the Climate Change Advisory Council 2017** | | | |
|---|---|---|---|
| **Date** | **Organisation** | **Subject** | **Attendees** |
| 24/10/2017 | Central Statistics Office | Sixth Administrative Data Seminar | Prof. John FitzGerald |
| 26/10/2017 | EPA | Post climate change lecture dinner | Prof. John FitzGerald |
| 05/11/2017 | Citizens' Assembly | Presentation on Climate Change and the Climate Change Advisory Council | Prof. John FitzGerald |
| 27/11/2017 | Nordic Embassies in Dublin | Nordic seminar on green transition and sustainable energy | Prof. John FitzGerald |
| 12/12/2017 | Met Éireann | Tackling Climate Change and its Consequences | Prof. John FitzGerald |

| **Council Correspondence (please note that these are available on the Council Website at *www.climatecouncil.ie*).** | | |
|---|---|---|
| **Date** | **Subject** | **To** |
| 07/03/2017 | Letter to Minister Naughten regarding the preparation of the National Mitigation Plan | Minister Denis Naughten, Minister for Communications, Climate Action and Environment |
| 16/03/2017 | Climate Change Advisory Council Response to the Consultation on the National Planning Framework | Niall Cussen, National Planning Framework, Department of Housing, Planning, Community and Local Government |
| 04/05/2017 | Sectoral actions outlined in the draft National Mitigation Plan | Mr Shane Ross TD, Minister for Transport, Tourism and Sport |
| 04/05/2017 | Sectoral actions outlined in the draft National Mitigation Plan | Mr Simon Coveney TD, Minister Housing, Planning, Community and Local Government |
| 04/05/2017 | Sectoral actions outlined in the draft National Mitigation Plan | Mr Michael Creed TD, Minister for Agriculture, Food and the Marine |
| 04/05/2017 | Council response to the draft National Mitigation Plan | Minister Denis Naughten, Minister for Communications, Climate Action and Environment |
| 05/.05/2017 | Climate Change Advisory Council Response to the Consultation on the National Clean Air Strategy | Paul McDonald, Air Quality Division, Department of the Communications, Climate Action and Environment |
| 11/05/2017 | Public Consultation on the Mid-Term Review of the Capital Plan 2017 | William Beausang, Department of Public Expenditure and Reform |
| 11/07/2017 | Council response to the Joint Oireachtas Committee on Finance, Public Expenditure and Reform, and Taoiseach on the Fossil Fuel Divestment Bill 2016 | Mr John McGuinness Joint Committee on Finance, Public Expenditure and Reform, and Taoiseach |
| 01/11/2017 | Council response to the draft National Adaptation Framework | Mr Denis Naughten TD, Minister for Communications, Climate Action and Environment |
| 01/11/2017 | Climate Change Advisory Council Response to the Design Consultation on the Renewable Electricity Support Scheme | RESS Consultation, Electricity Policy Division, Department of Communications Climate Action and Environment |
| 01/11/2017 | Council response to the publication of the draft National Planning Framework | Niall Cussen, National Planning Framework Department of Housing, Planning and Local Government |
| 02/11/2017 | Council response to the draft Electricity & Gas Network Sectoral Adaptation Plan | Mr Eamonn Confrey, Electricity Policy Division Department of Communications, Climate Action and Environment<br>CC: John O'Neill, Department of Communications, Climate Action and Environment |
| 13/11/2017 | Council Response to Budget 2017 to Department of Public Expenditure & Reform | Robert Watt, Secretary General Department of Public Expenditure & Reform<br>CC: Brian Carroll, Department of Communications, Climate Action and Environment |
| 13/11/2017 | Council Response to Budget 2017 to Department of Finance | Derek Moran, Secretary General Department of Finance<br>CC: Brian Carroll, Department of Communications, Climate Action and Environment |

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## Appendix 1 Legislation on Annual Review Report

*Annual Review by, and annual report of, Advisory Council*

*12. (1) The Advisory Council shall—*

*(a) conduct a review (in this section referred to as the 'annual review') in each year of the progress made during the immediately preceding year in achieving greenhouse gas emissions reductions, and furthering transition to a low carbon, climate resilient and environmentally sustainable economy, and*

*(b) not later than 30 days after the completion of the annual review, prepare and submit to the Minister a report (in this section referred to as the 'annual report') on its findings and recommendations consequent upon that annual review.*

*(2) Without prejudice to the generality of subsection (1), the annual report shall contain—*

*(a) a summary of the findings set out in the most recent national greenhouse gas emissions inventory prepared by the Agency,*

*(b) a summary of the most recent projection of future greenhouse gas emissions prepared by the Agency,*

*(c) such recommendations, as the Advisory Council considers necessary or appropriate, in relation to the most cost-effective manner of achieving reductions in greenhouse gas emissions in order to enable the achievement of the national transition objective,*

*(d) such recommendations as the Advisory Council considers necessary or appropriate, in relation to compliance with an existing obligation of the State under the law of the European Union or an international agreement referred to in section 2,*

*(e) such other recommendations or advice as the Advisory Council considers necessary or appropriate in order to enable the achievement of the national transition objective, and*

*(f) a summary of—*

*(i) the activities of the Advisory Council under section 11 (2), and*

*(ii) any information gathered in accordance with section 11 (2).*

*(3) Not more than 30 days after submitting an annual report to the Minister under this section, the Advisory Council shall publish the annual report by such means as the Agency may advise.*

## Appendix 2 Data Sources for Transition Indicators

| Name | Unit | Sources |
|---|---|---|
| GHG intensity of the economy | kt $CO_2$ e/€M GNI* | CSO (2017) Table N1624: Annex 1. Modified Gross National Income at Current Market Prices by Item and Year, https://www.cso.ie/<br>EPA (2018) National Inventory Report and Common Reporting Format,<br>Ireland Submission to the UNFCCC (online), https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2018 [accessed 4 July 2018] |
| Per capita GHG | t $CO_2$ e/ population | CSO (2017) Table PEA01: Population Estimates (Persons in April) by Age Group, Sex and Year, https://www.cso.ie/ EPA (2018) National Inventory Report and Common Reporting Format, Ireland Submission to the UNFCCC (online) |
| $CO_2$ intensity | kt $CO_2$/€M GNI* | EPA (2018) National Inventory Report and Common Reporting<br>Format, Ireland Submission to the UNFCCC (online), CSO (2017) Table N1624: Annex 1. Modified Gross National Income at Current Market Prices by Item and Year [online] https://www.cso.ie/ |
| $CO_2$ per capita | t $CO_2$/ population | CSO (2017) Table PEA01: Population Estimates (Persons in April) by Age Group, Sex and Year, [online] www.cso.ie EPA (2018) National Inventory Report and Common Reporting Format, Ireland<br>Submission to the UNFCCC (online) |
| Economy-wide efficiency | GVA/ t $CO_2$ e €/t $CO_2$ e | CSO (2017) Table T06 National Accounts at Constant Prices, [online] www.cso.ie<br>EPA (2018) National Inventory Report and Common Reporting<br>Format, Ireland Submission to the UNFCCC (online) |
| Total primary energy requirement | Megawatt hour | SEAI (2017) Energy in Ireland 1990- 2016 [online] https://www.seai.ie/resources/publications/Energy-in-Ireland-1990-2016-Full-report.pdf [Accessed 26/06/2018] |
| Emissions from peat and coal fired electricity | kt $CO_2$ | SEAI (2017) Energy in Ireland 1990-2016, https://www.seai.ie/resources/publications/Energy-in-Ireland-1990-2016-Full-report.pdf [Accessed 26/06/2018] EPA (2018) National Inventory Report and Common Reporting Format, Ireland Submission to the UNFCCC [online] |
| $CO_2$ Intensity of Electricity | g $CO_2$/ kilowatt hour | SEAI (2017) Energy in Ireland 1990-2016, https://www.seai.ie/resources/publications/Energy-in-Ireland-1990-2016-Full-report.pdf; [Accessed 26/06/2018] EPA (2018) National Inventory Report and Common Reporting Format, Ireland Submission to the UNFCCC [online] |
| % renewable of gross electricity consumption | % | SEAI (2017) Energy In Ireland Report 1990–2016; Table 10 [online]<br>https://www.seai.ie/resources/publications/Energy-in-Ireland-1990-2016-Full-report.pdf [Accessed 26/06/2018] |
| % renewable heat | % | SEAI (2017) Energy In Ireland Report 1990–2016; Table 9 [online] |

| Name | Unit | Sources |
|---|---|---|
| % residential energy from solid fuel (coal and peat) | % | SEAI (2017) Energy in Ireland 1990-2016 |
| A and B BER-rated residential "dwellings" | % | SEAI (2018) BER Research Tool, [Online] (accessed 27th February 2018) |
| A and B BER-rated commercial buildings | % | CSO (2017) Non-Domestic Buildings Energy Ratings Q1 2017,<br>CSO statistical release 21 April 2017 [Online] https://www.cso.ie/en/releasesandpublications/er/ndber/non-domesticbuildingenergyratingsq12017/ [accessed 4 July 2018] |
| Energy efficiency gains in public bodies | % improvement from business as usual | SEAI (2017) Annual Report 2017 on Public Sector Energy Efficiency Performance; https://www.seai.ie/resources/publications/2017_Annual_Report_on_Public_Sector_Energy_Efficiency_Performance.pdf [accessed 4 July 2018] |
| Energy consumption of public bodies | Gigawatt hour | SEAI (2017) Annual Report 2017 on Public Sector Energy Efficiency Performance |
| % renewable transport | % | SEAI (2017) Energy In Ireland Report 1990–2016; Table 12 [online]<br>https://www.seai.ie/resources/publications/Energy-in-Ireland-1990-2016-Full-report.pdf [Accessed 26/06/2018] |
| Distance by private vehicles | million km | CSO (2017) Road Traffic Volumes by Type of Vehicle, Year and Statistic, Table THA10 (online) www.cso.ie |
| Distance by private vehicles per capita | km | CSO (2017) Road Traffic Volumes by Type of Vehicle, Year and Statistic, Table THA10 [online], CSO (2017) Population Estimates (Persons in April) by Age Group, Sex and Year; Table PEA01 (online) www.cso.ie |
| Distance by goods vehicles | million km | CSO (2017) Road Traffic Volumes by Type of Vehicle, Year and Statistic, Table THA10 [online] www.cso.ie |
| Distance by Public Service Vehicles | million km | CSO (2017) Road Traffic Volumes by Type of Vehicle, Year and Statistic, Table THA10 [online] www.cso.ie |
| Private car new vehicles' fuel type | Number of new petrol and diesel vehicles | CSO (2017) New Vehicles Licensed for the First Time by Type of Vehicle Registration, Type of Fuel and Year, Table TEA03; CSO (2017) Road Traffic Volumes by Type of Vehicle, Year and Statistic, Table THA10 [online] www.cso.ie |
| New goods vehicles' fuel type | Number of new petrol and diesel vehicles | CSO (2017) New Vehicles Licensed for the First Time by Type of Vehicle Registration, Type of Fuel and Year, Table TEA03, CSO (2017), Road Traffic Volumes by Type of Vehicle, Year and Statistic, Table THA10 [online] www.cso.ie |
| Forestry cover | hectares | EPA (2018) National Inventory Report and Common Reporting Format, Ireland Submission to the UNFCCC [online] |
| Dairy Cattle | thousands | EPA (2018) National Inventory Report and Common Reporting Format, Ireland Submission to the UNFCCC [online] |

| Name | Unit | Sources |
|---|---|---|
| Non Dairy Cattle | thousands | EPA (2018) National Inventory Report and Common Reporting Format, Ireland Submission to the UNFCCC [online] |
| Sheep | thousands | EPA (2018) National Inventory Report and Common Reporting Format, Ireland Submission to the UNFCCC [online] |
| Total area of drained organic soils | hectares | EPA (2018) National Inventory Report and Common Reporting Format, Ireland Submission to the UNFCCC [online] |
| Farming Effiiency | GVA/ t $CO_2$ e €/t $CO_2$ e | CSO (2017) Table T04, Gross Value Added at Constant Basic Prices by Sector, [online] www.cso.ie , EPA (2018) National Inventory Report and Common Reporting Format, Ireland Submission to the UNFCCC [online] |
| Dairy Production Efficiency | kg $CO_2$e / kg milk | Teagasc (2018) National Farm Survey [online] https://www.teagasc.ie/publications/2018/teagasc-national-farm-survey-preliminary-results-2017.php |
| Beef Production Efficiency | kg $CO_2$e / kg beef | Teagasc (2018) National Farm Survey [online] https://www.teagasc.ie/publications/2018/teagasc-national-farm-survey-preliminary-results-2017.php |
| International Total Climate Specific Finance | Euros € | Article 16 "[Greenhouse gas] Financial and technology support provided to developing countries" Article 16 Support provided, Article 16 Report for Ireland, 2016, 2015, 2014. [online] https://ec.europa.eu/clima/policies/international/finance/transparency_en [see Member State Reporting] http://cdr.eionet.europa.eu/ |

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