Chapter 3
Climate

Climate Change

Introduction

Climate change is an overarching global challenge.

Responding effectively to climate change is both urgent and long term. It is urgent in that our actions and responses in the next 5–15 years may effectively lock in large-scale and irreversible planetary changes over this and subsequent centuries. The December 2015 Paris Agreement sets the international agenda for addressing this challenge. However, it must be addressed at national and sub-national levels and by cities, businesses and communities. At national level, the National Policy Position (DECLG, 2014) and the Climate Action and Low Carbon Development Act 2015 provide the policy framework for actions. In combination with EU-level emissions targets for 2020 and 2030, these specify the short-term actions and longer-term strategy to advance mitigation and adaptation actions. A brief overview of the science of climate change, the response options and policy context is provided here. The nature and scale of the challenges that Ireland faces in addressing climate change are also outlined.

Scientific Understanding

The scientific understanding of climate change is robust. Warming of the climate system is unequivocal and the human influence on this is clear.

The impacts of changes to the atmosphere on climate are well known. Major volcanic eruptions such as Pinatubo (1991) or Krakatoa (1883) produced plumes of fine particles which shaded and cooled the Earth, reducing subsequent summer temperatures by between 0.5°C and 1.0°C. Similarly, air pollutants typically act to temporarily "cool" the Earth. They also impact on human health and cause environmental damage (see Chapter 2). The accumulation in the atmosphere of relatively stable and inert gases, such as carbon dioxide, that trap energy is the key threat to our climate (Figure 3.1). In 2015, the atmospheric concentration of carbon dioxide reached 400 ppm, a level that has not occurred for at least 800,000 years. It is one of the many changes that the Intergovernmental Panel on Climate Change (IPCC) has described as unprecedented for centuries to millennia (IPCC, 2014a,b).

Climate change is primarily associated with the increase in the global average temperature. The average global temperature in 2015 was 1°C higher than the pre-industrial levels. This record level follows three decades that were successively warmer than any preceding decade since 1850. However, about 90% of the additional energy trapped by greenhouse gases (GHGs) is being absorbed by the oceans. This is contributing to sea-level rise due to thermal expansion (Figure 3.2). On average, global sea level has risen by about 20 cm in the last century. Changes evident in Ireland have tended to follow the global average, with an average temperature increase of just under 1°C over the last century. Since 1993, average sea level has risen around Ireland by just over 3 cm per decade.

The Responses to Climate Change

We Know What to Do to Address Climate Change

There are two linked responses to climate change:

- mitigation of emissions of the GHGs that are driving climate change
- adaptation to reduce vulnerability to the adverse impacts of climate change.

Mitigation of GHG emissions is the primary response to the threat of climate change and each country will need to play its part in taking effective actions. The aim of holding the increase in the global average temperature to well below 2°C, relative to pre-industrial temperature, frames mitigation actions from global to local levels – see topic box on Paris agreement. To achieve this objective, global emissions of carbon dioxide and other GHGs must be brought to near or below zero by the end of this century. Emissions of carbon dioxide must be reduced to net-zero before this time. Ireland's emissions have to follow a similar trajectory on a shorter timeline (see National Policy Statement, DECLG,[1] 2014).

Failure to take effective action is projected to result in dangerous and unmanageable global impacts, including undermining of global food production and major loss of natural ecosystems, and could cause irreversible flooding of low-lying coastal areas and loss of small island states. Projected impacts include major losses of coastal cities, population movement and likely conflicts over resources.

Adaptation is increasingly recognised as an important response to climate change, with an adaptation goal being included in the Paris Agreement (see Box). The aim

1 Note: The Climate Change functions in the former Department of Environment, Community and Local Government were transferred in July 2016 to the new Government department, the Department of Communications, Climate Action and Environment.

Figure 3.1 Schematic of Atmospheric Factors that Determine the Global Energy Balance (Source: Kiehl and Trenberth, 1997)

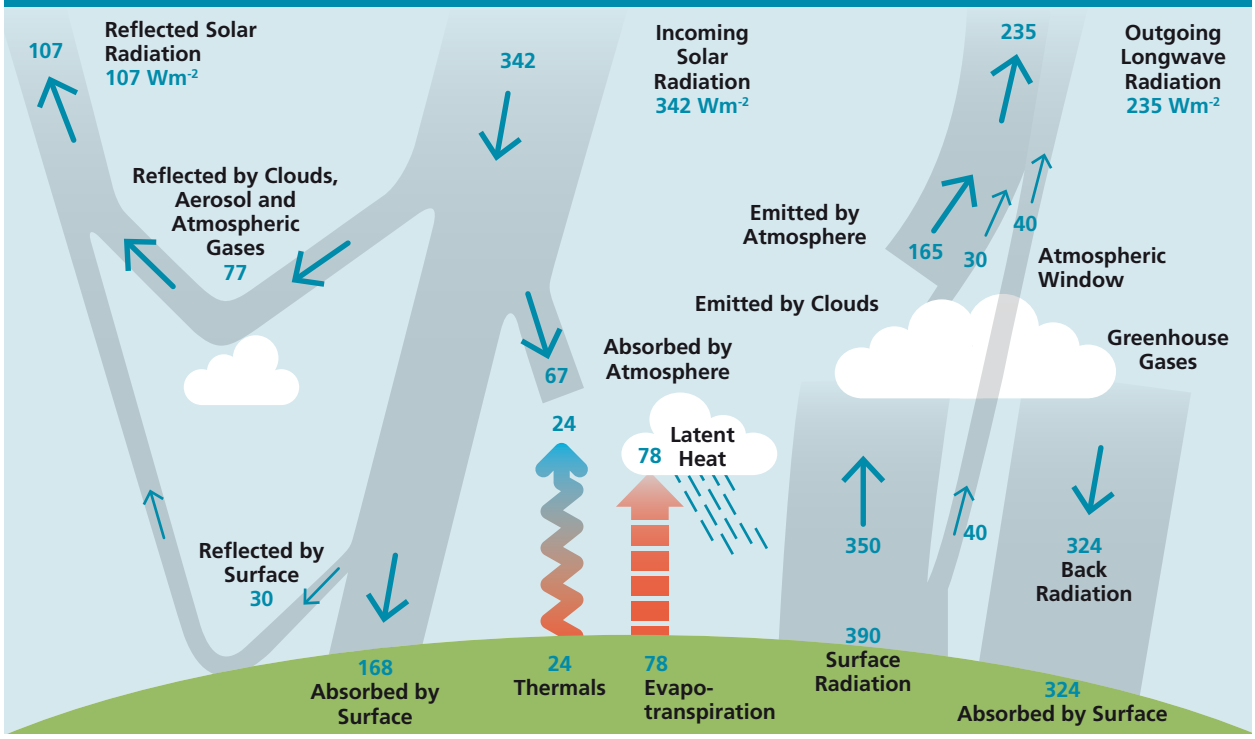
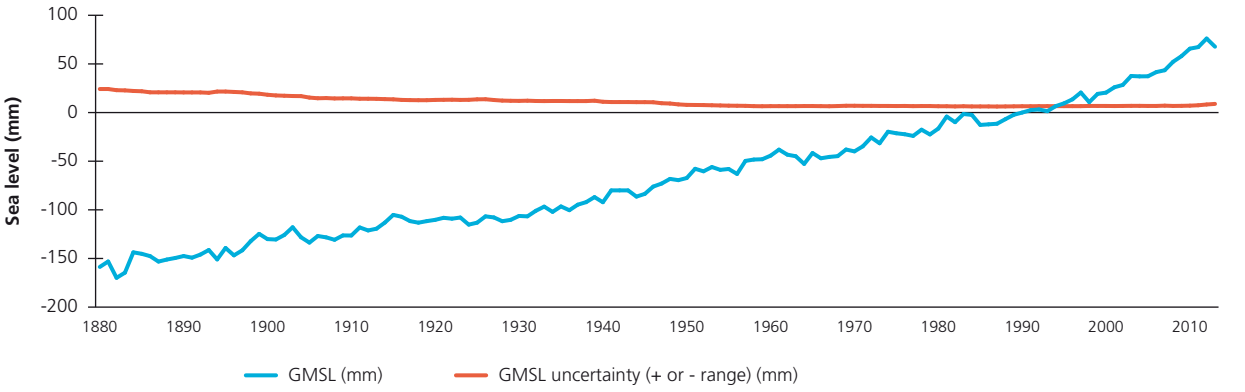


Figure 3.2 Global Sea Level Rise Data (Source: Church and White, 2011)



of adaptation is to reduce vulnerability to the current and projected impacts of climate change and increase resilience. Adaptation also brings opportunity through green growth, innovation, resilience and ecosystem services enhancement. Key steps in adaptation actions are the assessment of current vulnerabilities to weather extremes and the adoption of gradual changes; determining how these vulnerabilities can be reduced in the context of trends and projected changes; and carrying out the actions required to achieve these goals. Adaptation actions can be seen as an effective response only if they are coupled with the required mitigation actions. In this context, sectors and community actors should link mitigation and adaptation planning, investments and actions.

For Ireland, mitigation and adaptation actions are framed and informed by UN, EU and national policy. These include the UNFCC,[2] the Kyoto Protocol,[3] the UN Paris Agreement,[4] the EU Strategy on Adaptation to Climate Change,[5] the EU Climate and Energy Package,[6] the National Policy Position on Climate Change (DECLG, 2014) and the Climate Action and Low Carbon Development Act 2015.

The Paris Agreement

In December 2015, at a meeting of the UNFCCC in Paris, a new global agreement was reached to address climate change (UN, 2015). The agreement aims to:

- hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C
- increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low GHG emissions development in a manner that does not threaten food production
- make finance flows consistent with a pathway towards low GHG emissions and climate-resilient development.

To achieve this, GHG emissions must peak as soon as possible and then be reduced rapidly in order "to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century".

The Agreement establishes a long-term adaptation goal of "enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the 2°C temperature goal". This makes it clear that, if mitigation activities succeed in limiting the rise in global temperature, less adaptation will be needed.

The Paris Agreement is expected to enter into force in 2020. Progress will be determined by a regular global stocktake, which will assess how collective actions are aligned with the ambitions of the agreement. This will inform subsequent actions.

2 *www.unfccc.int/*
3 *www.unfccc.int/kyoto_protocol/items/2830.php*
4 *www.unfccc.int/paris_agreement/items/9485.php*
5 *www.ec.europa.eu/clima/policies/adaptation/index_en.htm*
6 *www.ec.europa.eu/clima/policies/strategies/2020/index_en.htm*

EU Climate and Energy Package

An Effective Suite of Policies to Address Climate Change is Essential.

The EU is a global leader of actions to address climate change. It is committed to reduce its collective emissions of GHGs by at least 40% relative to 1990 levels by 2030. The 2020 Climate and Energy Package aims to achieve a 20% reduction in total GHG emissions relative to 1990 levels. The required mitigation actions are advanced under two tracks:

- Emissions from large industrial sources such as electrical power generation sources are addressed at an EU level under the EU Emissions Trading System (EU ETS)
- Emissions from other activities, including transport agriculture, heating and waste, are addressed at a Member State level under the Effort Sharing Decision.

The Effort Sharing Decision targets for non-ETS GHG emissions are set at Member State level and, to achieve them, Ireland must reduce emissions of a basket of GHGs (including from Agriculture, Transport, Residential and Waste sectors) by 20% relative to 2005 levels over the period 2013–2020. Member State emissions reductions for the period 2021–2030 were announced in July 2016 and included a 30% reduction target for non-ETS emissions (relative to 2005).[7] The new proposal also includes a provision where Member States who have a large proportion of their emissions from the Agriculture sector can utilise additional flexibilities towards meeting the overall 30% target, in particular removals of carbon through Land Use, Land Use Change and Forestry. For activities covered by the EU ETS, emission caps for the period 2013–2020 will decrease by 1.74% annually. However, as part of a series of measures to address perceived weaknesses in the EU ETS, it has been agreed to increase the annual reduction cap from 1.74% to 2.2% from 2021. This will ensure that these emissions are reduced by 43% relative to 2005 by 2030. Other reforms to address the trading scheme carbon price and to support low-carbon innovation and energy sector modernisation were also agreed in 2015. Additional steps to accelerate decarbonisation of electricity, such as introducing a minimum price in the EU ETS, have been proposed by some Member States and promoted by Ireland's Climate Change Advisory Council.[8] Ireland has linked targets under the UN Kyoto Protocol. Removals associated with forestry and other land uses are included in this target.

Adaptation Action at the EU Level

Enhancing resilience through adaptation.

The EU *Strategy On Adaptation To Climate Change* aims to make Europe more climate resilient by taking a coherent pan-European approach and complementing the activities of Member States; it promotes:

- action by Member States
- better informed decision making
- climate-proofing common EU action: promoting adaptation in key vulnerable sectors.

The EU strategy notes that 'adaptation actions include mainstreaming of climate change (mitigation and adaptation) into EU sector policies and funds, including marine and inland water issues, forestry, agriculture, biodiversity, infrastructure and buildings, but also migration and social issues'. This cross policy dimension represents a significant governance challenge for the EU as well as down to nation, regional and local implementation levels. The EU Climate-Adapt web resource[9] is intended to supply information sharing, knowledge, and tools to assist adaptation actions across the EU.

7 *www.ec.europa.eu/clima/policies/effort/proposal/index_en.htm*

8 *www.climatecouncil.ie*

9 www.climate-adapt.eea.europa.eu/

Impacts of Climate Change in the Marine Environment

Rising sea temperatures and sea levels, and ocean acidification have been identified as some of the key stressors impacting on the state of the world's oceans and coastal environments as a consequence of Climate Change (EPA, 2009; IPCC, 2014). These three factors have the potential to seriously affect the functioning of marine and coastal ecosystems and biogeochemical cycles on global, regional and local scales (Gruber, 2011). These factors acting independently, in combination, or synergistically, are likely to further impact ecosystems which have already been stressed by other factors such as over fishing, chemical pollution and the introduction of alien species.

Temperature changes

Temperature plays an implicit role in many biological processes such as respiration, photosynthesis and remineralisation as well as influencing, along with salinity, the density of seawater and ocean stratification. Over the period 1971–2010 the global sea surface temperatures (surface to 75 depth) has increased by 0.11˚C per decade (IPCC, 2013a). In Ireland, while long-term temperature records are sparse, observations maintained by Met Eireann at Malin Head since 1958 show a progressive warming in the record since the 1990s of approximately 1°C. This warming is partly explained by the natural cycle of variability in the North Atlantic known as the 'Atlantic Multi-decadal Oscillation', but approximately half of the recent warming is attributed to an underlying global warming trend (Dwyer, 2012).

Sea level changes

Global mean sea level has risen by 0.19 m over the period 1901–2010 (IPCC, 2013a). Rising sea levels in combination with increased storm events that are also predicted to happen are likely to impact on many coastal habitats. An average sea level rise of 0.5 to 1 m by the end of the century, in combination with storm surge events, could result in approximately 300 to over 1,000 km^2 of coastal lands around Ireland being inundated by the sea (DeVoy, 2008). A rise of 1 m in sea level would see 30% of existing wetlands disappearing (DeVoy, 2008). The habitats most at risk include low-lying coastal lagoons, saltmarsh and estuaries, and of particular vulnerability are those that are prevented from extending landward because of the presence of some fixed or artificial boundary. Many of the low-lying estuarine sandflats, mudflats and lagoons found along the southeast coast, some of which have been identified as Special Areas of Conservation (SACs), could be threatened. These habitats provide rich feeding grounds for a variety of bird species as well as providing important nursery grounds for juvenile fish.

Coastal erosion

The 2013/2014 winter wave conditions that severely impacted the Atlantic coast of Europe were investigated and demonstrated that this winter was the most energetic along most of the Atlantic coast of Europe since at least 1948. Storm wave conditions such as were encountered have the potential to dramatically change the equilibrium state (beach gradient, coastal alignment, and near shore bar position) of beaches along the Atlantic coast of Europe. One of the consequences of Climate Change will be more frequent and extreme storm events (EPA, 2010).

National Legislation and Policy

Irish climate change policy takes significant step forward in 2015.

The National Policy Statement on climate change (DECLG, 2014) articulates a vision to transition to a competitive, low-carbon, climate-resilient and environmentally sustainable economy by 2050; based on:

- an aggregate reduction in CO_2 emissions of at least 80% (relative to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors
- an approach to carbon neutrality in the agricultural and land use sector.

The Climate Action and Low Carbon Development Act 2015 provides, inter alia, for approval of plans by the Government in relation to climate change mitigation and adaptation for the purpose of pursuing this transition and meeting international obligations and targets to 2020 and 2030. Key provisions of the Act include:

- the preparation and submission to Government for approval of successive 5-yearly National Mitigation Plans, which will specify the policy measures to reduce GHG emissions in Ireland
- the preparation of a National Adaptation Framework, which will reduce the vulnerability of the State to the negative effects of climate change and avail of any positive effects that may occur; it will be reviewed not less than once every 5 years, in keeping with the continued development of the evidence base and actions on adaptation and mitigation.

In addition to the national mitigation plan, there will be development of sectoral plans (e.g. transport, agriculture) and Local Authority plans.

The first National Mitigation Plan and the National Adaptation Framework must be submitted to Government by June and December 2017, respectively. The Minister for Communications, Climate Action and Environment[10] together with other relevant ministers (e.g. for transport, heritage and agriculture) will present annual transition statements to the Oireachtas on progress relating to climate mitigation and adaptation.

The Climate Change Advisory Council[11] was established by ministerial order under the 2015 Act to provide advice and recommendations to ministers and the Government on national responses to climate change. The Council is made up of seven members appointed by the Government and four *ex officio* members, who represent the Environmental Protection Agency, the Sustainable Energy Authority of Ireland, the Economic and Social Research Institute and Teagasc. The primary function of the Council is to evaluate and report on national progress in relation to mitigation and adaptation planning and implementation, as well as progress on international obligations.

Ireland's Greenhouse Gas Emissions

Greenhouse gas emissions have peaked but greater reductions are needed.

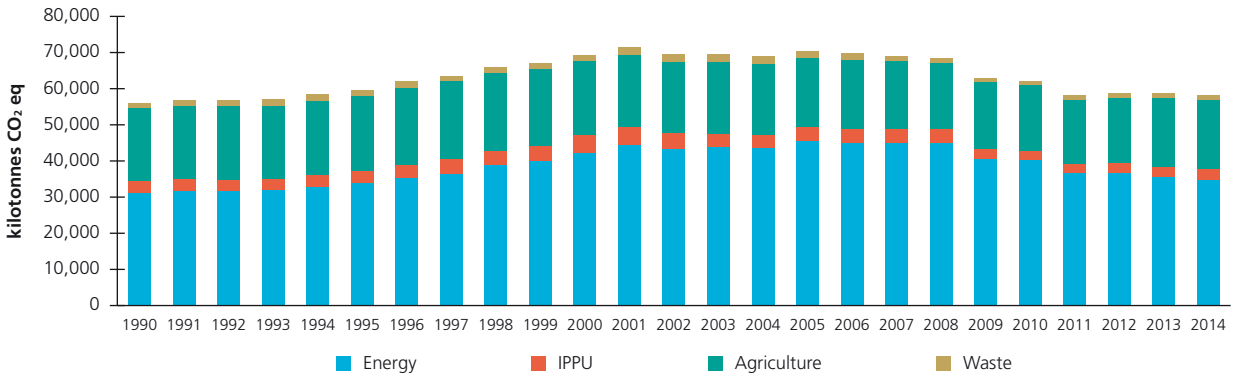
Ireland's GHG emissions peaked in 2001 at 71,394 kt CO_2 equivalent. In 2014, total emissions of GHGs, including indirect emissions from solvent use, amounted to 58,254 kt CO_2 equivalent, which is 18% lower than the peak value but still higher than 1990 emissions (non ETS base year for limits is 2005).

In 2014, the energy sector accounted for 60.1% of total emissions, agriculture for 32.2%, industrial processes and product use for 5.2% and the waste sector for 2.6% (based on the UN IPCC sectoral classification, see Figure 3.3). Carbon dioxide (CO_2) accounted for 62.9% of the total, with methane (CH_4) and nitrous oxide (N_2O) contributing 23.1% and 12.0% as CO_2 equivalent, respectively. The combined emissions of HFC, PFC, SF_6 and NF_3 accounted for 2.1% of the emissions[12]. Figure 3.4 shows the GHG emissions trend by sector and gas.

Fossil fuel combustion is the principal source of emissions and these are addressed in Chapters 10 and 11. The emissions from the agriculture sector, the other main source category, increased during the 1990s but decreased to 6.8% below 1990 levels in 2014.

In 2015, total emissions covered under the EU ETS were 16.83 Mt CO_2 equivalent, which is a 25% reduction on 2005 levels. This is, in part, due to the economic crisis, which had a strong impact on construction (especially cement manufacture). However, the increasing uptake of renewable energy in power generation also played an important role.

Figure 3.3 National Total Greenhouse Gas Emissions by Sector (Excluding Land Use, Land Use Change and Forestry) 1990-2014 (Source: EPA, 2016a)

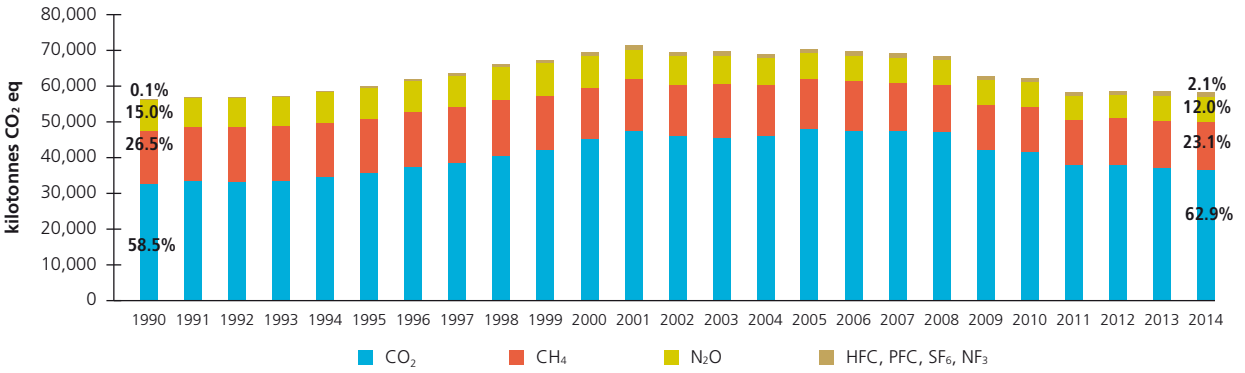


10 Refer footnote 1.

11 *www.climatecouncil.ie*

12 For an introduction to the greenhouses gases see: *www.epa.ie/media/GHG%20Infographic%202016.pdf*

Figure 3.4 Greenhouse Gas Emissions by Gas 1990-2014 (Source: EPA, 2016a)



Per Capita Emissions in Ireland and EU Emissions

Ireland's current greenhouse gas emissions amount to 12.6t CO_2 equivalent per person, 63% (7.9t CO_2 per person) of which emissions come from CO_2. Per capita CO_2 emissions rose to a peak of 12.4t CO_2 per person in 2001 (66% of total GHG per capita emissions), following which, apart from very slight increases in 2005 and 2012, it decreased by 2.8% per annum to the current level of 7.9t CO_2 per person (Figure 3.5).

Figure 3.5 Emissions of Greenhouse Gases (t CO_2 equivalent per capita) in Ireland from 1990 to 2014 and Showing Carbon Dioxide Emissions as a Proportion of the Total (Source: EPA, 2016a)

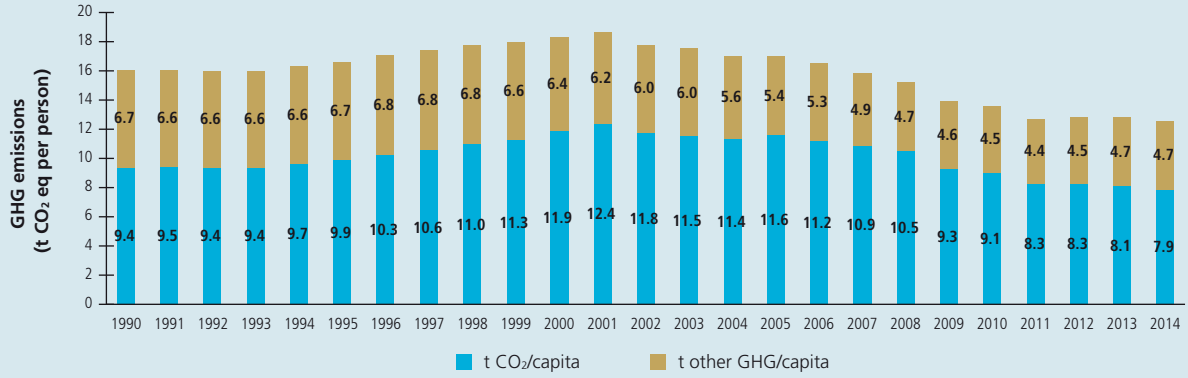
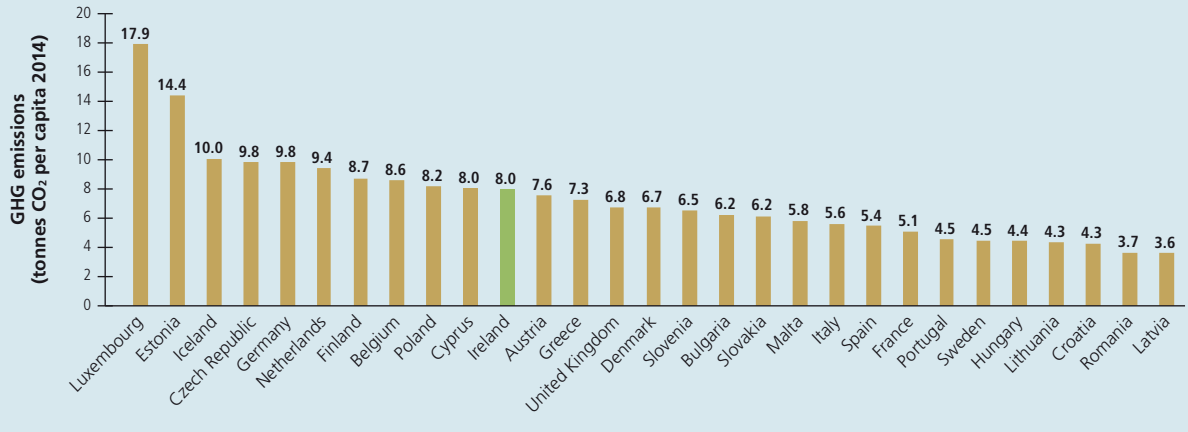


Figure 3.6 Emissions of Greenhouse Gases (t CO_2 per person) in the EU 2014 (Source: EEA, 2016)



Emissions Projections

Projections suggest that Ireland will not meet its emissions reduction targets.

The EU 2020 target is based on a combination of annual targets from 2013 to 2020 to give an overall reduction by 2020. Official projections of GHG emissions to 2020 are provided annually by the EPA based on two scenarios: (1) with current policies, regulations and incentives (i.e. With Measures, WM) and (2) with additional policies, regulations and incentives (i.e. With Additional Measures, WAM). These are depicted separately as blue and red bars in Figure 3.7. This shows that based on current policies, Ireland is projected to exceed its annual limits in 2016 and, even with additional polices, this limit would be exceeded in 2017.

For the period 2014-2020, agriculture emissions are projected to increase by 6–7%. Transport emissions are projected to show strong growth over the period to 2020, with a 10–16% increase on 2014 levels. Based on the two emissions scenarios described above, total emissions are projected to be 6% (scenario 1) or 11% (scenario 2) below 2005 levels in 2020 (i.e. WM and WAM). The target is a 20% reduction.

These projections are therefore a cause for significant concern in the context of the anticipated requirements for further reductions in GHG emissions in the period 2021-2030. Failure to meet the 2020 target would make future compliance challenges more difficult and costly. In addition, the analysis suggests that Ireland is not on track for, or projected to be moving in the right direction, to meet its National Policy Position, which aims to achieve a least 80% reductions in carbon dioxide emissions by 2050 relative to 1990 levels and achieving neutrality in the agriculture and land use sectors.

Further polices, regulations and incentives are therefore urgently needed to meet existing targets and to move to a pathway to achieve the 2050 transformation objective. Increased strategic planning, investment and resources are also needed to achieve this in the overall framework of EU and global commitments.

Land Use, Land Use Change and Forestry

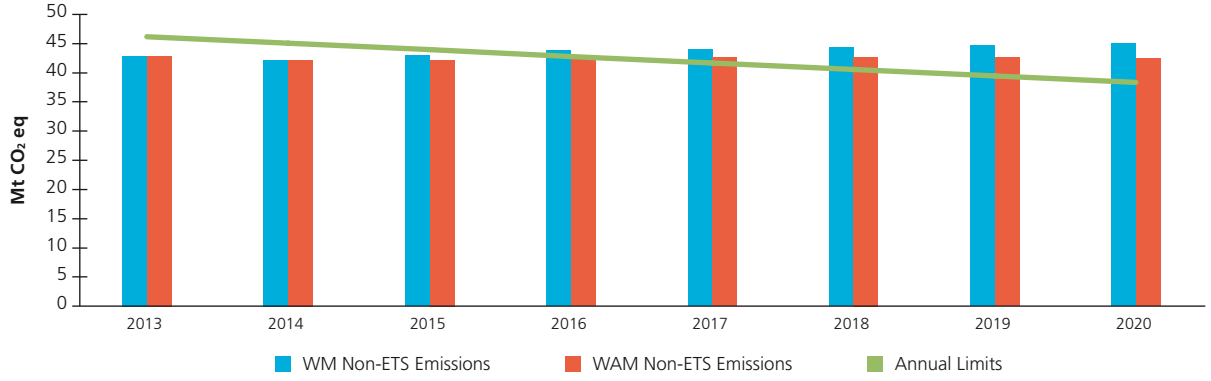
Land management has a key role in the national, EU and global response to climate change. The Kyoto Protocol established a complex set of rules for reporting and accounting for emissions and removals resulting from land use and land use change. Ireland has significant and healthy biosystems, including grassland, hedgerows and forests, which sequester carbon dioxide. Mineral soils and peat make up a large portion of Ireland's land areas and have high carbon content.

Under the Kyoto Protocol, Ireland currently accounts for GHG emissions and removals associated with forest land, cropland and grazing land. Peatlands and wetlands are not yet included but constitute a major area of carbon-rich land that needs to be protected. Since 1990, Ireland's forest area has expanded by approximately 260,000 ha. As these forests grow and mature, they will represent an important carbon dioxide sink and long-term carbon store in biomass and soil. The current national forestry policy addresses these strategic advantages (DAFM, 2014).

In general, well-managed grasslands on mineral soils tend to take up and store carbon in the soil. However, changes from grassland to arable land, in particular, can lead to significant carbon dioxide emissions as a result of the disturbance of the soil and the loss of vegetation above ground. Low-impact management practices can mitigate such effects without significantly reducing productivity.

The management of peatlands is a particular concern with respect to potential for loss of carbon. Peat extraction and change of use of drained peatland to grassland or forestry leads to high rates of carbon loss. In general, land management should aim to preserve or enhance areas that have active carbon uptake in soils and biomass, and reduce or eliminate areas that are a source of carbon emissions. Such altered practices also yield benefits for ecosystem services.

Figure 3.7 Greenhouse Gas Emission Projections Assuming Continuing with Existing Measures (blue bars) and Implementation of Additional Measures (red bars) and Comparison with the Linear Reduction Pathway Required Between 2013 and 2020 (Source: EPA, 2016b)



Climate Change Impacts and Adaptation

The impacts of climate change are evident on all continents and in all oceans.

Observed climate change impacts are most evident in the global temperature record, sea-level rise, loss of glaciers and ice-sheets and changes in the nature and intensity of precipitation events. These have impacted on human health, water resources and management systems, ecosystems, food production and rates and levels of coastal flooding. Global projections indicate that oceans will continue to warm, sea-level rise will continue during this century and sea-ice and glacier volumes will further decrease. Studies have shown that the intensity and frequency of extreme events are increasing and will further increase as a result of climate change (IPCC, 2013a). The character and severity of the impacts of climate extremes depend not only on the extremes themselves but also on exposure and vulnerability to these extremes.

The effects of climate change are projected to further impact on food production systems, water resources, coastal infrastructure, critical services and urban centres, resulting in increased displacement of people, societal stress and loss of land and other assets. Ireland's climate is changing in line with regional and global trends. Further climate change is projected to have diverse and wide-ranging impacts on the environment, society and economic sectors (see Box). Adaptation actions will be required to reduce adverse impacts and increase resilience to these and other impacts of climate change.

Sectoral Impacts of Climate Change for Ireland

- **Agriculture:** the main impacts are expected to result from changes in air and soil temperatures, changes in rainfall patterns and extreme events.
- **Marine environment:** changes in ocean temperature and acidity are projected to continue, resulting in changes to marine ecosystems and species, which will have implications for fisheries.
- **Biodiversity:** increasing temperatures will impact upon the geographical range and phenology (the timing of life cycle events) of native species. Projected shifts in climate, temperature and precipitation may result in the increased occurrence of invasive species and competitive pressures on Ireland's native species.
- **Coastal zones:** sea-level rise is projected to increase coastal erosion and flooding, including effects on major coastal cities.
- **Critical infrastructure:** water, energy, communications, transport and emergency services are at risk from a range of projected changes, including sea-level rise, increasing temperatures, changing rainfall patterns and extreme weather events.
- **Water management:** the projected changes are expected to impact on water management and will exacerbate existing pressures in terms of water supply, quality and flooding.
- **Human health and wellbeing:** increasing temperatures are likely to result in the increased incidence of heat-related mortality. However, an overall decrease in temperature-related mortality is expected because of decreases in levels of cold-related mortality. Increases in extreme events will have significant impacts on psychological health and wellbeing.

(Source: Climate Ireland)

National Policy Development

In December 2009, a carbon tax was introduced at a rate of €15 per tonne on certain uses of fossil fuels outside the EU ETS. This has since increased to €20 per tonne and, since April 2014, applies to all fossil fuels, including coal and peat. The carbon tax is estimated to reduce emissions by about 0.3 Mt CO_2 equivalent per annum. There are a number of other schemes and incentives to increase energy efficiency. These are outlined in Chapter 11.

National Climate Science Research

Advancing understanding and solutions.

The EPA has led on the development and co-ordination of climate change research in Ireland. The vision is to inform a carbon-neutral, climate-resilient Ireland by 2050. The approach has been to develop national capacity in co-operation with other state agencies and government departments and to advance research along four linked thematic areas:

- GHG emissions and removals data management systems aim to improve quantification/reporting of emissions and removals of GHGs. The focus is on those activities that are critical components of Ireland's emissions profile, especially those associated with land use, agriculture and bioenergy. This research supports and informs mitigation actions and their inclusion in national GHG inventories and projections
- Research carried out under the theme of 'Ireland and future climate, impacts and adaptation' aims to provide analysis of ongoing and future climate change and to use this to support the analysis of impacts-associated risks and vulnerabilities. The goals are to inform decision making on adaptation actions at the national, sectoral and local levels. Outputs from this research are central to risk assessment and adaptation planning at various levels
- Socio-economic and technological solutions and transition management aims to advance socio-economic analysis and modelling of sectoral and cross-sectoral transition pathways over medium to longer time horizons, for example to 2050; this research is solutions focused, with the aim of promoting cross-disciplinary analysis of effective technological and behavioural solutions at a range of scales. A key outcome from this research has been the identification of pathways to a carbon-neutral Ireland by 2050
- Air science research aims to address the crossovers between air pollutants and climate change. It includes research on ambient and local air quality and cross-cutting issues, including the linked processes and source activities responsible for air pollutants that are sources of GHG emissions and influence climate.

Since 2007, the EPA has supported over 108 climate change research projects to the value of €25 million. This investment has produced research that has been highly influential on national policy development, supported national engagement with EU and UN bodies and is estimated to have provided savings of €50 million in relation to improved analysis of GHG emissions.

Outlook and Conclusions

Determined actions are the key to the transition to a low-carbon future.

Both in Ireland and globally, 2015 was an important year for advancing actions on climate change. The nature and extent of the challenge are well described by the work of the IPCC and others. The policy structures are in place. The key challenge is moving to take effective actions. The first National Mitigation Plan and the National Adaptation Framework should provide the basis for the required transition to a low-emissions, climate-resilient economy and society, as outlined in the National Policy Statement, while meeting shorter-term emissions reduction targets.

Ireland is vulnerable to weather extremes and sea-level rise. Its coastal assets, transport and energy infrastructure are also vulnerable. Their vulnerability has been exposed by recent weather extremes, which are expected to become more frequent over the coming decades. It is in Ireland's interest to take effective actions to address climate change.

Ireland also needs to play an effective part in contributing to EU and global efforts to ensure that the global temperature increase relative to pre-industrial temperatures stays well below 2°C. Ireland is well positioned to provide leadership in key areas including the monitoring, reporting and verification of GHG emissions and removals from agriculture and land use.

Coherent cross-government engagement in, and support for, strategic and effective local and global actions to address climate change is in Ireland's interest.

Key Messages

Climate Change

Strategic planning and investment are required for Ireland to make an effective contribution to global actions to avoid dangerous and irreversible impacts of climate change and to benefit from the multiple opportunities that arise from required actions.

Ambitious and effective global actions are required to prevent the large-scale dangerous and irreversible impacts of climate change, and Ireland must play its part in advancing these actions.

Globally, emissions of carbon dioxide must be reduced to net-zero early in the second half of this century, and other GHG emissions must be balanced before the end of this century; Ireland's emissions have to follow a similar trajectory on a shorter timeline.

Considerable opportunities arise from the required transformation in global energy, transport and land use systems, and it is in Ireland's interest to lead in key areas of this transition.

There is an urgent need for further polices, regulations and incentives if Ireland is to meet existing EU targets and to move onto a pathway to decarbonising energy, transport and heating and to achieve effective GHG emission neutrality in the agriculture and land use sectors by 2050.

Ireland is vulnerable to adverse impacts of climate change, which are projected to become more frequent over the coming decades; effective adaptation actions are needed to reduce vulnerabilities and increase social, economic and environmental resilience.

Coherent cross-government engagement with, and support for strategic and effective local and global actions to address climate change is in Ireland's interest.

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