Ireland's Second Biennial Report 2016

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1. Introduction

As a Party to the UN Framework Convention on Climate Change, Ireland is required to report regularly on its implementation of the Convention in National Communications every four years. Ireland's most recent National Communication (NC6) was submitted in 2014[1]. In 2010, at the 16th Conference of the Parties (COP16) to the Convention in Cancun, Parties decided to enhance reporting on progress in achieving emissions reductions and on the provision of financial, technology and capacity building support, through a biennial reporting process. COP16 also decided to develop a Common Tabular Format (CTF) for the electronic reporting of information. At COP17 in Durban, in Decision 2/CP.17, Parties adopted the guidelines for this enhanced reporting and the following year, COP18 in Doha adopted the CTF contained in FCCC/CP/2012/8/Add.3 through Decision 19/CP.18.

This is Ireland's second biennial report (BR2) under the UNFCCC and has been elaborated in accordance with the Decisions 2/CP.17 and 19/CP.18.. The electronic information contained in the CTF is submitted separately.

COP17 also agreed the modalities and procedures for International Assessment and Review of emissions and removals in a rigorous and robust, transparent manner with a view to promoting comparability and building confidence. The Review process consists of technical expert review of reported information and participation in a multilateral assessment process. This Biennial Report is informed by lessons learned from the first Biennial Report (BR1) submitted in 2014 and its subsequent Technical Review and Multilateral Assessment which was completed in June 2015[2].

The Information provided on greenhouse gas emissions and trends is consistent with the information in Ireland's greenhouse gas inventory submission for 2015[3]. This was the first submission of the inventory under the Revision of the UNFCCC Inventory Reporting Guidelines on annual inventories for Parties included in Annex I to the Convention adopted by COP at Warsaw (Decision 24/CP.19).

The EU and its Member States are committed to a joint quantified economy-wide emission reduction target of 20 per cent by 2020, compared to 1990 levels. Therefore Ireland and other Member States of the EU have not submitted individual economy-wide emission reduction targets to the UNFCCC secretariat. The details of the EU joint target under the UNFCCC are clarified in the document *Additional information relating to the quantified economy-wide emission reduction targets* contained in document FCCC/SB/2011/INF.1/Rev.1 (FCCC/AWGLCA/2012/MISC.1).

[1] http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/ita_nc6_resubmission.pdf
[2] http://unfccc.int/national_reports/biennial_reports_and_iar/items/8824.php
[3] Ireland National Inventory Report 2015

2. Information on GHG emissions and trends, GHG inventory including information on national inventory system

2.1 Introduction and summary information from the national GHG inventory[4]

In 2013, total emissions of greenhouse gases including indirect emissions from solvent use (excluding the LULUCF sector) in Ireland were 58,820.88 kt CO_2 equivalent, which is 3.6 per cent higher than emissions in 1990 as presented in Figures 2.1 and 2.2. The total for 2013 is 18.1 per cent lower than the peak of 71,802.64 kt CO_2 equivalent in 2001 when emissions reached a maximum following a period of unprecedented economic growth. The *Energy* sector accounted for 60.8 per cent of total emissions in 2013, *Agriculture* contributed 32.2 per cent while a further 4.7 per cent emanated from *Industrial Processes and Product Use* and 2.3 per cent was due to *Waste*. Emissions of CO_2 accounted for 63.1 per cent of the national total in 2013, with CH_4 and N_2O contributing 22.5 per cent and 12.1 per cent, respectively. The combined emissions of HFC, PFC, SF_6 and NF_3 accounted for 2.3 per cent of total emissions in 2013. Trends of GHG emissions by sector and gas are presented in figures 2.1 and 2.2.

Fuel combustion in the *Energy* sector is the principal source of emissions in Ireland and major increases in fuel use have driven the increase in emissions in the 1990-2013 time-series. The largest increase took place in transport with an increase of 115.5 per cent on 1990 levels, while there were increases of 6.8 per cent and 1.3 per cent in the emissions from the industrial sectors and energy industries, respectively. The emissions from *Agriculture* sector, the other main source category, increased during the 1990s but have decreased to 8.5 per cent below 1990 levels in 2013. As the emissions from energy increased, the contribution of agriculture to total national emissions decreased from 36.5 per cent in 1990 to 32.2 per cent in 2013. This is primarily as a result of falling livestock numbers since 1998 due to reform of the Common Agricultural Policy (CAP).

Ireland's commitment on greenhouse gases under the Kyoto Protocol pursuant to its Article 3, paragraph 9, the Doha Amendment (1/CMP.8) is set out in Annex B of the protocol. Ireland's quantified emission limitation reduction commitment (QELRCs) for the period 2013 to 2020 is 80 per cent of its base year emissions. The QELRCs for the European Union and its Member States for the second commitment period under the Kyoto Protocol are based on the understanding that these will be fulfilled jointly with the European Union and its member States and Iceland, in accordance with Article 4 of the Kyoto Protocol. The legislative agreements setting out joint fulfilment under Article 4 of the Kyoto Protocol between the European Union and its Member States (Council Decision EU 2015/1339), and the European Union and its Member States and Iceland (Council Decision EU 2015/1340) were finalised in July 2015.

The European Union's Effort Sharing Decision (No. 406/2009/EC) established binding annual targets for Member States for the period 2013–2020. These targets cover emissions from most sectors not included in the EU Emissions Trading System (EU ETS), such as transport (except aviation and

[4] Ireland National Inventory Report 2015

international maritime shipping), buildings, agriculture and waste. Ireland's binding target is set out in Annex II of the decision and limits emissions to -20 per cent compared to 2005 greenhouse gas levels. Ireland's actual annual emissions allocations (AEAs) for each year of the period 2013 to 2020 are set out in Annex II to Decision 2013/162/EU as adjusted by the amounts in Annex II to Decision 2013/634/EU.

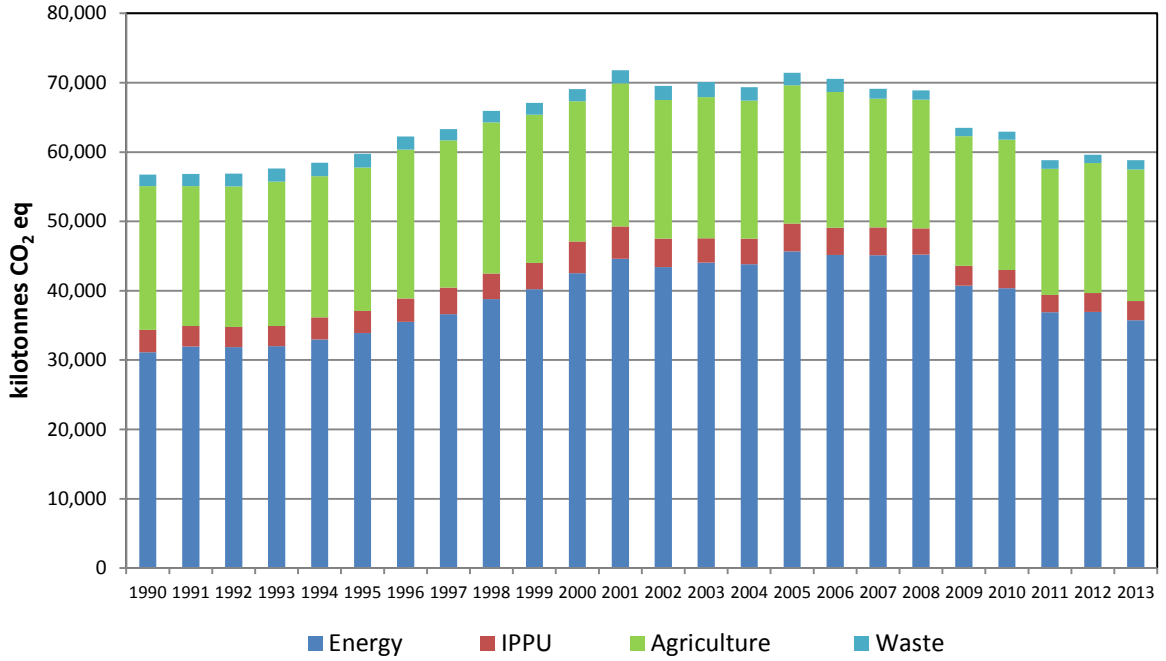

Figure 2.1 National total Greenhouse Gas emissions by sector (excluding LULUCF) 1990-2013

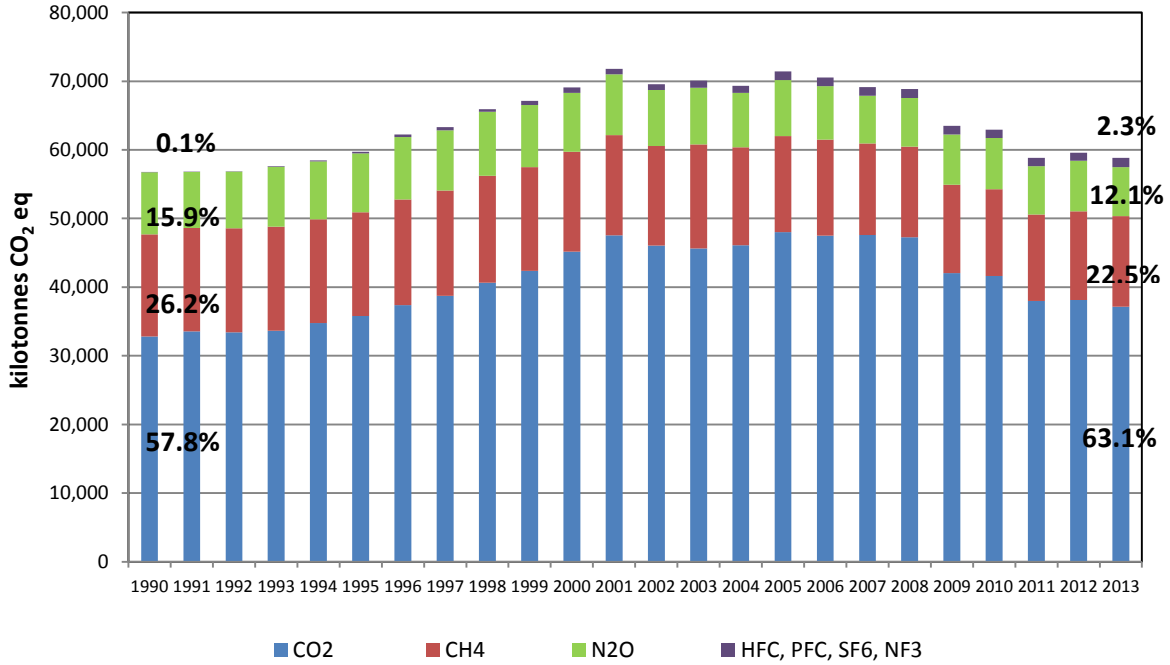

Figure 2.2 Greenhouse Gas emissions-by Gas 1990-2013

2.2 National inventory arrangements

The Environmental Protection Agency is required to establish and maintain databases of information on the environment and to disseminate such information to interested parties (Section 52 of the Environmental Protection Agency Act of 1992 (DOE, 1992)). The Act states that the Agency must provide, of its own volition or upon request, information and advice to Ministers of the Government in the performance of their duties (Section 55). This includes making available such data and materials as are necessary to comply with Ireland's reporting obligations and commitments within the framework of international agreements. These requirements are the regulatory basis on which the EPA prepares annual inventories of greenhouse gases and other important emissions to air in Ireland. It is in this context that in 1995 the Department of the Environment, Community and Local Government (DECLG) designated the EPA as the inventory agency with responsibility for the submission of emissions data to the UNFCCC Secretariat and to the Secretariat for the Convention on Long-Range Transboundary Air Pollution (CLRTAP).

2.2.1 Summary information on national inventory arrangements

The establishment of Ireland's national inventory system was completed by Government Decision in early 2007, building on the framework that had been applied for many years. The EPA's Office of Climate, Licensing, Resource and Research (OCLRR) was designated the inventory agency and the EPA was also designated as the single national entity with overall responsibility for the annual greenhouse gas inventory. Within the OCLRR, the Climate Resource and Research Programme (CRRP), compiles the national greenhouse gas emission inventories for submission on behalf of DECLG under the Framework Convention on Climate Change and Regulation (EU) 525/2013, the latter being the basis for EU Member States' reporting under the Convention and the Kyoto Protocol. All formal mechanisms together with the QA/QC (Quality Assurance/Quality Control) procedures are fully operational since they were established in the 2007 reporting cycle.

Following establishment of the national system, institutional arrangements directed towards national inventory reporting that involve the EPA, DECLG and other stakeholders were reorganised, extended and legally consolidated across all participating institutions to strengthen inventory capacity within the EPA. This ensured that more formal and comprehensive mechanisms of data collection and processing were established and maintained for long term implementation. In particular, the system puts in place formal procedures for the planning, preparation and management of the national atmospheric inventory and identifies the roles and responsibilities of all the organisations involved in its compilation. This was achieved through extensive discussions with all key data providers leading to the adoption of Memoranda of Understanding (MOU) between the key data providers and the inventory agency. These MOUs stipulate the scope, timing and quality of the inputs necessary for inventory compilation in accordance with the guidelines for national systems. Secondary MOUs are, in turn, used by some key data providers to formalise the receipt of data from their own particular sources. Table 2.1 lists the key data providers and indicates the range of data covered by MOU in the national system. A QA/QC plan is an integral part of the national system.

In addition to the primary data received from the key data providers, the inventory team draws on various other data streams available within the EPA, such as the National Waste Database, reports on wastewater treatment, Annual Environmental Reports from companies subject to Integrated Pollution Prevention Control and submissions prepared under the European Pollutant Release and Transfer Register and also obtains information from other diverse sources to prepare the inventories

for fluorinated gases and solvent use. The inventory team also draws on national research related to greenhouse gas emissions and special studies undertaken from time to time to acquire the information needed to improve the estimates for particular categories and gases.

The Emissions Trading Unit (ETU), also within the Climate Resource and Research Programme of the OCLRR, is a key component of the national system. The ETU are responsible for administering the European Union Emissions Trading System (ETS), under Directive 2003/87/EC (EP and CEU, 2003), in Ireland and, as such, provide annual verified emissions data to the inventory team.

The estimates of emissions and removals for forest lands under the Convention, as well as those in respect of Article 3, paragraph 3, activities under the Kyoto Protocol, are prepared by consultants contracted to the Department of Agriculture, Food and Marine (DAFM). These are delivered to the inventory agency under a Memorandum of Understanding between DAFM and OCLRR. A research fellow contracted directly to OCLRR is responsible for completion of the annual inventory for all other land categories in LULUCF for the annual inventory under the Convention and elected activities under Article 3, paragraph 4, of the Kyoto Protocol (Cropland management and Grazing land management). The deliverables received by OCLRR from DAFM and the research fellow include the completed CRF tables and draft NIR sections for their respective areas of responsibility.

The approval of the completed annual inventory involves sign-off by the QA/QC manager and the inventory manager before it is transmitted to the Board of the EPA via the Programme Manager of the Climate Resource and Research Programme in OCLRR. Any issues arising from the Board's examination of the estimates are communicated to the inventory experts for resolution before final adoption of the inventory. The results for the inventory year are normally released at national level in autumn of the following year. This is in advance of their official submission to the European Commission in accordance with Regulation (EU) 525/2013 in January of the reporting year and subsequently to the UNFCCC secretariat.

The national system is also exploited for the purpose of parallel inventory preparation and reporting under the LRTAP Convention ensuring efficiency and consistency in the compilation of emission inventories for a wide range of substances using common datasets and inputs.

Table 2.1 Key Data Providers and Information covered by MOU

Key Data Provider	Data Supplied	Deadline	Sector in which data are used
Sustainable Energy Authority of Ireland	National Energy Balance; Detailed national energy consumption disaggregated by economic sector and fuel	30 September	Energy, Waste
Department of Agriculture, Food and Marine	**Table 1.1-1.4** Statistical data for cattle compiled under the Animal Identification and Movement (AIM) scheme Fertiliser and lime statistics Poultry statistics Sheep statistics	30 September	Agriculture
Department of Agriculture, Food and Marine (Forest Sector Development Division)	**Table 2.1** GHG emission/removal estimates from all pools for forest lands under the Convention Statistical data on Afforestation, Reforestation, Deforestation and harvesting for forest land lands under Article 3.3 of KP GHG emission/removal estimates from all	30 September	LULUCF and Article 3.3 and 3.4 of the Kyoto Protocol

	biomass pools for KP Article 3.3 and elected activities under Article 3, paragraph 4, of the Kyoto Protocol (Cropland management and Grazing land management).		
Central Statistics Office	Annual population, livestock populations, crop statistics, housing survey data	30 September	Agriculture, IPPU, Waste
Bord Gais	Analysis results for indigenous and imported natural gas	30 September	Energy
Marine Institute	Annual Report on Discharges, Spills and Emissions from Offshore Gas Production Installations	30 October	Energy
Emissions Trading Unit	Verified CO_2 estimates and related fuel and production data for installations covered by the EU ETS[1]	30 April	Energy, IPPU
*Department of Communications, Energy and Natural Resources	National Oil Balance (as a component of the Energy Balance)	30 September	Energy
*Road Safety Authority	Road transport statistics from the National Car Test (NCT)	30 April	Energy
**Forest Service	(i) GIS data base on premiums and grants afforestation areas (iFORIS) with associated attributes (II) NFI database	30 September 2007, 2012	LULUCF and Article 3.3 & 3.4 activities
**Coillte	GIS data base of intersected of NFI permanent sample plot points (Coillte-NFI plots) with sub-compartment and management unit data.	30 September	LULUCF and Article 3.3 & 3.4 activities

[1]ETS – Emissions Trading System

*These bodies have MOUs with SEAI rather than with OCLRR

**These bodies have MOUs with the Department of Agriculture, Food and Marine rather than with OCLRR

2.2.2 Summary information on changes to national inventory arrangements since the last National Communication or Biennial Report

There has been no change in the national inventory arrangements since Ireland's sixth National Communication and Biennial Report in 2014.

3. Quantified economy-wide emission reduction target

Ireland is a Member State of the European Union. In 2010, the EU submitted a pledge to reduce its GHG emissions by 2020 by 20 % compared to 1990 levels (FCCC/SB/2011/INF.1/Rev.1 of 7 June 2011). In addition the EU provided additional information relating to its quantified economy-wide emission reduction target in a submission as part of the process of clarifying the developed country Parties' targets in 2012 (FCCC/AWGLCA/2012/MISC.1). Summary information on the target can be found in Table 3.1.

Table 3.1: Joint quantified economy-wide emission reduction target of the EU and its Member States

Parameter	Target
Base Year	1990
Target Year	2020
Emissions Reduction Target	20% reduction relative to 1990
Gases Covered	CO2 , CH4 , N2O, HFCs, PFCs, SF6
Global Warming Potential	AR4
Sectors Covered	Energy, Transport, Industrial processes, Agriculture, Waste (international aviation to the extent it is included in the EU ETS)
Land Use, Land Use Change and Forestry(LULUCF)	Excluded
Use of international credits (JI and CDM)	Possible subject to qualitative and quantitative limits

As this target under the convention has only been submitted by EU-28 and not by each of its Member States (MS), there are no specified convention targets for single MS. Due to this, Ireland as part of the EU-28, takes on a quantified economy-wide emission reduction target jointly with all Member States.

With the 2020 climate and energy package the EU has set internal rules which underpin the implementation of the target under the Convention. The 2020 climate and energy package introduced a clear approach to achieving the 20 % reduction of total GHG emissions from 1990 levels, which is equivalent to a 14 % reduction compared to 2005 levels. This 14 % reduction objective is divided between two sub-targets, a 21% reduction target for those sectors covered by the European Union Emissions Trading System (EU ETS), and a 10% reduction target for sectors outside the scheme.

Under the revised EU ETS Directive[5], one single cap covers the EU Member States and the three participating non-EU Member States (Norway, Iceland and Liechtenstein), i.e. there are no further differentiated caps by country. For allowances allocated to the EU ETS sectors, annual caps have been set for the period from 2013 to 2020; these decrease by 1.74 % annually, starting from the average level of allowances issued by Member States for the second trading period (2008–2012). The annual caps imply interim targets for emission reductions in sectors covered by the EU ETS for each year until 2020.

[5] Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community (OJ L 140, 05.06.2009, p. 63) (http://eur-lex.europa.eu/ LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:00 63:0087:en:PDF)

In the year 2014 verified emission of stationary installations covered under the EU ETS in Ireland totalled 15.95 Mt CO_2 e. This is 29% lower than the equivalent figure for 2005. Whilst some of these reductions are directly attributable to a reduction in economic activity, particularly in the area of construction, the increasing penetration of renewable technologies, primarily in relation to power generation, also plays an important role. The share of total final consumption of electricity provided by renewables increased from 7.2% to 20.9% between 2005 and 2013[6].

Non-ETS emissions are addressed under the Effort Sharing Decision (ESD)[7]. The ESD covers emissions from all sources outside the EU ETS, except for emissions from international maritime, domestic and international aviation (which were included in the EU ETS from 1 January 2012) and emissions and removals from land use, land-use change and forestry (LULUCF). It thus includes a diverse range of small-scale emitters in a wide range of sectors: agriculture, transport, the built environment, small industrial installations, fugitive emissions from the energy sector, emissions of fluorinated gases from appliances and other sources, and waste. Such sources currently account for about 60 % of total GHG emissions in the EU, but approximately 73% of emissions in Ireland.

While the EU ETS target is to be achieved by the EU as a whole, the ESD target was divided into national targets to be achieved individually by each Member State. In the Effort Sharing Decision national emission targets for 2020 are set, expressed as percentage changes from 2005 levels. These changes have been transferred into binding quantified annual reduction targets for the period from 2013 to 2020 (EC 2013), expressed in Annual Emission Allocations (AEAs). The quantified annual reduction targets 2013-2020 for Ireland are tightened from about 4% below 2005 levels in 2013 to 20% below 2005 levels by 2020 along a linear pathway[8]. Actual emissions levels for 2013 are around 12% below 2005 levels. Provisional inventory data for 2014 suggests that non ETS emissions were about 13% below 2005 levels. Whilst the early years of the 2013-2020 period are characterised by surpluses it is likely that there will be deficits in the later years of the commitment period. These surpluses generated can be carried forward for use in later years of the commitment period.

The monitoring process is harmonized for all European MS, especially laid down in the Monitoring Mechanism Regulation[9] .

[6] See http://statistics.seai.ie/chart.php?ref=RES04 for further details
[7] Decision No 406/2009/EC
[8] These figures are based on recalculations of the likely targets based on the new Global Warming Potentials and Good Practice Guidelines. Earlier European Commission Decisions detailing Member States annual targets were formulated using the old methodologies and GWP values.
[9] Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC; and the related implementing Regulation (EU) No 749/2014 **of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council** .

4 Progress in achievement of the quantified economy-wide emission reduction targets

4.1 Mitigation actions and their effects

Ireland as a member of the European Union takes on the quantified economy-wide emission reduction target jointly with all Member States. Irish policies and measures for the mitigation of greenhouse gas emissions, especially measures to achieve Ireland's target under the Effort Sharing Decision, contribute to the achievement of the joint EU target, together with the policies and measures of the other Member States of the EU. Common and coordinated policies and measures of the Union are applicable to all Member States and are described in the Biennial Report of the European Union.

4.1.1 Domestic Insitutional Arrangements

On December 10th 2015 the Climate Action and Low Carbon Development Act was signed into law. The Act provides a statutory basis for the national objective of transition to a low carbon, climate resilient and environmentally sustainable economy by the year 2050. In doing so, it also provides a solid statutory foundation to the institutional arrangements necessary to enable the State to pursue and achieve that national transition objective. The national transition objective was set out in the National Policy Position on Climate Action and Low Carbon Development adopted by Government in April 2014[1].

Among the key provisions of the Act are the preparation and adoption of:

- successive 5-yearly National Mitigation Plans (NMP) which will specify the policy measures to be adopted to reduce greenhouse gas emissions in Ireland; and
- National Adaptation Frameworks, to be reviewed every five years, which will specify the national strategy for the application of adaptation measures in different sectors and by local authorities to adapt to the inevitable effects of climate change in Ireland.

The Act also provides for the establishment of a Climate Change Advisory Council (CCAC) to provide advice and recommendations to Ministers and the Government on climate change matters. The CCAC had already been established on a non-statutory basis under the chairmanship of Professor John Fitzgerald, pending enactment of the legislation. The CCAC is made up of seven members appointed by Government upon the nomination of the Minister for Environment Community and Local Government and four ex-officio members who represent the Environmental Protection Agency, the Sustainable Energy Authority of Ireland, the Economic and Social Research Institute and Teagasc, the national body providing integrated research, advisory and training services to the agriculture and food industry and rural communities.

The Act requires the Minister for the Environment and other relevant Ministers to report regularly and transparently on how Ireland is performing towards meeting the objectives and measures set down in the Plans, in the form of annual transition statements to both Houses of the Oireachtas (Parliament) on progress with climate mitigation and adaptation efforts. The Act also requires the CCAC to conduct an annual review of progress made in the previous year in achieving GHG emissions

[1] http://www.environ.ie/en/Publications/Environment/Atmosphere/FileDownLoad,37827,en.pdf

reductions and furthering transition to a low carbon economy and to prepare an annual report on its findings and recommendations.

Under the provisions of the Act, the first NMP must be approved by Government by 9 June 2017. The NMP is currently under development and is being co-ordinated by the Department of Environment, Community and Local Government in collaboration with the Departments responsible for the key sectors in the transition process i.e. Departments of Agriculture, Food and Marine; Communications, Energy and Natural Resources; and Transport, Tourism and Sport.

Additionally some recent policy developments are worthy of note. In December of 2015 the Department of Communications Energy and Natural Resources published "Ireland's Transition to a low carbon energy future 2015-2030"[10]. Whilst this publication has a wide scope including issues such as energy security, energy costs and consumer participation there is a strong focus on the decarbonisation agenda. Amongst the most relevant commitments in the White Paper in regards to climate change are the following:

- A vision of a low carbon energy system means that greenhouse gas (GHG) emissions from the energy sector will be reduced by between 80% and 95%, compared to 1990 levels, by 2050, and will fall to zero or below by 2100.
- radically changing our behaviour as citizens, industry and Government by examining opportunities for share ownership schemes for renewables projects in local communities
- becoming more energy efficient – including by way of improved building regulations, and for example by publishing a new Public Sector Energy Efficiency Action Plan in 2016, re-designing the approach to residential energy efficiency based on the new behavioural change research, increasing support for business to access efficiency improvements and realising the multiple benefits of energy efficiency by coordinating energy, health and social inclusion policies through a new energy poverty strategy.
- increasing the share of electricity generated from renewable sources, including by introducing a new Renewable Electricity Scheme in 2016 and exploring the scope to provide market support to micro-generation
- moving to lower emissions fuels (e.g. moving from peat and coal to gas), and ultimately away from fossil fuels altogether
- increasing our use of electricity and bioenergy to heat our homes and fuel our transport
- increasing the Biofuels Obligation and improving take-up of zero and low carbon vehicles such as electric and natural gas vehicles (through grants and tax relief)
- supporting the wide scale deployment of renewable heat in the business, public and residential sectors by, for example the introduction of a Renewable Heat Incentive to apply to the non ETS sectors in 2016

These domestic efforts are strongly supported by the body of European Union Law which details Ireland's obligations in respect of climate change in particular in respect of monitoring, reporting and verification of emissions levels and future trends. Progress towards the economy-wide emission reduction target of the European Union can only be evaluated at Union level. To this end, the EU Monitoring Mechanism Regulation (Regulation (EU) No 525/2013) requires Member States to report to the European Commission annually on greenhouse gas emissions and related data and biennially

[10] http://www.dcenr.gov.ie/energy/Lists/Publications%20Documents/Energy%20White%20Paper%20-%20Dec%202015.pdf

on projections and policies and measures. Evaluation is done by the European Commission. Detailed information is available in Section 2.2 of the European Union BR.

4.1.2 Information on mitigation actions, including on policies and measures implemented or planned since BR1

A detailed overview of Ireland's portfolio of mitigation actions, including information on policies and measures implemented or planned to achieve the economy-wide emission reduction targets described in this biennial report, is included in Chapter 4 of Ireland's Sixth National Communication. A summary table on Ireland's portfolio of mitigation actions organised by sector: and including information on which gases are affected by the measures, is included as Table 3 in the CTF. For some of the measures included in BR1/CTF1 the information has been updated for BR2/CTF2. Where new information on the effects of measures or groups of measures has been provided, this is also included in Table 3 in CTF2. Section 5.6 of this report also provides an overview of the range of policies and measures implemented at a sectoral level and their impact on emissions in the projections scenarios. The following section gives a brief overview of changes to some of the key cross sectoral measures including the two key pieces of legislation which are agreed at European Union level.

Cross Sectoral Policies and Measures

The **EU Emissions Trading System** (EU ETS) was established in 2003 by Directive 2003/87/EC and is the largest emissions trading system in the world. In the Irish context the system covers over 100 large point source installations, responsible for approximately 27% of greenhouse gas emissions. The EU ETS is central to the EU fight against climate change in that it aims to deliver abatement where it is most cost effective. Since the last biennial report the following major changes to the EU ETS have been agreed.

1. A Market Stability Reserve shall be established in 2018 and the placing of units in the reserve shall begin on 01/01/2019[11]. This reserve will set aside units which are surplus to requirements of the scheme based on quantitative criteria and these units may be returned thereafter when the demand for the units increases relative to the amounts of units available for auction. The European Commission estimated that the structural surplus in the EU ETS was 2.07 Gt CO_2e at the end of 2014[12].
2. The European Council has agreed[13] that the rate of annual reduction of the cap of allowances should increase from 1.74% to 2.2% from 2021 onwards. This will ensure that these emissions are reduced by 43% relative to 2005 by 2030. Further reforms to the functioning of the EU ETS were also included in a proposal from the European Commission for a revised Directive which was published in July 2015. The main changes proposed relate to improved carbon leakage rules and funding low carbon innovation and energy sector modernisation[14].

In 2014 Irish ETS emissions were 27% lower than in 2005." (Source EEA ETS Data Viewer[15])

Emissions outside the EU ETS are regulated based on the **Effort Sharing Decision (ESD)**. Member States take responsibility for these emissions. The rule base of the ESD in so far as it impacts on

[11] Decision (EU) 2015/1814
[12] http://ec.europa.eu/clima/policies/strategies/progress/docs/com_2015_576_annex_1_cover_en.pdf
[13] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/145397.pdf
[14] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015PC0337R(01)&from=EN
[15] http://www.eea.europa.eu/data-and-maps/data/data-viewers/emissions-trading-viewer

Ireland is outlined in Section 3. The only significant development or change relative to the previous biennial report is that the European Council has agreed that these emissions should be reduced by 30% relative to 2005 by 2030. It is expected that the European Commission will table an implementing proposal as to how the burden should be shared amongst Member States during 2016. Ireland's emissions under the Effort Sharing Decision are estimated to be 13% lower than 2005 levels in 2014 (based on provisional estimates).

In December 2009 a **carbon tax** was introduced at a rate of €15 per tonne on certain uses of fossil fuels outside the EU ETS (under which emissions were already subject to a carbon price). Since then the rate has increased to €20 per tonne and the coverage of the tax has been extended to include transport fuels, heating fuels including coal and peat. The final extension of the tax at the full rate to coal and peat use was implemented in April 2014, having been originally implemented at a reduced rate one year earlier. There have been no substantive changes to the tax since that date. It is estimated that the carbon tax reduces emissions by about 0.3Mt CO_2e per annum.

Tax incentives are available for a wide range of energy efficient equipment through the **Accelerated Capital Allowance** (ACA) scheme. The scheme enables companies to claim 100% of the capital cost of certain energy efficient plant and machinery against corporation tax in the year of purchase. The purpose of the ACA scheme is to encourage businesses to purchase plant and machinery that are highly energy efficient and thus make significant savings on energy costs and reduce carbon emissions. The scheme was approved for an initial period of three years from 9 October 2008. The scheme has subsequently been extended twice, most recently up until the end of 2017.

4.2 Estimates of emissions reductions and removals from use of units from Market Based Mechanisms and Land Use, Land Use Change and Forestry

4.2.1 Market Based Mechanisms

Between 2008 and 2012 Irish ETS installations were allocated a total of 104.3 Mt CO_2e, and had total verified emissions of 87.6 Mt CO_2e. Installations are allowed to use international credits from the Clean Development Mechanism and Joint Implementation Mechanism up to a maximum of 11.1 Mt CO_2e[16] which covers the period from 2008 to 2020 inclusive. During the 2008-2012 commitment period (aka Phase II of the EU ETS) 3.7 Mt CO2e of certified emissions reductions and 2.9 Mt CO_2e of emissions reductions units were retired by these installations. A further 4.2 Mt CO_2e of these units have been exchanged for Phase III EUAs by Irish installations, giving a total use of 10.8 Mt CO_2e. These 4.2 Mt CO2e of units have been retired. For further information on the EU ETS see EUBR chapter 4.2.2.

The use of flexible mechanisms is also allowed under the ESD. All Member States can use 3% of their 2005 emissions per annum in terms of units from the Clean Development Mechanism and the Joint Implementation Mechanism. If these rights are not used in one year they can be used later in the commitment period or sold to another Member State. Certain Member States including Ireland can use a further 1% of 2005 emissions per annum, but only if the units are sourced from Least Developed Countries or Small Island Developing States. This right is not transferable between Member States or between years. In total these provisions could allow Ireland to use up to 15.6Mt CO_2e of units for compliance with its obligations through the use of flexible mechanisms over the

[16] This limit was originally to apply to the period 2008-2012 only. Full details of the Irish National Alloaction Plan are available at http://www.epa.ie/pubs/reports/air/etu/NAP2%20_Final%20_Allocation%20_Decision_040320082.pdf

period 2013-2020. However the current outlook is that Ireland is likely to face a small deficit (With Measures Projection) or a small surplus (With Additional Measures Projection). At this point no AEAs (or any other unit type) have been surrendered for compliance, but the first such transactions are expected to take place in late 2016.

In respect of demonstrating compliance with the first commitment period of the Kyoto Protocol, and in addition to those units mentioned above, Ireland retired 1.2Mt CO_2e of temporary CERs and 1.9Mt CO2e of units which were acquired under the provisions relating to international emissions trading as set out in Article 17 of the Protocol and its subsequent Decisions. CERs and ERUs totalling 5.3Mt CO2e and 0.07Mt CO2e are being carried forward and may be used for compliance with the provisions of the ESD. A further 7.8Mt CO2e of AAUs will be placed in the Prior Period Surplus Reserve[17].

4.2.2 Land Use, Land Use Change and Forestry

Information on emissions in the base year and in the reporting years can be found in CTF Table 4. The quantified economy-wide emission reduction target in FCCC/SB/2011/INF.1/Rev.1 does not include emissions/removals from LULUCF.

In respect of demonstrating compliance with its commitments under the first commitment period of the Kyoto Protocol Ireland retired 16.3Mt CO_2e of RMUs and cancelled a further 1.6Mt CO_2e in order to address the issue of emissions from deforestation. RMUs cannot be used in the context of the Effort Sharing Decision for the years 2013-2020.

4.3 Information on the assessment of the economic and social consequences of response measures

As a Member State of the European Union, Ireland's commitments under the Kyoto Protocol are being implemented under Decision 2005/166/EC, governing joint fulfilment under Article 4, and Decision 280/2004/EC, which covers specific emissions monitoring and reporting requirements. In this context, the minimization of adverse impacts on developing countries is also largely dictated by the European Commission's policy on climate change and by its policies and programmes affecting developing countries. Regulation at the European level also controls or influences market conditions, fiscal incentives, tax and duty exemptions and subsidies in all economic sectors in Member States.

The impact assessment of new policy initiatives has been established in the European Union, which allows their potential adverse social, environmental and economic impacts on various stakeholders, including developing country Parties, to be identified and limited at an early stage within the legislative process. Impact Assessment Guidelines specifically address impacts on third countries and also issues related to international relations. This provides a framework in which Member States like Ireland can also ensure a high level of protection of the environment and contribute to the integration of environmental considerations into the preparation and adoption of specified plans and programmes with a view to promoting sustainable development.

Detailed information in this regard is included in Ireland's National Inventory Report, 2014.

[17] Full details of the decisions made in respect of carryover and use of internationally traded units are available at http://www.environ.ie/en/Environment/Atmosphere/ClimateChange/KyotoProtocol/

5. Projections

5.1 Introduction

On foot of a commitment in the 2007 National Climate Change Strategy, national greenhouse gas emission projections are published on an annual basis. The most recently published set of projections[18] were based on two scenarios, a 'With Measures' and 'With Additional Measures' scenarios were developed. A 'Without Measures' scenario, was not produced in the most recently published projections. A sensitivity analysis is also presented which examines the effect of varied input variables on projected emission levels.

5.2 Projections of Greenhouse Gas Emissions

Under the With Measures scenario, total national emissions (excluding LULUCF) are projected to increase by 3.4 per cent by 2020 compared to 2013 (Figure 2). The largest drivers of this increase are increases in the Agriculture and Road Transport sectors. Under the With Additional Measures scenario total national emissions (excluding LULUCF) are projected to decrease by 6.6 per cent by 2020 compared to 2013. Under this scenario, increases in the agricultural and road transport sectors are somewhat offset by reductions (as a result of additional polices and measures) in the Manufacturing Industries and Construction and Commercial/Institutional and Residential sectors.

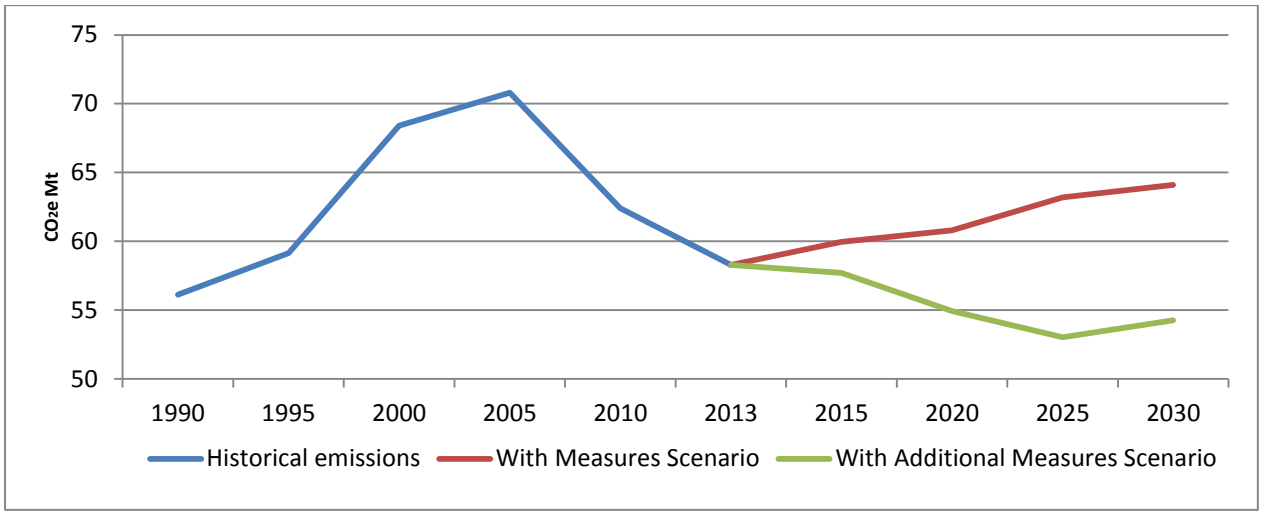

Figure 2. Historical and projected greenhouse gas emissions for the With Measures and With Additional Measures scenarios

5.3 Projections by Sector

5.3.1 Projections by Sector (With Measures Scenario)

The single largest source of emissions in 2013 was the agriculture sector when it contributed to 33.3 per cent of total national emissions (excluding LULUCF). By 2020 its share is projected to decrease slightly to 32.1 per cent and further reduce to 30.7 per cent in 2030. The second largest source of emissions in 2013 is the Energy Industries sector accounting for

[18] http://www.epa.ie/pubs/reports/air/airemissions/EPA%202015%20GHG%20Projections%20Publication%20Final.pdf

19.3 per cent of total national emissions. In 2020 it is projected to account for 20.7 per cent and 22.1 per cent in 2030.

The Transport sector is the third largest source of emissions in 2013 accounting for 18.8 per cent of emissions in 2013. By 2020 its sectoral share is projected to increase to 21.7 per cent and further increase to 23.3 per cent of total national emissions in 2030. Collectively the Industry and Commercial sectors were responsible for 15.4 per cent of national total emissions in 2013 and are projected to account for 14.1 per cent of national total emissions in both 2020 and 2030. The share of national total emissions which the Residential sector is responsible for falls from 10.9 per cent in 2013 to 9.6 per cent in 2020 and 8.2 per cent in 2030. In 2013 the waste sector accounted for 2.4 per cent of national total emissions, and is projected to account for 1.9 per cent in 2020 and 1.6 per cent 2030.

In 2013 the emissions trading sector accounted for 26.9 per cent of national total emissions and in 2020 is projected to account for 27.8 per cent and 29.4 per cent in 2030. Sectoral shares for the With Measures scenario are presented in Table 5.1 for historical and projected years.

Table 5.1 Sectoral share (With Measures scenario)

Percentage	1990	1995	2000	2005	2010	2013	2015	2020	2025	2030
Energy Industries	20.1%	22.7%	23.5%	22.2%	21.3%	19.3%	22.7%	20.7%	21.3%	22.1%
Residential	13.3%	10.8%	9.4%	10.2%	12.4%	10.9%	10.3%	9.6%	8.8%	8.2%
Industry & Commercial	16.8%	16.4%	18.4%	17.5%	15.2%	15.4%	13.8%	14.1%	14.1%	14.1%
Agriculture	37.8%	36.3%	30.6%	29.3%	31.0%	33.3%	31.2%	32.1%	31.6%	30.7%
Transport	9.0%	10.5%	15.6%	18.4%	18.3%	18.8%	19.8%	21.7%	22.5%	23.3%
Waste	2.9%	3.3%	2.5%	2.5%	1.9%	2.4%	2.2%	1.9%	1.7%	1.6%

5.3.2 Projections by Sector (With Additional Measures Scenario)

The single largest source of emissions in 2013 was Agriculture when it contributed to 33.3 per cent of total national emissions (excluding LULUCF). By 2020 its share is projected to increase slightly to 35.2 per cent with the sector accounting for 36.0 per cent in 2030. The second largest source of emissions in 2013 is the Energy Industries sector accounting for 19.3 per cent of total national emissions in 2013 and 17.8 per cent and 15.2 per cent in 2020 and 2030, respectively.

The Transport sector is the third largest source of emissions in 2013 accounting for 18.8 per cent of emissions in 2013. By 2020 its sectoral share is projected to increase to 22.8 per cent in and 26.3 per cent in 2030. Collectively the Industry and Commercial sectors were responsible for 15.4 per cent of national total emissions in 2013 and are projected to decrease to 13.1 per cent of national total emissions in 2020 and 13.4 per cent in 2030. The share of national total emissions which the Residential sector is responsible for falls from 10.9 per cent in 2013 to 9.0 and 7.3 per cent in 2020 and 2030, respectively.

By 2020 the emissions trading sector is projected to account for 24.6 per cent of national total emissions and in 2020 and 22.6 per cent in 2030. Sectoral shares for the With Additional Measures scenario are presented in Table 5.2.

Table 5.2. Sectoral share (With Additional Measures scenario)

Percentage	1990	1995	2000	2005	2010	2013	2015	2020	2025	2030
Energy Industries	20.1%	22.7%	23.5%	22.2%	21.3%	19.3%	21.3%	17.8%	12.8%	15.2%
Residential	13.3%	10.8%	9.4%	10.2%	12.4%	10.9%	10.0%	9.0%	8.4%	7.3%
Industry & Commercial	16.8%	16.4%	18.4%	17.5%	15.2%	15.4%	13.6%	13.1%	13.8%	13.4%
Agriculture	37.8%	36.3%	30.6%	29.3%	31.0%	33.3%	32.4%	35.2%	37.4%	36.0%
Transport	9.0%	10.5%	15.6%	18.4%	18.3%	18.8%	20.4%	22.8%	25.5%	26.3%
Waste	2.9%	3.3%	2.5%	2.5%	1.9%	2.4%	2.3%	2.1%	2.0%	1.8%

5.4 Projections by Gas

Projections by gas are only discussed for the With Measures scenario. Information by gas for the With Additional Measures scenario is presented in Annex I to this chapter.

5.4.1 Projections by Gas (With Measures Scenario)

Emissions of CO_2 accounted for 63.0 per cent of national total (excluding LULUCF) emissions in 2013, with CH_4 and N_2O contributing 22.5 per cent and 12.1 per cent, respectively. The combined emissions of HFCs, PFCs, SF_6, NF_3 and Non-Methane Volatile Organic compounds (NMVOCs) accounted for the remaining 2.4 per cent. By 2020 emissions of CO_2 are projected to account for 65.6 per cent of national total emissions, with CH_4 and N_2O accounting for 21.3 per cent and 11.3 per cent respectively. The contribution of fluorinated gases and NMVOCs reduces to 1.8 per cent in 2020. Table 5.3 provides historical emissions and projections by gas for the With Measures scenario.

Table 5.3. Historical emissions and projections by gas for the With Measures scenario (Mt CO_2eq)

	1990	1995	2000	2005	2010	2013	2015	2020	2025	2030
Carbon Dioxide	32.7	35.7	45.1	48.0	41.6	37.1	39.3	39.9	42.0	43.4
Methane	14.9	15.1	14.5	14.0	12.6	13.2	13.1	12.9	13.0	12.6
Nitrous Oxide	9.0	8.6	8.6	8.1	7.5	7.1	6.5	6.9	7.2	7.2
NMVOCs	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
F-gases	0.0	0.2	0.8	1.3	1.2	1.3	1.1	1.0	0.9	0.8

In 2013 the largest source to CO_2 emissions was Energy Industries accounting for 30.3 per cent. However by 2020 the largest contributor to CO_2 emissions is Transport at 32.6 per cent (29.8 per cent in 2013). By 2030, Transport accounts for 34.0 per cent of CO_2 emissions.

The second most significant contributor to greenhouse gas emissions in Ireland is CH_4 accounting for 22.5 per cent of emissions in 2013, 21.3 per cent of emissions in 2020 and 20.7 per cent in 2030. The main driver behind CH_4 emissions in Ireland is CH_4 emissions from cattle from enteric fermentation and manure management. The contribution of the agriculture sector to total CH_4 emissions is projected to increase from 88.2 per cent in 2013 to 94.4 per cent in 2020 and 95.0 per cent in 2030. Emissions from the agriculture sector are projected to increase as a result of industry lead expansion plans[19].

Similar to emissions of CH_4, the agriculture sector is the largest source of N_2O emissions in Ireland reflecting the significant quantities of nitrogen from animal manures and synthetic fertilizers applied to agricultural soils. Nitrous oxide emissions accounted for 12.1 per cent of national total emissions in 2013 and are projected to account for 11.3 per cent in 2020 and 11.8 per cent in 2030.

Emissions of the F-gases (HFCs, PFCs, SF_6 and NF_3) were 1.3 Mt CO_2 equivalent in 2013. Fluorinated gas emissions accounted for 2.3 per cent of the national total and are projected to decrease to 982.4 Gg CO_2e in 2020 and 834.7 Gg CO_2e in 2030. Table 5.4 provides historical and projected emissions of F-gas and NMVOC emissions in the With Measures scenario.

Table 5.4. Historical emissions and projections of F-gases and NMVOCs in the With Measures scenario (Gg CO_2eq)

	1990	1995	2000	2005	2010	2013	2015	2020	2025	2030
HFCs	0.6	41.1	303.6	939.3	1,127.6	1,276.7	1,032.1	914.3	823.9	759.8
PFCs	0.12	97.6	397.8	216.4	46.6	8.32	9.20	11.5	13.1	14.0
SF_6	33.9	79.1	51.8	96.8	33.1	43.5	50.5	56.6	59.5	61.0
NMVOC	79.3	84.0	76.3	79.1	67.2	66.1	73.1	91.5	104.1	110.9

5.5 Methodological Approach

Sustainable Energy Authority of Ireland (SEAI) publishes national energy forecasts showing future energy trends. These energy forecasts, most recently compiled in 2015[20], form the basis for almost all energy-related emission projections discussed.

The Sustainable Energy Authority of Ireland compiles two energy forecasts scenarios, which are used in national emission projections to 2035: Baseline and NEEAP/NREAP.

- The Baseline energy forecast projects forward Ireland's energy demand, incorporating the expected impacts of policies and measures that were in place (legislatively provided for) by the end of 2013. It represents a hypothetical future scenario in which no further policy actions or measures have been taken. It excludes policies that are committed to but which do not yet have measures in place to deliver them.

- The NEEAP/NREAP energy forecast presents an alternative view of future energy demand that accounts for both the National Renewable Energy Action Plan (NREAP) [21], submitted to

[19] http://www.agriculture.gov.ie/agri-foodindustry/foodharvest2020/ and http://www.agriculture.gov.ie/foodwise2025/

[20] http://www.seai.ie/Publications/Statistics_Publications/Energy_Forecasts_for_Ireland/

[21] http://www.dcenr.gov.ie/energy/en-ie/Renewable-Energy/Pages/Action-Plan.aspx

the European Commission in July 2010, and the 3rd National Energy Efficiency Action Plan (NEEAP) [22]. Therefore this forecast includes existing and planned policies and measures.

The Baseline energy forecast underpins the With Measures emission projection and the NEEAP/NREAP energy forecast underpins the With Additional Measures projection.

The Baseline energy forecast is produced by the Economic and Social Research Institute (ESRI) using the HERMES model to project domestic economic activity which in turn depends on international factors captured in the NiGEM[23] model. The forecast includes sectoral output figures and other relevant key variables such as price, economic growth, population, household growth and occupancy. To produce the finalised Baseline energy forecast, SEAI amends the output of the HERMES energy demand model to take account of the expected impact of energy efficiency measures put in place before the end of 2013 but which are considered too recent to be detectable in any time-series analysis. The NEEAP/NREAP energy forecast builds on the Baseline forecast with adjustments made to account for additional policies and measures outlined in the NEEAP and NREAP. A detailed description is presented in a number of SEAI reports[24] and a detailed description of the HERMES model and associated energy demand model is provided in an ESRI Working Paper[25].

The energy forecasts that underpin the energy-related emissions projections presented are based on a set of macroeconomic projections produced by the ESRI in their October 2014 Quarterly Economic Commentary[26]. The macroeconomic projections incorporate the recent strong return to growth in the Irish economy which has occurred much earlier than previously expected. Table 5.5 shows the key parameters underlying the macroeconomic outlook and therefore the With Measures and With Additional Measures emission projections scenarios. The forecasts are based on international fuel import oil, coal and gas prices published by the United Kingdom's Department of Energy and Climate Change in October 2014[27]. The carbon prices are those circulated by the European Commission in June 2014 as recommended harmonised values for key supra-nationally determined parameters to underpin national emission projections in EU member states. Carbon dioxide price assumptions in the non-ETS sectors are based in the medium term on the Finance Bill 2010[28] which saw the introduction of a carbon tax of €15 per tonne CO_2 on home heating and transport fuels. In the longer term the carbon price is assumed, for modelling purposes only, to follow the EU ETS carbon price.

Table 5.5 Key assumptions underpinning the energy forecasts

	2012–2015	2016–2020	2021-2025	2026-2030
		Average Annual % Growth		
GDP	2.5	4.6	2.6	1.3
GNP	3.8	3.6	3.4	2.9
Personal Consumption	0.4	2.5	4.4	3.4
	2015	**2020**	**2025**	**2030**
Housing Stock ('000)	1,992	2,062	2,173	2,290
Population ('000)	4,647	4,837	5,010	5,162
Carbon Price €$_{2010}$/tCO$_2$	7	10	14	35
Carbon tax €$_{2010}$/tCO$_2$	20	20	20	35

[22] http://www.dcenr.gov.ie/energy/en-ie/Energy-Efficiency/Pages/National-Energy-Efficiency-Action-Plan-(NEEAP).aspx
[23] National Institute Global Econometric Model
[24] http://www.seai.ie/Publications/Statistics_Publications/Energy_Forecasts_for_Ireland/
[25] https://www.esri.ie/publications/the-hermes-model-of-the-irish-energy-sector/
[26] https://www.esri.ie/publications/quarterly-economic-commentary-autumn-2014/
[27] https://www.gov.uk/government/publications/fossil-fuel-price-projections-2014
[28] Finance Bill 2010 http://www.revenue.ie/en/practitioner/law/bills/archive/finance-bill-2010/

Coal $\$_{2010}$/boe	16.4	20.1	23.7	27.6
Oil $\$_{2010}$/boe	93.6	98.9	124.3	154.2
Gas $\$_{2010}$/boe	50.8	49.3	58.7	62.5
Peat $\$_{2010}$/MWh	25	25	25	25

The energy forecasts completed in 2015, which are based on the 2013 national energy balance , form the basis for the majority of fuel combustion related emissions projections namely: Power generation; Road transport; Gas transport; Industrial combustion; Residential combustion; Commercial and institutional services combustion and; Fuel combustion in the agricultural sector.

Emissions from these sectors accounted for 98.7 per cent of energy-related emissions in 2013. Emission projections for the remaining fuel combustion activities (i.e. oil refining, peat briquetting, fugitive emissions, rail transport, domestic aviation, fishing and navigation) are calculated separately and are based on data provided by operators and from the inventory agency databases.

Non-energy related emissions cover the following sectors: Agriculture; Waste; Industrial processes. The methodology employed to develop emission projections for these sectors is discussed in the relevant sections of this chapter.

As stated, the With Measures emission projection is based on the Baseline energy forecast and includes existing policies and measures that were in place prior to the end of 2013. The With Additional Measures scenario includes existing measures and planned policies and measures and is based on the NEEAP/NREAP energy forecast. Sustainable Energy Authority of Ireland include planned policies and measures from both the NREAP and the NEEAP by subtracting the necessary energy savings from the Baseline energy forecasts to give the NEEAP/NREAP energy forecast. These measures and associated fuel and emission savings, as calculated by SEAI and the inventory agency, are reported in section 5.6. The impact of energy policy is only included to 2020, given current government commitments. Beyond that time (2020 – 2035) the trends indicate forecasted energy demand growth with an assumption that no further energy policy impacts post 2020. As government policy and targets for the post 2020 period are defined, these will be incorporated into the modelling. Hence, the trends post 2020 are both considered baselines from different starting points in 2020.

There have been no changes to the model (outside of updated economic data) or methodologies (outside of the use of the 2006 IPCC Guidelines) used to prepare projections since the first Biennial Report.

5.6 Sectoral Analysis and Total Effects of Policies And Measures

In the following sections the discussion on the total effects of policies and measures focuses on their effect with respect to their greenhouse gas mitigation potential by 2020. The information presented with respect to 2025 and 2030 is for information purposes only.

5.6.1 Energy Industries

Since 1990 the share of high carbon content fuels such as coal and peat used for electricity generation in Public Electricity and Heat Production has reduced and has been replaced with lower carbon intensive natural gas or zero carbon renewables, predominately wind. This fuel switching has been reinforced by a substantial improvement in generation efficiency due to the commissioning of

new combined cycle gas turbine (CCGT) plant. This has resulted in a decoupling of CO_2 emissions from electricity generation.

In the With Measures scenario renewable electricity contributes 5.1 per cent of the overall 16.0 per cent Renewable Energy Share (RES) in 2020, due to a 20.6 per cent increase in renewable fuels for electricity generation over the period 2013 to 2020. The renewable energy generated shows Ireland reaching 22 per cent of electricity consumption from renewable energy by 2020.

In the With Additional Measures scenario it is assumed that for 2020 there is a 40 per cent share of renewable energy in electricity generation as a result of continued expansion of wind energy and expansion of biomass electricity generating capacity through the implementation of biomass capacities published in the NREAP, and the continued development of landfill gas electricity generation and small-scale biomass CHP. The largest contribution is from wind which at 891 ktoe in 2020 is 74.4 per cent above that proposed in the With Measures Scenario. The impact of existing and planned policies and measures that will impact the Public Electricity and Heat Production sector are listed in Table 5.6 with the anticipated emissions savings.

Projections for oil refining and solid fuel manufacture are based on data provided by the relevant operators. Under the With Measures scenario, total energy industries emissions are projected to increase by 13.4 per cent over the period 2013 – 2020 to 12.9 Mt CO_2 equivalent. The increase in emissions is caused by a projected increase in the use of coal and reduction in the use of gas as a fuel for electricity generation. This is as a result of the current and projected low coal price (relative to gas). Under the With Additional Measures scenario, total energy industries emissions are projected to decrease by 11.2 per cent over the period 2013 – 2020 to 10.1 Mt of CO_2 equivalent taking into account the additional polices and measures identified in Table 5.6.

Table 5.6. Emissions savings due to policies and measures included in the With Measures and With Additional Measures scenarios for the Energy Industries sector

Policy and Measure	2020	2025	2030
			With Measures (Gg CO_2eq)
Increased efficiency in power generation	979.1	1,028.3	1,028.3
Reduced transmission and distribution losses	48.7	48.7	46.9
22% renewables by 2020	1,525.9	1,520.6	1,521.2
Reduced electricity demand from energy efficiency measures	246.0	245.8	236.5
Domestic Lighting	83.9	83.8	80.6
Total	**2,883.6**	**2,927.2**	**2,913.5**
			With Additional Measures (Gg CO_2eq)
Reduced electricity demand from additional energy efficiency measures	357.5	250.6	263.4
Increased electricity demand from electric vehicle roll-out	-54.4	-38.3	-40.5
Replacement of coal fired generation with natural gas	-	4,974.6	4,180.4
40% renewables by 2020	2,438.5	1,461.4	1,461.4
Total	**2,741.6**	**6,648.3**	**5,864.7**

5.6.2 Manufacturing Industries and Construction

Under the With Measures scenario, emissions from manufacturing industries and construction are projected to decrease by 16.3 per cent between 2013 and 2020 while final energy demand is projected to increase by 1.3 per cent over the same period. Under the With Additional Measures emission projection, emissions from industrial combustion are projected to decrease by 34.4 per cent whilst final energy demand increases by 6.0 per cent. The level of projected emissions under the With Additional Measures scenario is lower compared with the With Measures scenario as a result of the additional policies and measures outlined in Table 5.7. The largest savings are anticipated to be delivered through thermal energy sourced from renewable sources, mainly biomass.

Table 5.7. Emissions savings due to policies and measures included in the With Measures and With Additional Measures scenarios for the Manufacturing Industries and Construction sector

Policy and Measure	2020	2025	2030
			With Measures (Gg CO_2eq)
SEAI Large Industry Programme	417.9	417.9	417.9
CHP deployment	104.8	104.8	104.8
Accelerated Capital Allowance (ACA)	4.2	4.2	4.2
Renewable Heat	70.6	70.6	70.6
Better Energy Workplaces	17.7	17.7	17.7
Carbon Tax	131.3	131.3	131.3
Total	**746.5**	**746.5**	**746.5**
			With Additional Measures (Gg CO_2eq)
RES-H*	604.1	658.5	706.7
Retrofit	161.6	161.6	161.6
Total	**765.7**	**820.1**	**868.3**

* The NREAP target for thermal energy sourced from renewable sources is 12 per cent (across the residential, commercial services and industrial sectors) by 2020. This is referred to as RES-H.

5.6.3 Transport

Under the With Measures scenario, it is forecasted that renewable fuels account for 6.0 per cent of road transport fuel in 2020 (with biofuels making the largest contribution and the use of renewable electricity in electric vehicles a smaller contribution) thus increasing from the current level of renewables penetration (4.9 per cent) to meet the requirements of Biofuels Obligation Scheme 2010[29].

In the With Additional Measures emission projection for road transport, it is assumed that renewable fuels will account for 10 per cent of road transport fuel by 2020 (which includes electric

[29] http://www.dcenr.gov.ie/energy/en-ie/Renewable-Energy/Pages/Biofuels.aspx

vehicle) in line with the EU renewables target in Directive 2009/28/EC[30]. In addition, the impact of transport measures contained within the NEEAP and NREAP are included. Existing and planned measures are listed with the anticipated emissions savings Table 5.8.

Table 5.8. Emissions savings due to policies and measures included in the With Measures and With Additional Measures scenarios for the Transport sector.

Policy and Measure	2020	2025	2030
	With Measures (Gg CO_2eq)		
VRT and Motor tax changes	172.2	172.3	172.3
Improved fuel economy of private cars	908.1	908.5	908.9
Public transport efficiency improvements	41.6	41.6	41.6
Aviation efficiency	66.5	66.5	66.6
Carbon tax	23.9	24.0	24.0
Renewable fuels	636.2	687.0	723.1
Total	**1,848.5**	**1,899.9**	**1,936.5**
	With Additional Measures (Gg CO_2eq)		
Electric vehicle deployment	27.0	27.1	27.1
More efficient traffic movements	121.1	121.2	121.2
Natural gas savings between scenarios	23.9	28.6	33.3
RES-T*	468.3	507.0	532.5
Total	**640.3**	**683.9**	**714.1**

* Renewables (biofuels and 10% electric vehicle deployment) will account for 10% of road transport fuel by 2020

For aviation forecasted annual aircraft movement data is provided to the inventory agency. Emissions from domestic aviation navigation have remained relatively static over the last number of years and are assumed to stay at current levels. Emissions from Other Transportation which covers the use of natural gas in gas pipeline compressor stations are estimated separately for both the With Measures and With Additional Measures scenarios. Future gas demand is inferred based on forecasted gas demand in the residential, commercial and industrial sectors in both the With Measures and With Additional Measures scenarios.

The main source of emissions from the transport sector is road transportation, accounting for 95.8 per cent of emissions in 2013 and 2020. Under the With Measures scenario, emissions from road transport are projected to increase by 20.2 per cent between 2013 and 2020.

Under the With Additional Measures scenario, emissions from transport are projected to increase by 13.2 per cent between 2013 and 2020. The lower level of increase in emissions relative to the With Measures emission projections is primarily attributable to increased biofuel penetration and more efficient traffic movements projected to deliver significant savings.

[30] DIRECTIVE 2009/28/EC. The promotion of the use of energy from renewable sources

5.6.4 Residential

Under the With Measures emission projection, residential sector emissions are projected to decrease by 9.2 per cent between 2013 and 2020 while final energy demand is projected to decrease by 1.8 per cent over the same period.

Under the With Additional Measures emission projection, emissions are projected to decrease by 22.5 per cent between 2013 and 2020 as a result of the policies and measures outlined in Table 5.9. The largest savings in the With Additional Measures scenario are anticipated to be delivered through the National Retrofit Scheme, which aims to improve the energy performance of residential dwellings.

Table 5.9. Emissions savings due to policies and measures included in the With Measures and With Additional Measures scenarios for the Residential sector

Policy and Measure	2020	2025	2030
			With Measures (Gg CO_2eq)
2002 Building Regulations	309.0	309.0	309.0
2008 Building Regulations	262.7	262.7	262.7
Efficient Boiler Standard	286.5	286.5	286.5
Greener Homes Scheme	25.1	25.1	25.1
Warmer Homes Scheme	31.3	31.3	31.3
Home Energy Savings Scheme	84.8	84.8	84.8
Carbon Tax	**83.2**	**83.2**	**83.1**
Total	**1,082.6**	**1,082.6**	**1,082.5**
			With Additional Measures (Gg CO_2eq)
2011 Building regulations	105.4	105.4	105.4
Nearly zero energy dwellings	33.0	33.0	33.0
Retrofit scheme	711.6	711.6	711.5
RES-H*	-	208.2	440.8
Total	**850.0**	**2,938.2**	**1,290.7**

* The NREAP for thermal energy sourced from renewable sources is 12% (across the residential, commercial services and industrial sectors) by 2020. This is referred to as RES-H.

5.6.5 Commercial/Institutional Services

Under the With Measures scenario, emissions from the commercial/institutional services are projected to increase by 8.4 per cent between 2013 and 2020 while final energy demand is projected to increase by 23.4 per cent over the same period.

Under the With Additional Measures emission projection, emissions are projected to decrease by 24.7 per cent as a result of the policies and measures outlined in Table 5.10. Significant savings are projected to be delivered through the public sector energy efficiency target, the public and

commercial sector components of the National Retrofit Scheme, the 2012 Building Regulations and through the penetration of renewable energy in thermal heat production.

Table 5.10. Emissions savings due to policies and measures included in the With Measures and With Additional Measures scenarios for the Commercial/Institutional sector

Policy and Measure	2020	2025	2030
	With Measures (Gg CO_2eq)		
2005 Building Regulations	60.6	60.6	60.6
SEAI Small Business Support	75.7	75.7	75.7
SEEP and EERF	37.6	37.6	37.6
Accelerated Capital Allowance (ACA)	7.6	7.6	7.6
Public Sector Building Demonstration Programme	19.9	19.9	19.9
CHP deployment	44.4	44.4	44.4
Renewable Heat	29.9	29.9	29.9
Carbon Tax	69.5	69.5	69.5
Better Energy Workplaces	48.0	48.0	48.0
Total	**393.2**	**393.2**	**393.2**
	With Additional Measures (Gg CO_2eq)		
2012 Building regulations	125.5	125.5	125.5
Retrofit	160.6	160.6	160.6
Public Sector energy efficiency target	354.7	354.7	354.7
RES-H*	1.0	128.1	254.0
Total	**641.8**	**768.9**	**894.8**

* The NREAP target for thermal energy sourced from renewable sources is 12% (across the residential, commercial services and industrial sectors) by 2020. This is referred to as RES-H.

5.6.6 Industrial Processes

Industrial Processes and Product use includes cement and lime production, other product use of carbonates, non-energy products from fuels and the use of fluorinated gases. Major industrial processes within the chemical sector and metal production are no longer undertaken in Ireland. Process emission projections were developed for the cement and lime industries and other process use of carbonates only. Only one projected scenario was developed for these sectors. The other industrial process emission source glass production is no longer undertaken in Ireland therefore projected emissions are not estimated. Projected emissions from the cement and lime industries are estimated using projected GDP data.

Process emissions are projected to increase by 32.3 per cent from 1.3 Mt of CO_2eq in 2013 to 1.7 Mt of CO_2eq in 2020 under both the With Measures scenario, and With Additional Measures scenarios.

Fluorinated gases accounted for 2.3 per cent of Ireland's total national greenhouse gas emissions in 2013. The only relevant source of F-gas emissions in Ireland is production, use and disposal of

equipment containing these fluids (e.g. refrigerators, mobile air conditioning systems and electrical switch-gear).

Projections are presented for the four fluorinated gases: HFC, PFC, SF_6 and NF_3. In 2013, HFCs accounted for 96.0 per cent of total fluorinated gas emissions with the majority of these emissions estimated to come from stationary refrigeration and air conditioning systems in vehicles. PFCs, from semi-conductor manufacturing, accounted for 0.6 per cent of total F-gas emissions in 2013 while SF_6 accounted for 3.3 per cent with the majority of emissions coming from semi-conductor manufacturing and electrical equipment.

In the With Measures and With Additional Measures emission projection, the impact of Directive 2006/40/EC[31] relating to emissions from air-conditioning systems in motor vehicles is assumed implicit in emission estimates as a result of SI No. 127 of 2009[32] coming into effect in April 2009. The savings associated with the impact of Directive 2006/40/EC are included in both the With Measures and With Additional Measures scenarios. It is estimated that there will be a saving of 72.3 Gg CO_2 eq in 2020 from Directive 2006/40/EC. Under the With Measures and With Additional Measures emission projections, F-gas emissions are projected to decrease by 26.0 per cent between 2013 and 2020.

5.6.7 Solvent Use

With respect to emissions from Solvent Use, GDP growth is used to project emissions from each of the four subsectors: Paint Application; Degreasing and Dry Cleaning; Chemical Products and Other Solvent Use. Only one scenario was developed and emissions are projected to increase by 38.3 per cent between 2013 and 2020.

5.6.8 Agriculture

Emissions projections for CO_2, CH_4 and N_2O were developed for the agricultural sector. The agricultural activities of particular importance in Ireland are: (i) enteric fermentation (ii) manure management and (iii) agricultural soils. The methodology used to develop emissions projections for both CH_4 and N_2O are consistent with those employed in compiling the national greenhouse gas inventory. The key sources of CH_4 emissions in the agricultural sector are enteric fermentation and manure management. The key sources of N_2O emissions are manure management and agricultural soils. Two scenarios were developed for agricultural emission projections, a With Measures scenario and a With Additional Measures scenario. The projected activity data for agricultural emission projections were produced by the FAPRI-Ireland partnership[33] and provided to the inventory agency. The FAPRI-Ireland model is linked to the FAPRI world modeling system and so takes account of, and contributes to, the projections for prices obtained and quantities traded on the world markets. The activity data assumes that there is an expansion in the value of Irish agriculture over the period to 2020 to meet the targets set out in "Food Harvest 2020[34]" published by the Department of Agriculture, Fisheries and Food in 2010. The main targets set out in this document are as follows:

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

[32] Statutory Instruments. S.I. No 127. European Communities (Motor Vehicles Type Approval) Regulations 2009

[33] The research partners are Teagasc – The Irish Agriculture and Food Development Authority, and five Irish Universities, namely, NUI Cork, NUI Dublin, NUI Galway, NUI Maynooth and Trinity College Dublin

[34] Food Harvest 2020. A vision for Irish agri-food and fisheries. Department of Agriculture, Fisheries and Food, 2010. http://www.agriculture.gov.ie/media/migration/agri-foodindustry/foodharvest2020/2020FoodHarvestEng240810.pdf

- Increasing the value of primary output in the agriculture, fisheries and forestry sector by €1.5 billion by 2020. This represents a 33 per cent increase compared to the 2007-2009 average.
- Increasing the value-added in the agri-food, fisheries and wood products sector by €3 billion by 2020. This represents a 40 per cent increase compared to 2008.
- Achieving an export target of €12 billion for the sector by 2020. This represents a 42 per cent increase compared to the 2007-2009 average.

The With Additional Measures includes an estimate of the savings associated with the introduction of nitrification and urease inhibitors in synthetic nitrogen fertilizer to meet nutrient efficiency gains in the Ireland's Rural Development Programme 2014-2020[35]. It is envisaged that under this measure that there will be reduction in the requirement for nitrogen fertilizer by 10,000 tons nitrogen in 2018, increasing linearly to 30,000 tonnes in 2020.

In the With Measures scenario total emissions from the agricultural sector (IPCC Sector 3) are projected to increase by 1.9 per cent between 2013 and 2020 as a result of the targets set out in Food Harvest 2020. This is predominantly driven by a projected increase in dairy cow numbers of 21 per cent between 2013 and 2020 following the abolition of milk quotas in 2015 and a projected increase in fertilizer nitrogen use of 3.5 per cent by 2020.

Under the *With Additional Measures* scenario projected total emissions (IPCC Sector 3) will increase by 1.1 per cent by 2020 to 18.7 Mt CO_2 eq.

5.6.9 Waste

Emission projections for the waste sector are developed for CO_2, CH_4 and N_2O. Solid waste disposal to landfill is currently the main source of emissions from the waste sector. Methane emissions arise from solid waste disposal in landfill sites and wastewater and sludge treatment, whilst N_2O emissions also arise from the production of human sewage. In addition, CO_2, CH_4 and N_2O emissions arising from the incineration of hazardous wastes (solvents) in the pharmaceutical industry and the mechanical and biological treatment of waste are also estimated. The emissions associated with the incineration of municipal solid waste for electricity generation (WtE) are included in emissions estimates for electricity generation. At present only one such plant is in operation in Ireland, however a further larger incinerator is currently under construction with a proposed operational start in the second half of 2017. Only one scenario was developed for the waste sector. In these emission projections it is assumed that Ireland meets its Landfill Directive (1999/31/EC)[36] target in 2016 as it has for 2010 and 2013.

As only one projected outlook is undertaken for the waste sector, both With Measures scenario and the With Additional Measures are the same. Emissions are projected to decrease by 39.0 per cent between 2013 and 2020.

5.7 Land Use, Land Use Change and Forestry

The Land Use, Land Use Change and Forestry sector includes greenhouse gas emissions and removals due to land use and land use change. It consists of six subcategories: Forest Land, Cropland, Grassland, Wetlands, Settlements and Other Land. The approach taken in estimating greenhouse gas emission and removals from the sector utilises the approach used for the national

[35] http://www.agriculture.gov.ie/media/migration/ruralenvironment/ruraldevelopment/ruraldevelopmentprogramme2014-2020/RDPFinaldraft03072014.pdf

[36] Council Directive 1999/31/EC on the landfill of waste

greenhouse gas inventory in conjunction with a projected land use and land use change matrix developed with external consultants in 2014.

Emissions and removals from the sector follow a hierarchical approach in line with the GHG Projections Guidelines[37] published by the European Commission. In this approach the land uses with better information are projected first with the other land uses fitted in as remaining land areas. In Ireland, projected forest land areas are the most developed, followed by wetland areas and areas under settlement. Projected cropland and grassland areas are provided in conjunction with the activity data supplied for the agriculture sector.

5.8 Memo Items

Projected emissions from international maritime transport and international aviation are estimated. Emissions from international aviation are estimated based on forecasted landing and takeoff forecasts supplied to the inventory agency. Emissions from international maritime transport are assumed to equal 2013 levels for each projected year, but this will be kept under review.

5.9 Sensitivity Analysis

In conjunction with SEAI and ESRI a sensitivity analysis of SEAI's Baseline and NEEAP/NREAP energy forecast (which underpins the With Measures and With Additional Measures emission projections) was undertaken. Details of the assumptions used in the sensitivity analysis are presented in Table 5.11. Underlying oil price assumptions follow the "Recovery Scenario" assumptions derived by Fitzgerald et al. (2013)[38]. Coal and gas price assumptions follow those of the UK Department of Energy and Climate Change fossil fuel price projections[39] . The EUETS carbon price projections are derived from Point Carbon projections published in September 2013[40] . Sensitivity analysis was undertaken for the period out to 2030 only.

For the agriculture sector the sensitivity analysis undertaken assumes that one of the major tenets of the Food Harvest 2020 agriculture sector development plan, a proposed 50 per cent increase in milk production (based on average production levels in 2007-2009) in line with the removal of milk quotas in 2015 does not materialise as planned. This has knock on effects on the profile of the beef herd and structure of the national cattle herd.

The recent national waste statistics report[41], states that municipal waste is exported for recovery in incinerators abroad. This practice has occurred for the last number of years and the total quantity exported has been of the order of 350,000 tonnes per annum. In the uncertainty analysis it was assumed that this practice no longer occurs and that this material is disposed of in solid waste disposal sites in Ireland. Therefore it is assumed that an additional 350,000 tonne of municipal waste requires management in landfills for each future year. This represents an almost 50 per cent increase in the quantity of municipal waste that is currently landfilled.

37 http://ec.europa.eu/clima/policies/strategies/progress/monitoring/docs/ghg_projection_guidelines_en.pdf

38 FitzGerald, J., Kearney, I., Bergin, A., Conefrey, T., Duffy, D., Timoney, K., and Žnuderl, N. 2013. *Medium-Term Review: 2013-2020, No. 12,* ESRI Forecasting Series ESRI, Dublin.

39 DECC. 2013. *DECC Fossil Fuel Price Projections - July 2013,* Department of Energy and Climate Change, London. https://www.gov.uk/government/publications/fossil-fuel-price-projections-2013

40 http://www.pointcarbon.com/aboutus/pressroom/pressreleases/1.2584441

41 http://www.epa.ie/pubs/reports/waste/stats/EPA_NWR12_Complete_to_web_5Aug14.pdf

Table 5.11. Key assumptions underpinning the energy forecasts sensitivity analysis

	2012–2015	2016–2020	2021-2025	2026-2030
		Average Annual % Growth		
GDP	2.4	4.0	2.2	2.0
GNP	2.3	3.6	2.2	2.3
Personal Consumption	0.2	2.8	2.7	2.9
	2015	**2020**	**2025**	**2030**
Housing Stock ('000)	1,997	2,064	2,136	2,210
Population ('000)	4,647	4,837	5,010	5,162
Carbon Price €$_{2010}$/tCO$_2$	8	5	24	66
Carbon tax €$_{2010}$/tCO$_2$	15	5	24	66
Coal \$$_{2010}$/boe	16.7	19.4	19.3	19.3
Oil \$$_{2010}$/boe	69.3	67.2	66.0	65.1
Gas \$$_{2010}$/boe	45.7	47.5	47.2	47.2
Peat \$$_{2010}$/MWh	25	25	25	25

Sectoral and overall results of the sensitivity analysis split on emissions covered by Decision 406/2009/EC and total emissions included in the scope of the Union's emissions trading scheme established by Directive 2003/87/EC were examined. In comparison with Table 5.5, there are marked differences in fuel prices, in particular oil prices, with oil prices in the sensitivity analysis substantially lower than those used in the emission projections (€ 154.2 in period 2026-2030 compared to € 65.1 in the sensitivity analysis) which inter alia will lead to an increase in emission levels. Since the economic analysis that underpins the emission projections was developed there has been a marked drop in oil price internationally. In addition the long term price of ETS allowances in the sensitivity allowances is almost double that which underpins the emission projections. (€66 vs. €35 in period 2026-2030). Lower economic growth is assumed in the sensitivity with a per annum increase in GDP of 4 per cent compared to 4.6 per cent in Table 5.5 in period 2016-2020. Reduced economic growth is also evident in annual average growth in personal consumption.

In line with lower economic growth the resultant emission levels show that total Non-ETS emissions under both the With Measures and With Additional Measures scenarios are approximately 2 per cent, 3 per cent and 4 per cent lower in 2020, 2025 and 2030, respectively. There are however, substantial sectoral differences evident most notably in the transport and commercial/institutional sectors. Reductions in emissions in the agricultural sector are small in the order of a few per cent, largely as a result of historical expansion in dairy cow numbers since the launch of Food Harvest 2020 to meet forecasted demand in milk and milk products post milk quota removal in 2015. For the waste sector the management of an additional 350,000 tonnes of municipal waste per annum in solid waste disposal sites leads to an 8.2 per cent, 13.6 per cent and 18.0 per cent increase in emissions from the waste sector in 2020, 2025 and 2030, respectively.

5: Annex[42]

Summary of Greenhouse Gas Emissions by sector for the With Measures Scenario 1990-2030 (Gg CO_2 equivalent)

	1990	1995	2000	2005	2010	2013	2015	2020	2025	2030
Energy Industries	11,434.9	13,553.1	16,245.0	15,858.0	13,385.8	11,323.4	13,642.0	12,576.2	13,483.6	14,160.2
Residential	7,523.7	6,452.1	6,462.6	7,272.0	7,800.9	6,396.4	6,150.6	5,807.0	5,533.9	5,276.9
Industry & Commercial	9,546.0	9,803.7	12,687.0	12,477.4	9,535.9	9,034.4	8,293.5	8,595.0	8,902.8	9,025.3
Agriculture	21,466.0	21,671.7	21,156.6	20,912.7	19,511.5	19,564.2	18,718.0	19,489.9	19,994.6	19,674.9
Transport	5,135.2	6,271.4	10,788.5	13,121.4	11,528.1	11,067.7	11,862.3	13,177.7	14,223.8	14,966.3
Waste	1,645.7	1,976.0	1,751.6	1,786.2	1,174.4	1,434.7	1,299.4	1,149.6	1,056.8	994.6
Total (excluding LULUCF)	56,751.5	59,728.0	69,091.3	71,427.6	62,936.7	58,820.9	59,965.8	60,795.4	63,195.5	64,098.2
Total (including LULUCF)	61,276.1	66,625.3	74,922.9	74,843.9	67,253.4	62,694.1	61,892.1	63,059.0	67,212.7	69,465.8
Memo Items										
International Aviation	1,080.6	1,162.6	1,828.6	2,526.8	2,337.9	1,821.1	1,966.0	2,356.3	2,849.7	3,281.4
International Maritime Transport	57.4	373.2	482.8	333.7	434.7	444.9	444.9	444.9	444.9	444.9

[42] The sectoral breakdown presented differs to that presented in CTF table 6 and under section 5.6 due to the aggregation used which is in line with national publications. The data is presented to provide an indication of the trend in emissions from 1990 to 2030.

Summary of Greenhouse Gas Emissions by sector for the With Additional Measures Scenario 1990-2030 (Gg CO_2 equivalent)

	1990	1995	2000	2005	2010	2013	2015	2020	2025	2030
Energy Industries	11,434.9	13,553.1	16,245.0	15,858.0	13,385.8	11,323.4	12,281.5	9,780.4	6,796.9	8,255.0
Residential	7,523.7	6,452.1	6,462.6	7,272.0	7,800.9	6,396.4	5,796.9	4,956.9	4,475.7	3,986.2
Industry & Commercial	9,546.0	9,803.7	12,687.0	12,477.4	9,535.9	9,034.4	7,853.2	7,183.1	7,309.1	7,257.5
Agriculture	21,466.0	21,671.7	21,156.6	20,912.7	19,511.5	19,564.2	18,718.0	19,334.4	19,839.1	19,519.4
Transport	5,135.2	6,271.4	10,788.5	13,121.4	11,528.1	11,067.7	11,757.9	12,537.3	13,539.9	14,252.2
Waste	1,645.7	1,976.0	1,751.6	1,786.2	1,174.4	1,434.7	1,299.5	1,149.4	1,056.8	994.59
Total (excluding LULUCF)	56,751.5	59,728.0	69,091.3	71,427.6	62,936.7	58,820.9	57707.1	54,941.5	53,017.5	54,264.9
Total (including LULUCF)	61,276.1	66,625.3	74,922.9	74,843.9	67,253.4	62,694.1	59,633.3	57,205.1	57,034.7	59,632.6
Memo Items										
International Aviation	1,080.6	1,162.6	1,828.6	2,526.8	2,337.9	1,821.1	1,965.3	2,357.8	2,849.7	3,281.4
International Maritime Transport	57.4	373.2	482.8	333.7	434.7	444.9	444.9	444.9	444.9	444.9

Summary of Greenhouse Gas Emissions by gas for the With Measures Scenario 1990-2030 (Gg CO_2 equivalent)

	1990	1995	2000	2005	2010	2013	2015	2020	2025	2030
Carbon Dioxide (CO_2)	32,742.5	35,694.0	45,094.6	47,952.2	41,553.7	37,057.4	39,270.1	39,890.8	42,006.5	43,387.2
Methane (CH_4)	14,881.9	15,129.9	14,532.2	13,980.7	12,632.3	13,232.3	13,068.6	12,936.6	12,977.5	12,575.7
Nitrous oxide (N_2O)	9,013.2	8,597.9	8,585.9	8,134.8	7,476.1	7,135.7	6,461.3	6,893.0	7,209.5	7,188.2
NMVOC	79.3	84.0	76.3	79.1	67.2	66.1	73.1	91.5	104.1	110.9
F-Gases	34.6	217.8	753.1	1,252.5	1,207.3	1,328.6	1,091.8	982.4	896.5	834.7

Summary of Greenhouse Gas Emissions by gas for the With Additional Measures Scenario 1990-2030 (Gg CO_2 equivalent)

	1990	1995	2000	2005	2010	2013	2015	2020	2025	2030
Carbon Dioxide (CO_2)	32,742.5	35,694.0	45,094.6	47952.2	41,553.7	37,057.4	37,038.5	34,231.8	32,011.7	33,737.5
Methane (CH_4)	14,881.9	15,129.9	14,532.2	13,980.7	12,632.3	13,232.3	13,062.8	12,929.2	12,968.5	12,563.7
Nitrous oxide (N_2O)	9,013.2	8,597.9	8,585.9	8,134.8	7,476.1	7,135.7	6,439.9	6,705.4	7,035.3	7,016.6
NMVOC	79.3	84.0	76.3	79.1	67.2	66.1	73.1	91.5	104.1	110.9
F-Gases	34.6	217.8	753.1	1,252.5	1,207.3	1,328.6	1,091.8	982.4	896.5	834.7

6. Provision of financial, technological and capacity building support to developing country Parties.

Ireland continues to meet its obligations to provide financial, technology and capacity building support to assist developing countries to mitigate and adapt to the impacts of climate change. This support consists of both multilateral support through international funds as well as bilateral support – mainly focussed on Ireland's Key Partner Countries[43]. Detailed information on the support provided by Ireland is set out in the accompanying CTF tables 7, 8 and 9.

6.1 Finance

Following the end of the Fast-Start Finance period 2010-2012, in which Ireland exceeded its voluntary political commitment to provide up to €100m in public funding, reporting a figure of €110.2m, the period 2013-2014 saw the maintenance of fast start finance levels of support. Climate-specific finance amounted to €34.15m in 2013 and €33.67m in 2014. This included support for multilateral climate change funds including the Least Developed Countries Fund (LDCF) (€0.2m in 2013 and 0.9m in 2014) as well as the Least Developed Countries Expert Group (LEG) via the UNFCCC Trust Fund for Supplementary Activities (€0.05m in 2013 and €0.1m in 2014).

Ireland's climate finance in 2013 and 2014 has been predominantly provided through bilateral grants to Key Partner Countries through Irish Aid, Ireland's overseas development assistance programme. Some key features of the support provided by Ireland over the BR period (2013/2014) are highlighted below:

- Ireland's reported contributions for the BR period (2013/2014) were **entirely in grant-form**.
- Almost 95% of Ireland's contributions for the BR period (2013/2014) have been reported as **support for climate change adaptation**.
- Ireland's reported contributions for the BR period (2013/2014) were **prioritised towards Least-Developed Countries (LDCs)**, particularly those in sub-Saharan Africa.

The focus of these grants to date has been largely on achieving results in the areas of sustainable food and nutrition security, particularly in climate resilient agriculture, improved natural resource management, disaster risk reduction, improving efficient and sustainable energy at the household level and gender equality. Ireland also supports the climate change work of the World Resources Institute, the International Institute for Environment and Development, the Least Developed Countries Fund and the UNFCCC-LEG, as well as the work of UNSG Special Envoy on Climate Change – former Irish President Mary Robinson and her foundation, the Mary Robinson Foundation for Climate Justice.

Specific climate action reports were prepared for each country for 2013 and 2014 respectively – these are available on the Irish Aid website. The reports include information on country context, existing national plans and programmes and information on programmes and projects supported by Ireland in that year. Considering the NAPAs and NAPs as well as other documents/processes such as INDCs prepared by individual countries, and taking account of these in Irish Aid's programme

[43] Ethiopia, Malawi, Mozambique, Sierra Leone, Tanzania, Uganda, Vietnam, Zambia

development and country strategies, ensures that the resources provided are aligned with national plans and address effectively the needs of developing countries. In line with EU position (External Relations Council Conclusions November 2009), the mobilisation of Irish climate finance does not undermine or jeopardise the fight against poverty or continued progress towards development goals. Climate finance disbursed in 2013 through 2014 is largely the product of Ireland's Policy on International Development "One World, One Future" launched in 2013 which for the first time identifies climate change as one of six priority areas for action. Global hunger, human rights and accountability, essential services, fragile states, and trade and economic growth are the other identified priority areas for action.

6.1.1 Mitigation and Adaptation

The information included in the tables 7a and 7b clearly shows the breakdown between mitigation and adaptation, with those that target both in equal part are listed as cross-cutting. The majority of bilateral Irish-supported programmes support climate change adaptation while also building capacity in partner countries with the means and expertise to develop and implement their own national adaptation plans, though some mitigation projects are also supported. Total reported funding for mitigation (bilateral and multilateral) in 2013 and 2014 amounted to €2.564m and €1.53m respectively. Funding for adaptation in 2013 and 2014 amounted to €22.738m and €22.274m respectively. Cross cutting reported projects accounted for €8.843m in 2013 and €9.572m in 2014 and €0.3m for the GEMS Water project is included as 'other' in 2014 (50% coefficient applied).

6.1.2 Methodology for Reporting.

The Organisation for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC) Rio Marker methodology underpins the UNFCCC climate finance figures totals quoted and in the tables 7, 8 and 9.

6.1.3 Indicators:

The Rio Marker definitions were employed as indicators to identify and score disbursements as climate mitigation, adaptation or cross-cutting relevant. The Rio Markers work on a three-score system. Activities can be identified with;

- Principal marker of 2
- Significant marker of 1, or
- Not targeted; 0.

The choice of principle, significant or not-targeted relates to hierarchy of objectives, goals and intended outcomes in the programme or project design. A principle marker is applied if the marker policy is one of the principle objectives of the activity and has a profound impact on the design of the activity. A significant marker is applied if the marker policy is a secondary objective, or a planned co-benefit, in the programme or project design. The zero marker is applied to show that the marker policy was not targeted in the programme or project design. If this is unknown, the marker is left blank. The mapped climate finance in this report includes financial support both for activities scored as 'principal' (2) and for activities scored as 'significant' (1). This report categorises disbursements as adaptation where the scoring against the adaptation marker exceeds the scoring against the mitigation marker and vice versa. Where scoring is equal (and >0) under both adaptation and mitigation markers, the disbursement is counted as cross-cutting. In reporting bilateral climate finance we place a different weight on support for principal and significant activities. In aggregating finance for principal and significant activities, 'principal' activities are weighted with a coefficient of 100% and 'significant' activities are weighted with a coefficient of 50%. Where an activity has both adaptation and mitigation benefits, or is cross-cutting, it is weighted according to its highest score i.e. weights in mitigation and adaptation are not aggregated.

6.1.4 Delivery Mechanisms and Allocation Channels

Ireland's reported contributions for the BR period (2013/2014) were entirely in grant-form. A number of Government Ministries participate in delivering and allocating climate finance. The Department of Foreign Affairs and Trade allocated support to be delivered bilaterally through Irish Aid development programmes, and includes contributions to the World Resources Institute (WRI), the International Institute for Environment and Development (IIED), as well as supporting the work of UNSG Special Envoy on Climate Change – former Irish President Mary Robinson and multilaterally through contributions to the Least Developed Countries Fund and the UNFCCC-LEG,. The Department of Environment, Community and Local Government allocated multilateral support to the GEF and UNEP. The Department of Agriculture, Food and the Marine allocated multilateral support to the FAO and World Bank CGIAR, while the Department of Finance allocated multilateral support to the Asian Development Bank and the World Bank. These are reported in tables 7(a) and in 7(b) using OECD Rio Marker indicators.

In 2014 the Country Action Climate Reports also included a listing of disbursements by Irish Aid identified as relevant to climate change and/or disaster risk reduction to Civil Society Organisations (CSOs) which are included in Ireland Climate Action Reports but are not reported as part of Ireland's climate finance and hence not included in the accounting for this report.

Specific summary information on allocation and annual contributions are included in Tables 7a and 7b. In 2015, Ireland made an additional contribution of €1m to the LDCF and announced that 2016 would see an initial contribution of €2m to the Green Climate Fund (GCF).

6.1.5 Private Finance Mobilisation

Private climate finance mobilised by public sector intervention is not reported on at this time as Ireland currently does not have systems in place to collect such data. A cross-Government group has now been established with a mandate to consider private finance options as well as policy instruments to mobilise further climate finance and in tracking/reporting existing and subsequent flows.

6.1.6 Information on Ireland's climate finance contributions as reported in CTF

Currency exchange rate - Ireland's climate finance contributions for the BR period (2013/ 2014) are reported in "Euro (€) millions". The currency exchange rate used for conversion to USD $, as required in the CTF, was based on the Central Bank of Ireland's annual average exchange rate (Euro € to USD $) for 2013 and 2014 respectively.

Pledged / Committed / Provided

Ireland's ODA financial contributions are reported only after they have been provided (disbursed) to partners.

New and additional

Ireland has delivered climate finance even in the context of seriously reduced national budget spending. Ireland's contribution in 2013 and 2014 was drawn from grant and other non-refundable contributions provided by DECLG; DAFM; and climate-relevant ODA.

CTF Table 7 – Provision of public financial support: summary information

Allocation channels	European euro - EUR				
		Climate-specific [d]			
	Core/general [c]	Mitigation	Adaptation	Cross-cutting [e]	Other
2013					
Total contributions through multilateral channels	35,242,781.00		155,000.00	450,000.00	
Multilateral climate change funds [g]	1,421,000.00			250,000.00	
Other multilateral climate change funds [h]					
Multilateral financial institutions, including regional development banks	33,821,781.00				
Specialized United Nations bodies			155,000.00	200,000.00	
Total contributions through bilateral, regional and other channels		2,564,000.00	22,583,000.00	8,393,000.00	
Total	35,242,781.00	2,564,000.00	22,738,000.00	8,843,000.00	
2014					
Total contributions through multilateral channels	75,431,800.00	37,600.00	1,300,000.00	100,000.00	300,000.00
Multilateral climate change funds [g]	1,469,000.00		1,000,000.00		
Other multilateral climate change funds [h]					
Multilateral financial institutions, including regional development banks	32,085,000.00				
Specialized United Nations bodies	41,877,800.00	37,600.00	300,000.00	100,000.00	300,000.00
Total contributions through bilateral, regional and other channels		1,490,000.00	20,974,000.00	9,472,500.00	
Total	75,431,800.00	1,527,600.00	22,274,000.00	9,572,500.00	300,000.00

6.2 Technology Transfer and Development

The UNFCCC states that "promoting the effective development and transfer of environmentally sound technologies is critical in enabling developing countries to pursue their objectives for sustainable development in a climate-friendly manner". Technology in the UNFCCC context is usually understood to include physical technologies, knowledge and techniques. While there are very few standalone "capacity building" or "technology transfer" projects, frequently, funding for climate related activities will also include capacity strengthening and technology related components. A climate support mapping exercise undertaken by Irish Aid identified €3,761,421 in 2013 and €7,937,707 in 2014 as support for activities that included climate technology transfer. The mapping exercise included activities that have a significant research component as well as activities that support new technologies.

Examples of technology development and transfer are mainly located in Sub-Saharan Africa and include the deployment of:

- Climate forecasting systems to improve/enable accurate agricultural decisions,
- Research on climate adapted seeds and planting materials;
- Fuel efficient cookstoves and domestic thermo electric generators;
- Research on agroforestry and climate smart agriculture;
- Testing water filtration technology for disaster risk reduction.

Table 8 gives ten examples of support for technology development and transfer from each of the years 2013 and 2014.

The Irish Government's support for technology transfer in relation to implementation of the UNFCCC includes interaction through the Technology Mechanism. In 2014, Ireland also provided €100,000 to the Clean Technology Centre and Network which promotes the accelerated transfer of environmentally sound technologies for low carbon and climate resilient development at the request of developing countries.

6.3 Capacity Building

The UNFCCC describes capacity building as "enhancing the ability of individuals, organisations and institutions in developing countries...to identify, plan and implement ways to mitigate and adapt to climate change". Although the UNFCCC asks countries to report on capacity building support, there is no agreed methodology - the OECD DAC is considering this as an area for future development. A climate mapping exercise undertaken by Irish Aid identified €16,819,259 in 2013 and €17,711,207 in 2014 as support for activities that included capacity building for climate change. Table 9 provides ten examples of capacity-building support provided for each of the years 2013 and 2014.

Some level of capacity building is incorporated into all Irish Aid climate activities. However, the examples included in table 9 reflect where specific focussed efforts are made to train individuals and community groups to engage in climate change response and to build institutional capacity for planning and responding to climate change. Some notable examples include support in Tanzania for MVIWATA, the Network of small scale farmers' groups aiming to build capacity on climate and environment issues and to mainstream climate change in their strategy and policies; and support in Zambia under the Local Development Programme (LDP) of Northern Province for training in climate smart crops, livestock and aquaculture production, as well as conservation agriculture techniques. A further case study from Tanzania is included below.

Irish Aid also invested in building capacity of staff in Irish Aid and in partner countries (both government and civil society organisations), to integrate climate change into development programmes and projects. A Climate Change and Development Learning Platform was launched with the assistance of the IIED to facilitate the sharing of information and lessons between Irish Aid staff, climate and development experts, and Irish Aid's development partners in developing countries. These capacity building efforts continue into 2015 and 2016.The Climate Learning Platform supports countries in designing sustainable learning to address climate change, with a particular focus on integrating climate change into development programming, adopting climate-smart technologies, and incorporating sustainable smallholder household energy systems. The Climate Learning Platform can be accessed through the Irish Aid website and via www.climatelearningplatform.org.

Case Study of Irish Capacity Building Support

Through the Climate Change and Development Learning Platform, Irish Aid is supporting detailed longitudinal case studies in a number of key partner countries. An example of a recently completed case study is an Irish Aid funded "Pastoralist Programme" implemented by Care International and the Tanzania Natural Resource Forum (TNRF). The programme provides capacity building and funding for community-based organisations (CBOs) on securing resource access through improved local land management, gender rights and climate change awareness training. It also supports civil society organisations to advocate for "pro-pastoralist" policy at the level of national government. A study by IIED, commissioned by Irish Aid has shown that village land use planning has rapid impact. The facilitation of land use planning to support pastoralists in securing access to key resources is the best approach of realizing impact on natural resources access and governance. Village land use planning can involve segregation of land for farming, grazing, settlements and other land-uses. Through this process, planning clearly designates areas in which pastoralists and agro-pastoralists can manage and plan their resources including communal land (i.e. grazing land and reserve lands), water resources, and accessibility to minerals for livestock healthy improvement using customary institutions. This learning is incorporated into ongoing Irish Aid programme development and is also shared with the broader climate change and development community, including development partners via the Climate Learning and Development Platform.