ANNUAL REVIEW 2021

CLIMATE CHANGE ADVISORY COUNCIL

Annual Review 2021

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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:

Marie Donnelly (Chair, from February 2021)
Prof. John FitzGerald (Chair, to January 2021, member from February 2021)
Prof. Alan Barrett (ESRI, to September 2021)
Prof. Gerry Boyle (Teagasc, to October 2021)
Prof. Frank O'Mara (Teagasc, from October 2021)
Patricia King (from March 2021)
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Julie Sinnamon (from March 2021)
Prof. Peter Thorne (from February 2021)
Laura Burke (EPA)
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Sinéad O'Brien (from October 2021)
Dr. Cara Augustenborg (from October 2021)
Prof. Morgan Bazilian (from October 2021)
Jillian Mahon (from October 2021)

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. The Council is required to have an adaptation committee under the Climate Action and Low Carbon Development (Amendment) Act 2021.

Adaptation Committee Members:

Marie Donnelly (Chair, from February 2021)
Prof. John FitzGerald (Chair, to January 2021)
Mark Adamson
Prof. Gerry Boyle (Teagasc, to October 2021)
Prof. Frank O'Mara (Teagasc, from October 2021)
Laura Burke (EPA)
Prof. Robert Devoy
Ciarán Hayes (to December 2020)
Paddy Mahon (from July 2021)
Dr. Ina Kelly
Keith Lambkin
Prof. Conor Murphy
Roger Street
William Walsh (SEAI)

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1. Executive summary

The Climate Change Advisory Council provides independent and science-based advice to Government and policy makers on what Ireland needs to do to achieve a climate-resilient, biodiversity rich, environmentally sustainable and climate neutral economy by 2050. It is also tasked with assessing the progress made towards this goal via an Annual Review. This Annual Review considers progress of our national climate aims in 2020 through climate change mitigation and adaptation, and compliance with national, European Union (EU) and international obligations related to climate action.

This Annual Review of national progress is published following the publication of the Intergovernmental Panel on Climate Change (IPCC)'s Working Group I Sixth Assessment Report and the Environmental Protection Agency (EPA), Marine Institute and Met Éireann's State of Ireland's Climate 2020 report.[1,2] Both reports emphasise the need to decarbonise our economy and society through climate change mitigation while taking account of these impacts on Ireland's economy, society and environment through appropriate adaptation. Climate change is happening, and the extreme weather events experienced recently have shown that every country is vulnerable to its impacts. The IPCC found that to achieve the objectives of the Paris Agreement requires limiting cumulative CO_2 emissions, reaching at least net zero CO_2 emissions, along with strong, rapid and sustained reductions in other greenhouse gas emissions, including methane.

1.1 The implementation gap

Despite positive steps, there are a number of critical gaps in implementation where our policy and ambition is not yet translating into the necessary action, for example:

- Ireland has failed to meet its 2020 target of a 20% reduction in greenhouse gas emissions under the EU Effort Sharing Decision and will have to purchase emissions allowances from other Member States to meet the shortfall. National emissions projections published in June 2021 also suggest a significant exceedance of targets under the EU Effort Sharing Regulation to 2030 without the full use of the flexibilities anticipated in the Regulation.
- Many of the measures in the 2019 Climate Action Plan were delayed, with the transport and heat sectors of particular concern. Timely delivery of measures is essential if we are to meet our targets.
- The national Climate Action Delivery Board, whose role is to hold each department and public body accountable for the delivery of actions set out in the Climate Action Plan, did not meet in 2020 despite a commitment to meet quarterly.
- A significant gap remains between the ambition of the National Adaptation Framework to deliver climate resilience, and its implementation. Despite some progress at sectoral and local level, adaptation is still not adequately considered or represented in a range of policies and initiatives.
- The Annual Transition Statement for 2020 has not yet been published.
- Progress of the National Coastal Change Management Strategy expected in Q1 2021 is overdue.
- Ireland has not yet submitted a mandatory Long-Term Strategy to the EU due by the 1 January 2020 under the 2018 Energy Governance Regulation, nor a voluntary submission to the UNFCCC.

Such 'implementation gaps' underline the importance of a continued and deepening focus on climate governance in Ireland and the need to further institutionalise implementation, monitoring and evaluation of climate action.

The most recent Climate Action Plan published in November 2021, the first under the Climate Action and Low Carbon Development (Amendment) Act 2021 ('the Climate Amendment Act'), is intended to double the ambition of the 2019 Plan with the introduction of measures additional to the 2019 Plan. Its implementation is a vital next step in the roll out of ambitious climate action in Ireland. However, it is noted that the Climate Action Plan was published without the annex giving details of timelines and responsibilities. Such detail is essential to assessing and measuring implementation and ambition, particularly given the gap in delivery against previous targets.

The Climate Action Plan 2021 makes clear that the measures identified are still insufficient to reach the 51% target by 2030, and estimates the emissions reduction gap as 4 Mt CO_2 eq outstanding in 2030. Immediate action is needed to identify the solutions to this shortfall so as to incorporate them into the updated Climate Action Plan in 2022.

As the Council made clear in its proposed carbon budget programme published in October 2021,[3] the journey to climate neutrality will require significant societal change with rapid and sustained economic, social and technological transformation across all sectors of the economy. This also implies further strengthening of the whole of Government approach to addressing the national climate challenge.

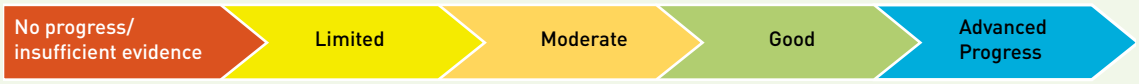
An increased focus on quantifying the emissions reduction or resilience enhancing potential of measures, and clearer outputs along with transparent and accessible monitoring of actions (thereby facilitating comparison of progress over time) under the 2021 and subsequent Climate Action Plans, is essential.

1.2 Climate resilience

Our climate is already changing with higher temperatures, higher rainfall and rising sea levels while the ocean is becoming warmer and more acidic. These changes are already impacting Ireland's economy, society and environment, demonstrating why adaptation and climate resilience are needed.

Despite some progress at sectoral and local level, adaptation is still not adequately considered or represented in a range of policies or initiatives. This year's Annual Review considers progress across the 12 National Adaptation Framework (NAF) sectors, local government and the NAF itself. As shown in Figure 1.1, the Council has been unable to give the highest score for adaptation progress to any sector.

Poor decisions made today that do not adequately account for ongoing and projected climate changes are locking in future vulnerabilities. The Council reiterates the essential importance of an integrated, multidisciplinary, long term systemic approach, within public policy making, towards adaptation and mitigation as a means of combating climate change and building resilience.



Sector (Department responsible)	Overall Progress Assessment
National Adaptation Framework (Department of the Environment, Climate and Communications)	**Moderate progress.**
Local Government (Local Authorities, CAROs)	**Moderate progress.**
Flood Risk Management (OPW)	**Good progress.**
Water Quality and Water Services Infrastructure (Department of Housing, Local Government and Heritage)	**Good progress.**
Built and Archaeological Heritage (Department of Housing, Local Government and Heritage)	**Moderate progress.**
Transport Infrastructure (Department of Transport)	**Moderate progress.**
Agriculture, Forest and Seafood (Department of Agriculture, Food and the Marine)	**Moderate progress.**
Biodiversity (Department of Housing, Local Government and Heritage)	**Limited progress.**
Electricity and Gas Networks (Department of the Environment, Climate and Communications)	**Limited progress.**
Communications Networks (Department of the Environment, Climate and Communications)	**No progress/insufficient evidence.**
Health (Department of Health)	**No progress/insufficient evidence.**

Figure 1.1: *Adaptation scorecard summary (Source: CCAC analysis, see Chapter 3)*

1.3 Emissions inventory and projections and sectoral trends

In 2019, total greenhouse gas (GHG) emissions fell 4.6% relative to 2018. Simultaneously, they were 9.9% higher in 2019 relative to the main reference year, 1990. Emissions peaked in 2001 (Table 1.2 and Figure 1.2). Provisional estimates[4] of emissions in 2020 suggest GHG emissions fell by 3.6% at a time of significant pandemic restrictions, but, without further substantial and sustained policy interventions, this will be reversed with economic recovery.

	Year			% change 2019 to 2018
	2017	2018	2019	
Total greenhouse gas emissions excluding LULUCF	62.1	62.5	59.8	-4.4%
Total greenhouse gas emissions including LULUCF	68.6	67.3	64.2	-4.6%

Table 1.1: *Total GHG emissions using the GWP_{100} metric (Source: EPA National Inventory Report 2021)*

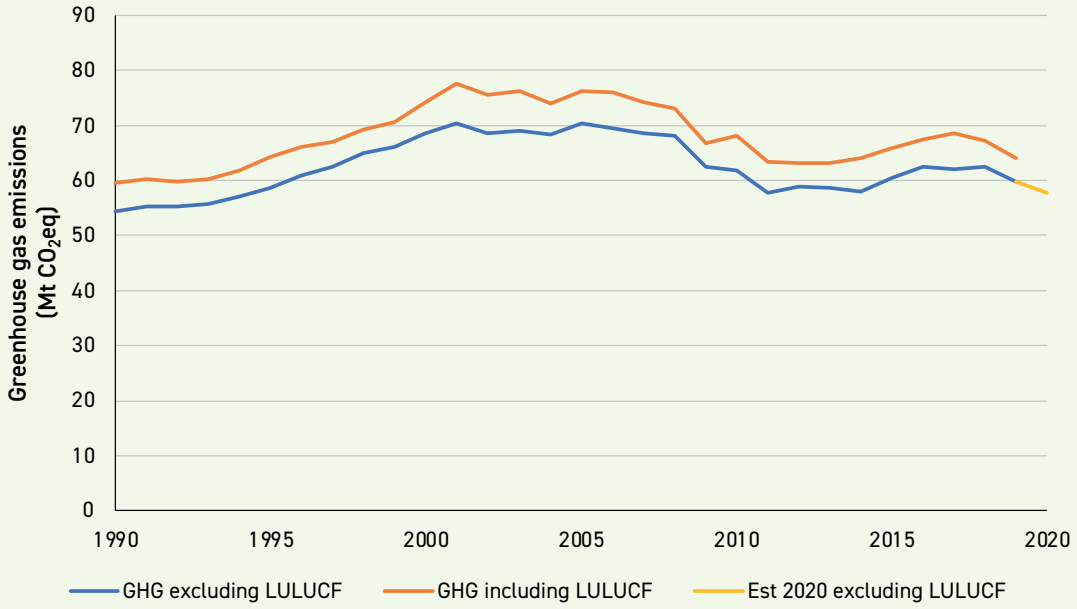


Figure 1.2: *Long term historic trend in total GHG emissions from 1990 to 2019* [5] *and projection for 2020 using* GWP_{100} *(Source: EPA National Inventory Report 2021)*

When considering national policy goals to 2050, Ireland is significantly off-track from paths that deliver long-term transition to climate neutrality. While progress is crucial across all sectors, it is particularly urgent in the LULUCF (Land Use, Land Use Change and Forestry) sector. Given the timescales of LULUCF, actions in coming years are key to realise 2050 ambitions.

The 'with existing measures' (WEM) projection published by the EPA in June 2021 shows an increase in total annual emissions relative to 1990, by 6.5% in 2030, and a 16.3% increase by 2040. The 'with additional measures' (WAM) projection, which assumes the successful and timely implementation of all measures for emissions reductions from the 2019 Climate Action Plan, shows a reduction of 12.2% on 1990 levels by 2030, and a further 6.1% by 2040. The increasing levels of national ambition arising from the Climate Amendment Act and EU 'Fit for 55' package, if they are to be met, will require a significant increase in the levels of emissions reductions from all sectors above and beyond what is already planned to be delivered in the 'with additional measures' (WAM) scenario.[a]

- **Agriculture** is the largest sectoral contributor to greenhouse gas emissions in Ireland. It is not on a sustainable low-carbon path. Expansion in production in some farming sectors has negated the impact of efficiency gains and reduced activity in other farming sectors leading to increased emissions. Significant action will be required to deliver a transition that supports low emissions agriculture and land use, reversal of water quality degradation and biodiversity loss, and achieve sustainable rural development.

- **Land Use Land Use Change and Forestry** is an important sector in relation to greenhouse gas emissions and removals in Ireland. Land management has the potential to remove significant CO_2 from the atmosphere, and thereby contribute to achieving climate neutrality. However, land use in

a 'With Existing Measures' (WEM) assumes that no additional policies and measures beyond those already in place by the end of the latest national GHG inventory year at the time of the projections compilation. 'With Additional Measures' (WAM) assumes implementation of the WEM scenario in addition to further implementation of planned government policies and measures adopted after the end of the latest inventory year. In the case of the latest projections (published in June 2021), this includes the implementation of Ireland's 2019 Climate Action Plan.

Ireland has been a significant net source of emissions in all years since 1990. Current projections expect land use to become an even larger net source of emissions in the coming years.

- **Transport** trends are not consistent with a sustainable low-carbon path, making emissions reductions more difficult, while also driving congestion and a host of sustainability problems and costs. It is necessary to accelerate electrification while putting an urgent priority on long-term integrated spatial and mobility planning that supports public transport and active travel in Ireland.

- Early progress in the **Built Environment** has stalled. Emissions reduction requires action on retrofit to improve homes, increased electrification of heat and deployment of renewables. Progress in industry and manufacturing has also slowed.

- **Electricity Generation** has been a good news story so far, as Ireland's best performing sector when it comes to reducing emissions. However, Ireland needs to focus on delivering carbon neutral power generation as soon as possible, and this will require increased connection of renewables and storage to ensure security of supply.

1.4 Costs and opportunities

The Council is mandated to consider the cost-effectiveness of climate action. There are higher cost implications of any delays in long-term action, requiring deeper and more costly cuts in emissions later. This includes any costs of compliance with 2020 and 2030 targets, given the impending deepening of 2030 emissions targets, under the European Climate Law and the related 'Fit for 55' package of legislative measures. The Council considers it prudent for the Department of Public Expenditure and Reform to update their estimates of the range of potential costs to 2030.

In the longer term, relying on purchasing credits can deepen carbon lock-in, forgoes the benefits of transition and imposes a cost on the exchequer, and thereby ultimately on all citizens. This is a cost that could be avoided by actual emissions reductions.

The carbon budgets proposed by the Council[3] balance the urgency for era defining change and practical feasibility whilst also providing for a 51% reduction in the total amount of greenhouse gas emissions from 2018 by 2030 in line with the ambition of the Climate Amendment Act. This transition will require rapid and sustained economic, social and technological transformation across all sectors of the economy and increased investment must start now. The time-lag between policy development, implementation and actual emissions reduction confirms this urgency. Unless Government takes action now, we will be unable to meet our targets in future years.

Meanwhile, the potential cost of climate change adaptation remains substantially unquantified at national scale, with it being left to individual sectors to address such issues. This approach is a barrier to effective decision making and opens the door to fragmentation and a conflict for resources.

The impacts of climate change are already felt across the globe. The prevention of further climate change in itself is the most important benefit of climate action and Ireland has committed to playing its part in this global effort. In addition to the direct benefits of climate action, there are more immediate indirect benefits, including benefits for human health, air and water quality, biodiversity and energy cost savings, along with opportunities for innovation which would enhance competitiveness within global markets which demand sustainability.

However, it is important to acknowledge that the transition will have a cost and preparations will be required to reduce the impact on the most vulnerable. Just transition is relevant to livelihoods, where carbon intensive economic activities become subject to increased pressure for transition. It also encompasses the need to ensure that poorer households do not bear the burden of policies to reduce emissions and also that the benefits of transition and Government supports are shared equitably. Just transition plans are in their infancy. We must learn from just transition actions to date, particularly in the Midlands, and just transition efforts will need to be proactive in identifying vulnerable communities and solutions.

1.5 Conclusion

This year's Climate Change Advisory Council Annual Review shows that greenhouse gas emissions fell in 2019 and are estimated to have fallen by a lesser amount in 2020. More rapid reductions and structural changes are required to meet our targets. At the same time our path towards future climate resilience requires more meaningful leadership and coordination across Government.

The Annual Review is intended to assist Government in advancing climate action at a time of both increasing urgency and public awareness of the challenge. It confirms that now is the time to put further policies, measures and investments in place to address it, while also ensuring supports for people, communities and businesses that will be impacted by the significant changes we will have to make. There has frequently been a gap between climate rhetoric and delivery in Ireland and this must end.

2. Introduction

The Annual Review 2021 is the fifth annual review carried out by the Climate Change Advisory Council. Each year the Council is mandated to review Ireland's performance during the immediately preceding year (in this case 2020) regarding the achievement of the country's national climate aims through climate change mitigation and adaptation, and compliance with European Union (EU) and international obligations related to climate action.

Despite the effects of the COVID-19 pandemic, atmospheric concentrations of the major greenhouse gases — carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) — continued to rise in 2020. According to the World Meteorological Organization (WMO), the global mean temperature for 2020 was 1.2 ± 0.1°C above pre-industrial levels (1850–1900),[6] making 2020 one of the three warmest years on record globally.[7]

This Annual Review follows the Intergovernmental Panel on Climate Change (IPCC)'s Working Group I Sixth Assessment Report[3] and the Environmental Protection Agency (EPA), Marine Institute and Met Éireann's 'State of Ireland's Climate 2020' report,[2] both of which confirm the need for more ambitious mitigation and an acceleration of the development and implementation of adaptation actions. Every inhabited region across the globe is now experiencing the effects of climate change and strong and sustained emissions reductions are required to limit climate change. These reports underline the imperative to decarbonise our economy and society through climate change mitigation while taking account of unavoidable impacts of climate change on Ireland's economy, society and environment through appropriate adaptation.

The recent Climate Action and Low Carbon Development (Amendment) Act 2021 ('the Climate Amendment Act')[8] sets out the legal framework for Ireland's transition to a climate-resilient, biodiversity rich, environmentally sustainable and climate neutral economy by no later than 2050. This is called the national climate objective. This replaces the national transition objective in the 2015 legislation.[a]

The Climate Amendment Act represents an increase in ambition and a widening of the policy objective. While much of the analysis in this report considers progress in 2020 against the climate policy objectives in place at the time, where appropriate, significant developments in 2021, such as the Climate Amendment Act and the latest Climate Action Plan are also noted. The Climate Amendment Act provides for a 2030 interim target, five-yearly carbon budgets, sectoral emissions ceilings, an annually updated Climate Action Plan and a Long-Term Climate Action Strategy.

The Annual Review also follows the publication of a proposed carbon budget programme by the Council,[3] in line with the amended legislation. The carbon budgets proposed for 2021-2025, 2026-2030 and 2031-2035 provide for a reduction of 51% in the total amount of greenhouse gas emissions from 2018 including land use, land use change and forestry, and are consistent with the national climate objective by 2050, as required under the legislation. From next year the Annual Review will also review progress in complying with the carbon budget and each sectoral emissions ceiling, in line with the amended legislation.

a The 2015 Act provided the statutory basis for the national transition objective laid out in the national policy position. The National Climate Policy Position established the national objective of achieving a competitive, low-carbon, climate-resilient and environmentally sustainable economy by 2050. It set out the level of greenhouse gas mitigation ambition needed and establishes the process to achieve the overall objective. The National Policy Position envisaged that policy development will be guided by a long-term vision based on: an aggregate reduction in carbon dioxide (CO_2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors and an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

The Annual Review 2021 reflects the requirements of Section 12 of the Climate Act and is organised into 10 chapters and the remainder of the report is structured as follows:

Chapter 3 discusses adaptation and Ireland's progress towards climate resilience as part of meeting the national climate objective.

Chapter 4 contains a summary of Ireland's national historic inventory for greenhouse gas emissions from 1990 to 2019 and future projections relevant to this subject.

Chapter 5 assesses the State's performance and compliance with its international obligations and targets for action on climate change, while **Chapter 6** assesses the State's performance and compliance with its national obligations and targets.

Chapter 7 details progress in sectors including Agriculture and Land Use, Transport, Built Environment, Electricity, and Industry, as well as their contribution towards Ireland's 2050 transition.

Chapter 8 outlines the significant cross-sectoral developments achieved throughout 2020.

Chapter 9 provides advice on the most cost-effective manner of achieving reductions in greenhouse gas emissions which would allow for the accomplishment of Ireland's 2050 goal.

Chapter 10 documents the activities and meetings of the Council and Adaptation Committee in 2020 in line with Section 12 of the Climate Act.

3. Progress towards a climate-resilient Ireland

Chapter 3 Key messages

- Actions at a global level can no longer prevent climate change entirely. In line with the precautionary principle and prudent risk management, greater attention has to be paid to increasing our resilience to the full range of potential changes projected, including considering 2°C warming and above.
- Progress in adaptation is being made. However, in its first 'adaptation scorecard' assessing Ireland's adaptation progress across sectors, the Council has been unable to give the highest overall score to any sector. Communications Networks and Health have received the lowest rating and the Electricity and Gas Networks sector shows only limited progress. The Council is particularly concerned that the Communications Networks sector did not engage with the assessment process despite requests for input.
- The 'adaptation scorecard' demonstrates some progress at sectoral and local level, but our path towards future climate resilience requires more meaningful leadership and coordination across Government. Adaptation is still not adequately considered or represented in a range of policies or initiatives. Policy continues to be almost myopically concerned with decarbonisation with minimal consideration of the potential economic, as well as social and environmental, costs of climate change. Focal points for adaptation in each public body may help address this.
- The potential cost of climate change adaptation remains substantially unquantified at national scale, with it being left to individual sectors to address such issues. The lack of a systemic, cross sectoral economic and financial approach is a barrier to effective decision making and opens the door to fragmentation and a conflict for resources. There are few, if any, other areas where such a situation involving potentially several hundred million euro would be allowed to continue.
- Climate research must more closely consider the requirements of decision makers, with long term planning and capacity building needed to deliver the necessary knowledge and innovations regarding adaptation and resilience.
- The new EU adaptation strategy is likely to inform the next iteration of the National Adaptation Framework (NAF), which is to be developed over 2022. The next NAF must focus on adaptation action, standardising and consolidating monitoring and reporting, and deepening the analysis of the implications of Ireland's future climate for our economy, society and environment. This requires a strategy to address any data and knowledge gaps necessary for the preparation and implementation of the next NAF.
- An integrated, multidisciplinary, long-term systemic approach, within public policy making, towards adaptation and mitigation as a means of combating climate change and building resilience is essential. This also includes the adaptation aspects of Just Transition. This will be essential to meeting the new National Climate Objective.
- Revised guidelines are required to inform the preparation of integrated climate action plans at local authority level. These must provide practical approaches to considering mitigation and adaptation together wherever possible. The resource and capacity constraints facing local authorities and the CAROs is recognised.

3.1 Introduction

Human influence has warmed the atmosphere, oceans and land, and climate change is already affecting many weather and climate extremes in every region across the globe.[9] In Ireland, annual precipitation was 6% higher in the period 1989 to 2018, compared to the 30-year period 1961 to 1990. The annual average surface air temperature in Ireland has increased by approximately 0.9°C over the last 120 years, with a rise in temperatures being observed in all seasons. Sea level around Ireland has risen by approximately 2-3mm/year since the early 1990s, while the ocean is becoming warmer and more acidic.[2] Even under the most ambitious global emissions reduction policies, such changes are expected to continue and intensify into the future.[54] These changes will continue to have an impact on Ireland's economy, society and environment and this is why adaptation is needed.

Ireland's first statutory National Adaptation Framework (NAF) was prepared under the 2015 Climate Act and published in January 2018. It provides a framework for local authorities and key sectors to assess the key risks and vulnerabilities of climate change, implement climate resilience actions, and mainstream climate adaptation considerations into policy. Under the NAF, Government Departments were required to prepare sectoral adaptation plans for 12 priority sectors by October 2019. These have a five-year lifespan. Under the NAF, each local authority also developed its own adaptation strategy. The Annual Review 2020 found that Ireland must build on such adaptation planning with action while also addressing adaptation gaps (for example there are no sectoral plans for tourism, the financial sector or coasts). This year, the Council presents an 'adaptation scorecard', examining the implementation of these national, sectoral and local adaptation plans and strategies. This follows a brief review of recent science and policy developments.

Both adaptation[a] and mitigation are essential to combat climate change and addressing both requires collaboration across all sectors and levels of government.[10] While coordinated climate action is essential, the Council has previously advised that the need for adaptation is under-recognised in Irish policy making and the discussion on recent Government policy initiatives in Section 3.6 below underlines this.[11] Despite some progress at sectoral and local level, public policy is almost myopically focused on mitigation with inadequate consideration of adaptation issues and limited integration and recognition of the potential for win-win solutions.[b] Policy rarely considers the risk our changing climate may present to meeting objectives (e.g. how climate change might affect current and future renewable energy sites and technologies), the benefits of early, planned adaptation, or how decisions today (e.g. how and where we build) may in fact amplify future vulnerabilities or lead to maladaptation. This policy approach risks normalising reactive, predominantly 'hard' or 'grey' responses (e.g. engineering) to extreme events while limiting the attention given to slow onset, chronic or pervasive risks and the opportunities to build societal, environmental and economic resilience, including the potential of nature-based adaptation.[c]

This may reflect the fact that mitigation has mainly progressed through a globally driven, top-down approach with relatively clear metrics, in comparison to adaptive strategies that are seen as being based on bottom-up considerations that are perceived as being more difficult to implement and monitor and that, by their nature, are local or regional.[12,13] This has also led to a mistaken perception that adaptation

a As in previous Annual Reviews, the Council has adopted the definition of adaptation in the Climate Action and Low Carbon Development Act 2015 (as amended): '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'.

b In the academic literature, separated approaches to mitigation and adaptation which ignore their trade offs and synergies is described as the 'mitigation–adaptation dichotomy'. See Biesbroek, G. R., Swart, R.J. and van der Knaap, W. (2009) 'The mitigation–adaptation dichotomy and the role of spatial planning', *Habitat International*, 33(3), pp. 230-237.

c As outlined in the NAF, adaptation measures may be considered grey (e.g. engineering solutions), green (e.g. making use of nature) or soft (e.g. regulatory change).

science is less urgent, 'softer' and more uncertain than mitigation science.[13] Such a tendency to treat adaptation as separate from mitigation without considering their overlap, and ignoring the need to ramp up ambition in both, has been criticised as a feature of Irish climate policy, but it is not unique to Ireland.[10,14]

The UN Environment Programme Adaptation Gap Report 2020 finds that global adaptation action is lagging far behind where it should be, concluding that while nations have advanced in planning and implementation, huge gaps remain, particularly in financing adaptation measures and advancing adaptation projects to the point at which they start to bring real reductions in climate risks.[15]

This chapter confirms the urgency of adapting to climate change and building the resilience of our economy, society and environment. It also shows that despite some progress and the availability of significant research, policy, and decision-making tools to build climate resilience, these require decision maker, community and civil society buy-in and deeper understanding of the financing requirements to be effective. Its findings are particularly relevant to the development of the next iteration of the NAF, which is due to be prepared in 2022.

3.2 Recent developments

Previous Annual Reviews have presented a comprehensive outline of observed and projected climate change for Ireland, and also of Ireland's adaptation policy — particularly the 2018 NAF. A brief update on these science and policy issues is presented below.

3.2.1 State of the climate 2020

Met Éireann's long-series temperature datasets agree with international studies, with warming most notable over the last 20 years. In Ireland, 2020 was the 10th consecutive year above the 1961-1990 average. Figure 3.1 shows the annual air temperature anomalies for Ireland for the period 1900-2020 compared with the 1961-1990 average. Temperatures are projected to increase by 1-1.6°C by mid-century (2041-2060) compared with the baseline period (1981-2000), with the largest increases in the east.

With respect to climate projections, a warmer atmosphere holds more moisture and is very likely to lead to more intense precipitation events. The IPCC has described an observed increase in pluvial (rainfall) flooding attributed to human influence which is projected to further increase at global warming of 1.5°C and above.[16] Heavy rainfall events in Ireland have already become more frequent and intense and are projected to become more so by mid-century. Some models also suggest that there may be increased propensity for droughts in the spring and summer. However, across a broad range of climate models and regional models there exists a substantial spread of outcomes regarding future precipitation changes for Ireland. This means that we will have to prepare for both increased flood risk and drought risk. This will have to be considered alongside increasing socioeconomic stressors such as population growth and urbanisation and the implications for flooding and urban heat islands, for example.

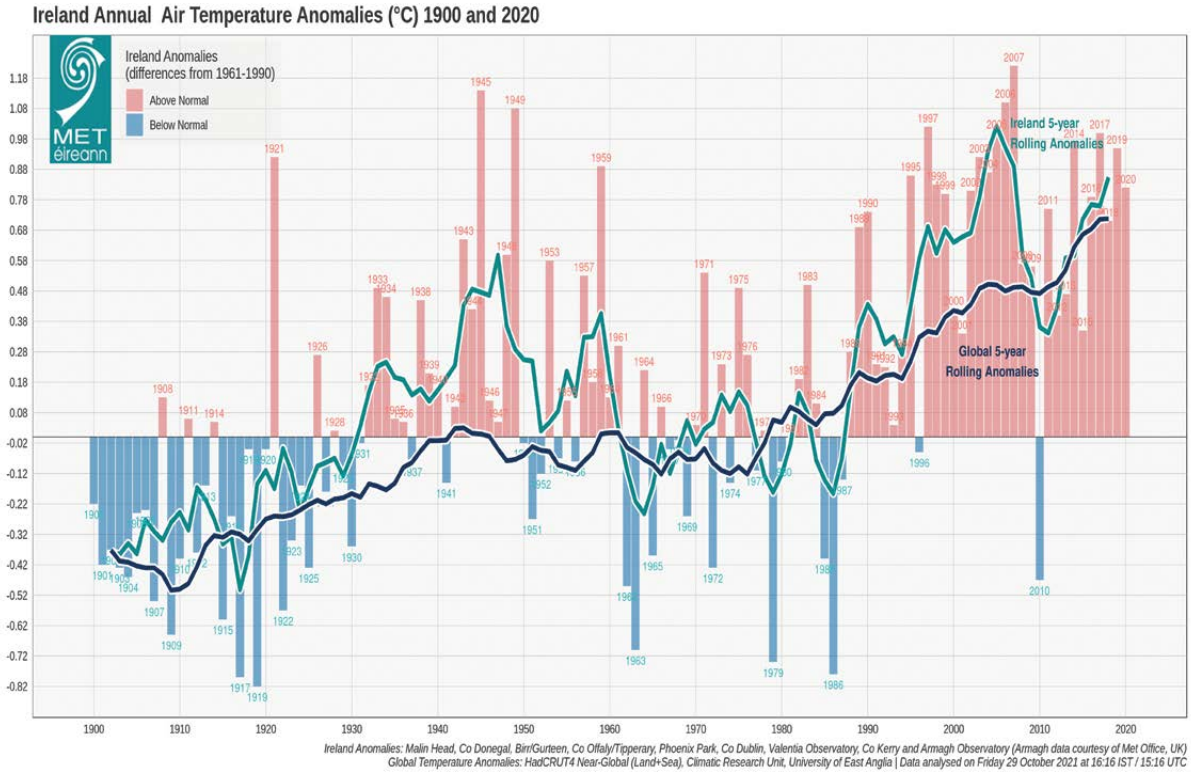


Figure 3.1: *The annual air temperature anomalies for Ireland for the period 1900-2020 compared with the 1961-1990 average*

February 2020 set a new monthly record, with 262% of normal rainfall recorded. A significantly drier than normal spring followed, affecting river flows as well as groundwater levels; a national water conservation order (hosepipe ban) was introduced after parts of the east experienced the driest spring on record, highlighting the existing vulnerability of our water supply to precipitation changes. Wetter conditions in June allowed some rivers to return to normal flows, but lakes and groundwater levels remained low for many locations. July was another wet month and many rivers recorded flows above average.[17]

In total, Ireland experienced eight named storms in 2020, of which six were verified storm force 10 (Brendan, Ciara, Dennis, Jorge, Ellen and Aiden). These saw reports of flooding of homes, businesses, motorways, national and local roads, along with power outages, travel disruption and fallen trees and poles.[18] The vulnerabilities and interdependencies of our infrastructure to a 'domino' effect during extreme events where, for example, power outages can affect water services or communications, were outlined in the Annual Review 2020. It also discussed our vulnerability to compound events, for example where vegetation loss due to wildfires may contribute to later flooding as in Inishowen in 2017.[19]

There is considerable uncertainty in relation to future storm patterns affecting Ireland. Our infrastructure and building stock will have to take account of the full range of projections of future storminess change, including highly uncertain projections of both frequency and intensity changes, as well as possible changes in extreme temperatures, droughts and intense rainfall events.

3.2.2 Policy processes

Since 2016, the Council has had an Adaptation Committee which now has a statutory underpinning under the amendment legislation.

The amended Act will also require that public bodies, in so far as practicable, perform their functions in a manner consistent with, and which advances, the aims of the NAF and sectoral adaptation plans. If sufficient weight is given to this requirement, it may provide significant opportunities for mainstreaming adaptation and resilience across Government — not just in Departments responsible for sectoral plans and local authorities — consistent with the risks and the solutions needed to manage those risks. Within all public bodies, focal points for adaptation and resilience should be identified — ones empowered to collaborate in such a way as to maximise the potential for coherence.[a]

The amended legislation allows for joint sectoral plans, which may be particularly useful for dealing with areas such as coastal resilience as this remains an adaptation gap where responsibility is spread across a number of Departments. This is a concern, as much of our infrastructure and population is located near our coasts and extreme sea level events are projected to become more frequent and more intense, leading to more coastal flooding, while shorelines along sandy coasts will retreat throughout the 21st century.[16] The Council notes that the Government has committed to the development of a Coastal Change Strategy and has established a cross departmental working group to bring this work forward on a whole of Government basis. However, the initial findings and recommendations of the group which were due in Spring 2021 are now overdue.[20] The amended legislation will also require local authorities to prepare climate action plans jointly addressing mitigation and adaptation. These are discussed further below.

The amended legislation also includes new matters that Ministers and Government must have regard to when developing sectoral adaptation plans under Section 6 of the Act, including 'the need to promote sustainable development and restore, and protect, biodiversity' and 'the social and economic imperative for early and cost-effective action in relation to climate change'. The amended legislation will also require local authorities to prepare climate action plans jointly addressing mitigation and adaptation. These are discussed further below.

'Forging a climate-resilient Europe — The new EU Strategy on Adaptation to Climate Change' was published on 24 February 2021. This replaces the 2013 EU Adaptation Strategy. The strategy outlines a long-term vision for the EU to become a climate-resilient society, fully adapted to the unavoidable impacts of climate change by 2050.[21] The 2013 strategy informed the 2018 NAF and it is likely that the new strategy will shape the next iteration of the NAF. The first deliverable of the strategy was the European Climate and Health Observatory launched on 4 March 2021.[b]

a This approach builds on learning from elsewhere, e.g. International Federation of Red Cross and Red Crescent Societies (2020). Law and Policies that protect the most vulnerable against climate-related disaster risks: findings and lessons learned from Pacific Island countries. Available at: https://www.asil.org/sites/default/files/documents/PICs-Full-Report-_Natoli-2020.pdf

b It can be accessed at: https://climate-adapt.eea.europa.eu/observatory/.

Box 3.1 EU Adaptation Strategy Objectives and Ireland

The EU adaptation strategy published in February 2021 has four principal objectives.

Firstly, it seeks to make adaptation smarter — improving knowledge on adaptation and managing uncertainty to inform effective action; more and better climate-related risk and losses data; promoting the use of digital technologies and climate services to underpin decision making; and enhancing the Climate-ADAPT platform. The strategy's focus on more and better climate related risk and losses data to avoid 'climate blind' decisions and policies and dialogue with insurers is relevant to previous Council recommendations.

Secondly, it aims to make adaptation more systemic — supporting policy development at all levels of governance, society and the economy and in all sectors by improving adaptation strategies and plans; integrating climate resilience in macro-fiscal policy, local adaptation action and promoting Nature-based Solutions for adaptation. There is a focus on local and city level adaptation and the Covenant of Mayors in the strategy. The strategy considers that 'The local level is the bedrock of adaptation, so EU support must help increase local resilience.' Ireland, through the Climate Action Regional Offices, may be well placed to provide leadership on this but the Council notes that their role is becoming more closely associated with mitigation (see Section 3.5). Consideration should be given to how the Commission's ambitions for nature-based adaptation interact with the 'biodiversity rich' and 'environmentally sustainable' components of the National Climate Objective set out under the amended climate legislation.

Thirdly, it seeks to speed up adaptation across the board — by accelerating the development and rollout of adaptation solutions; reducing climate-related risk; closing the climate protection gap and ensuring the availability and sustainability of fresh water. The action to 'stimulate cooperation regionally and across borders and enhance the guidelines on national adaptation strategies in cooperation with the Member States' may have implications for how the next iteration of the NAF is developed and how adaptation on an all-island basis is considered. The Council notes that the UK's Climate Change Risk Assessment published in 2021 includes commentary on climate change and Northern Ireland/Republic of Ireland relevant transboundary Government policy, such as on transboundary waters.[22]

Finally, it commits to stepping up international action on adaptation to climate change — increasing support for international climate resilience and preparedness, scaling up international finance to build climate resilience, and strengthening global engagement and exchanges. It is notable that the majority of Ireland's climate finance to the developing world is for adaptation and opportunities to share learning should be deepened.[23]

3.3 Progress in key sectors – Ireland's adaptation scorecard

3.3.1 Scorecard introduction

The Annual Review 2020 indicated that the implementation of the sectoral adaptation plans, local adaptation strategies and the NAF will be closely monitored in future Annual Reviews. According to the NAF 'It is essential, in terms of underpinning a whole-of-government approach to adaptation/resilience that the Advisory Council continue to liaise with the key sectors concerned so as to assess and monitor progress in achieving our objective for climate resilience'.[24]

Therefore, for the first time, this year's Annual Review includes an 'adaptation scorecard' to measure the progress of the sectors that were required to prepare adaptation plans under the NAF, local government and the implementation of the NAF itself.

Adaptation is an iterative process that involves learning by doing, and the challenges of monitoring and evaluating adaptation are well recognised.[10] However, there is now a significant body of research at International, European and National level regarding adaptation metrics and indicators which should be piloted, refined and implemented in Ireland.[25] This needs to begin in sectors such as health, agriculture, local government and biodiversity.

The EPA's 'Ireland's Environment — An Integrated Assessment 2020'[26] report found that a focus is needed on delivering on the ambitions outlined in the climate adaptation plans and strategies. A comprehensive national adaptation indicator programme is also needed. The Council's scorecard does not replace this process, or the monitoring of specific adaptation actions under national, sectoral and local plans through national adaptation governance structures, but rather assists in sharpening the focus on delivery.[a]

The assessment presented was conducted over Summer 2021 and is based on pro forma documentation provided by the relevant bodies to the Council's Adaptation Committee, and other reports and data. It is regrettable that an Annual Transition Statement for 2020 was not available to inform the analysis.[b] It is understood that an Annual Transition Statement for 2020 will be published later this year.[27] This annual progress monitoring will continue to evolve in future reviews to reflect developments each year.[c]

3.3.2 Scorecard findings and recommendations

A summary table of the findings is presented below in Table 3.1 and the detailed assessment by sector is included as an appendix. The assessment considers the degree to which the Adaptation Committee, in its judgement, and Council is satisfied progress is being made in implementing adaptation policy and increasing resilience to date with respect to the following three criteria, and an overall assessment has also been given:

1. Risk, prioritisation and adaptive capacity — identified risks are being addressed, adaptive capacity is increasing, knowledge gaps are being addressed and risks are being monitored.

2. Resourcing and mainstreaming — appropriate resourcing is being applied, long term decisions are taking account of future climate and adaptation is being mainstreamed.

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a Ireland's biennial reporting from March 2021 on adaptation plans and goals under the Regulation on the Governance of the Energy Union and Climate Action is available at: https://climate-adapt.eea.europa.eu/countries-regions/countries/

b The Council brought this to the attention of the Minister for the Environment, Climate and Communications in January 2021 Climate Change Advisory Council (2021). Communication to the Minister for the Environment, Climate and Communications. Available at: https://www.climatecouncil.ie/media/climatechangeadvisorycouncil/contentassets/documents/news/Climate%20Change%20Advisory%20Council%20letter%20re%20Annual%20Transition%20Statement%202020.pdf

c Under the Regulation on the Governance of the Energy Union and Climate Action in 2021 and every two years thereafter Member States report to the European Commission information on their national adaptation actions. The information submitted by Ireland in March 2021 is available at: https://ccadapt-demo.eea.europa.eu/countries-regions/countries/ireland

3. Governance, coordination and cross cutting issues — systemic coordination is in place and there is good coherence with other policies.

The Council has been unable to give the highest overall score of 'advanced progress' to any sector. The Council is particularly concerned that the key sector Communications Networks has not provided any response despite requests for input.[a]

Sectors with the most progress demonstrated clear ambition for adaptation within the sector with senior management and leadership buy-in. In these sectors the majority of identified vulnerabilities and risks were being addressed (though the Council recognises that this will be a particular challenge for some of the wider, cross cutting sectors such as biodiversity and health). These sectors demonstrated evidence that adaptive capacity is increasing (through targeted training for example) and knowledge gaps are being addressed with an effective interface between research and end user needs. They also showed good progress in monitoring and building knowledge of risks. They showed evidence that long-term decisions are accounting for the possible future climate with good evidence of mainstreaming with systematic coordination and good coherence with other policy. They clearly consider the risks associated with future socioeconomic changes. Finally, they demonstrated that appropriate resourcing is being applied to achieve policy goals, including staff and financial resourcing.

Access to data and research gaps remain an issue but in light of the number of/expenditure on adaptation research projects, it cannot be a barrier to 'no regrets' adaptation action.[b] It is also a concern that despite this research investment, adaptation skillsets and capacities are still seen as in short supply.

There is also a disparity in how adaptation is prioritised and resourced across Government Departments and even within sections responsible for different sectors in the same Department. This underlines the Council's concern that adaptation is not given sufficient weight in decision making and is not yet sufficiently mainstreamed and resourced in policy delivery at all levels of governance.

Amalgamated plans (for the three sectors of Agriculture, Seafood and Forestry under the Department of Agriculture, Food and the Marine and the two sectors of Water Quality and Water Services Infrastructure under the Department of Housing, Local Government and Heritage) may assist with policy integration and coherence but they make it a challenge to assess progress for individual sectors where progress may be uneven across the sectors included. For example, less information is available regarding seafood and water services infrastructure compared to the other sectors covered in the respective plans.

3.4 Climate research and climate modelling

National climate modelling research conducted at the Irish Centre for High-End Computing (ICHEC) and Met Éireann involves assessing climate change on both a global and regional scale. ICHEC's climate research activities are currently funded by the EPA, Met Éireann, the Marine Institute and the OPW. The global datasets resulting from this national effort are shared with the international research community (comprising Ireland's contribution to the Coupled Model Intercomparison Project CMIP6, which informed the IPCC's Sixth Assessment Report (AR6), for example[28]). A second main component of this climate modelling research involves simulating the future climate of Ireland on a national scale at high spatial resolution and an updated report on these projections was published in September 2020.[29] These policy

a Reporting through the Regulation on the Governance of the Energy Union and Climate Action in 2021, Ireland has identified the risk of changes in extreme precipitation, temperatures and windstorms for communications infrastructure such as overhead lines, street cabinets and base and transmission stations. See: https://ccadapt-demo.eea.europa.eu/countries-regions/countries/ireland

b Defined in the NAF as adaptation options 'which would provide immediate economic and environmental benefits and continue to be worthwhile regardless of future climate. They would be justified under all plausible future scenarios, including without climate change.'

relevant climate projections (previous iterations informed the NAF and sectoral plans, for example) are available through Ireland's Climate Information Platform, Climate Ireland (www.climateireland.ie).

This represents a small subset of a broader range of simulations completed by the global research community. This includes those under the auspices of the WCRP Climate Model Intercomparison Project (CMIP5/6) — available via various nodes of the Earth System Grid Federation — and the CORDEX regional downscaling experiments. Many of these data can be accessed via the Copernicus Climate Change Service Data Store (https://cds.climate.copernicus.eu/) and various visualisations and tools are also available via the IPCC AR6 interactive Atlas (https://interactive-atlas.ipcc.ch/) and WMO/KNMI data explorer (https://climexp.knmi.nl/start.cgi). To ensure that the full range of possible outcomes are accounted for it will be critical that adaptation decisions are made in the light of the full range of potential future climate outcomes projected by the full multi-model ensemble including a comprehensive accounting for both scenario uncertainty and model uncertainty. It is key that practitioners get relevant training in how to use and account for such uncertainties and that the Climate Ireland platform be evolved to show the full range of possible projected outcomes arising from the CMIP and CORDEX ensembles. Also, the IPCC Working Group II Sixth Assessment report to be published next year will provide a further assessment of scientific literature relating to impacts, adaptation and vulnerability. The Met Éireann research project TRANSLATE, delivered by ICHEC and MaREI (supported by Deltares), which is considering the full range of available datasets and associated uncertainty, is aimed at standardising national climate projections for Ireland and developing climate services to meet the Irish adaptation sector's climate information requirements.[30] The TRANSLATE project is a response to the Council's recommendation in its 2019 Annual Review that a common set of climate projections that capture the range of change in future climate projections should be developed for Ireland for use in adaptation, infrastructure and investment planning to 2050 and beyond. However, while TRANSLATE addresses this need in the short term, there is also a need for continued, long-term coordinated efforts at a national level on the interface between science and policy and aligning outputs to end user needs, particularly in light of the differing capacities and resources available to sectors and local authorities. The Council looks forward to considering the outcomes of the project.

Further information on climate monitoring, modelling, projections, scenarios and uncertainties in an Irish context, as reported to the European Commission in March 2021, is available on the Climate ADAPT platform at https://ccadapt-demo.eea.europa.eu/countries-regions/countries/ireland.

All this underlines the importance of building understanding of, and providing guidance on, the full range of scenarios available and how different climate model projections should be used in decision making in different decision contexts.[a] Resilience of the decisions we make will be contingent on the diversity of the information we use to make those decisions.

Decisions should consider the potential for warming of 2°C and beyond, taking account of the need for resilience to the full range of potential changes projected. Decision makers must be supported to get on with the business of adaptation within their area of policy expertise by being provided with knowledge, information and data suitable for their needs. Several sectors and local authorities have identified Climate Ireland as playing a key role in the development of their adaptation strategies.[31] Responsibility for the Climate Ireland platform was transferred to the EPA in January 2021 and they should continue to enhance its relevance, governance, functionality and scientific rigour in line with the recommendations of this and previous Annual Reviews.

a The UK Met Office, for example, has issued guidance on the use of the probabilistic, global and regional components of the UK Climate Projections (UKCP) depending on the decision making context. See: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-guidance---how-to-use-the-land-projections.pdf

Climate modelling is a continuous and long-term task requiring substantial computing resources and expertise to run the climate models and to analyse and share the resulting large datasets. This plays a crucial role in supporting climate research activities. Work on capturing the socioeconomic benefits of such investment through better understanding of future scenarios, potential climate impacts and their costs (as discussed below) must continue.

Table 3.1: *Adaptation Scorecard Summary (Accessible version available in appendices)*

Sector Criteria	Risk, prioritisation & adaptive capacity	Resourcing & mainstreaming	Governance, coordination & cross cutting issues	Overall Progress Assessment
National Adaptation Framework	Good	Moderate	Moderate	Moderate progress. The success of Ireland's overarching adaptation policy and progress towards climate resilience is hampered by the absence of a national resilience indicator set.
Local Government	Moderate	Limited	Good	Moderate progress. Local government has been required to undertake significant work to begin planning for climate change under the NAF. How building climate resilience integrates with increasing mitigation obligations in the sector will be a key consideration.
Flood Risk Management (OPW)	Advanced	Advanced	Good	Good progress. This sector has significant experience of climate change adaptation planning and in managing risk but ongoing collaboration with other sectors and consideration of relationship between flood risk and socio-economic developments remains key.
Water Quality and Water Services Infrastructure (Department of Housing, Local Government and Heritage)	Good	Good	Moderate	Good progress. This reflects the overall assessment of the two sectors of water quality and water services infrastructure. Ongoing attention must be given to demonstrating the resilience of water supply in particular.

Sector Criteria	Risk, prioritisation & adaptive capacity	Resourcing & mainstreaming	Governance, coordination & cross cutting issues	Overall Progress Assessment
Built and Archaeological Heritage (Department of Housing, Local Government and Heritage)	Moderate	Moderate	Good	Moderate progress. This sector has been required to undertake significant work as it begins planning for climate change under the NAF.
Transport Infrastructure (Department of Transport)	Moderate	Moderate	Good	Moderate progress. Though this sector has significant experience in adaptation planning, further work to build on this and further mainstream adaptation across it is required.
Agriculture, Forest and Seafood (Department of Agriculture, Food and the Marine)	Moderate	Moderate	Good	Moderate progress. This assessment considers progress across the three NAF sectors (agriculture, forestry and seafood) together though an overall asymmetry between the strong attention given to adaptation of agriculture compared to the other 2 sectors in the Department is noted.
Biodiversity (Department of Housing, Local Government and Heritage)	Limited	Limited	Limited	Limited progress. The wide range of adaptation challenges facing this key, deeply interdependent sector is acknowledged but further, coordinated, action is essential.
Electricity and Gas Networks (Department of the Environment, Climate and Communications)	Limited	No progress/ insufficient evidence	Limited	Limited progress. This is a concern particularly given the potential climate vulnerability arising from the electrification of the power system, personal transport, heat etc. as part of decarbonisation (in addition to cascading effects for other sectors).

Sector Criteria	Risk, prioritisation & adaptive capacity	Resourcing & mainstreaming	Governance, coordination & cross cutting issues	Overall Progress Assessment
Communications Networks (Department of the Environment, Climate and Communications)	No progress/insufficient evidence. The absence of a published Annual Transition Statement for 2020 and of a completed consultation template means limited information is available and in light of this a score of 'No progress/insufficient evidence' has been assigned. Given the increasing reliance on ICT and the risk of cascading failures in particular this is a concern.			
Health (Department of Health)	No progress/insufficient evidence. While fully recognising the unprecedented challenge to the health sector of COVID-19 since early 2020, the absence of a completed consultation template means limited information is available and in light of this a score of 'No progress/insufficient evidence' has been assigned. It is essential that the health sector scales up its action on climate change especially as the climate crisis will increasingly become a health crisis. The Lancet Countdown 2020 Report key message states 'The COVID-19 pandemic and climate change represent converging crises…we don't have the luxury of tackling one crisis alone… climate change and infectious disease share common drivers. Responding to climate change today will bring about cleaner skies, healthier diets, and safer places to live–as well as reduce the risk factors of future infectious diseases.'			

Notes: The detailed assessment under each of these criteria is included in the appendices. In the overall progress assessment this year the Adaptation Committee and Council have given slightly more weight to sectors demonstrating progress in addressing prioritised risks and vulnerabilities, building adaptive capacity and putting in place good governance and coordination structures. For example, adaptation actions may be well resourced but to be effective they must be coherent with other policies and sectors and addressing key, prioritised risks.

3.5 Assessment of national approach to adaptation

While some progress under the NAF, sectors and local government is identified above, overall climate policy making in Ireland is not adequately considering adaptation issues and there has been limited practical integration of adaptation and mitigation. Effective mainstreaming and leadership can be two drivers of successful adaptation and these are currently lacking in Ireland where a relatively small community of committed policy makers is responsible for trying to drive adaptation action and ensure such thinking guides decision making and is therefore having mixed results.[32]

Recent examples include the Creative Climate Action[33] fund which focuses substantially on mitigation despite the potential of the arts to raise awareness of adaptation issues,[34] while Our Rural Future — Rural Development Policy 2021-2025[35] does not have a significant adaptation component.

The Economic Recovery Plan,[36] and the National Recovery and Resilience Plan[37] under the EU Recovery and Resilience Facility, both published in June 2021, continue to focus on decarbonisation with limited, if any, consideration of adaptation issues and the imperative of ensuring the resilience of the Irish economy and society to climate change. Just Transition in these documents again considers the decarbonisation implications but not Just Resilience issues.

This is despite the new EU adaptation strategy identifying the Recovery and Resilience Facility as a potential source of financial support for local adaptation and Just Resilience actions and some other Member States appear to have used their plans in such a way.[a]

Indeed, the messaging of government regarding adaptation is increasingly confused, with the Economic Recovery Plan, for example, discussing the need for resilient enterprise and the imperative of supporting businesses 'to adapt to a carbon neutral economy' (i.e. mitigation) with no consideration of the need to adapt to the inevitable impacts of climate change and the risks to supply chains and distribution networks, for example. Other potential confusion may stem from the National Risk Assessment 2020's use of 'mitigation' when referring to flood relief.[38] The National Risk Assessment also discusses 'community resilience' but does not link it to the imperative for climate resilience, showing a missed opportunity for deepening policy coherence. This is despite the assessment identifying climate change as likely to increase the risk rating for storms, snow and ice, flooding, pandemic, disruption to energy supply and water supply.[38]

This limited consideration of adaptation is a concern. The United Nations Environment Programme has emphasised that the climate crisis will surpass the impacts of COVID-19 in both scale and longevity.[39] While approximately €915 million is available from the EU Recovery and Resilience Facility for Ireland's National Recovery and Resilience Plan now, it should be noted that this large amount could be dwarfed by the costs of climate change in the future, with some estimating that climate change impacts will cost the Irish economy billions of euros by 2050.[40] The Co-ordination, Communication and Adaptation for Climate Change in Ireland: an Integrated Approach (COCOADAPT) study published in 2013 estimated Irish adaptation costs at €80-800 million per year.[41] Adaptation actions have the potential to bring multiple benefits which the Global Commission on Adaptation has called the triple dividend. The first is avoided losses, the second is positive economic benefits through reducing risk, increasing productivity, and driving innovation, and the third is social and environmental benefits.[42]

The NAF recognises that leadership, political will and societal buy-in are essential for the implementation of adaptation, and decision makers may not be reflecting the public appetite for adapting to climate impacts. For example, a 2021 Eurobarometer survey found that among Irish people 85% (the highest level of all EU Member States, and well above the EU average of 62%) agree that adaptation to the adverse impacts of climate change can have positive outcomes for citizens in the EU and 86% agree that the costs of damages due to climate change are much higher than the costs of the investments needed for a green transition (above the EU average of 74%).[43]

However, these costs remain substantially unquantified at national scale, with it being left to sectors to address such issues. The Council has previously expressed concern that such an approach will lead to fragmentation, unrealised synergies, and conflict for resources.[19] This is a barrier to effective decision making and the Council considers that there are few, if any, other areas where such a situation involving potentially several hundred million euro would be allowed to continue. In light of this vacuum and in an effort to improve decision making, as discussed below, the Council is funding a fellowship beginning this year to provide an economic assessment of climate change impacts and adaptation options in Ireland.

Internationally, research suggests that climate change is not adequately prioritised at local level despite the potential for action, and instead it may be being treated as an 'add on' to mitigation.[44] The Climate

a For example, The Cypriot Recovery and Resilience Plan (available at: http://www.dgepcd.gov.cy/dgepcd/dgepcd.nsf/All/ACCC6F07CA46FD2EC22586DC00233297/$file/Cyprus%20Recovery%20and%20Resilience%20Plan%202021-2026.pdf) includes measures to facilitate both climate mitigation and adaptation locally and also flood and water security measures and Belgium's RRP includes a specific investment of €84 million in biodiversity and climate adaptation (available at: https://dermine.belgium.be/sites/default/files/articles/FR%20-%20Plan%20national%20pour%20la%20reprise%20et%20la%20re%CC%81silience.pdf).

Amendment Act requires each local authority to adopt a climate action plan addressing both adaptation and mitigation. As discussed, the Climate Action Regional Offices' (CAROs') role has expanded to include facilitating local authorities in meeting both mitigation and adaptation commitments under successive Climate Action Plans and the Local Authority Climate Action Charter signed between local authorities and the Minister for Climate Action in 2019.[45]

While the Council recognise the value of joint climate strategies[a] it is concerned that given local funding and capacity constraints and the demands of mitigation-focused national policy drivers, adaptation will be further deprioritised and made more reactive at local authority level just as progress to build resilience (though it is not yet sufficiently embedded or resourced) has begun to be made. This is in spite of adaptation measures being inherently applied locally.

Mitigation and adaptation are interlinked, and integrated local authority climate plans have significant potential to reduce emissions, build resilience and improve quality of life and wellbeing but this requires a deeper understanding of the co-benefits and trade-offs, by considering both adaptation and mitigation and embedding these considerations into a broad range of policies.[12]

It is essential that revised Ministerial guidelines for local authorities in the preparation of these climate action plans — which build on the experience of the first round of adaptation planning and will now incorporate mitigation — address these issues and provide practical approaches to considering jointly, where possible, both adaptation and mitigation. Any new guidelines developed should also consider the context of other approaches being developed such as Decarbonising Zones under the Climate Action Plan, while also considering social vulnerability and integrating effectively with sectoral and national priorities and national level risk assessments which have primarily been conducted by sectors. These, in line with other initiatives, should also emphasise the vital role that spatial planning can have with regards to adaptation and resilience in the face of future changes.

The national impacts of climate change are systemic and pervasive, and do not stop at county boundaries. Cooperative and joined-up approaches are therefore crucial to an effective response. Local level action on adaptation is essential but it requires multi-level coherence and systemic engagement in the face of national institutional and economic constraints such as those discussed above. Also, opportunities to develop community-based adaptation and adaptive capacity need to continue to be pursued.

3.6 Adaptation costs and investment

The new EU adaptation strategy published in February 2021 notes that in the EU economic losses from more frequent climate-related extreme events already average over €12 billion per year. Conservative, lower bound estimates show that exposing today's EU economy to global warming of 3°C above pre-industrial levels would result in an annual loss of at least €170 billion (1.36% of EU GDP).[46]

The Council's 2020 Annual Review highlighted the need for a quantitative assessment of climate impacts and adaptation for Ireland to enable the prioritisation of investment needs. The recently commenced Advisory Council/ESRI fellowship project will contribute to addressing this need. This project focusses on quantifying the initial climate change impacts and adaptation costs and benefits for Ireland applying the NAF in combination with existing literature and novel analyses. These estimates will also be used to implement climate change impacts and adaptation into the ESRI's Ireland Environment, Energy and Economy (I3E) economic model. The I3E model allows for the investigation of secondary spill-over effects of initial impacts and adaptation investments, including the potential economic benefits of adaptation

a The Council notes that the Dublin local authorities already have in place climate action strategies addressing mitigation and adaptation.

investments. The consequences of climate change for different industries, the overall macro-economy and the labour market will be taken into account along with the distributional effects across household types (e.g. rural vs urban, rich vs poor). This project can give valuable insights into not only the potential climate change impacts facing Ireland, but also their further effects on the economy, labour market and households. It will also provide evidence to assist the development of sound climate policies which recognise those industries and households most vulnerable to climate impacts. The CAROs' work on developing a standard semi-quantitative methodology for climate change risk and vulnerability assessments across the various local authority assets and infrastructure is also noted.

4. Summary of national greenhouse gas emissions and projections

Chapter 4 Key messages

- In 2019, total greenhouse gas emissions including LULUCF fell 4.6% relative to 2018 (4.4% excluding LULUCF). Total emissions in 2019 were 17.4% lower than the peak of emissions reached in 2001. However total emissions were 9.9% higher in 2019 relative to the reference year 1990.
- Provisional estimates published by the EPA suggest emissions excluding LULUCF fell 3.6% in 2020, relative to 2019. This was largely due to pandemic restrictions. However, in the absence of further policy interventions, this is expected to rebound during the post-pandemic recovery as activity levels increase.
- Projections indicate that if the 2019 Climate Action Plan is fully implemented, emissions will fall by 18.5% including LULUCF by 2030 (23.6% excluding LULUCF) relative to 2018. Ireland has fallen short of meeting its current 2020 targets and risks not achieving the 2030 emissions reduction targets. Ireland will likely need full access to the flexibility mechanisms under the EU framework to achieve compliance.

4.1 The national greenhouse gas emissions inventory

The Climate Action and Low Carbon Development Act 2015, as amended, tasks the Council, as part of its Annual Review, to provide a summary of the national greenhouse gas emissions inventory as published by the Environmental Protection Agency (EPA). It is the quantitative basis for the Council's review of progress in achieving reductions in greenhouse gas emissions.

4.1.1 Total emissions

The National Inventory Report (NIR) provides Ireland's official greenhouse gas emissions and removals data on an annual basis using international standards and guidelines adopted at EU and UN levels. Emissions are reported as CO_2 equivalent amounts using the GWP_{100} metric as published in the IPCC's fourth assessment report. The NIR includes GHGs from all sources and also the removal of carbon dioxide (CO_2) from the atmosphere.[a] The latest report details emissions from 1990 to 2019.[5] The inventory plays an important role in understanding the national contribution to climate change, and in informing climate action and policy. It provides evidence on trends in total emissions, by gas and by sector of activity, and attribution of what is driving these trends. The inventory is the key record of recent (Figure 4.1) and long-term historic emissions patterns (Figure 4.2). It also provides an indication of the effectiveness of existing policy responses to reduce emissions and to achieve related targets. Interannual variability in total emissions can be significant, reflecting the short-term influence of external factors such as weather conditions, international and national economic cycles. An interesting observation is the impact variability that Land Use, Land Use Change and Forestry can have on total emissions, when in individual years including LULUCF in the assessment can mean the change in total emissions changes sign.

In 2019, total GHG including LULUCF were 64.2 million tonnes carbon dioxide equivalent (Mt CO_2 eq), (59.78 Mt CO_2 eq excluding LULUCF). This is 4.6% (4.4%) lower than emissions in 2018. This followed a -1.9% decrease in emissions including LULUCF in 2018, the decrease being driven by interannual variation in the LULUCF contribution to total emissions. Total emissions excluding LULUCF in 2018 saw a 0.7%

a In Ireland, potential 'carbon sinks' include living systems such as forestry, peatland and soils. Sinks can either remove carbon dioxide from the atmosphere, or become an additional source, dependent on whether they are enhanced or degraded.

increase. Provisional estimates for 2020, published by the EPA,[4] indicate that total emissions excluding LULUCF decreased by 3.6% largely due to the impact of COVID restrictions on transport emissions, but tempered by increased emissions from the residential sector.

	Year			% change 2018 to 2019
	2017	2018	2019	
Total greenhouse gas emissions excluding LULUCF	62.1	62.5	59.8	-4.4%
Total greenhouse gas emissions including LULUCF	68.6	67.3	64.2	-4.6%

Table 4.1: *Total GHG emissions (Mt CO_2 eq) using the GWP_{100} metric*

Box 4.1 International aviation and maritime emissions

Reported total greenhouse emissions do not include emissions from the international aviation and maritime sectors. Domestic aviation and maritime are included under the transport sector. This follows IPCC guidelines to date, which recommend reporting international aviation and shipping emissions as footnotes to national inventories, and Article 2 of the Kyoto Protocol which requests countries to work through the relevant UN agencies (the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO)) to reduce emissions from these sectors. In recent years, and in light of the Paris Agreement's requirement for parties to establish economy-wide targets, a number of states have begun to incorporate international aviation and shipping into national targets and adopt mitigation measures complementary to measures adopted by ICAO and IMO. Emissions from these sectors are included in the national inventory report under the category 'international bunkers' referring to the source of these emissions: the purchase of international bunker fuels for aviation and shipping. International bunkers emissions amounted to 3.8 Mt CO_2 eq in 2019. This represents a small decrease on 2018 figures but is over three times the 1990 figure.

Long-term historic trends are important for transition, as they give an indication of the path a nation is on, which can be difficult to unlock. Figure 4.2 shows that total national GHG emissions peaked in 2001, declined after the financial crisis and recession, and then increased once more. Emissions in 2019 remain 3.4% higher than 2011, and 9.9% higher than the standard reference year of 1990.

Figure 4.3 gives an indication of the performance of each Member State in the EU 27, on the basis of the percentage change in emissions since 2005, which is the reference year for 2020 and 2030 targets. The data from the EEA illustrates that reductions in Ireland's emissions are not as significant as many other Member States. Furthermore, much of these reductions have taken place in the EU ETS where emissions fell by 37% over the period whilst emissions covered by the EU Effort Sharing Decision (ESD) fell by only 5% (despite Ireland's 2020 target of a 20% reduction by 2020). Further insights can be found by assessing change by gas and by sector.

Box 4.2 Uncertainty in inventory estimates

Under the Climate Act the Council's Annual Review is required to include a summary of the findings set out in the most recent national greenhouse gas emissions inventory and most recent projections of future greenhouse gas emissions prepared by the EPA. The EPA conduct an uncertainty assessment of all emissions sources. Section 1.8 and Table 1.12 of the Ireland's National Inventory Report 2021 submitted to the UNFCCC provides a summary of this analysis of the uncertainties in the GHG inventory.[47] The uncertainty analysis undergoes international expert review in the same process as the inventory submission itself. The analysis and review inform the priority areas for inventory development and improvement. However, it is important to note, following successful review, the values submitted to the EU and UNFCCC take on legal status for the purposes of assessment and accounting of compliance with international obligations.

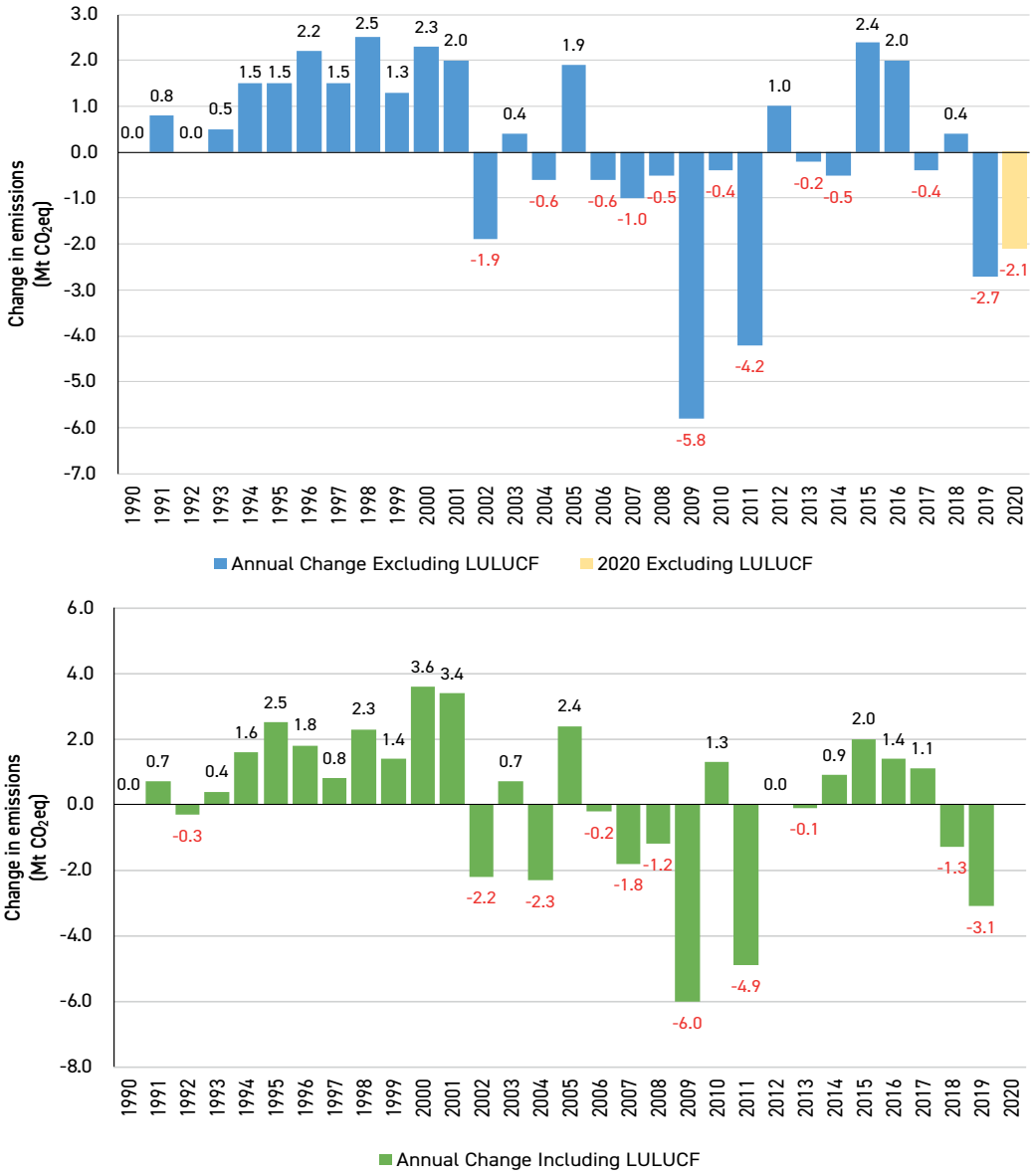


Figure 4.1: *Interannual change in GHG emissions excluding and including LULUCF from 1990 to 2019, with provisional 2020 data excluding LULUCF* [5]

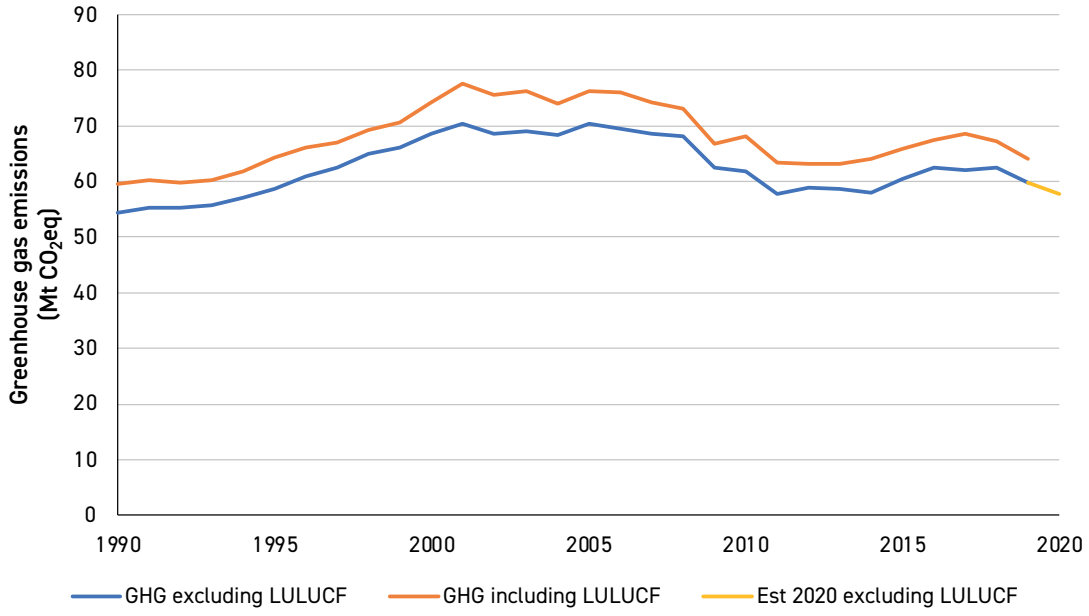


Figure 4.2: *Long term historic trend in total GHG emissions from 1990 to 2019*[5] *and provisional data for 2020*

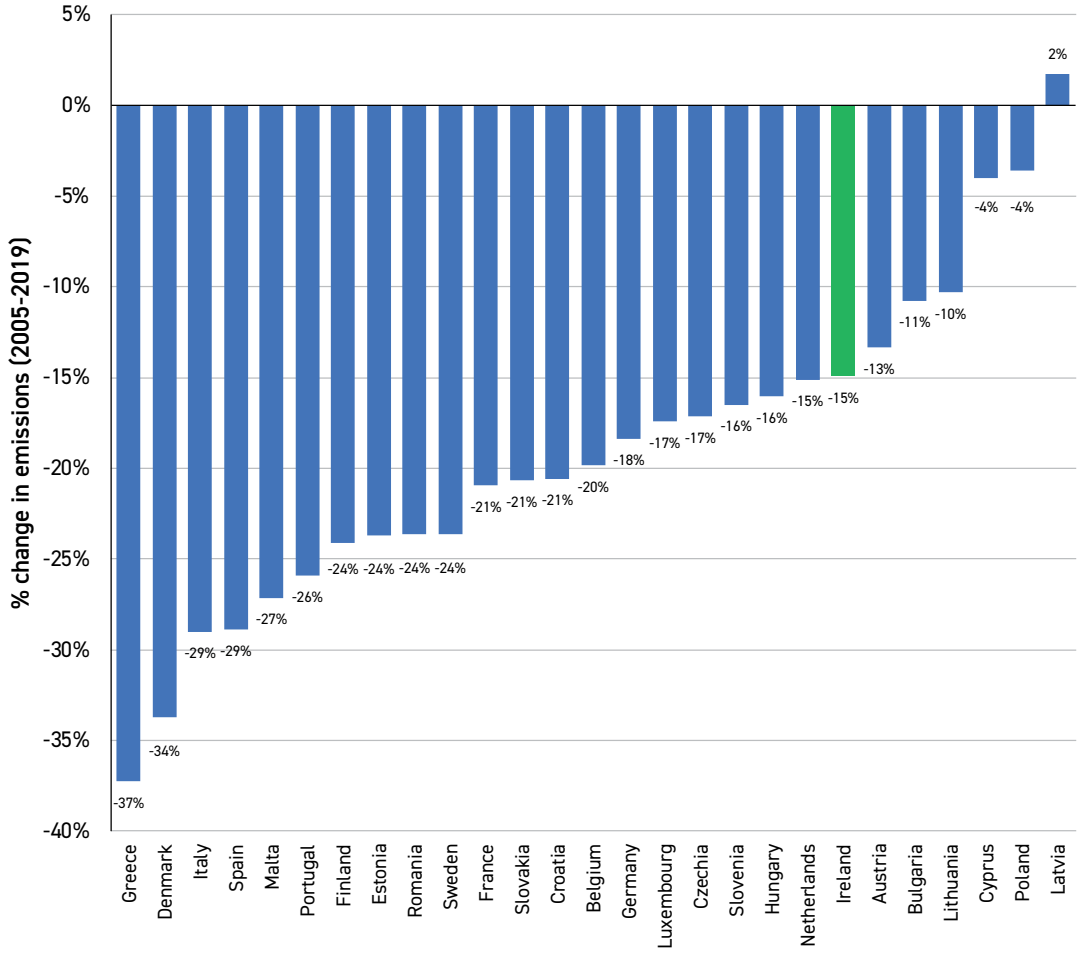


Figure 4.3: *Percentage change in emissions across the EU 27 from 2005 to 2019*[58]

4.1.2 Emissions by gas

This section considers the standard 'basket' of greenhouse gases, by source and sector: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and the industrial fluorinated gases, or 'F-gases'. The shares of emissions by gas in 2019, illustrated in Figure 4.4, are similar to 1990. Emissions excluding LULUCF in 2019 are dominated by carbon dioxide (62.4%), followed by methane (24.6%) and nitrous oxide (11.5%). Including LULUCF the percentage shares are carbon dioxide (63.7%), methane (23.6%) and nitrous oxide (11.3%) respectively. Carbon dioxide, the largest gas by share, arises primarily from the burning of fossil fuels: peat, coal, oil and gas. These fossil fuels are burned to produce heat and power, predominantly in transport, power generation and the built environment including the residential sector. Carbon dioxide emissions also arise from the manufacture of cement and lime and can be emitted or released by living systems, when organic matter breaks down.

In Ireland, methane and nitrous oxide emissions arise almost exclusively from agriculture, at 93% each. The key source of both gases are activities related to livestock production. Methane is produced as a by-product of the digestion of feed, and from the management of manure, while nitrous oxide occurs from applying synthetic fertiliser and animal manures to agricultural soils. The F-gases,[a] at 1.5% of total emissions in 2019, are gases that are used in a variety of applications, including refrigeration, air conditioning and in the manufacture of electronic and electrical equipment. Long-term trends by gas are illustrated in Figure 4.5, showing that carbon dioxide (+13.1%), methane (+7.1%) and 'F-gases' (+2,550%) have all increased since 1990, while nitrous oxide has declined (-10.6%).

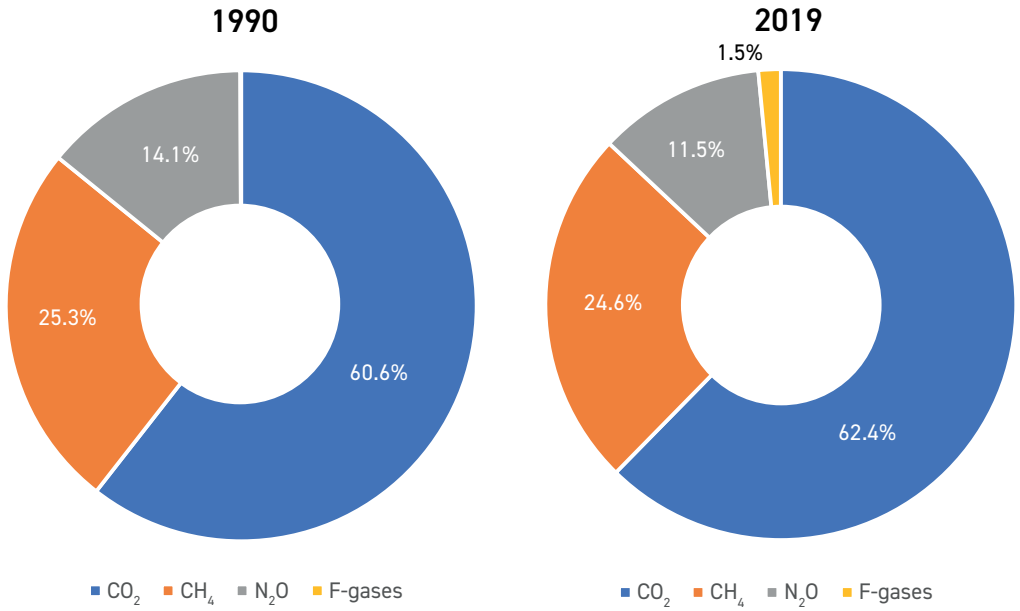


Figure 4.4: *Shares by greenhouse gas in 1990 and 2019 total emissions excluding LULUCF* [5]

a Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3).

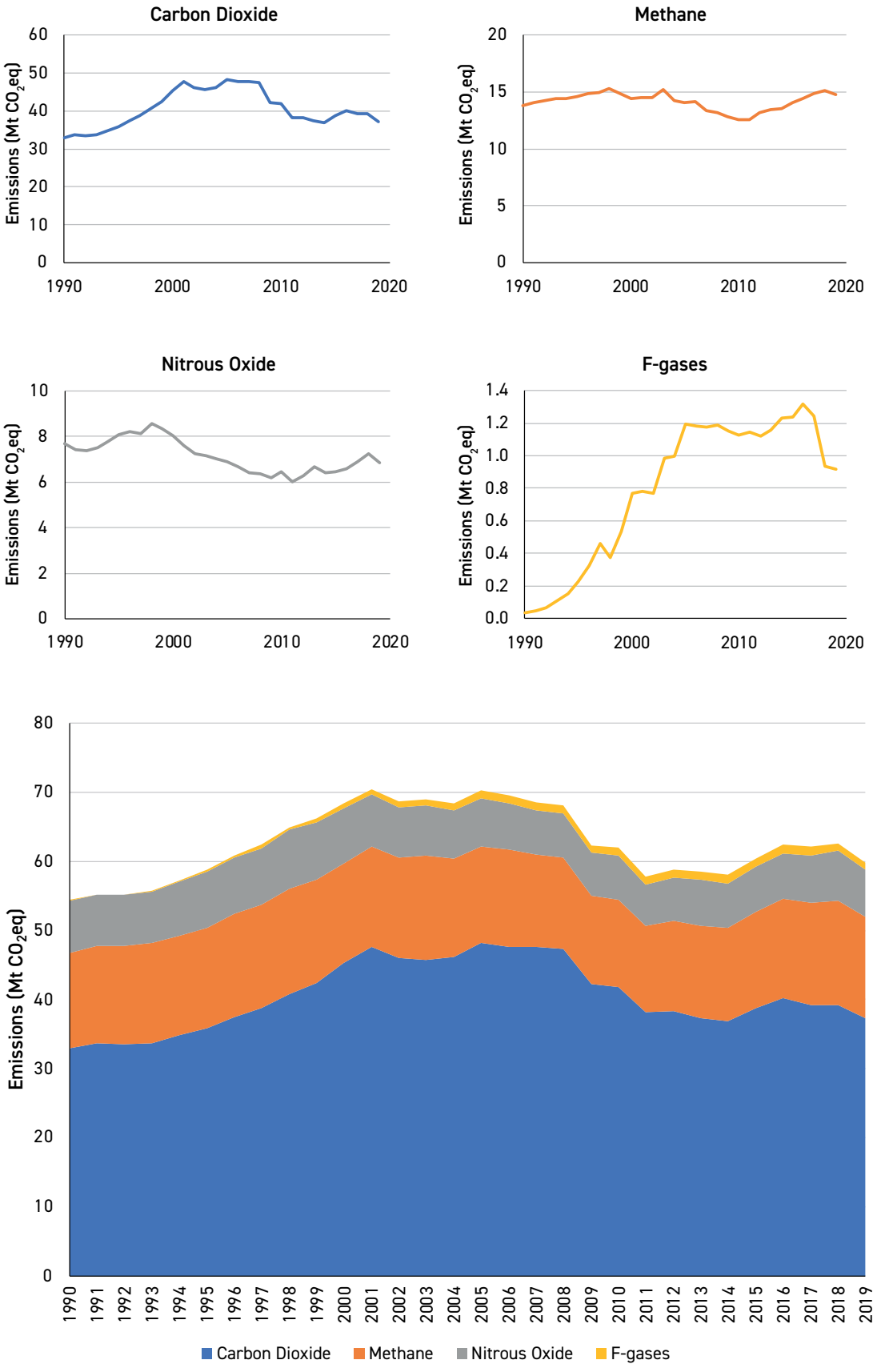


Figure 4.5: *Trends in GHG emissions by gas from 1990 to 2019 excluding LULUCF scaled by gas quantity and measured in Mt CO_2 eq* [5]

4.1.3 Emissions by sector of activity

Considering emissions by sector and year can enhance understanding of the sources of emissions by activity. In 2019, Agriculture was the largest sectoral emitter at 35.4% of the total, followed by Transport (20.3%), Energy industries (15.8%), Residential (10.9%) and Manufacturing Combustion (7.7%). These five sectors constitute 90% of emissions, with the remainder consisting of Industrial processes, F-gases, Commercial services, Public services and Waste. Table 4.2 presents the emissions inventory data for these activity sectors by million tonnes CO_2 eq (Mt CO_2 eq) in 2018 and 2019, and by the percentage change in emissions in that period.[48] Figure 4.6 presents the change in emissions by sector from 1990 to 2019.

Agriculture emissions reached a peak in 2018, growing by 3.9%, and then declining by 4.0% in 2019. The change in 2018 is attributed to a rise in animal numbers, an increase in synthetic nitrogen fertiliser use, and to a lesser extent an increase in the liming of soils. In 2019, emissions across all activities reverted to approximately 2017 levels. Provisional data for 2020 indicate emissions from Agriculture increased by a further 1.4%. The long-term trends in agriculture emissions are dominated by significant restructuring of the national cattle herd, which in recent years has been driven by an increase in dairy production in response to the removal of the milk quota in 2015 and consistently strong market exports[48] (see Section 7.2).

Emissions from *Transport* in 2019 were 137% higher than in 1990. Transport emissions reached a minimum value during the recession in 2012, but subsequently increased by 12.5%. They have been relatively stable for the past four years. Emissions are dominated by the road modes of passenger and freight movement, in the form of the private car and goods vehicles. This reflects long-term system drivers of emissions, in dispersed settlement patterns, and in the structure of mobility systems, that have favoured individualised and motorised road-based transport modes which to date have been powered almost exclusively by fossil fuels.

Energy Industry emissions decreased by 11.2% in 2019, continuing a long-term downward trend. Significant reductions in coal and peat power generation on the grid have combined with longer-term trends in improving efficiency, increased zero carbon power from wind, and a shift from coal and peat to natural gas generation, which is less carbon intensive but is still a fossil fuel.

Emissions attributed to the *Residential* sector in the inventory arise from the burning of fossil fuels, for space and water heating, and for cooking, and do not include emissions related to electricity consumption.[a] Emissions in 2019 decreased by 7.3%. These can vary year-by-year, due to warmer or cooler weather affecting heating requirements. This sector is discussed further in Chapter 7. In the long-term, the demand for heating in Ireland can be related to factors such as increasing population, increased floor area size, reduced occupancy levels, and lifestyles, all of which can act as drivers to increase emissions. Reflecting improved efficiency standards, emissions per household declined significantly from 1990 to 2014, but have been relatively static for the last five years (see Section 7.4.1).

Emissions from *manufacturing combustion* arise from burning fossil fuels to serve industrial space, water and process heating requirements. Emissions from this source decreased by 2.0% in 2019. Industrial processes are a different class of emissions, arising not from the burning of fossil fuels, but from chemical reactions that occur in the manufacturing process. Emissions from this sector decreased by 1.3% in 2019, following a 2.5% increase in 2018.

a These are reported under 'energy industries', to the producers of electricity, with the same approach followed for the other sectors that consume electricity.

Emissions of *F-Gases, Commercial Services, Public Services* and *Waste* had similar shares, together accounting for 6.0% of total national emissions in 2019. This accounting year saw minor increases in Commercial and Public services, and minor decreases in F-gases and Waste. While the current shares of these sectors are similar, long-term trends have varied. Commercial and public services have declined overall since 1990, but increased in both 2018 and 2019. Emissions from the waste sector declined significantly from 1990 to 2010, due to diversion of waste from landfill. These emissions increased as the economy recovered from the financial crisis but appear to have stabilised at levels approximately 42% of levels in 1990. Emissions of F-gases increased significantly from 1990 to 2005, and then dropped in the last two years, due to a regulated phase out of refrigerant and air conditioning gases (see Section 7.6.1).

Emissions from land use are discussed specifically in Section 7.2.2, and also noted in the compliance discussion of Section 5.3.

Emissions category	2018	2019	% Change
Agriculture	22.0	21.1	-4.0%
Transport	12.2	12.2	-0.3%
Energy Industries	10.6	9.4	-11.2%
Residential	7.0	6.5	-7.3%
Manufacturing Combustion	4.7	4.6	-2.0%
Industrial Processes	2.3	2.3	-1.3%
F-Gases	0.9	0.9	-2.3%
Commercial Services	0.9	0.9	1.8%
Public Services	0.9	0.9	1.2%
Waste	0.9	0.9	-0.4%
Total (excluding LULUCF)	**62.4**	**59.7**	**-4.4%**
Land Use Land Use Change and Forestry			
Emissions	9.6	9.5	-0.9%
Removals	-4.8	-5.1	5.5%
Net LULUCF	4.8	4.4	-7.2%
Total (including LULUCF)	**67.2**	**64.1**	**-4.6**

Table 4.2: *Total GHG by sector in the national inventory, for 2018 and 2019 (Mt CO_2 eq)*[48]

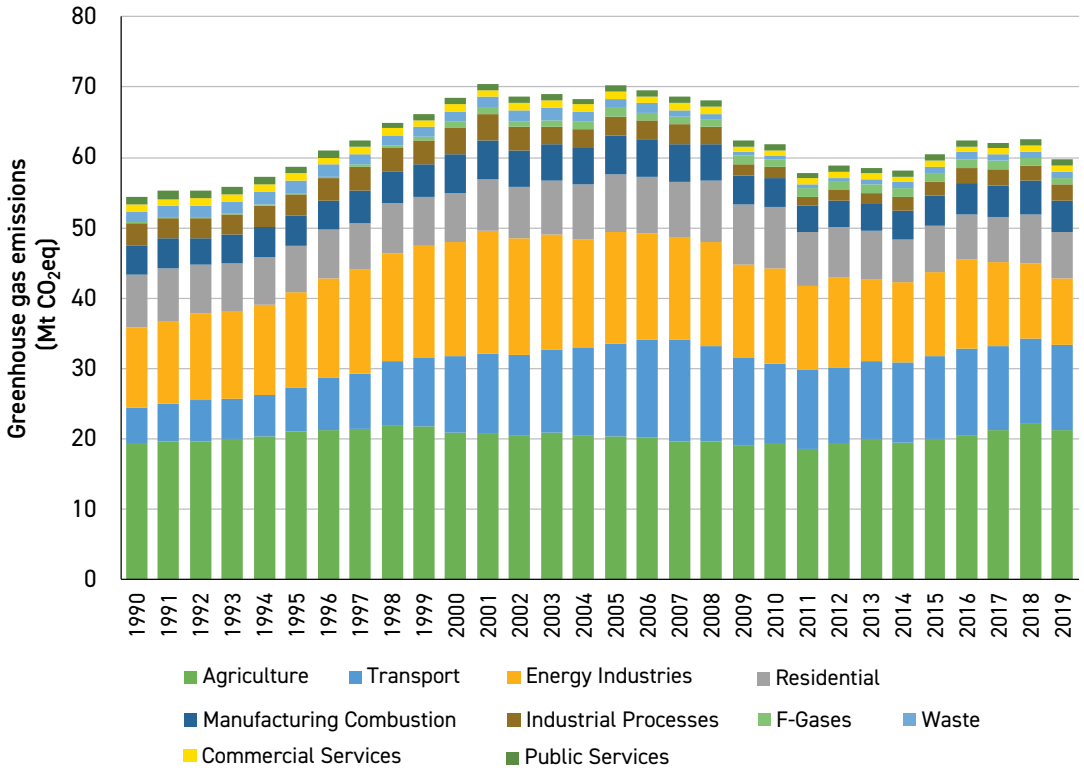


Figure 4.6: *Total historic GHG by sector 1990 to 2019*[5]

4.1.4 Improvements to emissions estimates in the EPA's inventory up to 2019

In line with the mandate for continuous improvement, changes to the national inventory system are made each year, including adoption of improved methodologies, data analysis and collection procedures and country specific emissions factors. To ensure continuity, the full time series from 1990 is recalculated and submitted, along with detailed descriptions of the revaluations themselves. In the latest Inventory,[5] two important improvements were adopted, in the estimation of methane emissions from Agriculture, and in refinements to carbon dioxide emissions from energy consuming sectors.

A review of data in the agriculture sector led to significant updates to the bovine methane model used to estimate emissions from livestock enteric fermentation and manure. These updates included new data for housing, manure storage, slurry spreading and animal feed. The quality of methane emissions estimates has been substantially improved. The updates have had different impacts in different years. As a result, for example, the values submitted in 2021 for Agriculture GHG emissions in 1990 decreased, and those in 2018 increased, relative to the values for the sector submitted in 2020.

For the energy consuming sectors, new survey data has been incorporated into the inventory, including the CSO 'Business Energy Use' survey. These improvements focussed on the use of fossil fuels, for space and water heating, in public and commercial service sectors, and led to a change in the allocation of fuel consumption across the sectors. In emissions terms, this means that while the total does not change, the carbon dioxide emissions share in specific sectors have altered, namely in the Residential, Commercial Services, Public Services and Manufacturing Combustion.

4.2 Projections of greenhouse gas emissions

A variety of approaches are employed internationally to develop insights into future change in emissions. The appropriate approach depends on the type of information required, whether it is driven by analysis or for strategic policy research, including compliance. In Ireland, official national emissions projections are published annually by the EPA, prepared in line with international guidelines. The most recent projections consider emissions up to 2040,[49] using the same gas and sector categorisation as the historic inventory. The Climate Action and Low Carbon Development Act 2015, as amended, requires the Council as part of its Annual Review to provide a summary of the most recent projections of greenhouse gas emissions as projected by the EPA.

Recent efforts to improve projections have focussed on agriculture data, econometric modelling, and the inclusion of recent patterns arising from pandemic restrictions.[49] Two alternative policy projections are developed, using the same baseline forecast, but with different policy assumptions: 'With Existing Measures' (WEM) and 'With Additional Measures' (WAM). The 2021 WEM projection includes only those policies and measures existing before the 2019 Climate Action Plan. The WAM projection uses the addition of the enhanced and new actions included in the 2019 Plan, as 'additional' measures.

The emissions projections discussed here focus on emissions excluding LULUCF as these are the most relevant for national targets in 2020. The WEM projection suggests an increase in total emissions from 1990, by +6.5% in 2030, and +16.3% increase by 2040. The WAM projection, to include the successful implementation and assumed emissions reductions from the 2019 Climate Action Plan, suggests a reduction of -12.2% on 1990 by 2030, and a further -6.1% in 2040. Figure 4.7 illustrates the projection from 2019 to 2040 in both scenarios.

The WAM projection is conditional on three outcomes occurring in the period to 2030; firstly, that baseline activity evolves as forecast, secondly that the actions[a] detailed in the 2019 Plan are fully implemented and thirdly, that these actions deliver the emissions reductions proposed in the Plan.[b] Meeting these three conditions would result in significant reduction of emissions from 2019 to 2030 in residential (-42%), energy industries (-33%) and transport (-26%), and a decline in agriculture emissions of -11%. A strong impact from pandemic restrictions is seen in the emissions projections for 2020 and 2021, forecasting a decrease of transport emissions and an increase in residential, with the trend in agriculture emissions unaffected by the pandemic. The increasing levels of national ambition arising from the Climate Amendment Act and 'Fit for 55' will require a significant uptick in the levels of emissions reductions from all sectors beyond what is already assumed to be delivered in the WAM scenario.

Under the Act, the projections form the basis to consider potential future emissions outcomes in Ireland, and therefore contribute to discussion of achieving the National Climate Objective 2050. Given this role, it would be desirable for the sectors to extend analysis of outcomes from 2040 to 2050 and to incorporate all sectors which will be the subject of carbon budgets. Recognising the challenge of forecasting in the medium to long term, it would also be desirable for the sectors to consider alternative scenarios and sensitivity testing of key assumptions, in line with practices that have emerged across parties internationally.

a The Climate Action Plan 2019 includes headline actions: 70% renewable electricity, almost 1 million EVs in transport, increased insulation and heat pumps in the built environment and efficiency measures in agriculture.

b Key uncertainties known to characterise projections internationally include, on the forecast side, that both activity assumptions and model accuracy hold over the timeline, and with respect to accounting of emissions reductions, that the proposed reductions by each measure are plausible, and that the implementing actions are delivered fully and in a timely manner.

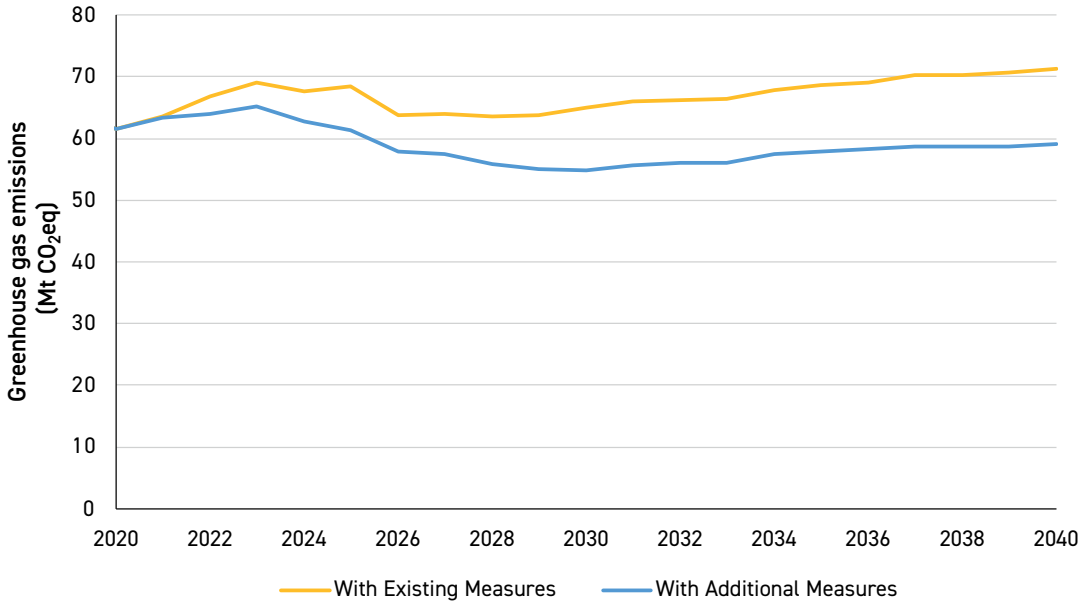


Figure 4.7: *Projections of total GHG emissions up to 2040 excluding LULUCF in existing measures projection (WEM) and With Additional Measures (WAM)*[49]

5. Performance and compliance in the context of international obligations and targets

Chapter 5 Key messages

- Ireland will not meet its EU Effort Sharing Decision 'ESD' overall emissions reduction target for the period 2013 to 2020 through domestic actions, and will require purchase of emissions allowances to meet the shortfall.
- National emissions projections published in June 2021 also suggest a significant exceedance of targets under the EU Effort Sharing Regulation to 2030 without the full use of the flexibilities anticipated in the Regulation.
- In the longer term, relying on purchasing credits can deepen carbon lock-in, forgoes the benefits of transition and imposes a cost on the exchequer, and thereby ultimately on all citizens. This expense could be better directed towards actual emissions reductions.
- The Council recognises the potential costs of compliance with 2020 and 2030 targets, particularly given the increased ambition under the European Climate Law and 'Fit for 55' package of proposals. The Council recommends the Department of Public Expenditure and Reform provide up to date estimates of the costs of compliance.
- The EU's 'Fit for 55' package, comprising 13 pieces of legislation, impacts most aspects of the Irish economy and sources of emissions, and its eventual adoption will have significant implications for Ireland. The Council recommends the Government engage positively to support the ambition of the 'Fit for 55' package and aims to offer the Government advice in this regard in 2022 following careful analysis of the detailed proposals.

5.1 Overview - International obligations and evolving requirements

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

The Paris Agreement set a long-term temperature goal to limit global warming to well below 2°C, and to pursue efforts to limit the temperature increase to 1.5°C, compared to pre-industrial levels. In terms of framing the emissions path, this is to be achieved by global peaking of greenhouse gases as soon as possible, to achieve net zero emissions by mid-century. Paris amended the compliance regime from the centrally-set binding emissions targets of the Kyoto Protocol, to a binding process of nationally determined contributions (NDCs) with each country setting its own target. Focus has moved from Kyoto compliance measured against historic emissions to the requirements for long-term transition and transformation by 2050, required under the Paris Agreement. EU Regulation 2018/1999 requires that Member States submit a long-term low greenhouse gas emission development strategy (LT-LEDS)[a] by the beginning of 2020. Parties to the UNFCCC may voluntarily submit such a strategy. Ireland has not to

a LT-LEDS are a strategic approach consistent with state of the art in understanding of climate action policy, as per the IPCC, to maximise domestic benefits by embracing win-wins and managing conflicts and tradeoffs. The process seeks to identify the short-term actions, aligned with long-term structural changes, on a transition path to low-carbon, sustainable and resilient outcomes by 2050. Regulation 2018/1999 provides a list of requirements for Long-Term Strategies to be submitted to the Commission.

date submitted its 30-year LT-LEDS to the EU or to the UNFCCC (one of only seven EU Member States not to have done so).[50] This is discussed further in Box 9.1.

The Convention and the Paris Agreement enjoy near universal global membership. Ireland is a signatory of the Convention and has also ratified subsequent Protocols and Agreements under the Convention. The EU is also a signatory, which requires Ireland to contribute to collective European efforts to reduce emissions.

In 2005, the EU established a central 'cap and trade' approach across the EU and partner countries, the Emissions Trading System (EU ETS). The EU ETS limits emissions from larger installations, in the power sector and manufacturing industry, as well as airlines operating between these countries. For emissions outside of the EU ETS, the EU agreed a set of binding emissions targets for Member States under the 'Effort Sharing Decision' (ESD) in the period up to 2020, and under the 'Effort Sharing Regulation' (ESR) in the period up to 2030.

5.2 Effort Sharing Decision (ESD) 2013 to 2020

The EU ETS, together with the EU Effort Sharing Decision (No 406/2009/EC3) or 'ESD', forms the basis for the EU objective to reduce total emissions by 20% on 1990 over the 2013 to 2020 period, in line with the EU commitment under the Doha Amendment to the Kyoto Protocol.[a] The ESD target for Ireland is to reduce its emissions from agriculture, transport, residential, commercial, small industry, and waste by 20% on 2005 levels by 2020. Annual binding limits are set for each year over the period 2013-2020.

The EPA inventory of emissions from 2013 to 2019[48] demonstrates that Ireland has not met the annual ESD target for the last four years, with the compliance gap widening in recent years, as per Figure 5.1. Ireland is estimated to cumulatively exceed its compliance obligations by 12.0 Mt CO_2 eq. The EPA provisional estimate of emissions for 2020 suggests that even with the impact of the pandemic restrictions, Ireland's emissions in 2020 will be just 7% below 2005 levels, leaving a distance to target in 2020 of +13%, the fifth year in succession above annual emissions limits.[4]

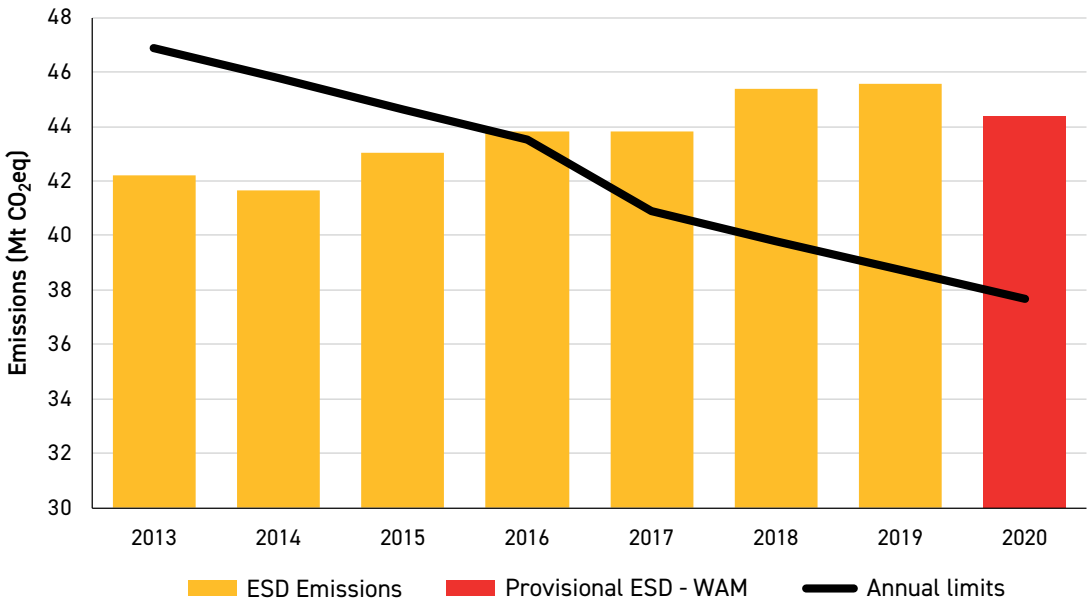


Figure 5.1: *Distance to target: ESD category emissions from 2013 to 2020 and binding limits by year*[47]

a The EU devised the Climate and Energy Package 2020 to support delivery at Member State level, with targets set for cutting emissions, increasing renewables and improving energy efficiency.

The European Commission has assessed Ireland's historic emissions inventories up to 2018. For the period from 2013 to 2018 Ireland had a cumulative 1.56 Mt CO_2 eq surplus of annual emission allowances (AEAs). This is due to emissions being lower than annual ceilings up to 2015, with the surplus banked. This will require the purchase of additional Annual Emissions Allocations (AEA) from Member States that have achieved their targets, in addition to drawing on credits previously purchased by the National Treasury Management Agency (NTMA). The final extent of compliance with the ESD target is set for determination by the European Commission in 2023, taking into account flexibilities permitted under the Effort Sharing Decision, in banking, borrowing and buying and selling emissions credits between Member States and using other Kyoto Protocol units as allowed under Article 5 of the ESD.

In March 2020, the Department for Public Expenditure and Reform (DPER) noted that Ireland is unlikely to meet either its climate or energy targets. The Department estimated the cost of purchasing compliance as likely to be in the range of €62m to €134m.[51] The Department considers that the renewable energy compliance will cost more, as it is expected that availability of credits will be higher in emissions allowances, as more states are in a position to meet 2020 emissions targets.[a] Relying on credits to meet target shortfalls can deepen lock-in to carbon intensive systems, forgoes the benefits of transition and imposes a cost on the exchequer, and thus ultimately citizens. Council reiterates its concerns about a reliance on purchasing emissions credits.[19]

5.3 Effort Sharing Regulation (ESR) 2021 to 2030

European Climate Policy is now entering a new phase for the period 2021-2030 with significant changes to the relevant Directives and Regulations. The 2018 Effort Sharing Regulation (ESR) set binding emissions targets for EU Member States from 2021 to 2030, for the same sectors as the ESD described in the previous section.[b] In order to achieve the emissions goals of the Paris Agreement, interpreted as 80-95% cut in emissions by 2050, it further deepened reductions, setting an EU-wide reduction target of 40% on 1990 levels by 2030.[c] This is split into separate ETS and ESR emissions reduction targets, of 43% and 30% respectively. Ireland has a national target of a 30% reduction relative to 2005 by 2030, in Effort Sharing 'ESR' category emissions. This provides a 'ceiling' for emissions of 384.3 Mt CO_2 eq over the ten-year period from 2021 to 2030. Verification that these targets are being met will be assessed by the European Commission as the decade unfolds. An indication of possible outcomes may be found in the compliance-based projections of the EPA. The EPA has projected emissions including and excluding the additional measures in the 2019 Climate Action Plan (known as WEM and WAM projections respectively). These projections, in Figure 5.2, show a total target exceedance of 78.3 Mt CO_2 eq[d] without the 2019 Climate Action Plan, and 37.8 Mt CO_2 eq when the 2019 Plan is included. This outcome under the 2019 Plan would still leave Ireland reliant on flexibility mechanisms to meet ESR targets. The importance of ambitious Climate Action Plans that are fully implemented is discussed further in Chapter 6.

In addition to continuing to allow certain flexibilities that existed in the period to 2020 (banking, borrowing and buying and selling credits between Member States), the ESR permits two new flexibilities in the period to 2030. Seeking to preserve the impetus for emissions reduction, the flexibilities are conditional and limited. The new flexibilities include using credits from the EU ETS, in which Ireland has negotiated a higher limit to the use of this specific flexibility of 4%, and using credits from the Land Use sector.

a The Department has estimated that purchasing emissions credits will cost €2m to €14m, while renewable energy targets will entail a compliance cost of €60m to €120m.

b Agriculture, transport, residential, commercial, non-energy intensive industry and waste.

c The Governance Regulation 2018/1999 sets requirements for Integrated National Energy and Climate Plans required of Member States to cover the ten year period to 2030. Proposals to increase the EU target to at least -55% on 1990 by 2030 have been published by the Commission in 'Fit for 55'.

d Using standard IPCC 5th assessment report Global Warming Potential coefficients

The EU ETS flexibility available to Ireland is limited in total to 19.1 Mt CO_2 eq over the decade. If Ireland avails of this flexibility, it forgoes some of the proceeds of EU ETS auctions. Were EUA prices to remain at the current relatively high levels then these revenues foregone would be quite significant over the decade. (By way of an illustrative example, if prices were to remain at the current elevated levels of about €60 per tonne, foregoing the revenues in respect to 19.1 Mt CO_2 eq would cost the State in the region of €1bn over the decade. It should be noted, however, that EUA prices have varied significantly since the inception of the EU ETS.) As noted in the previous Council Review,[19] the Government indicated in both the National Mitigation Plan (2017) and the 2019 Climate Action Plan[52] that it intends to use the ETS flexibility only *in extremis*.

The land use flexibility is limited to 262 million credits over the EU, with Ireland accorded higher access at 10% of the EU total, due to its larger share of emissions from agriculture. The Council notes that the availability of the Land Use flexibility is in considerable doubt, as the rate of removals of emissions by forestry[a] is projected to decline in the coming years, as a consequence of the persistent underachievement of national annual targets for afforestation. Land-use in Ireland has been a net emitter since 1990, and is projected to increase emissions into the future, rather than act as a net sink (see Section 7.2.2). LULUCF is an area where the EU proposals for 'Fit for 55%' may have particular impact, with a major restructuring of how the sector is treated proposed. The EPA projections suggest that both new flexibilities will be required in order for Ireland to comply with its existing ESR targets. This is predicated on three factors: i) maximum use of the two new flexibilities, ii) full and timely implementation of the 2019 Climate Action Plan, and, iii) that the assumptions in the projections hold to 2030.

The cost of compliance with ESR to 2030 was also considered by the Department for Public Expenditure and Reform in a briefing note.[51] The Department suggested any estimate of cost would be speculative, offering an indicative range of €1.46bn to €1.75bn to 2030 for emissions credits, estimated without the 2019 Climate Action Plan. The costs of compliance are highly uncertain with potential high costs to the public purse arising from failing to meet emissions and renewable energy targets. The Council considers it necessary to revisit compliance costs for 2030, noting the deeper targets implied by 'Fit for 55', and the European Climate Law (see Box 5.1). In this context, the Council reiterates the necessity for proactive and enhanced climate action in Ireland. This must include redoubling efforts, for implementation of existing and planned measures (see Box 6.1), but also for development of further measures, consistent with a steeper reduction curve than was conceived in the 2019 Plan.

a Dependent on afforestation and harvesting.

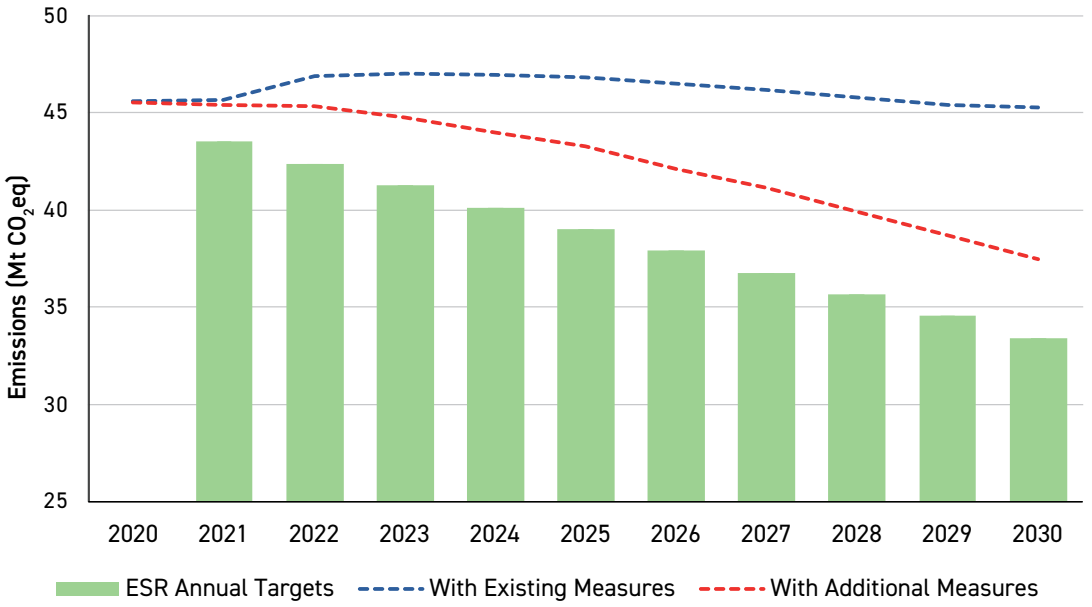


Figure 5.2: *Possible emissions trends to 2030, and annual emissions targets under the Effort Sharing Regulation*[49]

While the ESR targets form the current EU legal and policy architecture to 2030, proposals have already been published to significantly change the approach to climate action in the EU. These aim to deepen emissions reduction, for a climate neutral continent by 2050, supported by a -55% reduction target for 2030. The 'Fit for 55' proposals are discussed in Box 5.1.

Box 5.1 The EU 'Fit for 55' package

In July 2021, the European Commission adopted a package of proposals, 'Fit for 55', seeking to make the EU's climate, energy, land use, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. This is the intermediate step towards a climate neutral continent by 2050. The proposals aim to realise the European Green Deal, proposing legislative arrangements to deliver on targets agreed in the European Climate Law, to fundamentally transform the economy and society of the EU.

The proposals are interconnected, seeking to accelerate and deepen emissions reductions. They include proposals for

- a revision of the EU emissions trading system (EU ETS), including its extension to shipping, revision of the rules for aviation emissions and establishing a separate emission trading system for road transport and buildings
- a revision of the Effort Sharing Regulation on Member States' reduction targets in sectors outside the EU ETS
- a revision of the Regulation on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry (LULUCF)
- a revision of the Renewable Energy Directive and the Energy Efficiency Directive
- a revision of the directive on the deployment of alternative fuels infrastructure
- an amendment of the Regulation setting CO_2 emission standards for cars and vans

- a carbon border adjustment mechanism
- a social climate fund

By 2035, the EU aims to reach climate neutrality in the combined agriculture, forestry and land use (AFOLU) sector, including agricultural non-CO_2 emissions, such as those from fertiliser use and livestock. The 'ReFuelEU' and 'FuelEU' initiatives aim to increase uptake of sustainable fuels by aviation and maritime transport. A Carbon Border Adjustment Mechanism will put a carbon price on imports of a targeted selection of products from countries lacking commensurate climate action, thus diminishing risk of carbon leakage.

While the medium and long-term benefits of the proposed EU climate policies are estimated to outweigh costs, a socially fair transition is core to efforts. Proposals include measures such as a social climate fund to help protect vulnerable households, small enterprises and transport users. The Commission proposals will now be negotiated between the Member States and the EU Parliament.

The 'Fit for 55' package, comprising 13 pieces of legislation, impacts most aspects of the Irish economy and sources of emissions, and its eventual adoption will have a significant implications for Ireland. The Council recommends the Government engage positively to support the ambition of the 'Fit for 55' package and aims to offer the Government advice in this regard in 2022 following careful analysis of the detailed proposals.

6. Performance on the basis of national obligations and targets

Chapter 6 Key messages

- When considering national policy goals to 2050, Ireland is presently significantly off-track from paths that deliver long-term transition towards climate neutrality on that timescale.
- Positive strides have been made, including programmatic policy and administrative arrangements arising from the 2019 Climate Action Plan. However, implementation and enhanced mitigation and adaptation action under the amended climate legislation is now critical.
- Implementation of a number of measures in the Action Plan has been delayed. Achieving the necessary emissions reductions are contingent on full and timely delivery of all actions in the plan. The Council note that capacity and resources have been key stumbling blocks to effective implementation of the Climate Action Plan 2019. The need for capacity building and increased resources is therefore critical to transition.
- The Council has made proposals to the Minister for carbon budgets for the periods 2021-2025, 2026-2030 and 2031-2035. Future Annual Reviews will assess progress against carbon budgets and sectoral emissions ceilings and climate action plans.

6.1 Legal and policy context

The framework for climate action in Ireland has evolved significantly in the last seven years. Framing has moved from marginal short-term action - for initial steps to meet the requirements of the Kyoto Protocol - to long-term transition and transformation. The long-term framing seeks more alignment with deep emissions reduction, consistent with climate system stabilisation, and related evolution in standard policy and assessment practices internationally.

The National Policy Position was established in 2014 as a contribution to long-term vision for policy development.[a] It set a requirement for a national emissions pathway, defined as an aggregate reduction in carbon dioxide (CO_2) emissions of at least 80% (compared to 1990 levels), by 2050, across the electricity generation, built environment and transport sectors, and an approach to carbon neutrality in the agriculture and land-use sector. The statutory basis to achieve Ireland's long-term emissions reductions was first the 2015 Climate Action and Low Carbon Development Act, and subsequently the 2021 Climate Amendment Act, which represented an increase in ambition and a widening of the policy objective. As discussed in the Introduction, the Climate Amendment Act replaced the National Transition Objective (NTO) with the wider National Climate Objective (NCO), which puts into law a commitment for net-zero greenhouse gas emissions by 2050.

Key recent international framework developments include the IPCC fifth assessment report,[53] the Paris Agreement under the UNFCCC (2015), the IPCC Special Report on 1.5°C (2018), [54] the IPCC Special Report on Climate Change and Land (2019), and the IPCC sixth assessment report (WGI in 2021[1] with further reports to appear in 2022). A variety of EU requirements have also evolved in alignment, including the Governance Regulation (2018/1999), the EU Climate Law and 'Fit for 55' (see Box 5.1). Collectively these developments have led to a tightened interpretation of the long-term stabilisation goal, and related emissions pathways.

a In a long-term view that has regard for international obligations, promotion of sustainable development, cost effectiveness and inclusion of relevant scientific and technical advice.

6.2 Developments in national implementing policy

In pursuit of responses to the requirements of the 2015 Act, national policy for implementation has been evolving technically and administratively. The National Mitigation Plan (NMP) of 2017, a policy requirement of the 2015 Act, included more than 100 actions with the aim of beginning the process of long-term transformation to 2050. The 2019 Climate Action Plan sought to enhance the ambition of the NMP, specifically towards meeting the ESR target to 2030 - without purchasing compliance credits. The 2019 Plan sought deeper emissions reduction through devising 183 actions, including over 600 individual measures. The 2019 Plan aimed for consistency with the 2030 UN Sustainable Development Goals, to mainstream action,[a] and was accompanied by a prominent focus on enhanced governance and monitoring of policy implementation. The implementation of the plan itself is discussed further in Box 6.1. The 2020 Programme for Government, Our Shared Future, set the policy to reduce emissions at 7% per annum or 51% over the course of the decade to 2030, to deliver alignment with Paris Agreement commitments. This deeper target necessitates policy revision, for which the 2021 Climate Action Plan seeks to build on and replace the 2019 Plan.

The enhanced policy governance in the 2019 Plan has required quarterly implementation reports. The Q4 2020 implementation report shows progress on implementation at an overall delivery rate of 78% by quarter end.[55] The implementation report also noted that of those measures that were not implemented in previous quarters, 85% of them continue to be delayed. In advance of completion of the 2021 Plan, a set of Interim Actions were released in early 2021, seeking to ensure a continued focus on implementation, with 250 climate actions broken down into 561 measures. The first report on the Interim Actions[56] assessed a 78% delivery of actions. These are programmatic assessments and do not assess the likely emissions outcomes from either implemented or delayed measures. However, the Q4 2020 report notes the important conclusions that the emissions reductions envisaged by the 2019 Plan are reliant on full and early implementation of all measures. The significance of this statement is that the emissions reductions, envisaged in the 2019 Plan, become less likely as measures are delayed. The reports have outlined that delays are frequently attributable to underlying resource and capacity issues,[b] and such challenges have been evident since the inception of the 2019 Plan.

Annual Transition Statements are integral to the requirements of the 2015 Act, to facilitate assessment of progress. Statements are available for the four years to 2019, however, as discussed in Chapter 3, the Statement for 2020 currently remains outstanding.

a Including specific reference to SDG 13 to integrate climate change across national policies, strategies and planning.

b The Q1 2021, first *Interim Actions* implementation report (GOI, 2021) noted that delays in implementation were primarily related to complexity and technical aspects of climate action delivery, including: levels of stakeholder consultations required, persisting waste and forestry licencing issues, legislative complexities, tendering difficulties, and scale of outreach required. The report highlighted that resourcing and capacity issues are apparent in many instances, echoing challenges experienced with the 2019 Plan.

6.3 Performance in the context of national objectives

The Climate Action and Low Carbon Development Act 2015 set a national transition objective to transition to a low-carbon, climate-resilient and environmentally sustainable economy by 2050. The National Policy Position, 2014, further defined the objective. It had two components; the first 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 related to Agriculture, Land Use and Forestry of 'an approach to carbon neutrality' without compromising sustainable food production as its primary objective.

The Climate Action and Low Carbon Development Amendment Act, 2021, set a new National Climate Objective to pursue and achieve, by no later than the end of the year 2050, the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy. This Amendment Act came into effect in September 2021, and therefore much of the analysis in this section is based on the original national transition objective. In subsequent annual reports it will be possible to assess progress against the new national climate objective and provision of the Act, which includes 51% emissions reduction by 2030, sectoral emissions ceilings and net zero emissions by 2050.

Figure 6.1 shows that when considering total greenhouse gas emissions excluding agriculture and land use, therefore broadly corresponding to the sectors which had an 80% emissions reduction target by 2050 under the National Transition Objective (2015), Ireland is significantly off-track. Figure 6.1 illustrates that policy development and assessment in Ireland has been largely limited to scenarios out to 2030 and 2040. As noted previously, Ireland has not yet submitted its mandatory Long-Term Strategy to the EU, and thus policy developments to date, as reflected in the WAM scenario in EPA projections, only go out to 2040. Such a short-term approach to policy development is known to be sub-optimal for cost effective emissions reduction. In the illustrative example emissions reductions are implemented in a linear manner from 2021 to 2050, approximating 0.9 Mt CO_2 eq per year, or 2.4% of 2019 emissions. To achieve the higher level of ambition of net zero emissions by 2050 would require emissions reductions of approximately 1.3 Mt CO_2 eq per year from these sectors. Transition and transformation are delivered by long-term strategy and analysis, implemented by action in the short term, as per IPCC conclusions in the AR5 synthesis report. The IPCC have reaffirmed that this strategic process can deliver win-win outcomes, and assist in managing trade-offs and conflicts.[57] This is crucial if national transition is to be achieved in a cost effective, fair and sustainable manner. Ireland would therefore benefit from developing a range of strategic policy scenarios, addressing current gaps in knowledge on possible and preferable pathways to 2050.

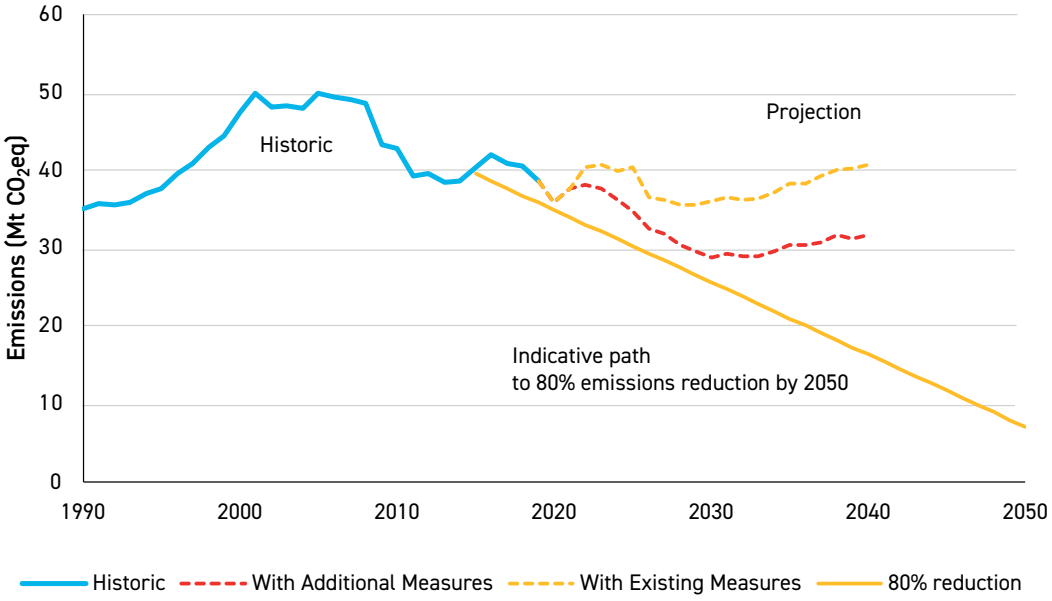


Figure 6.1: *Greenhouse gas emissions from all sectors excluding agriculture and LULUCF of 80% emissions reduction path to 2050*[5,47]

Figure 6.2 provides the historic and projected agriculture and land-use emissions from the EPA.[5,47] The figure also provides an illustration of the scale of removals required to achieve climate neutrality within the sector. This depends on the definition of neutrality and on the metrics used for assessment. In this figure, the standard GWP_{100} metric has been used.[a] In the illustrative example carbon dioxide removal is ramped up in a linear manner from 2021 to 2050, approximating 0.9 Mt CO_2 eq per year, or 3.5% of net 2019 emissions from the sectors. By 2050, carbon dioxide removals of 26 Mt CO_2 eq balance the projected residual emissions. Land-use in Ireland is currently a net source of emissions. Significant progress in the implementation of action to reduce or eliminate emissions and to enhance removals, including afforestation, is required in the near term in order to realise removals in the longer term. It is not clear how removals at this scale would be achieved, and would almost certainly involve the deployment of novel technologies. It is also not clear what emissions removals would be required in the period from 2040 to 2050, as projections are limited to 2040.

a Working definition of Climate Change Advisory Council in 2020: "Carbon neutrality is achieved when the net sum of emissions and removals of greenhouse gases associated with all activities within the economy makes no further additional physical impact on global warming" (CCAC, 2020).

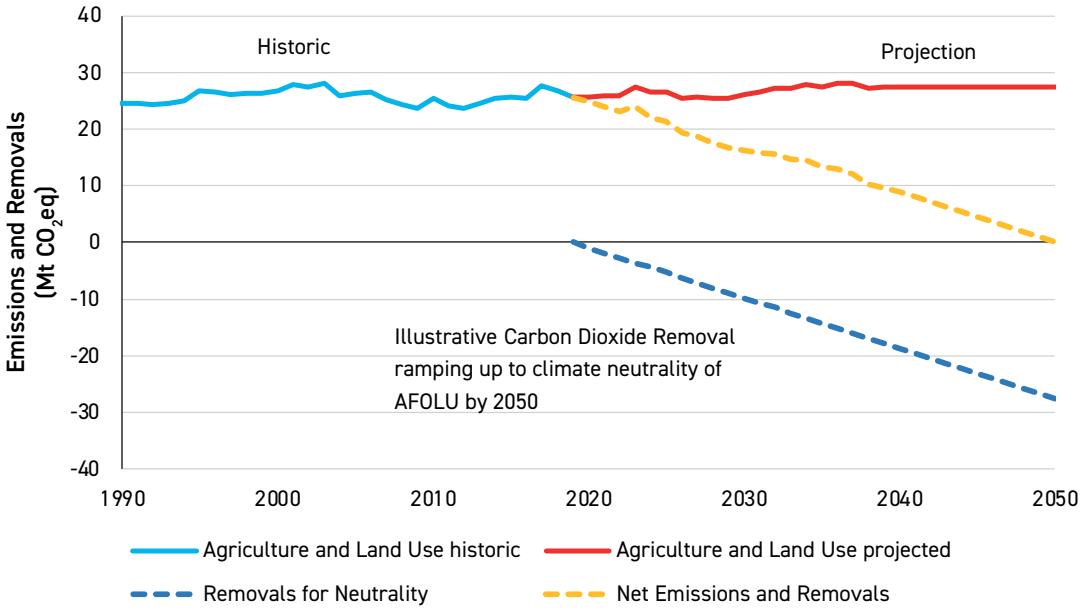


Figure 6.2: *GHG emissions from agriculture and LULUCF including an illustrative pathway for removals to achieve neutrality by 2050*[5,47]

6.4 Carbon Budgets

The Climate Action and Low Carbon Development (Amendment) Act (2021) mandates the setting of 5-year carbon budgets. The Council recently proposed carbon budgets for the periods 2021 to 2025, 2026 to 2030, and 2031 to 2035 to the Minister. The carbon budget proposals are currently under consideration by the Minister. When the carbon budget proposals have been passed by the Oireachtas, these will be included in the assessment of progress in future Annual Reviews. The passing of the carbon budgets will be followed by the setting of sectoral emissions ceilings. It is the intention of the Council to also include review of progress against sectoral emission ceilings by government in future Annual Reviews.

Box 6.1: Implementation of 2019 Climate Action Plan

The thorough implementation of Ireland's Climate Action Plans is key to Ireland reaching its national and international mitigation and adaptation targets.

Notwithstanding the COVID-19 pandemic, the Council is concerned that the national Climate Action Delivery Board, the role of which is to hold each department and public body accountable for the delivery of actions set out in the Climate Action Plan, did not meet in 2020, despite a commitment to meet quarterly. This risks undermining the priority given to coordinated implementation of climate action across Government. It also underlines the continued fragility of climate governance in Ireland and the need to further institutionalise implementation, monitoring and evaluation.

When the 2019 Climate Action Plan was replaced with the publication of Interim Climate Actions 2021, it had a 78% implementation rate with a view to the remaining incomplete actions being carried over to the 2021 Climate Action Plan, the majority of which were already included in the Interim Climate Actions. The single action under the label of "Where We Stand" in the 2019 Climate Action Plan, the ambition of which was to "evaluate in detail the changes required to adopt a more ambitious commitment of net zero greenhouse gas emissions by 2050" was not achieved. The

categories of actions with the highest percentage of measures achieved were Adaptation (100%), Waste and the Circular Economy (96%), Carbon Pricing and Cross-cutting Policies (96%), and Agriculture, Forestry and Land Use (94%). The categories of actions with the lowest percentage of measures achieved, apart from the "Where We Stand" category, were the Public Sector Leading by Example (68%), Transport (71%), and Electricity (79%). The Council notes, however, that these numbers do not necessarily reflect the difficulty of implementation of the measures achieved in each sector, nor their emissions reduction or resilience enhancement potential. The adaptation measures, for example, are high level focusing on the putting in place of sectoral and local adaptation plans and strategies (the implementation of these is discussed in Chapter 3).

Future Annual Reviews will continue to consider the progress made under future Climate Action Plans, which are now to be updated annually.

Table 6.1: *Implementation of 2019 Climate Action Plan*

Section	Total n. of measures	Measures achieved	Measures delayed	Percentage achievement per section
Where We Stand	1	0	1	0%
Governance of the Challenge	6	5	1	83%
Carbon Pricing and Cross-cutting Policies	28	27	1	96%
Electricity	121	95	26	79%
Enterprise	24	21	3	88%
Built Environment	103	82	21	80%
Transport	65	46	19	71%
Agriculture, Forestry and Land Use	109	102	7	94%
Waste and Circular Economy	28	27	1	96%
Public Sector Leading by Example	37	25	12	68%
Ireland's International Action on Climate Breakdown	5	4	1	80%
Citizen Engagement, Community Leadership and Just Transition	83	67	16	81%
Adaptation	7	7	0	100%

Sources: *Climate Action Plan 2019, Interim Climate Actions 2021, Climate Action Plan Progress Reports, CCAC Analysis*

Of the 2019 Climate Action Plan's 109 measures that were incomplete by the end of 2020, 76 equivalents were recorded as being included in the Interim Climate Actions 2021.

As the equivalence of ambition of some of the above 76 measures, compared to the 2019 Climate Action Plan, is ambiguous, the Council suggests that at least 33 delayed measures from the 2019 Climate Action Plan did not appear in the Interim Climate Actions 2021. Examples include measures in support of ocean energy research, and ones in support of electricity/gas providers providing detail to customers on their energy use and potential energy savings. The Council looks forward to seeing if these are addressed in the implementation of the recently published 2021 Climate Action Plan, which will be examined in more detail by the Council over the coming months.

The Council is particularly concerned by the delay in measures designed to increase penetration of renewable energy onto the Irish market, and to increase EV charging infrastructure. Such a delay is disappointing given the measures' significant emissions reduction potential. Reasons given for such delay include issues related to capacity, resourcing and expertise, speed of legislative process, the complexity of work and engagements, ongoing EU negotiations and the impact of the COVID-19 pandemic.

Some key achievements of the 2019 Climate Action Plan include:

- the ongoing work accomplished in the process of restoring 22,107 ha of raised bogs
- the options developed for the management of rewetted organic soils
- the strengthened supports established for private afforestation alongside the launch of the "Woodland Creation on Public Lands" scheme
- the development of a forest carbon calculator
- the advances in profiling homes for retrofitting opportunities and providing funding for residential and community retrofit programmes

The Council understands that steps are being taken to clarify the intended output of each measure in future Climate Action Plans and would strongly welcome the inclusion of emission mitigation potential for each mitigation action. Some information is in the public domain in this regard (via the EEA Policies and Measures Database[58]) but further detailed information of this type would greatly improve the transparency and accountability of future climate action.

7. Mitigation sectoral analysis

Chapter 7 Key messages

- In most sectors, measures have not been sufficient, and are overwhelmed by absolute growth in consumption, requiring consideration of more than energy and carbon efficiency.
- Agriculture is not on a sustainable low-carbon path. Expansion in production in some farming sectors has negated the impact of efficiency gains and reduced activity in other farming sectors leading to increased emissions. Analysis indicates the projections of emissions from the sector are very sensitive to assumptions of market prices and appropriate allocation of supports under the Common Agricultural Policy. Significant action will be required to deliver a transition that supports low emissions agriculture and land use, reversal of water quality degradation and biodiversity loss, and achieve sustainable rural development.
- The Land Use, Land Use Change and Forestry (LULUCF) sector requires urgent actions if the potential for negative emissions are to be achieved in the coming decades. Actions to eliminate emissions and enhance removals must be implemented in the near term in order to switch from a source to a significant potential carbon sink.
- Transport trends are not consistent with a sustainable low-carbon path, making emissions reductions more difficult, while also driving congestion and a host of sustainability problems and costs. It is necessary to accelerate electrification while putting an urgent priority on long-term integrated spatial and mobility planning in Ireland, if a transformational sustainable path is to be delivered.
- Early progress in the Built Environment has stalled. Returning to emissions reduction requires action on retrofit to improve homes, increase electrification of heat and to install renewables.
- The Built Environment is an important area for just transition and jobs. Delivering on this requires capacity, training and private investment, alongside programme measures that can address differences across ownership and building type.
- Electricity has been a good news story, Ireland's best performing sector when it comes to reducing emissions.
- Ireland needs to focus on delivering carbon neutral power generation as soon as possible, and this will require increased connection of renewables and storage to ensure continuity of supply.
- Progress in the decarbonisation of industry and manufacturing has stalled.
- Ireland needs to implement enhanced programmes for sustainable consumption and production, in addition to supporting improvements to the EU ETS.

7.1 Indicators of transition

An evidence-based approach to transition is taken; we look at data reflecting progress in behavioural, technical, structural and infrastructural changes that are key to long-term achievement of the national transition objective. As in previous Annual Reviews, a potential range of indicators for transition is presented.

Indicators are included in Table 7.1, 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 7.1 thus presents an extended illustrative list of indicators to give a broader perspective on the state of transition across the sectors in Ireland.

Measuring progress in transition goes beyond 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.

The indicators may not fully reflect progress towards Ireland's objectives. For example, the indicator for distance travelled by private vehicles per capita should decrease with an increase in public transport, cycling and walking. However, that indicator won't reflect the decarbonisation that occurs when the vehicle stock transitions to a low- or zero-emissions or autonomous fleet. These dimensions point to the need for a broader basket of indicators to be employed in measuring a low-carbon transition that will encompass all sectors in our economy and society.

Sector	Name	2014	2015	2016	2017	2018	2019	Unit
Total	GHG intensity of the economy	0.36	0.37	0.35	0.34	0.32	0.3	kt CO_2eq/€M GNI*
	GHG per capita	12.5	12.9	13.18	13	12.9	12.15	t CO_2eq/Population
	CO_2 intensity of the economy	0.24	0.24	0.23	0.22	0.21	0.19	kt CO_2/€M GNI*
	CO_2 per capita	7.95	8.25	8.47	8.17	8.07	7.57	t CO_2/Population
	Economy-wide efficiency	€2,765.03	€2,727.88	€2,825.68	€2,906.77	€3,120.02	€3,356.49	GNI*/t CO_2eq €/t CO_2eq
	Total primary energy requirement	154,272	161,762	168,333	168,426	171,984	169,845	Megawatt hour (MWh)
Power generation	Emissions from peat- and coal-fired electricity generation	6,349	7,052	6,841	5,796	4,160	2,661	kt CO_2
	CO_2 intensity of electricity	455	465	480	437	375	324	Gt CO_2/kilowatt hour (kWh)
	% renewable of gross electricity consumption	23.5	25.5	26.8	30.1	33.2	36.5	%
Residential/ Commercial/ Public	% renewable heat	6.2	6.2	6.3	6.6	6.3	6.3	%
Residential	% residential energy from solid fuel (peat and coal)	16.2	15.3	13.8	13.6	13.8	11.7	%
	A and B Building Energy Rating (BER)-rated residential 'dwellings'	–	12.0%	13.0%	14.0%	15.0%	16.0%	% of BER data set
Commercial	A and B BER-rated commercial buildings	–	14.0%	13.8%	13.6%	13.2%	13.6%	% of non-dwelling BER data set, excluding hospitals, health, community, nursing homes, schools and colleges
Public	Energy efficiency gains in public bodies	–	21.0%	20.0%	24.0%	27.0%	29%	% improvement from business as usual
	Energy consumption of public bodies	–	9,343	9,375	10,248	10,178	9,898	Gigawatt hours (GWh)

Sector	Name	2014	2015	2016	2017	2018	2019	Unit
Transport	% renewable transport (RES-T)[a]	3.1	3.3	3.0	4.1	3.9	4.7	%
	Distance by private car	32,645	35,020	36,623	37,181	35,975	35,453	Million kilometres
	Distance by private car per capita	7,027	7,470	7,727	7,758	7,407	7,204	Kilometres
	Distance by goods vehicles	7,259	7,021	7,410	7,785	7,891	8,023	Million kilometres
	Distance by public service vehicles	1,157	1,167	1,194	1,219	1,228	1,240	Million kilometres
	Private car new vehicles' fuel type	91,157	119,066	138,778	121,883	112,590	98,962	Number of new petrol and diesel vehicles (as % of all new)
		98.70%	98.30%	97.80%	95.90%	92.90%	87.34%	
	New goods vehicles' fuel type	16,243	22,926	28,039	24,066	25,380	24,337	Number of new petrol and diesel vehicles (as % of all new)
		99.90%	99.90%	99.60%	99.90%	99.70%	98.75%	
Agriculture and Land-Use	Forestry cover	752,890	758,383	764,082	769,395	773,229	776,650	Hectares
	Dairy cows (December)	1,127.7	1,239.9	1,295.2	1,343.3	1,369.1	1,425.8	Thousands
	Non-dairy cows (December)	1,041	1,053.2	1,042	1,018.3	982.3	956.9	Thousands
	Other cattle (December)	4,074.1	4,129.2	4,276.2	4,311.9	4,242.1	4,177	Thousands
	Sheep (June)	-	5,138.7	5,179.2	5,197.1	5,109.3	5,145.8	Thousands
	Nitrogen fertiliser use	331,782	330,959	339,104	369,089	408,495	367,364	Tonnes of nitrogen
	Total area of drained organic soils	866,294	878,613	881,456	873,782	866,485	860,860	Hectares
	Dairy production efficiency	1.24	1.14	1.13	1.14	1.19	1.14	LCA kg CO_2eq /kg milk
	Beef production efficiency	13.0	12.2	11.9	12.0	12.1	11.7	kg CO_2eq/kg beef (live weight)
Finance	International total climate-specific finance	€33,674,000	€36,003,000	€52,696,000	€64,471,435	€77,213,146	€93,684,608	Euros

Table 7.1: *Indicators of transition across sectors*

a The table contains some revisions compared with the Annual Review 2019. The % Renewable transport (RES-T) weighted figures have been changed to RES-T figures without weightings. SEAI reports RES-T with and without weightings. RES-T with weightings includes double certificates for advanced biofuels.

7.2 Agriculture and Land Use

7.2.1 Agriculture: inventory, driving forces and projections

Agriculture is the largest sectoral contributor to greenhouse gas (GHG) emissions in Ireland, at 35.3% of the national total in 2019.[5] Emissions declined by 4.0% in 2019, and recent provisional data from the EPA records a small increase of 1.4% in 2020.

Greenhouse gases from agriculture are reported under seven source activities, as per Figure 7.1. Emissions are dominated by methane (CH_4) from livestock digestion of fodder (enteric fermentation), and from manure management systems. Nitrous oxide (N_2O) emissions occur from use of artificial fertilisers, manure management and animal excreta while grazing. Carbon dioxide (CO_2) emissions occur due to the fuel combustion of machinery across agriculture and the use of liming to improve soil condition, with forestry and fishing a minor source. The EPA have noted that total emissions from Agriculture in 2018 were the highest in the 30-year time series.[47]

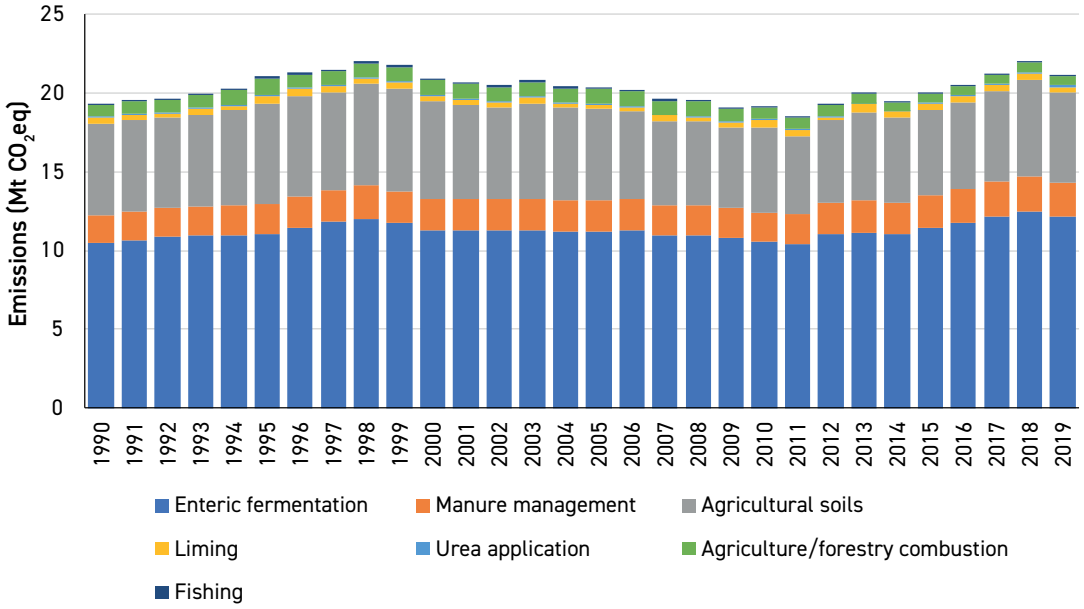


Figure 7.1: *Historic GHG emissions from agriculture, including fuel combustion emissions from machinery used in Agriculture, Forestry and Fishing*[5]

Analysis in the EPA inventory report describes the significance of the livestock population in driving emissions, accounting for 91.2% of methane emissions from agriculture. It is also the largest determinant of nitrous oxide (N_2O) emissions from agriculture at 92.2%, through artificial fertiliser and manure spreading on soils and deposition of manure on soils by grazing animals.[47] Central Statistics Office data shows that total cattle numbers in 2020, at 7.21 million, are returning towards the 1998 peak number of 7.64 million. The structure of the herd is also important as beef and dairy systems have markedly different emissions profiles. Figure 7.2 shows methane emissions from ruminant livestock from 1990 to 2019.[a]

a Annual CSO Livestock Survey for December -1847 to 2020. See: https://data.cso.ie/product/LSD.

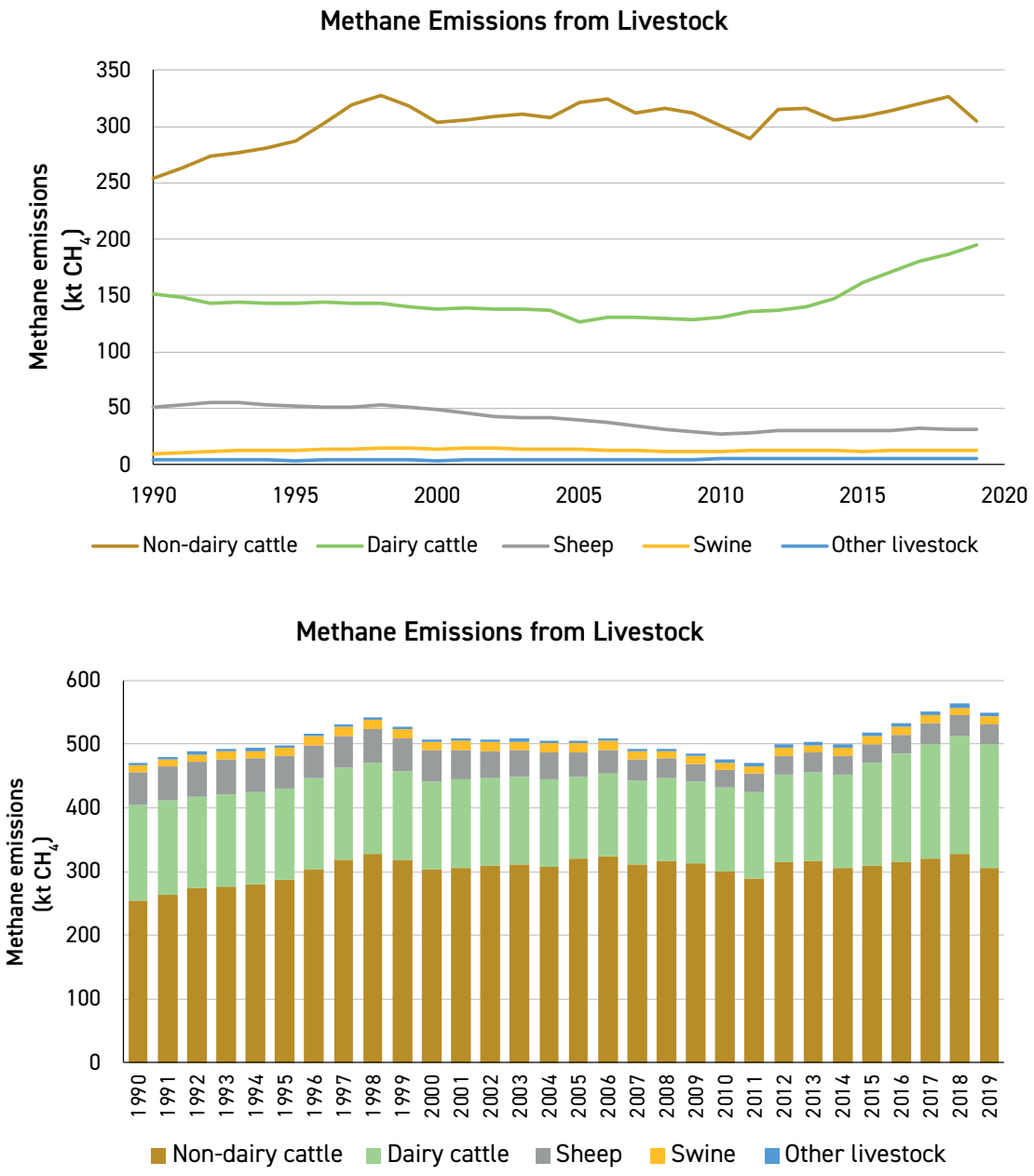


Figure 7.2: *Methane emissions from livestock in Ireland (Source: EPA Inventory)*

Policy, in addition to the export markets, plays an important role in the development of agriculture in Ireland. The EPA inventory notes that the decrease in emissions from 1998 was a result of reductions in cattle and sheep numbers, and in the use of synthetic nitrogen - due to successive reforms of the Common Agricultural Policy, including cessation of headage payment and decoupling of payments from production. However, the lifting of the the milk quota regime in 2015 resulted in a significant increase in emissions from the dairy sector, and is largely responsible for the increase in overall emissions from the sector in recent years. Government policy has sought to expand production, through Food Harvest 2020 and Food Wise 2025, and emissions have risen since 2011 as a result. A new strategy, Food Vision 2030 was launched earlier this year. The export market is the key market for national output.[59]

To determine projected future emissions, the EPA take into account production policy targets and related trends in activity and policies introduced to reduce emissions.[60] An increase in dairy cattle is forecasted, alongside a decline in beef and in tillage. This reflects the expectation that milk production will continue

to be profitable while beef and tillage provide lower economic return. The projections assume delivery of the 2019 Climate Action Plan measures, to improve the carbon efficiency of production, and the adoption of a suite of measures which reduce absolute emissions as outlined in the Teagasc MACC.[a,61] Figure 7.3 illustrates the 'With Existing Measures' (WEM) and 'With Additional Measures' (WAM) 2019 Climate Action Plan projections to 2040 for the agriculture sector. Emissions under 'existing measures' are projected to grow by 6.5% by 2040, while with the additional measures 2019 Climate Action Plan they are projected to decline by 7.8%.

In 2019, the EPA undertook a sensitivity analysis to consider the potential impact on emissions of changes in fossil fuel prices. In 2020, a similar sensitivity analysis was performed for the agriculture activity forecast to improve understanding of the range of plausible outcomes from the sector in keeping with EU Regulation (2018/1999).[b] The sensitivity analysis scenario included a 10% increase in farm gate milk prices compared to the WEM scenario and an increase in the allocation of budget from the Common Agricultural Policy to support production within the suckler herd. The scenario led to a 7% increase in total cattle numbers and a related increase in use of nitrogen fertiliser. These higher levels of activity lead to an emissions increase of 6% (1.8 Mt CO_2 eq) by 2030 relative to the WEM projection.[c] Key insights from the sensitivity analysis are the need for policies which are coherent across the sector, to ensure supports are consistent with environmental objectives and the risk of high market prices stimulating over-production in Ireland.

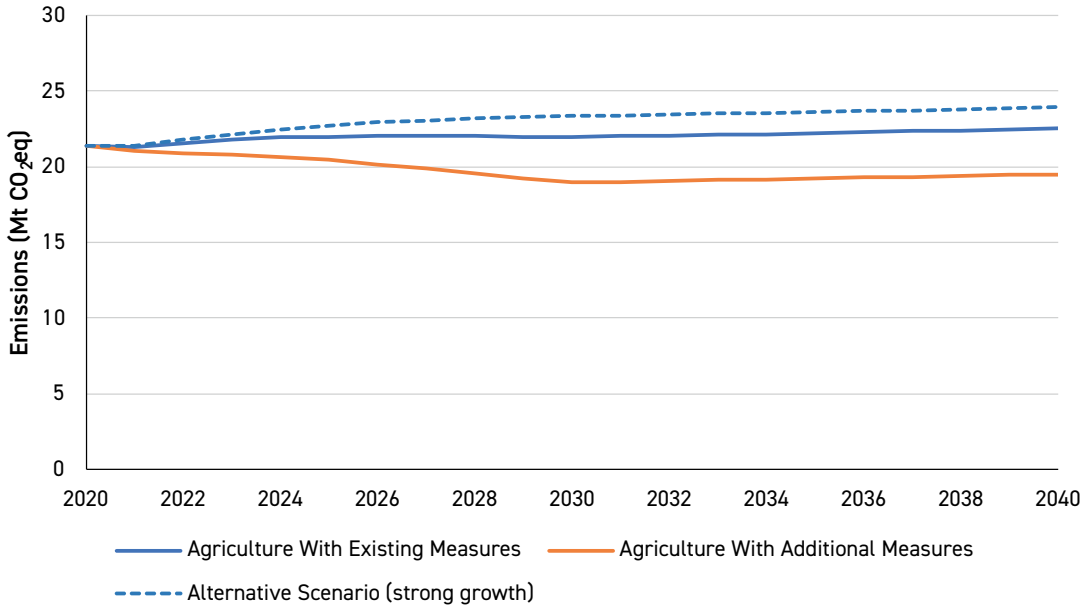


Figure 7.3: *Projections of emissions from agriculture (Mt CO_2 eq) under 'with existing measures' and 'with additional measures' based on 2019 Climate Action Plan*[49] *(Source: EPA)*

7.2.2 Land Use, Land Use Change and Forestry: inventory, driving forces and projections

The Land Use, Land Use Change and Forestry (LULUCF) sector considers the influence of human interventions and management on the complex biophysical systems of land and vegetation leading

a Largely implementation of measures identified in the Teagasc *Marginal Abatement Cost Curve* (Lanigan et al., 2019): nitrogen use efficiency; use of protected urea products; improved animal health; extended grazing; reducing crude protein in pigs; low emission slurry spreading; and inclusion of clover in pasture swards.

b This explores sensitivity to possible higher production activity in agriculture under the WEM projection.

c The agriculture sensitivity analysis is considered using the existing measures 'WEM' projection. Therefore it does not include the measures in the 2019 Plan ('WAM' projection). As such, it is not a forecast of a likely outcome, but does give an indication of sensitivity to a higher activity forecast.

to both emissions and removals of greenhouse gases. Emissions and removals are reported across five land use categories; Forest Management, Cropland, Grasslands, Wetlands, Settlements and Other Land. A sixth category, Harvested Wood Products, quantifies the carbon stored in durable products manufactured from timber harvested in the state and is therefore closely linked to both forest management and markets. Management practices on agricultural grassland and managed peatland are the major net sources of emissions in Ireland. Management of the soil, especially drainage, is the key factor in both cases. Draining of organic soils and peat degrades the ability of land to act as a carbon store, leading to emissions, as organic matter in the soil breaks down. Forest management has been reported as a net removal of carbon dioxide, mainly due to the high rates of afforestation in the 1980's and 1990's and the accumulatation of carbon into forest biomass. The carbon stored in Harvested Wood Products has been increasing over time, as commerical plantations mature and a proportion of the harvest is diverted to durable products.

LULUCF is an important sector for mitigation in Ireland, in terms of the proposed policy function to act as a carbon sink, to remove CO_2 from the atmosphere, and thereby contribute to meeting national climate objective targets. However, LULUCF in Ireland has been, and continues to be, a significant net emitter, as per Figure 7.4, indicated by the black line for 'total LULUCF'. The Council's 2020 Annual Review noted this as urgent for analysis and policy attention. Total removals, predominantly from forested land, have been on an increasing trend, reaching 5.2 Mt CO_2 eq in 2019. However, the total emissions from LULUCF has consistently exceeded the removals by a substantial margin. In 2019, emissions were 9.6 Mt CO_2 eq, exceeding removals, leading to net emissions of 4.4 Mt CO_2 eq.

The drivers of future change include the scale and structure of land use activities between the following major uses: grasslands for grazing and fodder; cropland; forestry; biodiversity, amenity and settlement. How these evolve can be related to macro-economic policy and market factors, but also to social and cultural factors, along with decisions of individual landowners responding to these factors. How land is managed at the micro-level determines the emissions that arise from each use. This is particularly important with respect to drainage and rehabilitation of peatlands, agroforestry and afforestation activities. SeQUEsTER, led by Dr. David Styles, is a transdisciplinary research project funded by the Environmental Protection Agency and Department of Agriculture, Food and the Marine that combines bioeconomic modelling and life cycle assessment to identify promising pathways towards net zero GHG emissions in Ireland's agriculture, forestry and other land use sector. It provides tools to explore insights into the interactions between different uses and land management options, their deployment and impact on emissions and removals.[a]

The reasons for the projected increase in emissions from LULUCF are complex, but are largely driven by the legacy of afforestation rates in recent decades and projected forest management and harvesting activities over the next decade. The substantial afforestation programme in the 1980s and 1990s will see large areas of commerical forests reaching harvest times in the next decade. While this will make a significant volume of timber available for harvested wood products, which are projected to increase removal and storage, there will be a decrease in the carbon stocks of the forests themselves. Ultimately, a large proportion of the forests will be replanted and the cycle of carbon removal will continue. However, the national forest is entering into an extended phase where carbon losses through harvesting will exceed carbon removal through growth, and regrowth, in the rest of the forest. This problem was foreseen, and national policy has been to offset this situation through high on-going rates of afforestation. Unfortunately, actual afforestation rates have failed to meet targets since 1996.

a https://www.plantagbiosciences.org/project/sequester/

Wetland emissions are projected to decrease significantly in the period to 2030. However, the lack of policy coherence beyond 2030 means projections to 2040 do not indicate continued emissions reductions. Grasslands net emissions are projected to decrease by approximately 1% and post 2030 emissions are projected to increase. Decreases in emissions will be contingent on the effective implementation of a coordinated suite of policies to support re-wetting, restoration and other improved land management measures and implementation of robust monitoring and assessment systems to verify the impact on emissions and removals.

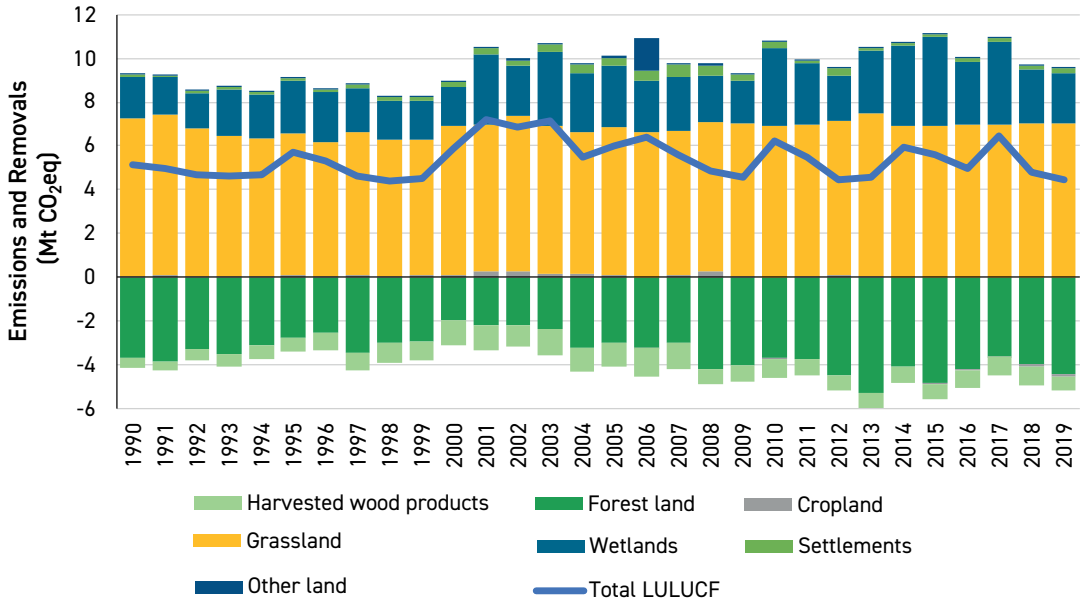


Figure 7.4: *Historic emissions and removals from the LULUCF sector in Ireland*[5]

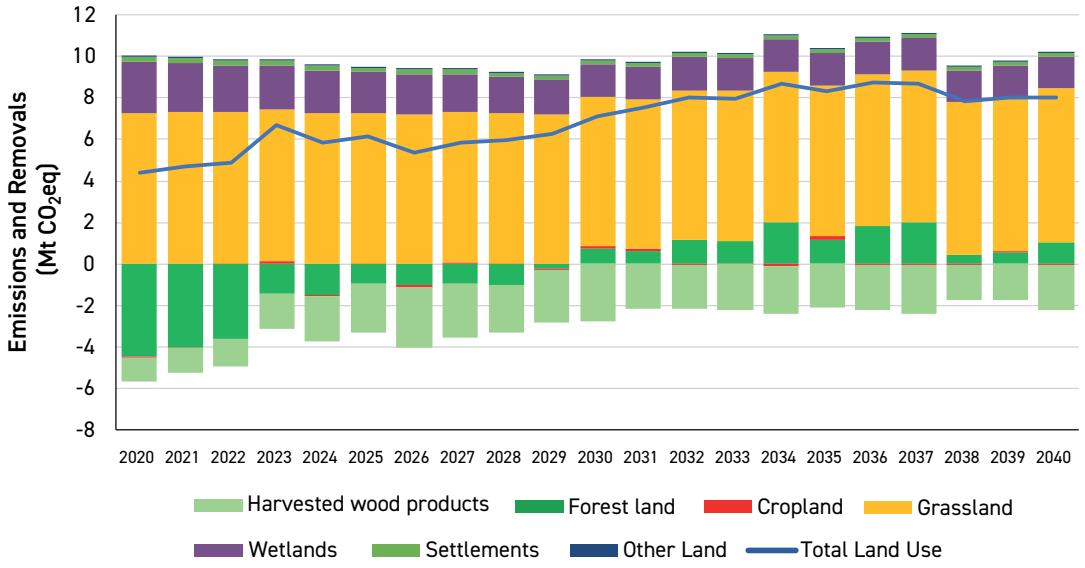


Figure 7.5: *Projection of future emissions and removals from land use*[62]

7.2.3 Agriculture and Land Use: policy and transition

The vision outlined in the Ag Climatise Strategy published in December 2020 is to "develop a climate neutral food system compatible with the Paris temperature goals, whereby the climate impact of biogenic methane is reduced to zero and remaining agricultural emissions are balanced through land use and a significant contribution to renewable energy" by 2050. The Council notes the attention to organic farming, bioeconomy, diversity of land use and participatory processes. It also notes there is a need to greatly enhance the scope and range of action required for climate neutrality, and that measures which seek to stabilise emissions of methane and improve nitrogen use efficiency (resulting in reduced nitrous oxide emissions) envisaged in the strategy have not been adopted to date at a rate sufficient to counter the impact of increased production and a general intensification of agricultural practice in many regions. Furthermore, as noted by the IPCC AR6 WGI there is a need for strong, rapid and sustained reductions in global methane emissions. The Council notes that the Food Vision 2030 strategy launched in 2021 adopts the Ag Climatise strategy as the basis for sectoral development and articulates a target to reduce methane emissions by at least 10% relative to 2018, and that the Strategy commits to the adjustment of this target subsequent to the agreement of specific sectoral targets as allowed for under the Act.[63]

The Council have considered the agriculture and land sector in Ireland in previous reports.[a,11,19] While improvements in carbon efficiency are being recorded,[64] the Council has repeatedly noted that agriculture is not on a sustainable path, and gains in production efficiency alone are not enough to address the need for reduction in total emissions. The Ag Climatise strategy sets out a roadmap to reduce absolute emissions and this will need to be implemented and augmented in the coming years. In seeking transition, key areas noted for action by Council[19] include:

- Nitrous oxide emissions must be substantially reduced,
- The need to manage livestock numbers within biophysical boundaries,

a The 2019 and 2020 Annual Reviews included sectoral analysis of agriculture and land use. The 2019 Annual Review (CCAC, 2019) also included a *Special Focus chapter on 'Agriculture, Forestry and Other Land Use,'* formed from a longer report. The 2020 Annual Review (CCAC, 2020) included an additional chapter on *'Perspectives on Agriculture and Land Use.'*

- Efforts must be intensified to find ways to reduce methane emissions at scale,
- Policy should focus more on nature-based carbon removals, and,
- Long-term land-use strategy is required.

The Common Agricultural Policy (CAP) can be used as an instrument of change, with sustainable management of natural resources and climate action representing one of the three main objectives of the CAP. Also, enhancing research, and providing advisory support for farmers, and farmer-driven partnerships, can enhance practice. The Council notes the launch in 2021 of the Teagasc-led Signpost programme which is a €17 million multi-annual collaborative partnership of farmers, industry and State agencies, working together for climate action at farm level. This is also relevant to afforestation in the land use sector.

Generous incentives have been provided for afforestation, but uptake is not sufficient, highlighting that other market, regulatory, social, and cultural barriers need to be addressed.

The EU 'Farm to Fork Strategy',[65] and a variety of prominent national and international assessments, have identified the need to ensure agriculture, food production and food consumption policies are coherent, consistent and are aligned with broader environmental, climate and health objectives. Practices to reduce emissions have evolved to recognise the need to apply a holistic integrated approach to food and agriculture, to work for consumers, producers, climate and the environment.[26,54,66,67,68] The Intergovernmental Panel on Climate Change (IPCC) noted that research consistently identifies the mitigation potential,[69] and improved health outcomes, of dietary changes from reduced consumption of animal based products and reduced food waste.[70] A similar finding emerged from the EU dietary change scenarios of 'A Clean Planet for All' report. Researchers in Teagasc participating in the SuHeGuide project examining synergies between healthy and sustainable diets[a] offer an example of national-level study that can complement international research on synergies across public health and sustainability policy. The social dimension also increases in prominence when it is recognised that policies to reduce emissions may have social implications, which need to be addressed for a Just Transition. Engagement with stakeholders will be important to ensure that the farming community benefits from the necessary changes in land use, including a focus on jobs and training, for new opportunities in sustainability innovations.

Innovation in agricultural policy must be matched by innovation in land use policy and planning. The Programme for Government: Our Shared Future, 2020, promised to undertake a national land use review, including farmland, forests, and peatlands, so that optimal land use options inform all relevant government decisions. It is important that opportunities for diversification of land use are exploited, including high nature value and carbon farming, land sparing, agroforestry and afforestation.

In Ireland, any strategic approach for agriculture and land use should dovetail rural development and enhance farmer's livelihoods, along with environmental sustainability and public health. Through applying a 'systems lens' on food and agriculture, policy can identify and promote win-wins, and manage trade-offs, to secure a just transition and resilient outcomes, while pursuing opportunities for sustainability innovations.[b] It requires consideration not just of production levels and 'sustainable intensification', but the application of an integrated, holistic approach, that balances the variety of economic, social and environmental objectives that are relevant to food, agriculture and public policy. The multiple benefits

a SuHeGuide: Food based dietary guidelines for sustainable and healthy lifestyles

b Including priority on national diversity of food, land use and rural livelihoods, in response to food security, climate impact resilience, external market risks and economic development opportunities.

for climate adaptation and mitigation, biodiversity protection, water protection and sustainable rural development must be incorporated into this agriculture and land use planning approach.

7.3 Transport

7.3.1 Transport: inventory and driving forces

Transport emissions include road transportation together with rail and domestic aviation and maritime emissions, but excludes international aviation and maritime emissions. Transport was the second largest sectoral emitter of GHG in Ireland in 2020.[48] Provisional data for 2020 shows that emissions dropped by almost 15.7%, due to the impact of pandemic movement restrictions on private transport activity.[71] It is unlikely that this trend will continue, in the absence of policy intervention, as transport activity returns towards pre-pandemic levels.

Long-term trends show that emissions from transport have increased by 137% between 1990 and 2019, as per Figure 7.6.[a] To consider policy options, it is useful to split road transport data into different forms of passenger and freight activity. CO_2 data from the Sustainability Energy Authority of Ireland (SEAI)[72] demonstrates that emissions are dominated by private cars at 51%, followed by road freight (including trucks and lighter vans) at 26%, as per Figure 7.7.

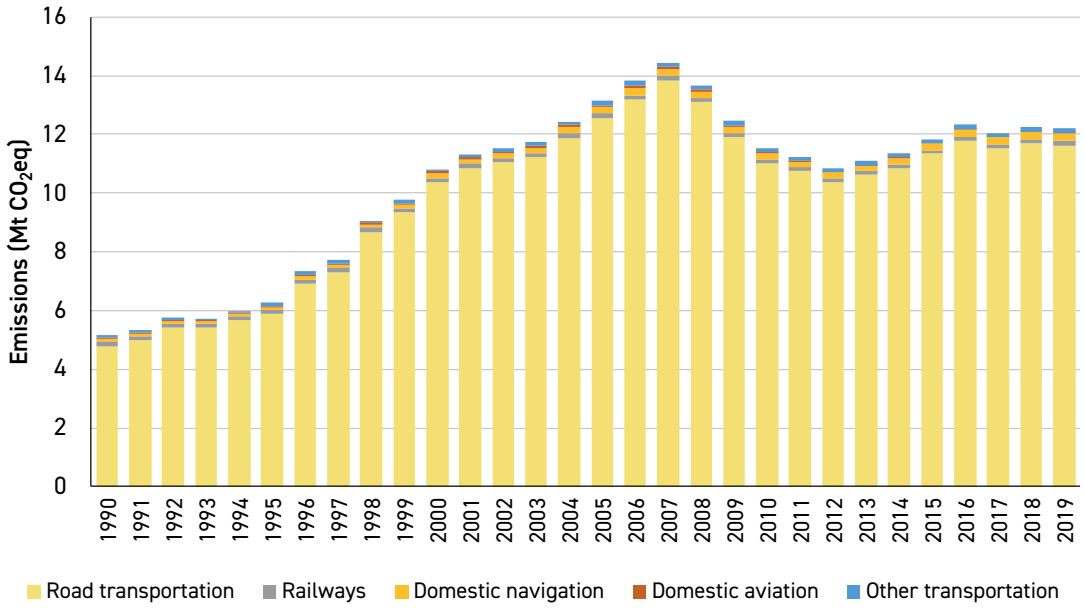


Figure 7.6: *Historic GHG emissions from transport in Ireland in the EPA inventory*[5]

a When international aviation data from SEAI is included it suggests that transport CO_2 emissions have grown by 153%.

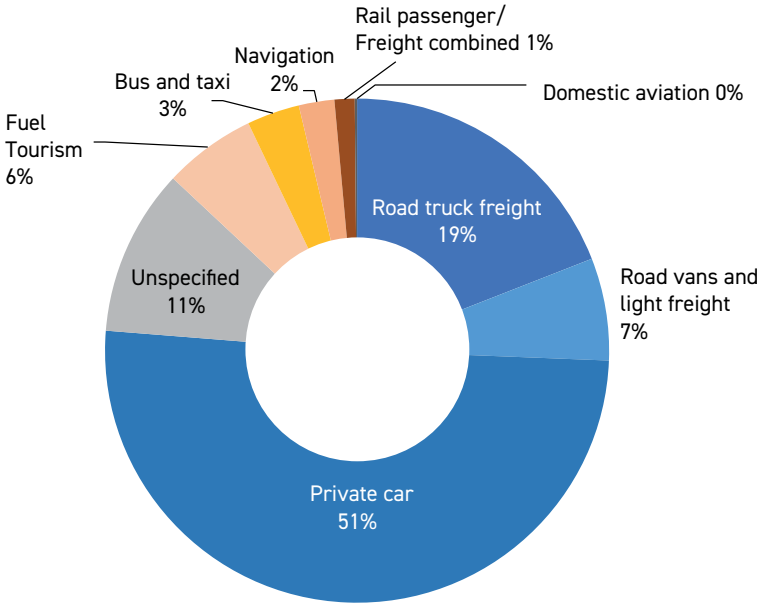


Figure 7.7: *Shares of CO_2 emissions by vehicle mode in 2019*[71]

To engage in transition of transport it is crucial to understand the driving forces of emissions, and what makes them significantly different between countries.[a] Road-based individualised carbon-intensive transport modes have become increasingly 'locked-in', as infrastructure is built and practices evolve. As transport emissions have increased significantly in Ireland, Ireland ranks as the 4th highest per capita in the EU.[26] While emissions may have been relatively stable in the four years to 2019, they need to decline significantly to address Ireland's climate commitments. Analysis by SEAI shows that the energy intensity of Ireland's passenger and freight transport, per passenger and tonne kilometre, has been approximately double that of the EU average from 2000 to 2014.[73]

Ireland experienced high economic and population growth in recent decades, both of which can push emissions upwards. However, the outcome significantly depends on two key factors in how systems are organised: through settlement patterns[b] and by transport mode. Global analysis shows that carbon intensive transport development involves dispersed settlement and prioritising roads and the private car.[74] In contrast, concentrated settlement, and active and public transport modes significantly reduce emissions, and come with many other benefits for sustainable development. Analysis of transport in Ireland across recent decades clearly demonstrates that a more carbon intensive path has been followed. This has involved permitting dispersed settlement[75,76,77,78] and favouring road infrastructure investment,[79] and the private car and road freight as preferred modes.[80] A carbon intensive path is also a less sustainable path,[c] and is known to have significant costs.[d] In Ireland, policy efforts to reduce emissions have concentrated on improving energy and carbon efficiency. These measures have been counteracted by increasing activity levels and larger vehicles.

Aviation emissions from flights within the EU are included under the EU Emissions Trading Scheme (EU ETS). When introduced in 2012, free allowances in aviation accounted for approximately 75% of emissions

a Transport emissions per capita in Ireland, at 2.51 t CO_2, are 40% higher than the EU average of 1.80 t CO_2. From EDGAR data, see EPA (2020).

b Settlement patterns involve how housing and economic activities are concentrated or dispersed in spatial development. For passenger mobility in Ireland, this is mainly structured by walking, cycling, rail, bus or private car. For freight mobility, it involves rail and road forms.

c Road and car-based development are associated with: increased GHG emissions; traffic congestion; air pollution; noise; biodiversity impacts; sealing of surfaces; and higher rates of injury and mortality due to road traffic accidents (EPA, 2020).

d The economic, competitiveness and externality costs of continuing 'carbon intensive' development are known to be significant (Sovacool *et al.*, 2021), increasing the difficulty, and damaging the cost effectiveness, of transition to a low-carbon future.

in the sector. This appears to have weakened the impact of the ETS price signal,[19] as emissions grew year on year to 2019. In 2019, free allowances accounted for 41% of emissions in the sector.[a] International aviation, for flights outside the EU, and international maritime emissions, are noted as memo items in national inventories. While they are reported, they do not count towards current national emissions targets, despite increasing rapidly over the longer term.[26,48,52]

7.3.2 Transport projections

The projections of future GHG emissions from transport consider the future emissions that could arise from earlier policy (With Existing Measures), and alternatively, when the 2019 Climate Action Plan is implemented (With Additional Measures). The projections estimate a notable reduction in transport emissions by 2030 (Figure 7.8) assuming successful delivery of all measures in the 2019 Climate Action Plan. SEAI modelling for the projections shows that the 2019 Plan is dominated by two measures, providing 89% of projected reductions: by increasing the number of electric cars to 840,000 (-2.67 Mt CO_2), and increasing the amount of biofuels to 10-12% (-0.99 Mt CO_2).

A rapid expansion of Battery Electric Vehicle (BEV) uptake is required, though this in itself is not sufficient to ensure Ireland achieves its transport emissions targets. The BEV target will be challenging and will require, for example, investment in charging infrastructure, though it is anticipated that European regulations may assist in increasing the supply of BEVs and reducing their cost. CSO data shows that BEV purchases have begun to accelerate[81] but may not be keeping pace with 2019 Climate Action Plan targets (of 550k BEVs by the end of the decade).[52]

Transport has struggled in the past to reach targeted levels of renewable energy though biofuel blending has been a successful policy. The projections do not include any notable shift in modes to active and public transport, estimated at just 0.63% of the emissions reduction to 2030. This is not an indication of the technical potential of emissions reduction from modal shift, rather it is an indication of modest targets for modal shift in the 2019 Plan.

a These percentages relate to the free allocations and verified emissions of Irish installations in the aviation sector. Available at: https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1

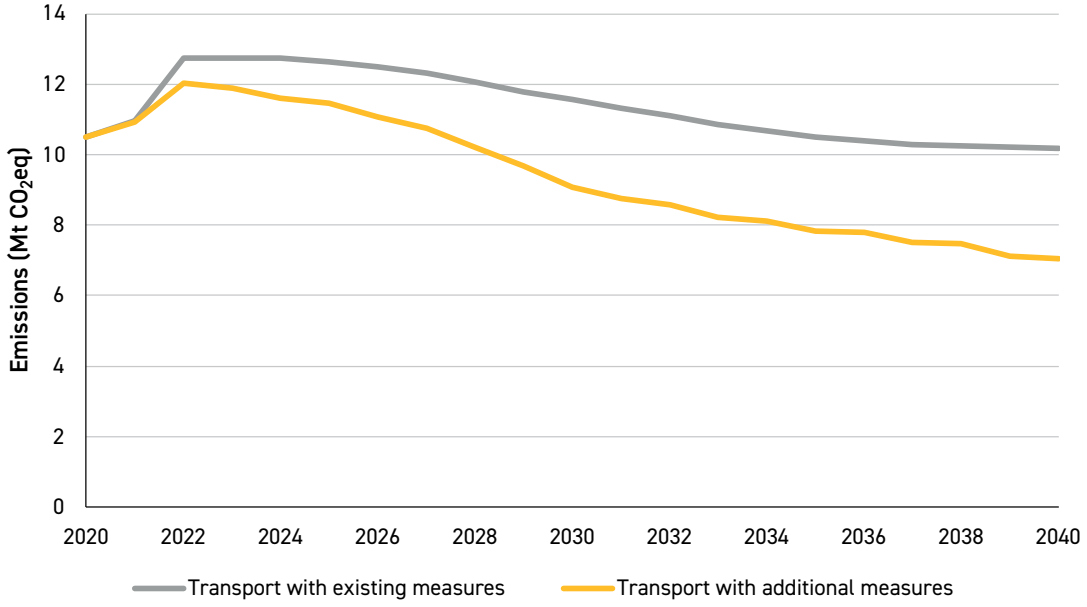


Figure 7.8: *Projections of GHG emissions from transport*[49]

7.3.3 Transport: policy and long-term transition

In Ireland, policy planning and analysis of transport transition have been dominated by 'decarbonisation' measures, to improve efficiency up to 2030.[a] Diffuse settlement patterns 'lock-in' high levels of private vehicular transport. International evidence strongly supports the necessity for systems transformation, using a long-term focus to 2050.[54,65,73] Ireland's lock-in to a higher emissions path urgently requires consideration of how to prevent further settlement and infrastructure lock-in,[b] and approaches to repair that which already exists.

Given the strong path dependence in Ireland, policy discussion is increasingly noting the importance of going beyond efficiency, to apply the Avoid-Shift-Improve[c] approach.[19,26,82,83] The continued absence of a long-term strategy for Ireland limits the opportunities for such a perspective and will impede the ability to transition.

The EPA have described the requirements of such an approach in Ireland, outlining how it requires changes to: (i) evidence and scenarios, (ii) policies and measures, and (iii) governance and investment.[26] These recommendations reflect key findings from the IPCC, through policy experience globally. Long-term national strategies and policy visions must be supported by short-term regional and local implementation plans,[73] with a central role for analysis that supports the broadening of measures. Crucially, in addition to energy switching, and improvements to vehicles, it requires exploring different visions of future settlement patterns, and related sustainable mobility infrastructure, for active and public transport. Historically, a key challenge in Ireland has been the lack of integration of long-term spatial and transport planning on one side (analysis of different settlement patterns and mode options), with energy and emissions modelling for mitigation on the other (analysing energy and carbon efficiency).

a The National Planning Framework considers to 2040, but did not consider transformation paths -the potential for major long-term shifts in settlement and mobility patterns.

b The long life of urban form and transport infrastructure makes them particularly prone to lock-in of energy and emissions pathways, lifestyles and consumption patterns, that are then difficult to change. See IPCC AR5 (Seto *et al.*, 2014).

c The standard policy approach for changing settlement patterns and transport systems that has emerged internationally, is a hierarchy of *Avoid-Shift-Improve*, which uses a holistic and integrated systems perspective. *Avoid* is achieved through spatial planning and demand management; *shift* through moving to active modes of walking and cycling, followed by rail and bus; and, finally, ***improve*** through the energy and carbon efficiency of vehicles. See discussion in EPA (2020).

Long-term studies of the contribution to mitigation of spatial planning and mode transformation - of avoid and shift - have not yet been done in Ireland. Modelling studies of mitigation have focused almost exclusively on BEVs and biofuels, and other energy and carbon efficiency 'improve' measures. This focus on 'improve' measures leaves significant gaps in knowledge on fundamental measures, at the top of the ASI hierarchy, required for a 'sustainable mobility transformation' to a low emission future.[26]

Ireland is expected to experience economic and population growth in the coming years. It also has high emissions per capita, and is exhibiting signs of lock-in to a high emissions path in settlement and transport. These conditions lead to a unique and heightened need to urgently prioritise exploring settlement and modal alternatives, and improving the evidence-base necessary to support this discussion. A priority on avoid and shift measures can afford opportunities for low-cost/ no-cost and high benefit outcomes. These high benefit outcomes cannot be achieved with 'improve' measures alone, and have yet to be analysed in the Irish context.

To make informed policy choices, for a cost effective transition, it is important to have studies that enhance awareness and understanding of the technical and economic potential of transforming settlement patterns, and mode choice, and also to understand the many opportunities to improve people's lives, as Ireland transitions to a low carbon future. A key challenge is to understand the different requirements of urban and rural settings, and of interregional connections. The sustainability implications of different modes[a] and prominent aspects of 'just transition' also arise. Equity is a key dimension of sustainable mobility policy, as private car dominance can favour those on higher income.[84] Enhancing public and active travel therefore has a key role in social equity, but also in providing independence for those with mobility impairments or disabilities.[b] In order to prioritise the necessary areas for improvement of knowledge in Ireland, a high-level national assessment, with respect to key avoid, shift and improve measures, is provided in Table 7.2. The assessment reflects current state of the art in knowledge of climate action internationally.[54,73]

a From dispersed pattern and private car dominated mobility; the economic costs of congestion; capital and emissions costs of vehicle purchase and road building; and poorer traffic safety and public health outcomes. For modal shift, these include low capital costs of increases in cycling, to higher capital costs of rail expansion -but also potential high benefits.

b The National Disability Authority (NDA, 2020) embrace the concept of "*Transport for All*". This is generally accepted across the EU, with public transport and active mode infrastructure playing the core roles for people with reduced mobility. This includes people with more permanent disabilities, but also temporary mobility impairment, due to pregnancy, injury or illness.

ASI	Field	Theme	Gap assessment	Knowledge requirements
Avoid	Spatial Planning	Long-term settlement patterns	Limited to single 2040 path in National Planning Framework (NPF), alternative paths and mitigation potential unknown	Visions of alternative settlement patterns to 2050: 'vibrant village' (compact, sustainable and high quality of life) versus dispersed
Avoid	Integrated Spatial and Transport Planning	Integrated settlement and mobility alternatives	Analysis limited to marginal increase in bus and rail, long-term transformation alternatives and mitigation potential unknown	Scenarios of integrated settlement and mode shift to 2050, considering active and public transport dominance, in addition to existing private car dominance
Avoid	Spatial Planning	Sprawl repair	Limited to 'infill' development in NPF, potential unknown	Study retrofit of compact development, and of active and public transport infrastructure, in existing urban locations
Avoid	Demand management	Pricing and logistics	Studies of carbon pricing, congestion charging and logistics advanced in Ireland	Integrate with long-term spatial and mode studies
Shift	Transport Planning	Active mode walking and cycling	Short and long-term mitigation potential of active mode transformation in Ireland unknown	Study of potential alternatives needed across urban and rural.[a] Short-term gains possible[73]
Shift	Transport Planning	Public transport rail	Long-term mitigation potential of rail passenger and freight transformation in Ireland unknown	Long-term study of rail expansion needed to understand potential, including EU policy[85]
Shift	Transport Planning	Public transport bus	Short and long-term mitigation potential of bus transformation in Ireland unknown	Study of potential needed, including rural bus expansion.[86] Short-term gains possible[73]
Improve	Energy and Carbon efficiency	Vehicles and fuels - private	Study of private car efficiency, Electric Vehicles and biofuels advanced in Ireland	Integrate with long-term spatial and mode shift scenarios. 'Just transition' risks with biofuels[73]
Improve	Carbon efficiency	Vehicles and fuels - public	Short-term study of electric and biofuel options established	Integrate with long-term study of scenarios of public transport expansion

Table 7.2: *High-level assessment of gaps in knowledge for sustainable low-carbon transition of transport in Ireland*

As discussed in last year's Annual Review, heavy-duty, long-haul road freight presents particular challenges for decarbonisation though significant emissions reduction can be achieved through development of a suite of interlocking and consistent policy instruments. These include fuel economy regulations, carbon taxes on transport fuels, road pricing, widespread data-sharing and collaboration

a Active modes were significant in rural Ireland up until recent decades. Sloman et al. (2019) has looked at the investment dimension in England, in both urban and rural settings

across the supply chain as enabled by digital technologies, and sustained investment in research, development and deployment of ultra-low- and zero-carbon fuels and associated infrastructure.

7.4 Built Environment

Here, the Built Environment comprises the residential sector, commercial services and public services. In the 2019 inventory residential emissions accounted for 10.9% of total emissions, with 1.5% each for commercial and public services.[5] This broad sector is sometimes described as 'heat,' as space and water heating are the primary energy demands from these three sectors. In the inventory, 'demand-side' emissions from electricity consumed by these sectors are excluded, as these are attributed to the power generation sector, or 'supply side'.

In 2019, residential GHG emissions declined by 7.3%, while there were small increases in commercial and public services, by 1.8% and 1.2% respectively.[48] A number of aspects influence the change in residential emissions in a particular year, including weather and energy prices. The EPA note milder weather in 2019 would have led to less winter heating requirements, and consequently the reduction in emissions observed.[48] In the long-term, a variety of driving forces act on heat emissions. The preliminary data for 2020 shows that the Residential sector was one of few sectors estimated to have seen an increase in emissions. As a result of the pandemic, residential sector emissions (mainly home heating) grew by 9%, due to people staying at and working from home.[70] In contrast, combined commercial and public services declined by 1.2% in 2020, with temporary closure and curtailment of business a factor.

7.4.1 Residential: inventory, driving forces and projections

The driving forces pushing residential emissions in Ireland include increased house numbers, increased floor areas and decreased occupancy, with drivers limiting emissions including improved 'thermal performance,' and switching away from peat, coal and oil to cleaner, lower carbon energy such as electricity.[77] The tightening of energy efficiency regulations and improved programmes for insulation bore fruit in the residential sector. The improved thermal performance made the residential sector one of the best performing in Ireland, up to the middle of the last decade. However, as can be seen in Figure 7.9, the improvement has since stalled. Energy and carbon efficiency measures have not been sufficient to continue driving a downward trend. When emissions from electricity consumed by the residential sector are included, data from SEAI shows a similar pattern.[71] Analysis of the intensity of residential energy demand per capita by SEAI suggests that consumption was almost double (0.55 toe/capita) the EU average (0.29 toe/capita) in the last year of analysis of 2014.[72] As Ireland has a more temperate climate than most EU comparators, this may suggest relatively poor energy efficiency in national housing stock.

The projections of emissions to 2040 consider measures that existed up to 2019 (existing measures) and the enhanced (additional) measures in the 2019 Climate Action Plan.[72] The existing measures projection considers a number of programmes for renewable heating systems, attic and wall insulation and other energy efficiency upgrades for private households and communities ('Better Energy Homes' and 'Warmer Homes' Schemes, 'Better Energy Communities' Programme and the impact of building regulations). The 2019 Climate Action Plan involves a number of enhanced objectives:

- replace 385,000 residential oil boilers with heat pumps, and a ban on oil boilers (2022) and gas boilers (2025) in new homes,
- energy efficiency programmes involving upgrades to homes, and retrofits to achieve BER 'B2' rating, and,

- addition of 120 GWh of heat from district heating by 2028, growing linearly from 2023.

The 2019 Climate Action Plan projection in Figure 7.9 envisages a decrease by 47% between 2020 and 2030, down to 3.8 Mt CO_2 eq. This projection is based on assuming a full delivery of the enhanced objectives in the 2019 Plan, and that these are successful in delivering enhanced emissions reductions. The targets are challenging. Deep retrofit has a high up front cost which may be difficult for many households to bear particularly where the expected payback period is measured in decades rather than years. In the absence of a long-term plan building buy-in from home owners, the residential rental sector and finance providers, sectoral emissions are seen to rise in the projections after 2030.

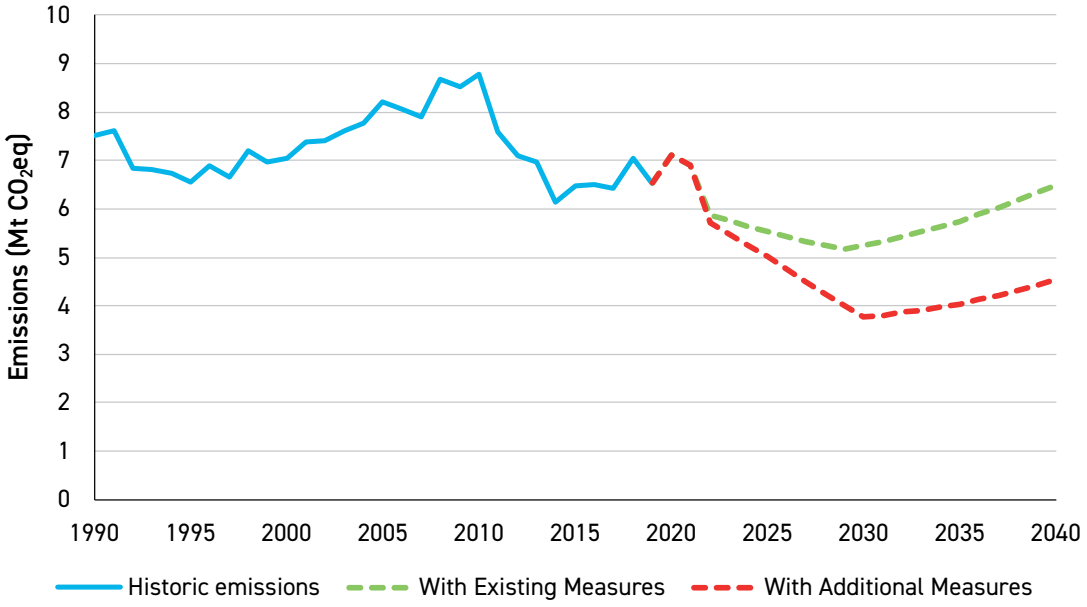


Figure 7.9: *Historic and projected GHG emissions from Residential sector*[5, 49]

7.4.2 Commercial and public services: inventory, driving forces and projections

Emissions from Commercial Services and Public Services both increased, by 1.8% and 1.2% respectively, in 2019, continuing a trend in evidence since 2009.[5] As emissions arise from space and water heating, both are driven by consumer demand for services, by energy choice of technology, and also by the behaviour of occupants. The EPA noted that 2019 showed a drop in public service renewables of 13.7%.

The projection of the Climate Action Plan 2019 (Figure 7.10) suggests that emissions could decrease by 31.8% between 2020 and 2030 to 1.2 Mt CO_2 eq. Similar to the residential sector, this assumes full and successful delivery of renewable heat and energy efficiency programmes in the 2019 Plan. Also similar to residential projections, the lack of actions to reduce emissions after 2030 sees emissions increase once more, as growing activity is not covered by policy for transition. In the existing measures projection this leads to emissions being higher in 2040 than in 1990, with emissions in 2050 unknown.

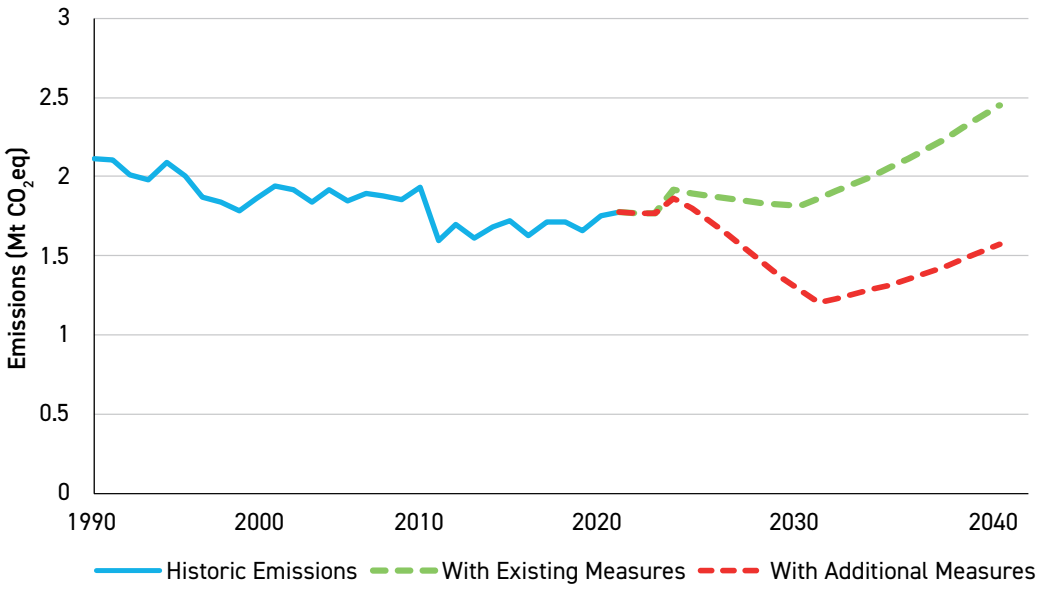


Figure 7.10: *Historic and projected GHG emissions from Commercial and Public Services*[5, 49]

7.4.3 Built Environment: policy and long-term transition

The technical challenge to transition the built environment, sometimes framed as 'heat', requires changes to the building stock to reduce the energy consumed (energy efficiency) and changes to the type of energy consumed, to eliminate fossil fuels by switching to electricity and renewables (carbon efficiency). To meet ambitious mitigation targets requires an acceleration of retrofit, to address the energy and carbon efficiency of the existing stock, the continued application of regulations for the Nearly Zero Energy Building (NZEB) standard, and to use electricity and renewable energy instead of fossil fuels. The poor energy efficiency of older Irish housing suggests this is an important policy area for further development.

Transition of the built environment involves not just technologies and architecture, but behaviour, lifestyle, and culture, which have significant impacts on building energy consumption and related emissions. The holistic approach for demand reduction shows that behaviour can account for up to 50% of emissions reductions by 2050.[73] A holistic approach addresses the importance of programmatic considerations and just transition. Programmatic considerations are core, as improving energy and carbon efficiency of the existing building stock requires: incentives to retrofit; access to capital; addressing bottlenecks in skills and labour supply; and overcoming barriers such as the 'hassle factor' of engaging in improvements, as noted in the UK.[19]

A carbon tax can be used to support action, and for recycling revenue towards funding retrofit activities. Evidence from international review shows pricing is less effective than programmes and regulation, while suggesting both can be complementary.[73] Recognising this, the 2019 Climate Action Plan seeks both to implement programmes to improve thermal performance, and increase renewables, but also to provide the price incentive, which can help address rebounds. While there are useful actions included in the 2019 Plan, there are no policies agreed for post 2030. The actions in the 2019 Plan will not be sufficient to meet the target of 51% emissions reduction by 2030, nor to eliminate emissions before 2050. The implications of the 'Fit for 55' (see Box 5.1) and the National Climate Objective 2050 in the 2021 Act, mean that ambition will need to be ramped up, and measures to accelerate the programme will need urgent consideration. The current policy approach in the 2019 Plan provides no indication of the

intended path to 2050. The implications of the retrofit approach set out in the Government's Housing for All strategy,[87] launched in September 2021, will be considered in future Annual Reviews.

In the interests of just transition, the Council have previously recommended that built environment transition is paid for privately where possible, with government supports prioritised to vulnerable households and then to households where emissions are highest.[19] The residential sector offers an early opportunity to demonstrate the benefits of a just transition, if investment is targeted towards those without access to capital; improving health and comfort, while reducing emissions. A challenge will be driving the rental sector to engage in upgrades, where there may be less incentive for landlords to improve properties. An additional challenge may lie in the need to secure cost-effective cooling for adaptation, recognising the growing risk of heat waves and high temperatures.

7.5 Electricity and energy industries

7.5.1 Context and emissions inventory

This sector is the third largest by emissions in Ireland, but has also been the most successful at reducing emissions. It is often discussed as 'electricity,' as virtually all emissions are from power generation in Ireland, with relatively small quantities from others, such as oil refining, as per Figure 7.11. In 2019, emissions decreased by 11.2%, as coal and peat-fired electricity generation declined, while renewables including wind and hydro power increased.[48] The long-term pattern in electricity, has seen coal, peat and oil-fired generation decline, with increases in lower-carbon gas and zero carbon renewables. The SEAI Energy in Ireland Report notes a number of positive achievements in 2019, with a 70% reduction in coal use in power generation, with wind accounting for 32% of all electricity generated, avoiding 3.9 million tonnes of CO_2 emissions.[88] SEAI highlighted that the carbon intensity of electricity fell to its lowest recorded level in over 70 years.

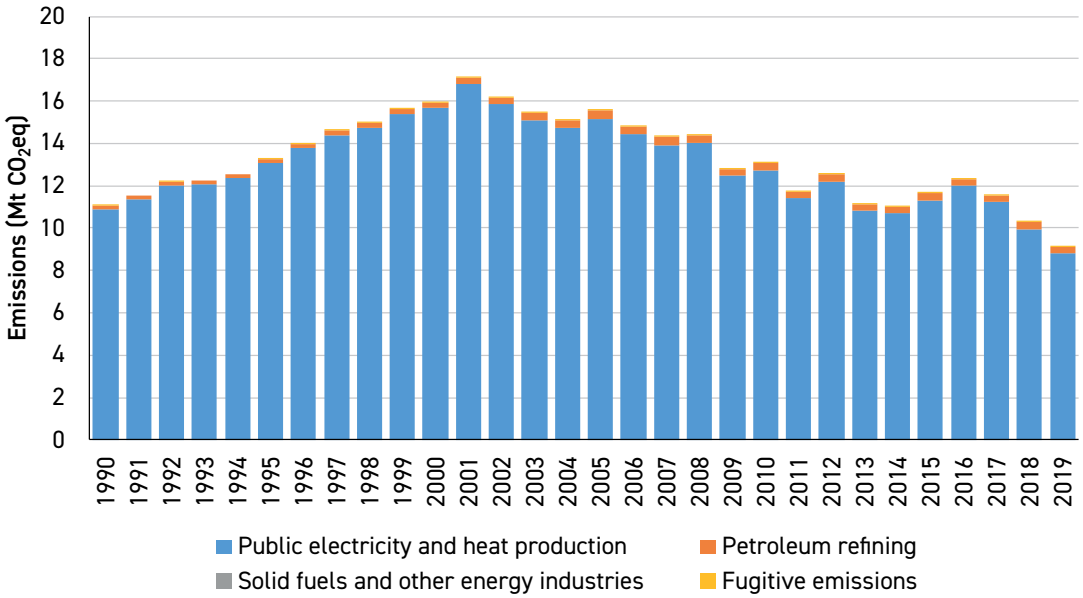


Figure 7.11: *Historic GHG emissions from energy industries including electricity generation*[5]

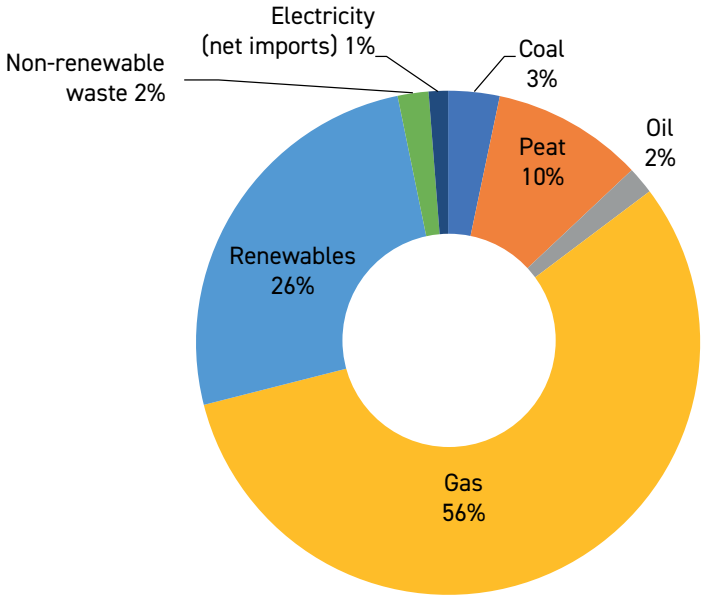


Figure 7.12: *Shares of CO_2 emissions in electricity inputs by fuel type in 2019*[71]

7.5.2 Electricity driving forces

The driving forces behind emissions from electricity can be considered from demand and supply side perspectives. On the demand side, economic growth and more affluent lifestyles can drive demand for energy from homes and businesses. Shifts in behaviour, such as increased appliance use and shifts in the structure of the economy, e.g. new data centres, drive demand. Policy or technology choices also influence demand, including increased electrification of heat and transport. Eirgrid expect a significant increase in electricity demand driven by large energy users up to 2025, and electrification of heat and transport up to 2040.[89] In this context, security of supply is critical.

On the supply side, the source of energy to generate electricity is the biggest determinant of emissions. The choice of energy source, whether renewable sources such as wind or solar, or fossil fuels such as gas, oil, coal or peat is driven largely by fuel prices on international markets, the carbon price in the EU ETS or domestic policy for energy security and emissions reduction. The efficiency of electricity generation installations and of the distribution network are also relevant. As technology has evolved globally, the costs of renewable energy options are falling significantly and improving their performance.[73] National and European policy, corporate policy, and carbon pricing mechanisms such as the EU ETS, can assist the push away from fossil fuels: peat; coal; oil; and gas, to renewable and low-carbon energy. Ireland has a long history of hydro power production, but has major opportunity for growth in wind, due to available resource on land, and off-shore. Further opportunities exist in solar, marine and decentralised energy. Storage and demand-responsive supply solutions will be important to maintain a secure electricity supply in future.

7.5.3 Projections of future emissions

The WEM scenario[59] sees emissions from electricity reduce by 19% from 2018 to 2030 (-1.9 $MtCO_2$ eq). The WAM projection (which includes elements of the 2019 Climate Action Plan) envisages a decrease in emissions by 36% (-3.6$MtCO_2$ eq) over this period. As can be seen in Figure 7.13, both projections show a rising trend in emissions from 2028 onwards, as increases in electricity demand outpace additional measures to reduce emissions.

Key differences between the two projections include the levels of wind power in electricity production by 2030, and in the closure of Moneypoint coal-fired power plant. The 2019 Climate Action Plan projection increases the 2030 wind generation from 55% (with existing measures) to 70%, and sees Moneypoint coal-fired plant retire one year earlier in 2024.

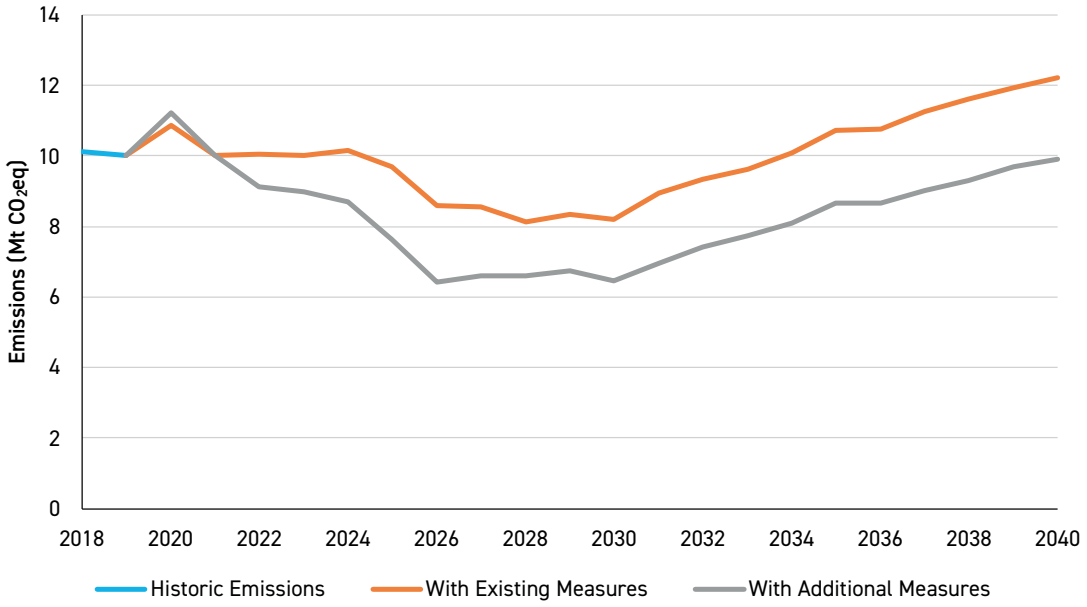


Figure 7.13: *Projected GHG emissions from electricity and public heat*[49]

7.5.4 Electricity: policy and transition

It has been concluded with strong evidence internationally, that the replacement of fossil fuel based energy systems (peat, coal, oil and gas), is necessary to reach climate goals.[73] Electricity and energy industries are expected to decarbonise more rapidly than other sectors, and low emissions scenarios are dominated by technologies including renewable energy and Carbon Capture and Storage (CCS). For deployment at scale, CCS remains expensive globally and remains unproven for application at scale in powerplants.[a] As renewable energy has already become cost competitive with fossil-generated electricity in many locations, it is central to low emissions outcomes.[54]

Ireland's island context means that it has specific needs in developing a carbon neutral, secure and affordable electricity system, but it also provides unique opportunities. To engage with the strategic issues, Ireland's Transition System Operator, Eirgrid, have produced a set of alternative long-term scenarios, of possible outcomes if there is policy change.[87] One of the scenarios, 'Coordinated Action,' explores achieving a carbon neutral electricity system in Ireland by 2040. This path would require a waypoint achievement of 70% renewable electricity by 2030 — the target in the 2019 Climate Action Plan. Eirgrid noted in 2019 that this would require a doubling of the recent connection rate for renewables. Other important technical and policy issues include:

- the need for grid development and increased interconnection;
- the potential of renewables, particularly off-shore wind;
- demand management;
- micro-generation by consumers;

a Bandilla, K. (2020) Carbon Capture and Storage https://www.sciencedirect.com/science/article/pii/B9780081028865000311

- storage of electricity; and
- potential use of CCS.

The electricity sector has been Ireland's best performing sector in terms of absolute reductions in emissions to date. It is important that this progress continues, so that it can support low-carbon electricification of transport and heat. The 2019 Climate Action Plan included important measures to deliver emissions reductions to 2030, but shows a notable gap in policy in the post 2030 path. As the EPA projections demonstrate,[59] Ireland is not currently on this potential path to achieve emissions neutrality, demanding development of coordinated long-term policy.

Eirgrid caution that without strong impetus for investment in deep decarbonisation technology, large volumes of CO_2 will be locked into the system for another thirty years. There is a role for coordinated technology policy from government institutions, in addition to pricing carbon in the ETS to deliver this low carbon transition.[19]

The strategic opportunities offered by renewable energy in Ireland are significant. The sector offers new opportunities for employment while creating savings on imports of fossil fuels, which also drive emissions. Energy exports are also a possibility, including proposals from ESB to shift activities at Moneypoint towards hydrogen production.[a]

In developing on-shore wind and upgrading the grid, bringing the public along is an important part of just transition, and will help realise the opportunities. This requires attention to public participation, and also to community gain, including the potential of rural cooperatives — a common model in other EU countries.[b] Given the ambition for this sector to 2030, greater efforts and innovative approaches are required to ensure public participation in and acceptance of the infrastructure development.

7.6 Other sectors

7.6.1 Context, inventory and driving forces

This section includes Manufacturing combustion; Industrial processes; Flourinated gases; and the Waste sector. Manufacturing combustion involves emissions from the burning of fossil fuels in production usually for heat, and accounted for 7.7% of total national GHG in 2019. In Ireland, Industrial Processes emissions are dominated by the manufacturing of cement, which accounted for 3.8% of total emissions in 2019. Flourinated gases and Waste each accounted for 1.5% of emisisons in 2019. Flourinated, or 'F-gases', are synthetic gases found in a diverse range of products and industrial processes, as noted in Chapter 4, and are dominated by refrigeration and air conditioning.[47] The Waste sector includes emissions from solid waste disposal sites, wastewater handling, and incineration of waste not used for energy recovery. Emissions from the Waste sector are dominated by the methane that arises as the organic waste deposited and sealed in landfills.

In 2019, the EU ETS covered 80.3% of manufacturing combustion and industrial process emissions in Ireland. The remaining 19.7% of emissions from these sectors including F- gases and Waste, come under the EU Effort Sharing Regulation and national policy measures.[c] Trends in historic emissions from each of these sectors are shown in Figure 7.14. Emissions from manufacturing combustion peaked in 2005; emissions declined during the recession to a minimum in 2011 but have been on an upward trend since.

a ESB's 'Green Atlantic' proposal for Moneypoint, in 2024, includes plans for Hydrogen production from renewables, demonstrating transition as opportunity.

b See the European federation of citizen energy cooperatives: https://www.rescoop.eu

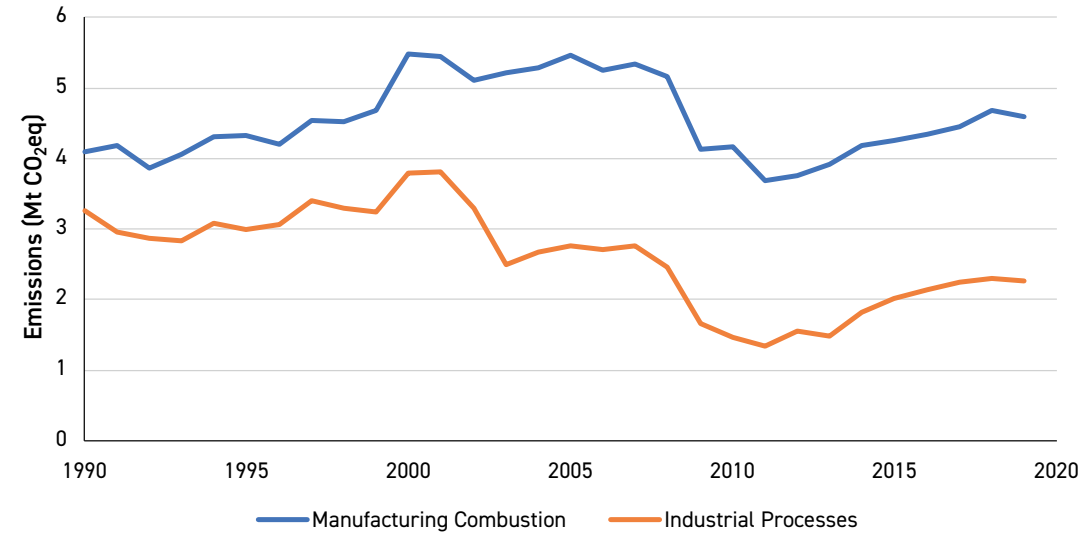
c Perfluorocarbons (PFCs) from the production of aluminium are covered under the EU ETS.

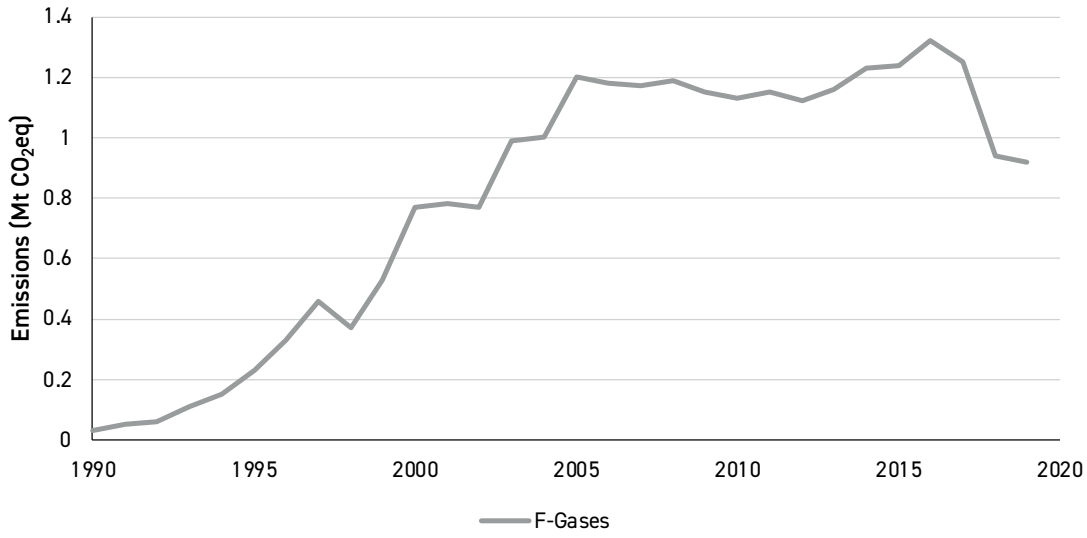
Emissions from industrial processes have a similar pattern, attributable both to increases in activity but also due to structural change. The closure of some chemical industry plants led to an earlier sharp reduction in emissions in 2001, while a drop in construction activity during the recession led to decreased cement production. The more recent increase in construction activity has pushed cement emissions upwards since 2012. Although a relatively small proportion of total emissions, flourinated gases have increased steadily until 2016, with increased use in refrigeration and air conditioning. The main cause of the more recent decline in f-gases has been the phase out of high global warming potential (GWP) gases under the 'F-Gas Regulation' (EU No. 517/2014).

Emissions from the waste sector declined significantly from 1990 to 2009, attributable to two causes: a change in the volume and type of waste sent to landfill, due to improved recycling and composting rates, and improved management of landfill greenhouse gases, avoiding fugitive emissions. The avoidance of fugitive emissions was enabled through regulation for recovery of methane on site, which in some cases is 'flared', or burned off to the atmosphere, and in other cases it is used as a fuel source for electricity production. These emissions reductions were also likely a result of policy changes such as the Landfill Directive (Directive 1999/31/EC on the landfill of waste), and license requirements for landfills, which saw a gradual decline in the number of active landfills since the 1990s.

Since 2009, there has been a slight rise in emissions from the waste sector, but not as much as would be expected given recent increases in waste generation. These emissions figures may be reflecting the shift away from disposing of residual waste in landfills, and increased capacity for incineration nationally (as of 2020, only three active landfills accept municipal waste in Ireland).[90] The waste sector is significantly affected by increased rates of material consumption, and data from the EPA demonstrate that while there have been some improvements in recycling and composting rates, this has not been enough to offset the overall increases in waste generation in Ireland, which consistently fail to decouple from economic growth.[88]

The 2020 Waste Action Plan for a Circular Economy[91] reiterated the link between the circular economy and climate action. The Circular Economy Strategy[92] supported by the Circular Economy Bill 2021[93] will provide national policy framework for Ireland's transition to a circular economy, and provides a whole of government approach to reduce waste impacts on the climate. Regulation and technological change can, when combined, induce notable reductions in emissions.


Emissions (Mt CO_2eq)
0
1
2
3
4
5
6
1990
1995
2000
2005
2010
2015
2020
Manufacturing Combustion
Industrial Processes


Emissions (Mt CO_2eq)
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1
1.2
1.4
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1995
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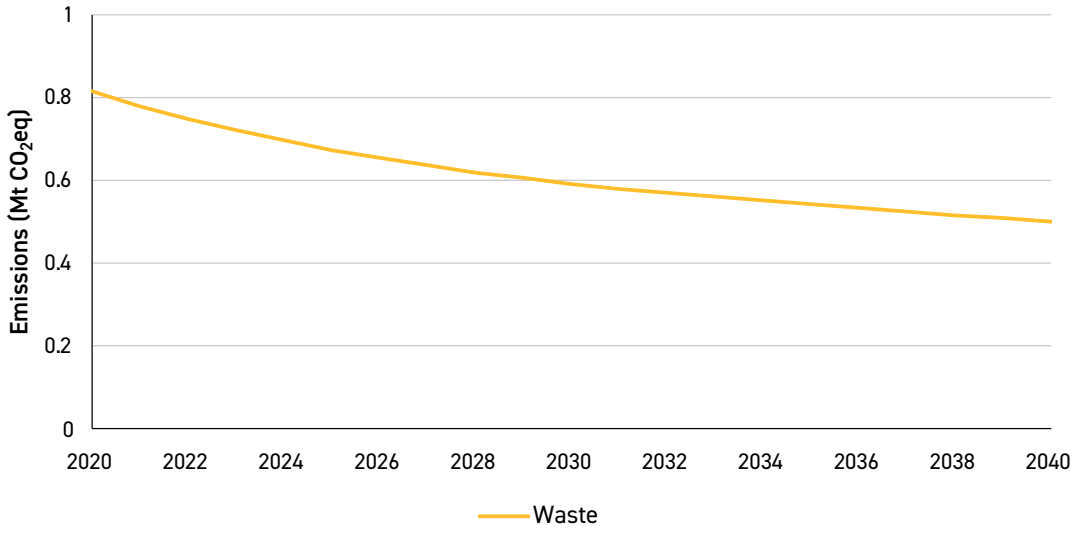
2020
F-Gases


Emissions (Mt CO_2eq)
0
0.2
0.4
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0.8
1
2020
2022
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2034
2036
2038
2040
Waste

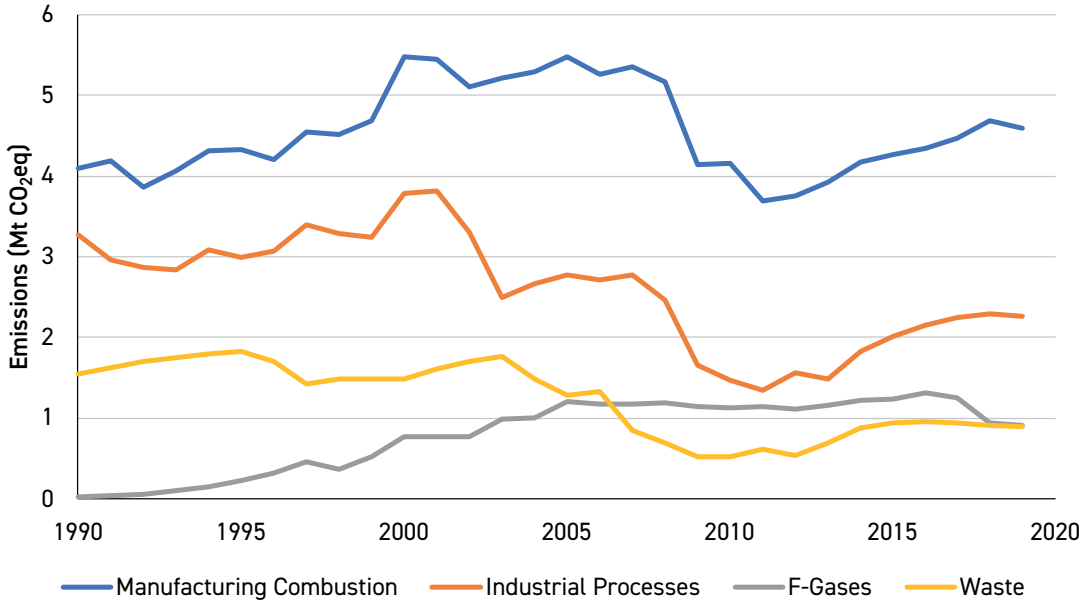

Figure 7.14: *Greenhouse gas emissions from industry, waste and F-gases*[5]

7.6.2 Projections of future emissions

The projection of industry and others under the WAM 2019 Climate Action Plan scenario is presented in Figure 7.15. Under both projections, increases in manufacturing activity lead to increases in combustion emissions. The difference between the two scenarios is the projected implementation of more energy efficiency measures envisaged in the 2019 Plan.

For Industrial Processes, there is no difference between 'with existing measures' and 'with additional measures' projections. Both projection scenarios envisage an increase in activity leading to increases in emissions, dominated by the cement sector. This highlights the need for innovation in both technologies and policy.

There is also no difference between the two scenarios' projections of Waste emissions, with increased diversion of waste from landfill, to recycling and composting, delivering reduced emissions. The projections of the F-gases show reductions, with the Climate Action Plan projection assuming a higher technological shift towards the use of alternative gases in air conditioning units and heat pumps.

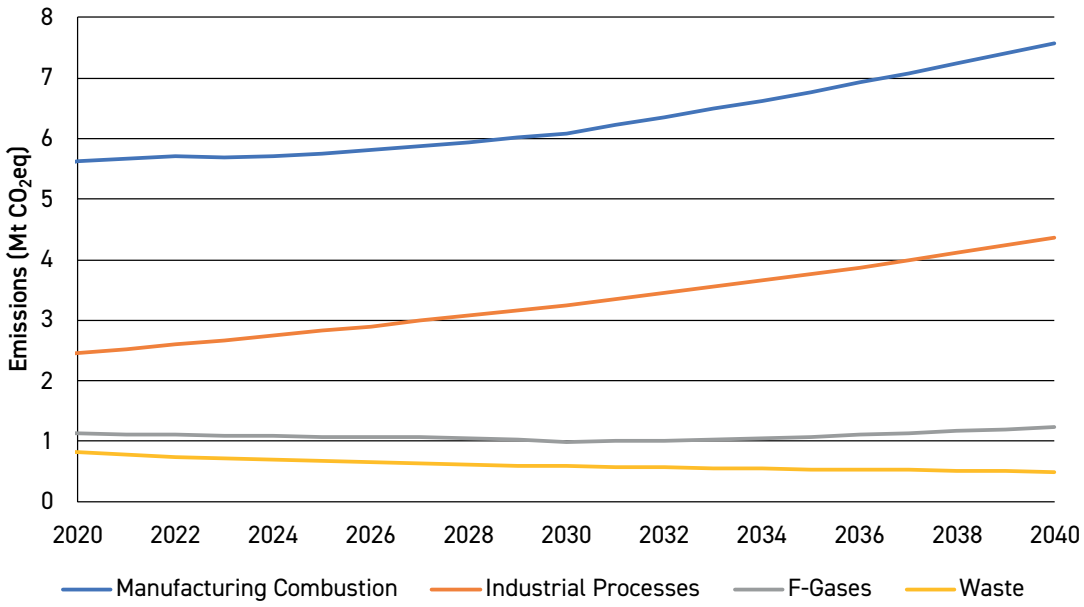

Figure 7.15: *'With Additional Measures' projection of 2019 Climate Action Plan for industry and others*[47]

7.6.3 Other sectors: policy and transition

Long-term low-carbon transition policy options for industry are well documented in the technical literature.[73] They include shifting the structure of the economy and demand reduction through behavioural choices for sustainable consumption. Technical options include changing product lines and process designs towards less resource- and energy-intensive and circular economy systems, and changing technologies to more energy- and carbon-efficient forms. Carbon efficiency can be improved by moving from fossil fuel consumption for processes on-site, to electricity and renewables. Cement is identified as a 'hard-to-decarbonise' sector, where the alternatives need to be demonstrated and tested, cost-effective and adopted by the construction industry.[73]

The decrease in emissions in manufacturing combustion and industrial processes, starting in 2001, were primarily due to the closure of chemical plants. Activity decreased further during the recession but has since increased and emissions are projected by the EPA to continue to increase into the future. The 2020 Annual Review noted at the time that the carbon price signal in the ETS had been too low to support decarbonisation.[19] This carbon price signal has since increased considerably.

The Waste and F-gases sectors have both demonstrated how some discrete sectors and gases can be more amenable to policy and regulatory change, to push shifts in practices and technologies towards emission reduction. There is a clear challenge to the other sectors considered in this section. Measures to improve efficiency of production have not been sufficient, and have been overwhelmed by absolute growth in production. For deep decarbonisation, innovation is required more than energy and carbon efficiency.[73]

8. Significant cross-sectoral developments

Chapter 8 Key messages

- Just transition is crucial and must be considered beyond the energy sector. Lessons from the experience in the Midlands should be identified.
- Public participation is vital to just transition, and for effective climate action. To maximise the potential of the National Dialogue, enhanced efforts are needed, supported by appropriate resources.
- Carbon pricing is a useful tool, in which Ireland has made progress. Council welcomes the increase in the carbon tax in Budget 2022, and the commitment to earmark the additional revenues for climate action and just transition.
- Forestry and soils will require significant enhancements if they are to deliver negative emissions in the coming decades. Regardless of policy and action in the short term they will remain a net source up to 2030. Other negative emissions technologies will need to be developed and deployed.
- Enhanced resources should be secured on a continuous basis for analytical capacity, recognising the importance of research and evidence based decision making, as the scale and pace of transition widens and accelerates.

The following highlights developments in a number of headline cross-sectoral themes of most relevance to our carbon neutral, climate resilient transition.

8.1 Sustainable Development and the UN SDGs

The IPCC have highlighted that sustainable development is fundamental to long-term low-carbon transition.[54,73] Sustainable development provides a lens to consider just transition and work, and all topics referenced in the Climate Action and Low Carbon Development (Amendment) Act 2021. Implementing sustainable development, and related climate action, involves mainstreaming action across all of public policy, rather than limiting efforts to energy and emissions.

To implement the UN 2030 Agenda for Sustainable Development[54] and its 17 Sustainable Development Goals (SDGs) in Ireland, 169 targets related to the goals have been devised in the first National Implementation Plan (2018-2020), with the second plan due in 2021.

Internationally, the UN High-level Political Forum is responsible for follow-up and review of the 2030 Agenda. Countries are encouraged to review implementation of the SDGs regularly, and to present Voluntary National Reviews at the High-level Political Forum. Ireland presented its first Voluntary Review at the Political Forum in July 2018, with the second expected in 2022.

A new research project funded by the EPA has examined interactions between the SDGs, to enhance policy coherence for sustainable development.[94] This approach recognises that transition policies can support multiple social, economic and environmental goals, as win-win outcomes, or can create conflicts. It is therefore crucial that Government identifies and maximises these synergies, and minimises trade-offs.[54]

8.2 Just transition

'Just transition' and 'climate justice' are both cited in the Climate Action and Low Carbon Development (Amendment) Act 2021. The Council's proposed carbon budget programme has regard to climate justice, as required under the Act.[3] Just transition is noted in the Paris Agreement and can also be related to the overall agenda of the UN SDGs. Just transition is relevant to livelihoods, where carbon intensive economic activities become subject to increased pressure for transition. It also encompasses the need to ensure that poorer households do not bear the burden of policies to reduce emissions and also that the benefits of transition and Government supports are shared equitably.

The focus of the Just Transition Commissioner in Ireland has been the Midlands, to assist workers as peat extraction ceases, and peat-fired power stations close. In 2020, the Commissioner published his first, second and third progress reports.[95,96] The Commissioner has noted lessons learned including the need for a strategic approach to implementation at the local and regional level. The Commissioner has emphasised the core role for the Regional Spatial and Economic Strategies, strategic partnerships and a focus on consultation and collaboration.[94,97] The Government update documents €177 million of national funding for the midlands region. Key initiatives include:

- €108 million for peatland restoration,
- €20 million for the Midlands Retrofit Programme for local authority homes and,
- €10 million support for 35 innovative and employment generating projects in the Midlands.

This range of projects illustrate priorities on livelihoods, public housing, biodiversity and economic innovation. A national fund of €77 million has been secured from EU Just Transition Funds.[98] This will be underpinned by the national Territorial Just Transition Plan, which is expected to be completed by the end of 2021.

Just transition plans are in their infancy, and will need to expand beyond the energy sector and beyond the Midlands.

8.3 Participation

The previous Annual Review[19] noted that there needs to be a coherent focussed approach to public participation, in terms of both mitigation and adaptation. Discussing progress in the early development of the National Dialogue on Climate Action, the Review considered that the impact has been somewhat limited and local in scope. While recognising the challenges of the COVID-19 pandemic for participation in 2020, a more strategic approach to build evidence on behavioural change, engage with stakeholders and secure public participation has been deemed necessary by Council alongside new methods of engagement with a wider stakeholder base.

8.4 Carbon pricing

Carbon pricing involves putting a price on greenhouse gas emissions, such as carbon dioxide (CO_2) from fossil fuels, so that the price of goods and services includes the cost of the emissions related to their consumption. Ireland employs the three main carbon pricing approaches; taxing carbon, emissions trading and shadow pricing.

8.4.1 Carbon tax

The Irish carbon tax applies to carbon dioxide emissions from liquid and solid fossil fuels, including petrol and diesel, coal, peat briquettes, heating oil and gas. Carbon taxes can be used to support the 'policy portfolio' for transition, including the regulatory and technology policies necessary to deliver cost effective emissions reductions.[54,99,100,a] Carbon taxes are useful to prevent rebounds in fossil fuel consumption if the price of fossil fuels drops and can act as a source of funds to protect the vulnerable[19] and to invest in transition. The Annual Review 2020 recommended that the carbon tax be raised to €35 per tonne of carbon dioxide equivalent in Budget 2021, noting that negative impacts on the poorest households can and should be offset by effective use of the carbon tax revenue. A working paper released in 2020 by the ESRI proposed that using a third of revenues from the carbon tax, targeted to increase welfare payments, can reduce poverty, as a progressive measure that leaves people better off.[101]

Following the announcement on 12 October 2021 of Budget 2022 the carbon tax increased by €7.50, from €33.50 per tonne to €41 per tonne, with a commitment to rise up to €100 per tonne by 2030. The Department for Public Expenditure and Reform estimated the total revenue from the carbon tax available for investment in climate action in 2022 to be €412m.[102] This carbon tax revenue has been earmarked for:

- Investment in Residential and Community Energy Efficiency €202m,
- Targeted Social Protection Interventions €174m, and,
- Continuation of 2020 Carbon Tax Investment such as €21m for the fuel allowance, €5m for Peatlands rehabilitation, €9m for greenways and urban cycling, and €6m for the Just Transition fund.

The Council welcomes the increase in the carbon tax in Budget 2022 and the commitment to increase the carbon tax in line with previous Council recommendations, and the provisions for targeted spending of revenue to protect those on lower incomes is noted.

The Council also welcomes the progress made by the Department of Finance and the Department of Public Expenditure and Reform in green budgeting analysis for Budget 2022.[103]

8.4.2 The EU Emissions Trading System (EU ETS)

The EU ETS places a price on carbon from electricity plants, large manufacturing industry, as well as intra-EU flights. A cap is set on the total amount of CO_2, N_2O and PFCs that can be emitted by the installations covered by the system, with the cap reduced over time, thus requiring total emissions to fall. Within the cap, installations buy or receive emissions allowances, which they can trade with one another as needed. Following the reform of the EU ETS in 2018, the reduction of 'free allowances' and the ambition set out in the proposals for 'Fit for 55', the price of carbon has doubled in 2021. While the EU ETS has contributed to reducing emissions in the EU, progress in Ireland has varied across sectors (see Section 7.6). The Council previously expressed concern about the weak price signal[19] but this has markedly improved in the past year. Further analysis will be required to determine the effectiveness of the reformed EU ETS to assist Ireland in meeting its goals for 2030 and 2050.

a Global policy assessment from the IPCC considered studies demonstrating that a mix of policies, including stringent energy efficiency, can be more cost-effective than a carbon tax alone (Rogelj et al., 2018).

8.4.3 Shadow pricing

Shadow pricing is the technique of applying a cost to greenhouse gas emissions, in the assessment of investments, and can be implemented in private or public assessment, to guide better decisions. For appraisal of public investment in Ireland, the higher price of emissions was set in circular 18/2019.[104] The Council notes that the cost of carbon currently applied in expenditure appraisal is €100 in 2030 and €265 in 2050 for non-ETS emissions, with a lower cost applied to emissions within the EU ETS sector (the Council considers that the pricing for EU ETS carbon will need to be revisited in the light of rapid price increases this year). Completing a robust approach to appraising investment has additional requirements, noted in international review by the OECD.[105] Recent peer reviewed papers highlight that Ireland needs to lengthen the time horizon of analysis,[106] and reduce the discount rate.[107] These changes would facilitate the full value of emissions costs being included in assessment, bringing national practices for appraisal into line with those internationally in comparable nations.[75]

8.5 Finance and investment

Finance and investment can become an economic enabler of transition, if it is re-directed from carbon intensive 'brown growth' to low emissions 'green growth'. This process of re-directing and increasing finance and investment has roles for both public and private actors. Public investment programmes can be transformative when aligned with climate and sustainability goals.[98] However, public financing and investment alone will not be sufficient to deliver on the national climate objective ambition.

The European Commission aims to mobilise public and private financial resources to support around €1 trillion in green investment, through the European Green Deal Investment Plan (EGDIP) - also referred to as Sustainable Europe Investment Plan (SEIP) — including a Just Transition Mechanism. The role of private investment is crucial due to the need for alignment of private finance and investment with climate goals, it's role in supporting innovation, and also due to the scale of investment required. Tools being employed to encourage this alignment include carbon taxes, climate risk disclosure and the EU taxonomy of environmentally sustainable economic activities.[a] Robust implementation is required to ensure such tools are effective, in particular to avoid accusations of 'greenwashing'.

The challenge of leveraging finance, for the scale of investment required, has led to an increase in activity in 'green bonds', where the proceeds are exclusively applied to finance new or existing green projects. The first Irish sovereign green bond issue came to market in 2018, with an issuance size of €3 billion, and a 2031 maturity. Subsequent issuance of this bond in 2019 and 2020 raised an additional €2 billion and €1 billion respectively. This initiative is generating a multibillion euro finance stream for investment in priority sectors, such as public transport.[108] This bond market sector, originally dominated by Supernational and Country issuers, has seen considerable growth over 2019/2020 with extensive issuance from an array of industry sectors. The increasing need for sustainable investment driven by both regulatory requirements and public demand, underlines the likely trajectory for green bond issuance. Recent developments in the EU Green Bond standards requiring use of proceeds to align with the EU Taxonomy Regulation should provide investors with additional transparency and assurance and underpin increased growth in demand for green bonds and increased issuance in 2021. This could be a significant source of funding for Ireland's low carbon transition.

The Annual Review 2020 noted that Irish retail banks have been slow to become active in providing 'green finance' or loans for investment in sustainability to individuals or small and medium enterprises.[19]

a See: https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

However, it is now possible to access green loans for certain activities such as purchase of an EV or purchase of an energy efficient home in some retail banks, credit unions and non-bank finance providers in Ireland (e.g. An Post). While this is positive, more development of sustainable financing is required. Given the need to leverage public financing and investment to address climate adaptation and mitigation, consideration should be given to broader application of blended finance models and investment platforms using EU Green Deal and private capital.

8.6 Negative emissions

In advice to government on carbon budgets, Council has previously noted the importance of negative emissions, also known as carbon dioxide removals, to meet the temperature goal in the Paris Agreement, limiting temperature increase to at most 2°C and aiming to keep temperature change below 1.5°C. The Council's proposed carbon budget programme includes provision for LULUCF while the Council emphasised the need for investment in negative emissions to meet the national transition objective by 2050. The EPA State of the Environment Report 2020 highlights that in addition to the development of scenarios to reduce fossil carbon emissions to zero, emphasis must be placed on the development of a 'removals' pathway to 2050.[26] The report notes that a focus on forestry-based solutions needs to be complemented with technologies such as direct air capture and bioenergy with carbon capture and storage, neither of which have yet been proven at scale. The Annual Review 2020[19] noted the article by McMullin et al.,[109] considering the negative emission options for Ireland. Using increased forestry and enhanced soil carbon sequestration are identified as currently available approaches to remove CO_2 from the atmosphere.

Section 7.2 of this Review has highlighted afforestation as an urgent issue for policy attention in Ireland, in keeping with the 2020 Annual Review.[19] Land-use is currently a net emitter in Ireland, but has the potential to become a net sink, if a comprehensive programme is devised to address low rates of afforestation, alongside peatland rewetting and restoration. This could align with reducing emissions from agriculture, by diversifying economic activity. If designed and implemented appropriately, it could also be used to support rural development and improve farmers' incomes. However, it will need to be carefully managed in order to avoid biodiversity and water impacts. There is also potential to use forestry and peatland rewetting and restoration to support natural flood management[110] integrating mitigation and adaptation, as is discussed in Chapter 3.

The EPA projections highlight, that based on current trends, forestry is set to become a net emitter before 2030.[59] As increasing well-targeted afforestation is associated with a number of win-win outcomes, it demands urgent and sustained attention from policy, to devise measures that can deliver on potential, and embrace the variety of policy objectives, whilst safeguarding against unforeseen negative impacts on water and biodiversity.

8.7 Zero-carbon fuels

The EPA State of the Environment Report 2020 considers that the elimination of fossil carbon dioxide emissions is a necessary part of transition, involving systemic, institutional, technological and financial barriers.[26] Zero-carbon fuels (e.g. green hydrogen, biofuels from sustainable sources) offer a potential approach to deep decarbonisation of the electricity and gas networks, heavy duty vehicles and the industrial sector. Planning needs to start now to realise the potential at scale.

As demand increases for zero-carbon fuels, this creates more potential for low-carbon economic activity. As discussed in Section 7.5.4, the plans announced in 2021, to shift activities at Moneypoint towards

production of hydrogen from renewable wind energy, offer an opportunity for sustainability innovation in the structure of the economy. Just transition requires consideration of how this new employment can benefit the local community, as carbon intensive activity ceases.

8.8 Climate research

Knowledge must be continually improved as the transition unfolds, to support better decision making by policy makers, citizens and by business. The IPCC reports demonstrate the voluminous research that is available at the global level, regarding our changing climate, and on the systems, practices and technologies that can deliver sustainable and resilient low emissions outcomes. Ireland has a role to play in improving this global knowledge, and also in translating it to the national level. The EPA State of the Environment Report 2020 notes the importance of national and international research on the physical science of climate change, adapting to impacts and in 'mitigating' or reducing emissions.[26] The report notes that further research is required to support the implementation of policies and plans, to set Ireland on a path to climate neutrality and climate resilience by 2050.

Research on climate action and climate change is a public good, that requires funding support from both public and private sources. It can contribute to informed policymaking and prioritisation of actions, and is a necessary input to policy, if it is to be evidence-based. The Climate Research Coordination Group (CRCG), established by the EPA, consists of government departments, state agencies and local authorities. The CCRG reports annually on national progress in climate change-related research, in terms of funding disbursed. The group's third report,[111] highlighted 84 new climate related research competitive awards were made during 2020, with a budget commitment of €21 million. This is in comparison to 2019, which saw 72 new awards, with a total budget commitment of €23.1 million. The report also noted, that in 2020, the Irish research community drew down a further €36.2 million from EU sources, for climate-related research projects, against €49.3 million in 2019.

In order to provide an assessment and synthesis of key findings from funded research in Ireland, the Interim 2021 Climate Action Plan has established a requirement for a national report every five years. The first national five-year assessment of climate research activities (5YAR) in Ireland has been initiated by the EPA, and is due to be carried out over the period 2021–2023. The objective is to deliver an assessment of our understanding of climate change based on scientific research and systematic observations in Ireland, and linked EU and global analysis. The assessment will provide, in a timely manner, the knowledge required for decision making to address climate change. It will build on and localise information contained in the IPCC Sixth Assessment Report and focus on Ireland specific challenges and opportunities.

The Irish academic community has recognised the need to work together across the island of Ireland to further research into the climate and biodiversity crises and their solutions. The All-island Climate and Biodiversity Research Network includes membership from all universities on the island and many of the SFI research centres and has produced a green paper for consultation.[112] The green paper calls for sustained funding that can support ongoing collaboration across disciplines and institutions to foster long-term collaborations, answer the most pressing research questions, and train the scientists and experts required to enable the transition, and ultimately increase the impact of Irish research at European and global levels.

A positive correlation between countries' preparedness for climate change, and their publication numbers, can be shown.[113] The importance of research is recognised, for understanding physical science, impacts and adaptation, and transition through sustainable development and climate action. Considering key

areas for capacity-building in Ireland will be beneficial, to highlight those areas requiring enhanced resources though long-term, multi-annual rather than short-term ad hoc approaches, as transition accelerates, and policy needs evolve.

9. Advice on cost-effective achievement of the National Climate Objective

Chapter 9 Key messages

- Delivering on a cost-effective transition requires urgent action, guided by a comprehensive long-term strategy, to facilitate sustainable development and emissions reduction. Council emphasises that comprehensive and timely implementation of policy is key, in addition to the enhancement of actions that will be required for consistency with 2030 and 2050 goals.
- Ireland has not yet published a Long-Term Strategy. Council is concerned about potential higher cost implications of delay in long-term action, requiring deeper and more costly cuts in emissions later. Council considers it necessary for government to adopt a Long-Term Strategy, that is comprehensive and integrated with key policies across the range of relevant sectors.
- Topical examples of challenges that need to be addressed in the Long-Term Strategy are decarbonising difficult sectors such as freight and industry, managing the full decarbonisation of the electricity supply and, within agriculture, divergent signals from market forces and policy objectives.
- The Climate Action Plan 2021 contains significant actions and ambition across all sectors of the economy. The funding requirements will be very challenging for the state, businesses and households.
- Despite the ambition of the Climate Action Plan 2021, a gap of 4 Mt in emissions reductions remains outstanding, relative to the 51% target by 2030 articulated under the Amendment Act. Urgent action is needed to identify the solutions to this shortfall so as to incorporate them into the updated Climate Action Plan in 2022.
- The Council notes that investment in research can support a more cost-effective transition to proceed across all sectors, on an informed basis.

9.1 Cost-effective approaches

The Council is mandated under the Climate Action and Low Carbon Development Act to provide advice on cost-effective approaches to achieve the national climate objective.

Recognising the need to enhance climate action in Ireland, the Climate Action and Low Carbon Development (Amendment) Act 2021, was commenced in September of this year. The legislation provides the framework within which climate action will be achieved in Ireland in the coming years.

This chapter provides preliminary advice in the context of the recent publication of the Climate Action Plan 2021 in November 2021 (the first under the amended legislation) which it considers to be a vital next step in the roll out of ambitious climate action in Ireland.[a] However, the detailed Annex of Actions accompanying the Climate Action Plan and setting out timelines and responsibilities was not available at the time of finalising this report and therefore the implementation plan will be considered in more detail by the Council over the coming months. The Council urges a focus on implementation of the Plan, particularly given the gap in delivery against previous targets as outlined earlier in the Annual Review.

a Box 6.1 outlines the relationship between the initial Climate Action Plan 2019, Interim Climate Actions 2021 and the Climate Action Plan 2021.

An ambitious target of a 51% reduction of emissions by 2030 relative to 2018, required by the legislation, has been set out in the carbon budgets proposed by Council, and it is now time to focus on the delivery of this ambition. The Council's proposed carbon budget is supported by economic analysis of the transition for Ireland. The Council has stressed that the carbon budget programme for the decade requires immediate action and investment in the first period in order to deliver the accelerated reductions in the second carbon budget period which are required to meet the 2030 target of a 51% reduction relative to 2018.

As set out in the Carbon Budget proposals to the Minister there is a compelling need for a significant upscaling in the levels of investment across all relevant emitting sectors. Ireland is rarely found wanting in respect of the delivery of strategic plans but what is now required is a relentless focus on the implementation of the actions listed in the plan. There needs to be a very strong emphasis on those elements of the plan which enable urgent investments in renewable and other technologies that deliver the largest emissions reductions, led by all of Government on a sustained basis.

9.2 National knowledge and advice

The following draws on analysis in Chapter 7 and discusses potential cost-effective measures in each of the five sectors while reflecting on the proposed actions contained in the Climate Action Plan 2021. The chapter concludes by discussing the need for a Long-Term Strategy to ensure cost-effective transition.

9.2.1 Agriculture and Land Use

Generally the approach taken in the recently published Ag Climatise National Climate and Air Roadmap for the Agriculture Sector[114] has been criticised for an apparent lack of ambition, with the EPA noting that while the 2019 Climate Action Plan contained a commitment to significantly reduce GHG emissions, the Food Vision 2030 strategy was insufficient, and noting that any further plans to expand the dairy herd were unsustainable pending evidence for, and implementation of, effective solutions to reduce emissions. However, it contained some positive elements such as the promotion of organic farming, a commitment to improving national food security and a strategy to increase farm led carbon sequestration. However, as evident from the sensitivity analysis published by the EPA, the sector is responsive to market signals and policy interventions which can provide drivers for increased emissions (see section 7.2).

The efficiency measures outlined in the 2019 Climate Action Plan have been considered on a cost effectiveness basis and require full implementation. In addition to these existing measures, enhanced measures will be required, to meet deeper 2030 and 2050 emissions targets.

The Climate Action Plan 2021 has implications for farmers largely in terms of both Agriculture and LULUCF emissions reduction targets. However, farmers are also likely to engage in actions that will contribute to the achievement of the energy sector target.

The Plan has set a 22%- 30% emission reduction target for the agriculture sector by 2030 and a 37-58% reduction in LULUCF emissions. There are large scientific uncertainties associated with the measurement of agriculture and LULUCF emissions and removals due to the biogenic nature of the emissions. It is challenging to develop interventions that alter biological processes that vary substantially on a spatial and temporal basis, making it difficult to both mitigate emissions and to verify the extent of the mitigation achieved. Indeed, the Plan makes particular reference to the technical difficulties associated with reducing methane emissions from enteric fermentation and LULUCF uncertainties.

The Plan makes a commitment for nitrous oxide mitigation to be the main mitigation pathway in the first two carbon budget periods. It estimates that 1.5 -2.0 Mt CO_2 eq per annum reduction in nitrous oxide emissions can be achieved by changing farm management practices between now and 2030. This is underpinned by specific actions in the Plan addressing sources of nitrous oxide emissions.

There is also an urgent need to mitigate methane emissions from both enteric fermentation and manure management. The Plan calls for the development of feed additives, a breeding programme to produce low emission bovines, a reduced age at slaughter for beef cattle, and the improvement of forage quality in order to reduce enteric methane. It should be noted that there is a low likelihood that these measures (with the possible exception of reduced age at slaughter) will deliver any reductions during the first carbon budget. Feed additives that are likely to be in commercial use in the short term will be administered only during the housing period and their use during the grazing season will require further product development and may only come on-stream towards 2030. Inclusion of feed additives in bovine diets will also be dependent on testing to ensure that there are no residues in the associated meat or milk products. Breeding for low-methane animals and alternative forages have greater uncertainty as reduction strategies and may deliver low impact up to 2030.

Actions to support renewable energies require capacity building in terms of biogas and biomethane which can contribute to manure methane reduction and fossil fuel displacement.

In terms of Land Use emissions and removals, the Plan envisages that net greenhouse gas emissions from the sector will reduce from 4.8 Mt CO_2 eq in 2018 to 2-3 Mt CO_2 eq by 2030. It should be noted that there is a high degree of scientific uncertainty associated with both the emissions and removals from this sector, particularly in terms of carbon removals and emissions from soils. The Plan commits to significant actions to support improving our understanding of the science and the necessary monitoring and verification systems to enable achieving high levels of ambition for the sector.

Enhancing forest removals will be the largest long-term Land Use Change mitigation strategy and this is reflected in the large number of associated actions.

Critically, the development of 'Carbon farming' and indeed progress in adoption of all of the above measures will require a policy framework that provides the incentive to farmers to make production decisions that favour the achievement of the Plan's objectives.

Projections suggest that international market demand for dairy and beef will remain strong over the current decade and beyond. Therefore, market forces alone are unlikely to provide the incentives to farmers to adopt mitigation actions, especially where those actions come at a cost to the farmer. The low level of incomes in some sectors of Irish agriculture, limited access to capital, high age profile, an aversion to risk taking, and a range of societal factors, all represent barriers to change that have to be overcome. Strong policy incentives that recognise the diversity in the sector will be required.

It is important to consider the potential of other land uses for the long-term, including forestry, horticulture, recreation and ecosystem services such as peatland rewetting and restoration, supporting biodiversity, carbon sequestration and flood protection. These strategic sustainability innovations for the economy can potentially deliver benefits for livelihood and employment, and for rural development, but must take account of just transition and ensuring that this adjustment takes place in a way that does not adversely affect those on low incomes. This includes recent investment in the dairy sector, as encouraged by CAP reform and the response to a strong market for dairy output.

9.2.2 Transport and spatial planning

The 2019 Climate Action Plan ramped up the Battery Electric Vehicle (BEV) and biofuels targets, as cost effective measures. As discussed in Section 7.3, emissions reductions in the sector also necessitate immediate attention to spatial and transport planning, for compact settlement and modal shift to public transport, walking and cycling.

Transport actions in the Climate Action Plan 2021 include numerous approaches to reducing emissions from the sector — both technical (electrification) and demand management focused (increased active travel, improved spatial planning). The potential contribution of higher capital cost measures, such as public transport infrastructure, to cost effective emissions reduction in the long term is significant and must address existing spatial and infrastructural 'lock-in', while also preventing further lock-in.

The public sector taking the lead in zero emission vehicle procurement, with the mandated purchase of such vehicles from the end of 2022, will be an important signal to the broader public of confidence in these technologies. Public confidence also relies on the continued development of a reliable public charging network. The measures proposed may be challenging, with significant investment required, but will also come with substantial co-benefits such as cleaner air, more liveable cities and reduced import dependence.

In comparison to the Climate Action Plan 2019, the Climate Action Plan 2021 has an increased focus on the freight sector, with an important target of 3,500 low emission HGVs by 2030. Unlike the previous Plan, the revised Climate Action Plan 2021 does not focus exclusively on Compressed Natural Gas (CNG) for the sector but instead includes hydrogen and electrification as potential options. The government now needs to ensure that the forthcoming Ten-Year Strategy for the Road Haulage Sector provides a clear roadmap for sectoral decarbonisation, which is drafted in close consultation with the industry.

Increased biofuel blending rates should be approached with caution, and transparency is needed as to the actual planned increase in volumes as increasing electrification of the vehicle fleet reduces overall fuel demand. Ireland is heavily dependent on imported Used Cooking Oil (UCO) to meet its existing biofuel blending target, despite some concerns as to the traceability and thus sustainability of this feedstock.[115,116] Before an increase in blending rates is implemented, Ireland should conduct a full assessment of the sustainability implications of such a move, and needs to ensure that sufficient safeguards are put in place.

Aviation and shipping are integral parts of our transport system and are vital for our economy and society. The reporting of International aviation and maritime emissions is discussed in Box 4.1. The Climate Action Plan 2021 does not give significant attention to their necessary decarbonisation pathways. While European measures are important, it is also important that Ireland pursues the development of low-carbon alternative fuels as both a strategic necessity for the island and also as a new market to be supplied. Some of these fuels, such as hydrogen for shipping and hydrogen-derived fuels for aviation, will require substantial quantities of additional renewable electricity. While the Climate Action Plan 2021 makes reference to such fuels, it is important that Ireland plans for the resulting additional renewable electricity demand over the coming years and decades. This should be seen as both an opportunity, to develop new fuels in Ireland, and a necessity, to protect two sectors vital to Ireland's connectivity.

Research and analysis is needed to assist policy making to assess optimal approaches to achieve emissions reductions through spatial and transport planning. It is essential that analysis and policy take a long-term view, and consider transformative spatial, transport and climate action planning, in parallel.

9.2.3 Built Environment

This sector is a priority for just transition, jobs and for cost effectiveness of transition. This can be supported by public policy, providing regulation and enablement programmes, including private finance.

The Government's 'Housing for All' strategy envisages a significant programme of building.[87] Opportunities exist to reduce the embedded carbon in construction under this programme while reducing running costs. For example, there is a role for substitution of traditional concrete and cement products with timber and other low carbon materials.

The Climate Action Plan 2021 has identified a range of actions for the Built Environment and Retrofit sectors.

The Climate Action Plan 2021 includes a whole-of-Government National Retrofit Plan and outlines the approach which will be required to achieve these actions. These are spread across multiple Departments and Agencies and feature significant interdependencies. Decarbonisation of this sector must take account of practical realities and constraints, and the impacts of other Government policies such as 'Housing for All'.[87]

Information from analysis on the expected outputs from the current suite of policies will be critical in informing which policies need to be adjusted, and by how much, over the coming years. Given that the Irish housing stock is not one homogenous grouping, but rather a number of distinct populations of house types, there will need to be constant tailoring and adjustment of policy levers throughout the coming years to ensure all house types are serviced. This will be further informed by the forthcoming heat study from SEAI which is likely to shed considerable light on the role of district heating in decarbonising Irish homes.

The Plan recognises that at the present time the largest constraints to successful delivery are supply chain issues, both in the availability and costs of raw materials and labour. From a raw materials perspective, Ireland is experiencing similar supply chain issues to many other jurisdictions. Lead times on the supply of many items critical to the retrofit industry are significantly extended, and alongside this there is evidence of cost inflation. It is generally acknowledged in the industry that material supply chain issues will correct themselves over the coming year; however, prices are likely to remain high. While overall construction inflation was generally forecast to run at approximately 7% per annum, much higher levels of cost increases have been recorded for certain items, such as external wall insulation, which has increased by up to 20%.

Supporting retrofit of the existing stock necessitates policy that accelerates current rates of energy efficiency and renewable energy installations. This will require enhancement of industry capacity, through training, and can increase employment.

An important factor regarding the achievement of Climate Action Plan targets is the capacity of the supply chain and retrofit contractors to scale their businesses to the requisite level in the coming years. There is likely to be direct competition between new build and retrofit sectors for a limited pool of qualified workers, as well as increased demand for significant activity across the domestic, commercial and public sectors.

In light of this, the development of a new One Stop Shop scheme (the basis of which is that the OSS will offer the home owner a complete end-to-end service for the delivery of home energy upgrades) will launch in early 2022. Multi-annual funding until 2025 has been confirmed in the National Development

Plan, and a clear market signal has been given that significant levels of additional funding will be provided right through until 2030.

The Financing and Funding Models actions under the National Retrofit Plan are significant, given the scale and timeline for delivery. The action to introduce a residential retrofit loan guarantee scheme under the National Retrofit plan is notable. While the full details of the scheme are not confirmed, it is likely to be a blended finance structure of both national and EU financing for risk sharing support and private sector credit. This will deliver lower cost funding and complement the national funding already available in the form of grants. This action is the first Irish example of specific tailoring of risk sharing products to meet sectoral climate initiatives for the consumer. However, given the scale of the National Retrofit Plan and the complexity of issues around housing and ownership profile, it is likely additional incentives (e.g. taxation) may still be required to drive take up.

In the area of commercial/public retrofit initiatives, while no action is determined in this plan, developments in other jurisdictions suggest consideration should be given to designing investment platforms based on blended finance structures where the power of public finances can be leveraged to overcome market failures and 'crowd in' private sector financing. It may be particularly useful to include the aggregation of small projects where traditional financing may be difficult to obtain. This model could also be adapted in other sectors under the Climate Action Plan.

Council reiterates that it is necessary for the cost of building upgrades to be primarily borne privately, where the owner has means, though some facilitation and innovative financial tools (such as the above) would be important. Public investment should be prioritised for public housing, addressing energy poverty and leveraging private finance. There is a need to evaluate the requirement for a B2 BER energy rating as the minimum standard for retrofit supports, as emissions reduction, rather than energy efficiency, is the desired outcome.

While measures are typically targeted at homeowners, the rental sector is significant and retrofitting policies arising from the 'Housing For All'[87] strategy need to be ambitious and successfully delivered for a just transition.

9.2.4 Electricity and energy industries

Full decarbonisation of energy industries, especially electricity, is necessary for achievement of the National Climate Objective.

Rapid and ambitious decarbonisation of the electricity system, using sustainable natural resources of wind, solar, hydro and marine, underpin the delivery of emissions reduction not only in the power sector but also across other sectors such as transport, buildings and industry. It is urgent that consumers, communities, farmers and businesses are supported to become renewable self-consumers, and are entitled to store and sell their excess electricity and be remunerated at a level that reflects the market value of that electricity. In response to the increase in 'Amber' alerts in Ireland's electricity system, the roll out of 'smart' technologies, especially smart meters for consumers, and grid management services by large companies, such as demand and frequency response services, need to be accelerated.

Security of supply is critical. Electricity demand is expected to increase, driven by large energy users and the electrification of heat and transport. This is reflected in the adaptation scorecard where the limited progress in building the resilience of the electricity and gas sector to potential climate vulnerability, despite the increased importance of the electricity supply, is discussed in Chapter 3.

Ensuring the transmission grid — both on shore and offshore — is resilient for the increasing volumes of renewable power, and that the distribution grid is responsive to higher demand from transport and heating will require capital investment now in order to deliver the high level of renewable electricity foreseen by 2030, including investment in the grid itself and storage solutions. It is essential that procedural delays including in the establishment of the Maritime Area Regulatory Authority (MARA), Renewable Electricity Support Scheme (RESS) auctions, planning and regulatory constraints do not delay the urgent facilitatory investment.

9.2.5 Other sectors

These include manufacturing combustion, process emissions, 'F-gases' and waste. In the long-term, innovation in industry is required, especially to identify technologies and energy sources for displacement of fossil fuels, and of carbon-intensive materials.[19] For manufacturing, developments in the circular economy may have potential and could be an important addition to the EU ETS. There is also potential to reduce emissions in the waste sector.

There is considerable potential for further reductions in the emissions of 'F-gases', arising from measures mandated under the Kigali Amendment to the Montreal Protocol, through the substitution of high GHG potential gases with sustainable alternatives.

The Climate Action Plan 2021 identifies a number of initiatives within these sectors to reduce emissions and promote the development of the green economy.

9.2.6 Employment and enterprise

The Green economy provides significant opportunity for existing companies and potential new companies across many sectors as set out in the Climate Action Plan 2021. For Ireland to exploit the maximum level of opportunities, however, it will be necessary to ensure the development of the appropriate skills. The Expert Group on Future Skills has estimated that this could require up to 22,000-27,000 roles by 2030. The development of this skills base is a significant task. It is proposed in the new Climate Action Plan that the development of relevant regional skills is a key theme in the refresh of the Regional Enterprise Plans to 2024. The early development of the appropriate skills base is critical to achieving the targets in the Plan e.g. retrofitting houses, renewable energy infrastructure etc. Council believes that the development and implementation of plans to develop the scale of relevant skills needs to be accelerated immediately both nationally and regionally.

The potential for employment creation as outlined in the Climate Action Plan 2021 will require the early resolution of issues relating to the proposed scale of renewable energy planned, particularly offshore wind projects, and the success of initiatives in driving demand for retrofitting houses, including the development of appropriate financial supports to address affordability issues. Council notes the proposed development of the Offshore Renewable Energy Development Plan (OREDP II) and the National Retrofit Plan and believes that achievement of the targets set out in the Climate Action Plan will be strongly impacted by the success of such policy instruments and they therefore need to be prioritised. Such core measures will provide opportunity for the creation of new companies and the development of existing companies providing low carbon and sustainable products and services with significant potential for creating high quality employment.

Achievement of the ambitious enterprise targets in the Climate Action Plan will require enterprises to implement significant investment programmes to improve energy efficiency of buildings, processes and transport, some of which have negative business cases. While sustainability will be increasingly critical

to success for companies going forward, there will also need to be appropriate policy support to ensure that the necessary scale of investments are made to deliver the targeted emission reductions across the enterprise base in Ireland in the immediate term.

9.2.7 Cross sectoral and delivery

Cross-sectoral approaches to emissions reduction can enhance cost-effectiveness. The Council notes that the carbon tax is now implemented in alignment with previous Council recommendations. The effectiveness of the reformed EU ETS is discussed in Section 8.4.2.

The measures in the Climate Action Plan 2021 are divided into two categories: Core Measures and further measures. Delivering Core Measures such as ramping up renewables, modal shift, zero-emissions heat and LULUCF measures will not be sufficient to deliver the scale of ambition set out in the Plan. Further measures have been identified to bridge the gap such as accelerating sustainability transformation in agriculture and the deployment of zero-emission gas (e.g. biogas/biomethane/hydrogen) and carbon capture and storage in industry sectors (CCS).

These further measures are more challenging technically and will require the development of disruptive technologies and/or significant investment. Council would strongly urge that a programme of work to deliver these required further measures be prioritised and funded. Implementation of these measures is not trivial. It is critical to achieving the targets set out in the Plan in the proposed timeframe. Furthermore, the plan points out that not enough measures have been identified to reach the targets and it specifies that savings of 4 Mt CO_2 eq remain unallocated on an economy wide basis. Using the sectoral abatement ranges included in the plan this gap could also be expressed as a range between 1.8-9.8 Mt CO_2 eq. Given the uncertainty associated with delivering these further measures, and closing the gap for 2030, the Council recommends that immediate action be taken to identify the solutions so as to incorporate them into the updated Climate Action Plan in 2022.

As noted in the Council's letter to the Minister on carbon budgets,[117] removals will be required to achieve the national climate objective. There is an urgent need for a long-term strategy to deliver the removals required. It will be necessary to enhance insight into how larger streams of investment can be channelled in to supporting transition. Significant investment will be required to achieve the transition and Government needs to explore all options using public, EU and private capital to finance this in order to achieve the scale of transformation required.

The funding requirements of the Climate Action Plan 2021 are very challenging. Key actions in the mobilisation of investment and sustainable finance, highlight the need for increased national green bond funding and more transparency around its allocation and impact. There is a need to maximise financing opportunities under the EU Green Deal through EIB Financing Ireland and to use the mandate of key national financing agencies to deliver innovative financing solutions, while also mobilising private finance to align with the national climate objective. The leverage of private sector investment will be vital to the successful delivery of the plan. Given the increasing private sector appetite for 'green' investments and loan portfolios, driven by citizen power and regulation such as the EU Sustainable Finance Disclosure Regulation, there should be opportunities for increased collaboration between the public and private financial sectors in developing innovative solutions. Important new initiatives include the development of a leading sustainable finance hub in Dublin (Department of Finance) and the establishment of international sustainability standards (e.g. the EU taxonomy).

The Climate Action Plan 2021 provides limited definitive actions on financing or investment solutions, but in some sectors, (e.g. buildings, enterprise) identifies where public funds in collaboration with private

investment may be used to deliver financing solutions. While the collaborative approach is positive, given the lead time required to determine requirements, design solutions, and engage private sector investors, the potential for delayed delivery is a concern, particularly where a state agency may be the conduit for several financing solutions under the plan. Finally, when mandating large consumer actions, such as retrofit and the move to BEVs, the structure and capacity of the Irish financing market to deliver financing is not considered adequately.

The cost-effective achievement of the National Climate Objective to 2050, will require a Long-Term Low Emissions Development Strategy. As discussed in Chapter 5, this is now an urgent priority for climate action in Ireland. It is noted that early action facilitates long-term transition and reduces costs, and is critical for infrastructure and spatial planning. The development of the long-term strategy needs to be informed by a range of scenarios to 2050 to explore the full range of options available to policy. This is discussed in Box 9.1 'From national long-term scenarios to national Long-Term Strategy'.

Box 9.1 From National long-term scenarios to national Long-Term Strategy

The lack of a Long-Term Strategy to 2050 is a critical gap in Ireland's policy approach, with respect to the ability to achieve the National Climate Objective to 2050, in a cost-effective manner. The increase in emissions noted in the EPA projections after 2030,[49] and then ending in 2040, are an illustration of challenges that arise when climate action policy is framed primarily by the short to medium-term. Furthermore, the 2021 IPCC AR6 WGI report makes clear that emissions will need to reach net zero by mid-century and then be net negative on a sustained basis to meet the ambitions set forth in the Paris Agreement. This policy gap leaves Ireland behind its peers, raising concerns about the ability to achieve long-term targets. It is noted that the Department of the Environment, Climate and Communications initiated a public consultation on Ireland's Long-term Strategy on Greenhouse Gas Emissions Reduction in November and December 2019.[a] However, a Long-Term Strategy has not been published.

To respond to the need for a Long-Term Strategy, it is important that this process embraces key learnings at the global level. There is no single path to a low emissions future. Choosing between options requires a long-term strategy to guide policy choices through alternative paths, that can enable climate action and sustainable development.[73] A Long-Term Strategy is necessary to avoid investment in the economy becoming locked-in to stranded assets and high emissions activities. In framing cost-effective policy, techniques such as Cost-Benefit Analysis and Cost Effective Analysis can be useful, but it is also necessary to consider other aspects and policy objectives such as biodiversity and Just Transition.[19,73,98] It is important to note that sector specific studies give greater insight to the mitigation potential of industry, buildings and transport, than to those typically identified by cross sectoral optimisation models.[54]

National strategic response can be greatly enhanced by the exploration of multiple scenarios, responding to uncertainty and the needs of long-term strategy. A scenario approach can include defining social, cultural, political and institutional drivers.[118] Scenarios of alternative developments also allow consideration of the implications of transformative shifts, in systems, practices, and technologies, such as in settlement and mobility, or agriculture and land use, and in key themes, such as consumption, inequality and biodiversity.

A scenario process can widen the scope of potential policy, and can be inclusive of themes that are key to Just Transition. It can be used strategically, towards maximising win-win outcomes, and managing trade-offs and conflicts, as a goal-oriented exercise. Scenario processes can encompass driving forces that cannot be fully captured in quantitative models of economies and technologies, but are crucial for sustainable, cost effective and just transition. In order to address the needs of long-term strategy, Ireland can benefit significantly by building new and enhanced capacity, for long-term scenario analysis, to complement development of modelling capacity.

a Public Consultation on Ireland's Long-term Strategy on Greenhouse Gas Emissions Reduction: https://www.gov.ie/en/consultation/cfb2d-public-consultation-on-irelands-long-term-strategy-on-greenhouse-gas-emissions-reduction/

10. Activities of the Council

As required under Section 12(f) of the Climate Action and Low Carbon Development Act 2015 (as amended), the activities of the Council in 2020 are listed here.

Date	Organisation	Subject	Attendees
06.01.2020	Department of Foreign Affairs and Trade	Heads of Mission Conference	Prof. John FitzGerald
08.01.2020	Embassy of Denmark	Launch the Danish company Obton's long-term investment in Irish solar power	Council Secretariat
16.01.2020	Department of the Taoiseach	Dinner in honour of H.E. Dr. Ursula von der Leyen, President of the European Commission	Prof. John FitzGerald
16.01.2020	EITAS Ltd	Community based approach to energy upgrades	Prof. John FitzGerald
21.01.2020	Irish Farmer's Association (IFA)	Climate Action in Agriculture – A Balanced Approach	Prof. John FitzGerald
22.01.2020	School of Natural Sciences, Trinity College Dublin	Irish Natural Capital Accounting for Sustainable Economics	Prof. John FitzGerald
29.01.2020	Department of the Taoiseach	Climate Change Advisory Council	Prof. John FitzGerald, Council Secretariat,
29.01.2020	Regional Assemblies of Ireland	Regional Development Monitor	Prof. John FitzGerald
31.01.2020	3 Counties Energy Agency (3CEA)	3CEA 10 Year Strategy Launch Event	Prof. John FitzGerald
06.02.2020	Danish Council on Climate Change (Klimarådet)	International exchange on climate change	Prof. John FitzGerald, Prof. Alan Matthews, Council Secretariat
06.02.2020	SEAI	Decarbonisation of the Public Sector & Carbon Budgets	Council Secretariat
19.02.2020	College Historical Society, Trinity College Dublin	Chair of debate: This House Believes That The Duty To Stop Climate Change Lies With The Individual	Prof. John FitzGerald
21.02.2020	European Banking Institute	Second Session: Sustainable Finance	Prof. John FitzGerald
24.02.2020	CPD Ireland	Role of business in assessing our climate change challenges and panel discussions	Prof. John FitzGerald
28.02.2020	Irish Fiscal Advisory Council	Path for the Public Finances	Prof. John FitzGerald
04.03.2020	IIEA/Trinity Business	Trinity Business + Technology Forum 2020: A New Europe: Europe's Green Deal	Prof. John FitzGerald
05.03.2020	The Bray Heads	Really tackling climate change	Prof. John FitzGerald

Date	Organisation	Subject	Attendees
09.03.2020	Irish Farmers' Association (IFA)		Prof. John FitzGerald
09.03.2020	Department of the Taoiseach	Research and Modelling Sub-Group on the Environment	Council Secretariat
10.03.2020	Davey	EU Green Deal	Prof. John FitzGerald
10.03.2020	TU Dublin, Bolton St campus	Climate Change	Prof. John FitzGerald
30.03.2020	SEAI	SEAI/EPA update on the National Energy Modelling Framework (NEMF)	Council Secretariat
07.04.2020	Department of Communications, Climate Action and the Environment	Future of the Climate Change Advisory Council	Prof. John FitzGerald
08.04.2020	Office of the Planning Regulator	Stakeholder engagement	Council Secretariat
09.04.2020	Devenish	Research	Prof. John FitzGerald
24.04.2020	Mainstream	Phone Call	Prof. John FitzGerald
01.05.2020	UCD Geary Institute	Seminar on the current crisis and tackling climate change	Prof. John FitzGerald
01.05.2020	ICRAG	ICRAG Governance Board	Prof. John FitzGerald
20.05.2020	Irish Wind Energy Association	Low-carbon transition and any views you have on wind energy	Prof. John FitzGerald
25.05.2020	PwC	PwC Report	Prof. John FitzGerald
02.06.2020	ESRI	Current work on electricity	Prof. John FitzGerald
16.06.2020	Forest Industries Ireland (FEI)	Forestry developments in Ireland	Prof. John FitzGerald
18.06.2020	MaREI	New Research	Prof. John FitzGerald
06.07.2020	European Parliament	Speaking at EC Climate Law proposal webinar	Prof. John FitzGerald
16.07.2020	Department of Communications, Climate Action & Environment	Climate Change Advisory Council	Prof. John FitzGerald, Council Secretariat
02.09.2020	Concept Dairy	Tackling economic sustainability for the dairy sector	Prof. John FitzGerald
03.09.2020	Forest Industries Ireland (FEI)	Forestry and climate change discussion	Prof. John FitzGerald,
08.09.2020	British Embassy Dublin	Economic impact of COVID, Challenges of climate change	Prof. John FitzGerald
11.09.2020	ESB	ESB Networks' Business Plan 2021-2025	Prof. John FitzGerald
05.10.2020	Ervia	Carbon Capture and Storage and the potential of Hydrogen	Prof. John FitzGerald

Date	Organisation	Subject	Attendees
07.10.2020	Energy Ireland	Decarbonising Ireland – The Challenge for the Energy Sector	Prof. John FitzGerald
16.10.2020	Environment Ireland	Tackling the climate emergency	Prof. John FitzGerald
16.10.2020	Irish Farmer's Journal	Irish Farmer's Journal Webinar	Prof. John FitzGerald
21.10.2020	SEAI	2021 SEAI National Energy RD&D Call	Prof. John FitzGerald, Council Secretariat
21.10.2020	Government of Ireland	National Economic Plan Stakeholder Engagement	Council Secretariat
22.10.2020	Government of Ireland	Shared Island	Prof. John FitzGerald
22.10.2020	OECD	Structural Reform Support Programme (SRSP) Consultation	Council Secretariat
28.10.2020	EEAC	Advising on a Just Transition	Prof. Anna Davies, Prof. John FitzGerald, Council Secretariat
28.10.2020	Joint Oireachtas Committee	Pre-Legislative scrutiny of Climate Action and Low Carbon Development (Amendment) Bill 2021	Prof. John FitzGerald
01.11.2020	Construction Industry Federation's 2020 Annual Conference	Discussion Panel on Project 2040	Prof. John FitzGerald
04.11.2020	Council Review	Interview Budget 2021	Prof. John FitzGerald
05.11.2020	Ecologic	EEA/Ecologic session at EEEN2020 conference – policy evaluation role of national climate advisory bodies	Prof. John FitzGerald, Council Secretariat
06.11.2020	Alltech	Sustainability challenges facing Irish Agriculture	Prof. John FitzGerald
10.11.2020	ESTG Conference	Challenges for Ireland in Tackling Climate Change	Prof. John FitzGerald
25.11.2020	Northern Ireland Environment Forum 2020	Progress towards meeting the Climate Change Challenge	Prof. John FitzGerald
25.11.2020	Small Firms Association (SFA)	Ireland's road to economic recovery and opportunities for transitioning to a low carbon economy	Prof. John FitzGerald
26.11.2020	SEAI	2020 National Energy Research and Policy Conference – Decarbonisation of Ireland's Heat Sector	Prof. John FitzGerald
27.11.2020	Department of the Environment, Climate and Communications	Climate Change Advisory Council	Prof. John FitzGerald

Date	Organisation	Subject	Attendees
30.11.2020	European Movement Ireland	Investing in a Green Future – Ireland's transition to a Green Economy	Prof. John FitzGerald
09.12.2020	Glanbia	Glanbia Board Meeting: Sustainability - Agriculture	Prof. John FitzGerald
10.12.2020	Kemmy Business School, University of Limerick	Future Cities Event: Climate risks/creating a more sustainable Ireland post-COVID	Prof. John FitzGerald

Climate Change Advisory Council and Adaptation Committee Meetings 2020

Date	Purpose	Attendees
27.02.2020	Climate Change Advisory Council Meeting	Prof. John FitzGerald (Chair), Prof. Alan Barrett, Prof. Gerry Boyle, Laura Burke, Prof. Peter Clinch, Prof. Anna Davies, Prof. Ottmar Edenhofer, Prof. Alan Matthews, William Walsh.
02.04.2020	Climate Change Advisory Council – Adaptation Committee Meeting	Prof. John FitzGerald (Chair), Mark Adamson (OPW), Laura Burke (EPA), Prof. Robert Devoy (UCC), Ciarán Hayes (CCMA), Dr. Ina Kelly (HSE), Keith Lambkin (Met Éireann), Roger Street (Oxford University).
23.04.2020	Climate Change Advisory Council Meeting	Prof. John FitzGerald (Chair), Prof. Gerry Boyle, Laura Burke, Prof. Peter Clinch, Prof. Frank Convery, Prof. Anna Davies, Prof. Alan Matthews, William Walsh.
21.05.2020	Climate Change Advisory Council Meeting	Prof. John FitzGerald (Chair), Prof. Gerry Boyle, Laura Burke, Prof. Peter Clinch, Dr. Joseph Curtin, Prof. Frank Convery, Prof. Ottmar Edenhofer, Prof. Alan Matthews, William Walsh.
21.05.2020	Climate Change Advisory Council – Adaptation Committee Meeting	Prof. John FitzGerald (Chair), Mark Adamson (OPW), Prof. Gerry Boyle (Teagasc), Laura Burke (EPA), Prof. Robert Devoy (UCC), Ciarán Hayes (CCMA), Dr. Ina Kelly (HSE), Keith Lambkin (Met Éireann), Dr. Conor Murphy (Maynooth University), Roger Street (Oxford University), William Walsh (SEAI).
11.06.2020	Climate Change Advisory Council Meeting	Prof. John FitzGerald (Chair), Prof. Alan Barrett, Prof. Gerry Boyle, Laura Burke, Prof. Frank Convery, Dr. Joseph Curtin, Prof. Anna Davies, Prof. Alan Matthews, William Walsh.
23.07.2020	Climate Change Advisory Council Meeting	Prof. John FitzGerald (Chair), Prof. Alan Barrett, Prof. Gerry Boyle, Laura Burke, Prof. Peter Clinch, Prof. Frank Convery, Dr. Joseph Curtin, Prof. Alan Matthews, William Walsh.
23.07.2020	Climate Change Advisory Council – Adaptation Committee Meeting	Prof. John FitzGerald (Chair), Prof. Robert Devoy (UCC), Ciarán Hayes (CCMA), Dr. Ina Kelly (HSE), Keith Lambkin (Met Éireann), Dr. Conor Murphy (Maynooth University), Roger Street (Oxford University).
3.09.2020	Climate Change Advisory Council Meeting	Prof. John FitzGerald (Chair), Prof. Alan Barrett, Prof. Gerry Boyle, Laura Burke, Prof. Peter Clinch, Prof. Frank Convery, Prof. Alan Matthews, William Walsh.
17.09.2020	Climate Change Advisory Council Meeting	Prof. John FitzGerald (Chair), Prof. Gerry Boyle, Laura Burke, Prof. Peter Clinch, Prof. Frank Convery, Prof. Anna Davies, Prof. Alan Matthews, William Walsh.
08.10.2020	Climate Change Advisory Council – Adaptation Committee Meeting	Prof. John FitzGerald (Chair), Mark Adamson (OPW), Prof. Gerry Boyle (Teagasc), Prof. Robert Devoy (UCC), Ciarán Hayes (CCMA), Keith Lambkin (Met Éireann), Dr. Conor Murphy (Maynooth University), Roger Street (Oxford University), William Walsh (SEAI).
12.11.2020	Climate Change Advisory Council Meeting	Prof. John FitzGerald (Chair), Prof. Gerry Boyle, Laura Burke, Prof. Frank Convery, Dr. Joseph Curtin, Prof. Anna Davies, Prof. Ottmar Edenhofer, Prof. Alan Matthews, William Walsh.
17.12.2020	Climate Change Advisory Council – Adaptation Committee Meeting	Prof. John FitzGerald (Chair), Mark Adamson (OPW), Prof. Gerry Boyle (Teagasc), Laura Burke (EPA), Prof. Robert Devoy (UCC), Keith Lambkin (Met Éireann), Dr. Conor Murphy (Maynooth University), Roger Street (Oxford University).

Appendix 1 – Adaptation scorecard

Risk, prioritisation and adaptive capacity	Resourcing and mainstreaming	Governance, coordination and cross cutting issues	Overall Progress Assessment
National Adaptation Framework			
Good progress. Progress on the 12 priority actions of the NAF is noted though there is less progress on its 13 supporting objectives. The status and role of Climate Ireland should further develop and a clear role for the National Dialogue in raising awareness of community level adaptation is needed. National adaptive capacity has developed but gaps persist in the policy architecture for adaptation, including regarding risk assessment and the operationalisation of research.	Moderate progress. Adaptation needs to be further mainstreamed in policy and expenditure, not just regarding flooding. Though there are now a range of structures and arrangements to position adaptation considerations into decision making, there is limited evidence on how this has affected outcomes including in planning, public expenditure or emergency management or how climate resilience has permeated decision making. Adaptation remains primarily funded in an ad-hoc way and information on the costs or investment requirements remains limited.	Moderate progress. Reflecting the reflexive nature of adaptation governance, the effectiveness of the national adaptation steering committee structures and local and sectoral structures should be kept under review. Existing structures should be leveraged more rather than setting up new ones to try ensure adaptation is adequately considered across wider policy. Less evidence of the integration of adaptation with mitigation or the development of a distinct vision for adaptation in climate action policy which may assist with this. Data sharing must be advanced and should be driven by the Department.	Moderate progress. The success of Ireland's overarching adaptation policy and progress towards climate resilience is hampered by the absence of a national resilience indicator set.

Risk, prioritisation and adaptive capacity	Resourcing and mainstreaming	Governance, coordination and cross cutting issues	Overall Progress Assessment
Local Government			
Moderate progress. Some information on how specific identified climate hazards are prioritised and being addressed and linked to action and ongoing risk assessments or scenarios considered. Less attention seems to be paid to other identified risks such as heatwaves and drought. It is welcome that a comprehensive climate action training programme is in place.	Limited progress. Recognition of the importance of integrating adaptation but less evidence of this in practice, despite significant opportunities identified. Limited evidence of consideration of adaptation and mitigation co-benefits, trade offs etc. Significant resource needs identified but not filled centrally and focus appears to be on securing mitigation funding. Limited information on costs/investment requirements though some innovation in collecting this.	Good progress. Approach to monitoring progress in the sector is developing well but 2,451 actions across LAs represents a significant challenge for MRE. Influence of national policy and guidance from a range of Departments on some initiatives identified may limit coordinated action and these require coherence with national and local climate goals.	Moderate progress. Local government has been required to undertake significant work to begin planning for climate change under the NAF. How building climate resilience integrates with increasing mitigation obligations in the sector will be a key consideration.
Flood Risk Management (OPW)			
Advanced progress. Clear identification of priority activities linked to ongoing pilot work at scheme level and actions within the plan.	Advanced progress. Evidence of embedding climate change adaptation within work and resourcing of a specific team within the OPW to implement the plan in conjunction with other actors.	Good progress. Evidence of ongoing collaboration, particularly in spatial planning. Flood mapping produced by sector provides a resource for all sectors and policy makers. Better consideration of biodiversity, integrated catchment-based approaches and capturing other co-benefits in flood relief schemes will be essential.	Good progress. This sector has significant experience of climate change adaptation planning and in managing risk but ongoing collaboration with other sectors and consideration of relationship between flood risk and socioeconomic developments remains key.

Risk, prioritisation and adaptive capacity	Resourcing and mainstreaming	Governance, coordination and cross cutting issues	Overall Progress Assessment
Water Quality and Water Services Infrastructure (Department of Housing, Local Government and Heritage)			
Good progress. These sectors are addressing clear results of a prioritisation exercise. However less information is available on how business continuity impacts or interruptions for water services providers consider cascading impacts from other sectors. A number of research projects are underway.	Good progress. Examples of integration across programmes and other initiatives are evident but the strategy for mainstreaming adaptation could be more clear, particularly in terms of future water supply.	Moderate progress. Limited information is available on the MRE process for the plan and what updates in 2022 might address or how these integrate with other sectors. How long term planning in the sectors links to future climate scenarios and the decisions of other sectors and socioeconomic development should be developed, particularly regarding future water supply needs.	Good progress. This reflects the overall assessment of the two sectors of water quality and water services infrastructure. Ongoing attention must be given to demonstrating the resilience of water supply in particular.
Built and Archaeological Heritage (Department of Housing, Local Government and Heritage)			
Moderate progress. 9 priority risks identified in the sectoral plan but not clear how each of these is being managed. Evidence of efforts to grow adaptive capacity across scales.	Moderate progress. Limited dedicated resources in place to oversee and support delivery of the sectoral plan but linking of climate change and grant schemes, most recently the community monuments fund, is potentially powerful.	Good progress. Efforts to integrate with the Climate Action Plan and developing cross sectoral links and capacity. Recognition of the need to address data gaps	Moderate progress. This sector has been required to undertake significant work as it begins planning for climate change under the NAF.

Risk, prioritisation and adaptive capacity	Resourcing and mainstreaming	Governance, coordination and cross cutting issues	Overall Progress Assessment
Transport Infrastructure (Department of Transport)			
Moderate progress. Though work is underway on addressing some risks and vulnerabilities, how changes in extreme events (such as storms and heatwaves) are being considered is less clear, with varying levels of adaptation planning across different aspects of the transport sector. Adaptive capacity is beginning to ramp up but gaps in the sector remain.	Moderate progress. Earmarking of funding to address knowledge gaps is welcome but this cannot become a delay to action. Range of funding mechanisms is noted, including most notably for regional and local roads and rail, but these appear to be fragmented without evidence of adaptation being mainstreamed/integrated into major long term investment.	Good progress. Recognise Department's early engagement with other critical infrastructure sectors and their recognition of the interdependencies and potential for joint approaches but without continued focus and commitment from other sectors this progress may be lost.	Moderate progress. Though this sector has significant experience in adaptation planning, further work to build on this and further mainstream adaptation across it is required.
Agriculture, Forest and Seafood (Department of Agriculture, Food and the Marine)			
Moderate progress. A wide range of potential priority impacts are identified and while adaptive capacity is identified as important to addressing these and awareness raising is underway, there is limited evidence of how these impacts are being managed overall (though fodder is a focus).	Moderate progress. Future role of adaptation in the Common Agricultural Policy will be a key consideration in how progress and ambition is furthered. Linking adaptation and mitigation requires ongoing attention through the DAFM forestry programme and in particular in seafood policy.	Good progress. Significant engagement with the local government sector but less evidence of how cross sectoral linkages are leading to improved implementation and outcomes.	Moderate progress. This assessment considers progress across the three NAF sectors (agriculture, forestry and seafood) together though an overall asymmetry between the strong attention given to adaptation of agriculture compared to the other 2 sectors in the Department is noted.

Risk, prioritisation and adaptive capacity	Resourcing and mainstreaming	Governance, coordination and cross cutting issues	Overall Progress Assessment
Biodiversity (Department of Housing, Local Government and Heritage)			
Limited progress. While the interconnected nature of the sector is recognised, specific vulnerabilities facing biodiversity and priority actions to address these are not clear. The Council considers that leveraging programmes led by other Departments (such as the Common Agricultural Policy) to advance biodiversity adaptation is made more difficult because of this.	Limited progress. A range of research and restoration projects are underway, particularly regarding bogs and peatlands, but linkages to mitigation policies are unclear. Resource constraints in NPWS appear to be limiting its ability to engage with other actors.	Limited progress. How monitoring responsibilities of the NPWS under EU Directives inform adaptation actions and MRE is unclear. Though the decision to use existing oversight structures to implement the sectoral plan is sensible, adaptation links to the National Biodiversity Action Plan appear to require development.	Limited progress. The wide range of adaptation challenges facing this key, deeply interdependent sector is acknowledged but further, coordinated, action is essential.
Electricity and Gas Networks (Department of the Environment, Climate and Communications)			
Limited progress. Further evidence that specific risks facing the sector are being addressed and interdependencies between the electricity and gas networks are being addressed from a vulnerability perspective is required.	Insufficient evidence regarding how climate resilience is being resourced and mainstreamed by the Department and operators in this sector.	Limited progress. Further clarity regarding the governance of adaptation in this sector and its coordination with other national, local and sectoral adaptation structures is required.	Limited progress. This is a concern particularly given the potential climate vulnerability arising from the electrification of the power system, personal transport, heat etc. as part of decarbonisation (in addition to cascading effects for other sectors).

Risk, prioritisation and adaptive capacity	Resourcing and mainstreaming	Governance, coordination and cross cutting issues	Overall Progress Assessment
Communications Networks (Department of the Environment, Climate and Communications)			
No information received.	No information received.	No information received.	No progress/insufficient evidence. The absence of a published Annual Transition Statement for 2020 and of a completed consultation template means limited information is available and in light of this a score of 'No progress/insufficient evidence' has been assigned. Given the increasing reliance on ICT and the risk of cascading failures in particular this is a concern.

Risk, prioritisation and adaptive capacity	Resourcing and mainstreaming	Governance, coordination and cross cutting issues	Overall Progress Assessment
Health (Department of Health)			
No detailed information received.	No detailed information received.	No detailed information received.	No progress/insufficient evidence. While fully recognising the unprecedented challenge to the health sector of COVID-19 since early 2020, the absence of a completed consultation template means limited information is available and in light of this a score of 'No progress/ insufficient evidence' has been assigned. It is essential that the health sector scales up its action on climate change especially as the climate crisis will increasingly become a health crisis. The Lancet Countdown 2020 Report key message states 'The COVID-19 pandemic and climate change represent converging crises... we don't have the luxury of tackling one crisis alone... climate change and infectious disease share common drivers. Responding to climate change today will bring about cleaner skies, healthier diets, and safer places to live–as well as reduce the risk factors of future infectious diseases.'

Note: In the overall progress assessment this year the Adaptation Committee and Council have given slightly more weight to sectors demonstrating progress in addressing prioritised risks and vulnerabilities, building adaptive capacity and putting in place good governance and coordination structures. For example adaptation actions may be well resourced but to be effective they must be coherent with other policies and sectors and addressing key, prioritised risks.

Appendix 2 – Accessible adaptation scorecard summary

Sector Criteria	Risk, prioritisation & adaptive capacity	Resourcing & main-streaming	Governance, coordination & cross cutting issues	Overall Progress Assessment
National Adaptation Framework	Good	Moderate	Moderate	Moderate progress. The success of Ireland's overarching adaptation policy and progress towards climate resilience is hampered by the absence of a national resilience indicator set.
Local Government	Moderate	Limited	Good	Moderate progress. Local government has been required to undertake significant work to begin planning for climate change under the NAF. How building climate resilience integrates with increasing mitigation obligations in the sector will be a key consideration.
Flood Risk Management (OPW)	Advanced	Advanced	Good	Good progress. This sector has significant experience of climate change adaptation planning and in managing risk but ongoing collaboration with other sectors and consideration of relationship between flood risk and socioeconomic developments remains key.
Water Quality and Water Services Infrastructure (Department of Housing, Local Government and Heritage)	Good	Good	Moderate	Good progress. This reflects the overall assessment of the two sectors of water quality and water services infrastructure. Ongoing attention must be given to demonstrating the resilience of water supply in particular.

Sector Criteria	Risk, prioritisation & adaptive capacity	Resourcing & main-streaming	Governance, coordination & cross cutting issues	Overall Progress Assessment
Built and Archaeological Heritage (Department of Housing, Local Government and Heritage)	Moderate	Moderate	Good	Moderate progress. This sector has been required to undertake significant work as it begins planning for climate change under the NAF.
Transport Infrastructure (Department of Transport)	Moderate	Moderate	Good	Moderate progress. Though this sector has significant experience in adaptation planning, further work to build on this and further mainstream adaptation across it is required.
Agriculture, Forest and Seafood (Department of Agriculture, Food and the Marine)	Moderate	Moderate	Good	Moderate progress. This assessment considers progress across the three NAF sectors (agriculture, forestry and seafood) together though an overall asymmetry between the strong attention given to adaptation of agriculture compared to the other 2 sectors in the Department is noted.
Biodiversity (Department of Housing, Local Government and Heritage)	Limited	Limited	Limited	Limited progress. The wide range of adaptation challenges facing this key, deeply interdependent sector is acknowledged but further, coordinated, action is essential.

Sector Criteria	Risk, prioritisation & adaptive capacity	Resourcing & main-streaming	Governance, coordination & cross cutting issues	Overall Progress Assessment
Electricity and Gas Networks (Department of the Environment, Climate and Communications)	Limited	No progress/ insufficient evidence	Limited	Limited progress. This is a concern particularly given the potential climate vulnerability arising from the electrification of the power system, personal transport, heat etc. as part of decarbonisation (in addition to cascading effects for other sectors).
Communications Networks (Department of the Environment, Climate and Communications)	No progress/insufficient evidence. The absence of a published Annual Transition Statement for 2020 and of a completed consultation template means limited information is available and in light of this a score of 'No progress/ insufficient evidence' has been assigned. Given the increasing reliance on ICT and the risk of cascading failures in particular this is a concern.			
Health (Department of Health)	No progress/insufficient evidence. While fully recognising the unprecedented challenge to the health sector of COVID-19 since early 2020, the absence of a completed consultation template means limited information is available and in light of this a score of 'No progress/insufficient evidence' has been assigned. It is essential that the health sector scales up its action on climate change especially as the climate crisis will increasingly become a health crisis. The Lancet Countdown 2020 Report key message states 'The COVID-19 pandemic and climate change represent converging crises…we don't have the luxury of tackling one crisis alone… climate change and infectious disease share common drivers. Responding to climate change today will bring about cleaner skies, healthier diets, and safer places to live–as well as reduce the risk factors of future infectious diseases.'			

Notes: The detailed assessment under each of these criteria is included in the appendices. In the overall progress assessment this year the Adaptation Committee and Council have given slightly more weight to sectors demonstrating progress in addressing prioritised risks and vulnerabilities, building adaptive capacity and putting in place good governance and coordination structures. For example, adaptation actions may be well resourced but to be effective they must be coherent with other policies and sectors and addressing key, prioritised risks.

Endnotes

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