



Ireland's Greenhouse Gas Emission Projections

2012-2030

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Ireland's Greenhouse Gas Emission Projections - Overview

- Ireland is on track to meet its commitment under the Kyoto Protocol. This is in marked contrast to the projection in Ireland's 2007 National Climate Change Strategy which forecast a total distance to target of 18 Mtonnes of CO₂eq.
- Whilst the reduction in the distance to target for the Kyoto Protocol period is a positive outcome in terms of compliance, its occurrence is, primarily, a direct result of the current economic recession and economic outlook for the future. In order to meet future targets, Ireland cannot rely on a recession and needs to develop as a low carbon economy going forward.
- There continues to be a significant risk that Ireland will not meet its 2020 EU targets even under the most ambitious emission reduction scenario. There is projected to be a cumulative distance to target of 7 – 24 Mtonnes for the period 2013-2020 with Ireland breaching its annual limits in 2015-2016. Strong projected growth in emissions from transport and agriculture are the key contributors to this trend.

Introduction

The Environmental Protection Agency produces greenhouse gas emission projections on an annual basis for all sectors of the economy in collaboration with relevant State and other bodies. These projections are compiled to meet EU reporting obligations and, also, to inform national policy development. The projections presented here were submitted to the European Commission under Council Decision 280/2004¹ to fulfill reporting obligations in 2013. These projections update those published in April 2012² by the EPA.

Greenhouse gas emissions are projected to 2020 using two scenarios. The ‘worst case scenario’ assumes that no additional policies and measures, beyond those already in place by December 2011, are implemented (*With Measures* projection). Under this scenario, emissions are projected to increase by 9% by 2020. The ‘best case scenario’ assumes that Government targets for 2020, for example renewables targets, will be fully achieved (*With Additional Measures* projection). Under this scenario, emissions increase by 1% by 2020. Therefore, assuming that these two scenarios represent two possible pathways for greenhouse gas emissions in Ireland to 2020, emissions are projected to be 1-9% higher in 2020 when compared to current levels. The macroeconomic assumptions used in developing these emission projections are provided by ESRI. Forecasted activity data (animal numbers, crop areas and fertiliser use) are provided by Teagasc. The key macroeconomic assumptions and a more detailed description of the two scenarios is provided in Appendix I and II. In addition, a comparison with EPA projections published in 2012 is presented in Appendix III.

¹ Decision No 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol

² Ireland’s Greenhouse Gas Emissions Projections 2011-2020. Environmental Protection Agency (2012)

Kyoto Protocol (2008 – 2012)

Under the Kyoto Protocol, Ireland is required to limit total national greenhouse gas emissions to 314.2 Mtonnes of CO₂eq over the five year period 2008 – 2012 which is equivalent to 62.8 Mtonnes of CO₂eq per annum. The Kyoto Protocol limit is calculated as 13% above Ireland’s 1990 baseline value which was established and fixed at 55.61 Mtonnes of CO₂eq following an in-depth review of Ireland’s 2006 greenhouse gas inventory submission to the UNFCCC.

These latest projections indicate that the distance to target for the Kyoto Protocol will be 0.2 – 0.7 Mtonnes. Ireland is, therefore, on track to meet its commitment under the Kyoto Protocol, and it is likely that there will be a very low requirement for the use of credits to ensure compliance with the agreed limit. These emission estimates include the impact of forest sinks as allowed for under Article 3.3 of the Kyoto Protocol and the impact of the EU Emissions Trading Scheme (EU ETS).

Figure 1 shows emissions for the period 1990 to 2012 for both a *With Measures* scenario and a *With Additional Measures* scenario and compares with the Kyoto Protocol limit for the 2008 – 2012 period.

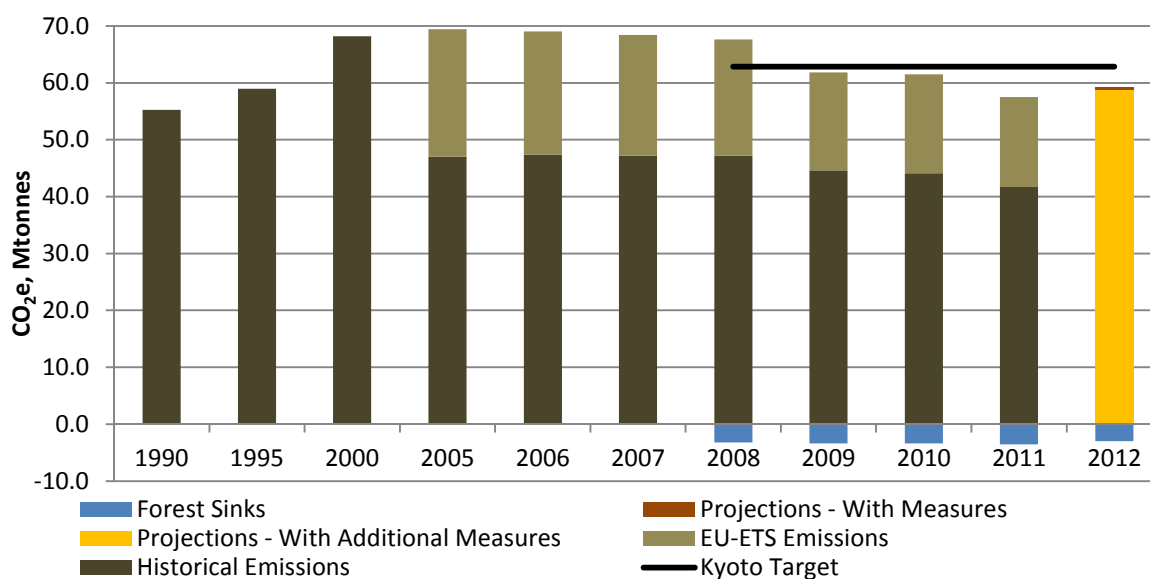


Figure 1. Historical and projected greenhouse gas emissions (including forest sinks) for the 2008 – 2012 period for each scenario and the Kyoto Protocol target

The reduced distance to target, relative to last year’s projection, is partly as a result of reductions in energy demand in the residential, industrial and commercial and energy industries sectors. In addition improvements to the calculation methodologies for forest sinks resulted in an increase in the estimates of the carbon sink available for each year of the commitment period 2008-2012.

The distance to target is determined by considering the relative contributions of the ETS and non-ETS sector emissions to total national emissions. Ireland’s National Allocation

Plan (2008-2012)³ allocates 22.3 Mtonnes of CO₂ annually to those installations covered by the EU Emissions Trading Scheme. The remainder (i.e. 62.8-22.3=40.6 Mtonnes of CO₂eq) is compared with projected non-ETS sector emissions (including the impact of forest sinks) to assess the distance to target.

³ Ireland's National Allocation Plan for Emission Trading 2008 - 2012. Final Allocation Decision. Environmental Protection Agency. (2008).

EU 2020 Targets for non-ETS sector emissions

Under the EU Commission's *Climate and Energy Package*, Ireland is required to deliver a 20% reduction in non-ETS greenhouse gas emissions by 2020 (relative to 2005 levels). In addition, Ireland also has binding annual emission limits for the period 2013-2020 to ensure a gradual move towards the 2020 target. The non-ETS sectors cover those sectors that are outside the EU Emissions Trading Scheme and includes the agriculture, transport, residential and waste sectors. Member States are permitted to meet their annual targets through a number of mechanisms which include carry forward of a quantity of its annual emission allocation from the following year, use of transfers from other Member States and the limited use of international credits from project activities as long as certain criteria are met.

The target for Ireland's non-ETS sectors is to reduce emissions by 20% in 2020 relative to 2005 levels. This limit was set in 2012 following a review of Ireland's national greenhouse gas inventory at 37.5 Mtonnes of CO₂eq⁴. It is estimated that Ireland will exceed its 2020 limit by 5 – 8 Mtonnes of CO₂eq. This is 3% – 10% below 2005 levels compared with a limit of 20%. In addition, the projections indicate that Ireland will exceed its binding annual limit in 2015-2016 and will exceed its obligations over the 2013-2020 period, cumulatively, by 7 – 24 Mtonnes of CO₂eq. The impact of forest sinks are not included in this assessment in line with EU accounting rules which stipulate that forest sinks may not be used for compliance towards EU 2020 targets.

The key contributors to emissions in the non-ETS sectors are transport and agriculture. Agriculture emissions are projected to grow on an annual basis out to 2020 which reflects the impact of Food Harvest 2020 and removal of milk quota. In total, agriculture emissions are projected to increase by 12% by 2020 on current levels. Transport emissions are also projected to show strong growth over the period to 2020 with a 12-22% increase on current levels depending on the level of policy implementation.

Figure 2 shows projected emission levels for non-ETS sector emissions under the *With Measures* and *With Additional Measures* scenarios. In addition, it shows the annual compliance/non-compliance in relation to the annual binding emission limits.

⁴ 69.3 Mtonnes of CO₂eq (Total 2005 National Emissions) – 22.4 Mtonnes of CO₂ (2005 ETS Emissions without De-minimis) = 46.8 Mtonnes of CO₂eq (2005 non-ETS Emissions) - 20% = 37.5 Mtonnes of CO₂eq. However, some further adjustment of this figure is anticipated due to corrections for alterations to the scope of the ETS.

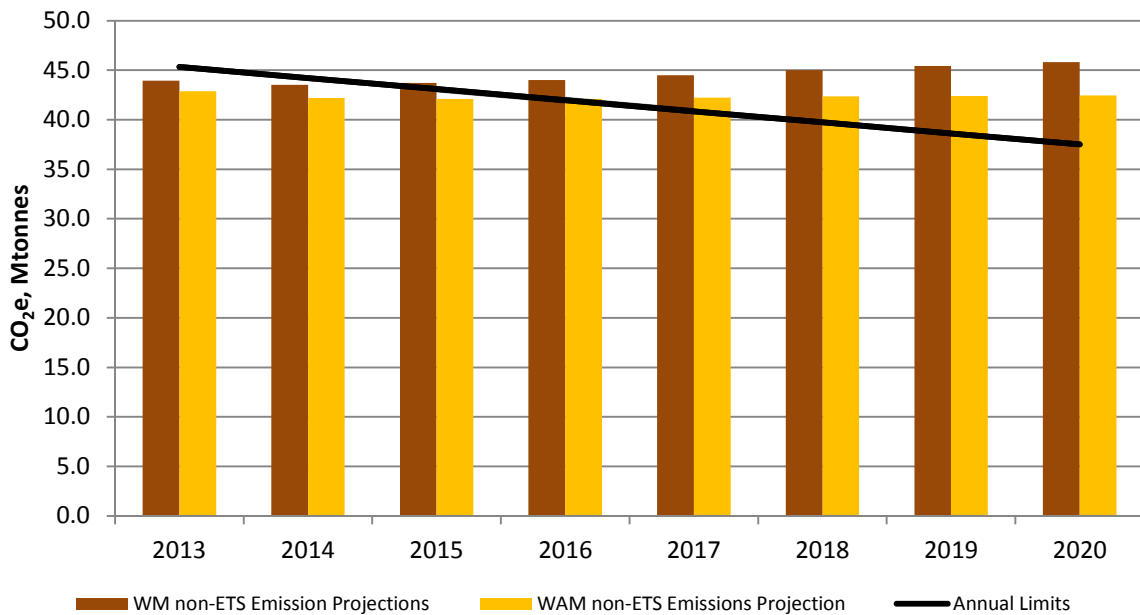


Figure 2. With Measures and With Additional Measures greenhouse gas emissions projections and comparison with the linear reduction pathway required between 2013 and 2020

Table 1 indicates the range of the annual compliance/non-compliance over the period 2013-2010. This is also shown graphically in Figure 3.

It is important to note that the *With Additional Measures* scenario assumes that all targets in Government policy documents such as the NEEAP⁵ and NREAP⁶ are met. The difficulties associated with meeting these targets should not, however, be underestimated. Failure to meet these targets will result in higher emissions levels than those projected under this scenario and result in Ireland’s emission levels moving even further from its emission reduction targets.

Table 1. Range of annual compliance/non-compliance based on the With Measures and With Additional Measures

Mtonnes of CO ₂ eq	2013	2014	2015	2016	2017	2018	2019	2020	Total
	<i>Annual compliance/non-compliance</i>								
Annual Limits	45.3	44.2	43.1	42.0	40.9	39.7	38.6	37.5	
With Measures*	-1.6	-0.8	0.5	2.0	3.6	5.2	6.7	8.3	23.9
With Additional Measures*	-2.5	-2.0	-1.0	0.1	1.4	2.6	3.8	5.0	7.4

*A negative sign indicates that emissions are below the annual allowed limit.

⁵ Maximising Ireland’s Energy Efficiency. The National Energy Efficiency Action Plan 2009-2020. Department of Communications, Energy and Natural Resources, 2009; Ireland’s second National Energy Efficiency Action Plan to 2020. Department of Communications, Energy and Natural Resources, 2012.

⁶ National Renewable Energy Action Plan, Ireland. Submitted to the European Commission under Article 4 of Directive 2009/28/EC. Department of Communications, Energy and Natural Resources, 2010

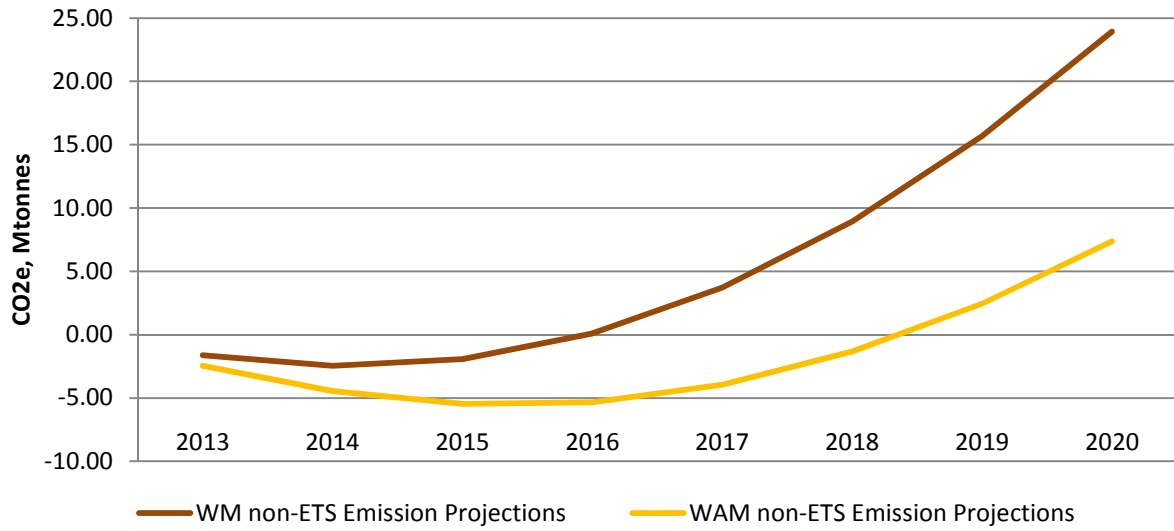


Figure 3. Projected cumulative distance to target for Ireland's Non-ETS emissions 2013 to 2020

Sectoral Emissions to 2020

Transport

- Under the *With Measures* scenario, transport emissions are projected to increase by 22% over the period 2011 – 2020 to 14 Mtonnes of CO₂eq. The *With Measures* scenario includes:
 - the impact of VRT and motor tax changes (introduced in 2008)
 - improvements to the fuel economy of private cars, supported by the EU Regulation which mandates maximum levels of CO₂ for new cars to 120g/km in 2015 and 95g/km in 2020
 - renewable energy penetration of 3% out to 2020 which is supported by the Biofuel Obligation Scheme 2010⁷.
- Transport sector emissions are projected to be 1.2 Mtonnes of CO₂eq higher in 2020 compared with last year's projection. This is attributed to forecasted increases in petrol and diesel use for road transport. In addition, revisions to historical data and changes in the underlying methodology have had an impact on the energy forecast for this sector relative to last year's projections.
- Under the *With Additional Measures* scenario, transport emissions are projected to increase by 12% over the period 2011 – 2020 to 13 Mtonnes of CO₂eq returning transport emission to 2009 levels by 2020. In this scenario, it is assumed that:
 - renewable energy penetration is 10% by 2020 – this is the RES-T target which is a binding target under the Renewable Energy Directive⁸. The Biofuels Obligation Scheme 2010⁷ and the rollout of Electric Vehicles (EVs) underpin the achievement of this target. Electric vehicles account for only 1.5% of the RES-T target by 2020, with biofuels contributing the remaining 8.5%.
 - more efficient road traffic movements and public transport efficiencies will deliver savings.

Energy

- Energy sector emissions comprise emissions from power generation, oil refining, peat briquetting and fugitive emissions. Emissions from power generation accounted for 97% of energy sector emissions in 2011 and are responsible for a similar share of emissions over the projection period.
- Under the *With Measures* scenario, total energy sector emissions are projected to increase by 11% over the period 2011 – 2020 to 13 Mtonnes of CO₂eq. 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

⁷<http://www.dcenr.gov.ie/Energy/Sustainable+and+Renewable+Energy+Division/Biofuels+Obligation+Scheme.htm>

⁸ Renewable Energy Directive of June 2009 (28/EC/2009)

the current and projected low coal price (relative to gas). Renewables penetration in 2020 is projected to be 24% under this scenario.

- Under the *With Additional Measures* scenario, total energy sector emissions are projected to increase by 1% over the period 2011 – 2020 to 12 Mtonnes of CO₂eq. In this scenario, it is assumed that renewable energy reaches 40% penetration by 2020 with the largest contribution coming from wind. It is envisaged there will be an additional expansion of renewable electricity generation (from 56 MW currently to 285 MW in 2020) from co-firing biomass, the construction of an additional waste to energy plant and the continued development of landfill gas electricity generation and biomass CHP. In addition the construction of at least 25 MW of wave energy is included in the forecast.

Agriculture

- Agriculture sector emissions comprise emissions from enteric fermentation, manure management and nitrogen application to soils. For agriculture emission projections, there is one scenario or outlook for the future which assumes full achievement of the *Food Harvest 2020* targets by 2020. The data underpinning the projections are provided to the EPA by Teagasc and include forecast animal numbers, crop areas and projected nitrogen fertiliser application to soils.
- The main targets set out in the *Food Harvest* strategy are (i) increase the value of primary output in the agriculture, fisheries and forestry sector by €1.5 billion by 2020 (ii) increase the value added in the agri-food, fisheries and wood products sector by €3 billion by 2020 and (iii) achieve an export target of €12 billion for the sector by 2020.
- Enteric fermentation, manure management and nitrogen application to agricultural soils account for on average 45%, 27% and 22%, respectively of total emissions from agriculture. Emissions from the combustion of fossil fuels accounts for on average 5% of total emissions from agriculture. Total emissions from agriculture are projected to increase by 12% over the period 2011 – 2020 to 21 Mtonnes of CO₂eq.
- Agricultural emissions are 0.6 Mtonnes of CO₂eq higher in 2020 relative to last year's projections. This is mainly attributable to revised animal numbers and revised nitrogen fertiliser application over the projection period. Teagasc assume that less dairy cows are required to meet the *Food Harvest* milk target of 50% increase in output by volume by 2020 compared with last year's projections. In contrast, the beef herd is projected to increase slightly over the projection period to enable the value added target for beef output to be met. In addition, fertiliser nitrogen sales are assumed to increase by approximately 16% by 2020.

Residential

- Under the *With Measures* scenario, emissions from the residential sector are projected to be relatively stable at 7 Mtonnes of CO₂eq between 2011 and 2020.

The following measures are included in the *With Measures* emission projection: Greener Homes Scheme, Warmer Homes Scheme, Home Energy Savings Scheme, Energy Efficient Boiler Standard, 2002 and 2008 Building Regulations.

- Under the *With Additional Measures* scenario, emissions are projected to decrease by 24% between 2011 and 2020 to 5 Mtonnes of CO₂eq. Under this scenario, the following measures are included:
 - the Better Energy Homes (residential retrofit) and the 2011 Building Regulations are projected to deliver significant savings.
 - increased penetration of renewables is assumed in line with meeting the national RES-H target (i.e. 12% thermal heat from renewables by 2020). This is assumed to be driven by newly built homes complying with the renewable energy requirements in the 2008 and 2011 Building Regulations.

Industry and Commercial Services

- Under the *With Measures* scenario, emissions from the industry and commercial services sector are projected to decrease by 4% to 8 Mtonnes between 2011 and 2020. The effect of the current recession on the construction sector and subsequent downturn in cement production is included in the projection for this sector. In addition, the impact of the Accelerated Capital Allowance Scheme, SEAI energy agreements such as the Large Industry Network, CHP biomass and supports for energy efficiency improvements are included in this scenario.
- Under the *With Additional Measures* scenario, emissions from the industry and commercial services sector are projected to decrease by 16% to 7 Mtonnes between 2011 and 2020. In this scenario, energy demand from industrial and commercial services sectors is 12% lower than the *With Measures* scenario as energy efficiency policies and measures are assumed to be adopted and implemented. These include
 - the implementation of 2012 Building Regulations and the public and commercial sector components of the National Retrofit Scheme.
 - increased penetration of renewables in line with meeting the national RES-H target which is driven by recently approved REFIT tariffs for biomass CHP.

Waste

- There is one scenario for waste sector emission out to 2020. Greenhouse gas emissions from the waste sector are projected to decrease by 28% between 2011 and 2020 to 0.7 Mtonnes of CO₂eq. It is assumed that the Landfill Directive targets (Directive 1999/31/EC), for the diversion of biodegradable waste from landfill, are met progressively in 2013 and 2016 following on from Ireland's achievement of the 2010 Landfill Directive target. Achievement of the targets in 2013 and 2016 is assumed on the basis of measures and initiatives designed to

divert biodegradable waste from landfill. These include guidance published by the EPA⁹ for EPA landfill licence holders in relation to biodegradable waste diversion obligations, increases in the landfill levy and the introduction of the Food Waste Regulations for commercial operations (2009) and households (2013) which require the source separation and collection of food waste for recycling.

- It is assumed that CH₄ capture increases from the current level of 67% of CH₄ generated in 2011 to 75% in 2020.

⁹ Municipal Solid Waste – Pre-treatment & Residuals Management. An EPA Technical Guidance Document. (2009)

Sectoral Contributions for the Kyoto period (2008-2012) and 2020

In terms of sectoral contributions to total national emissions over the Kyoto period, Figure 4 shows the projected share from each of the sectors. The sectoral share is the same for both the *With Measures* and *With Additional Measures* scenarios over the Kyoto period. Agriculture and transport sector emissions account for almost 50% of emissions under both scenarios.

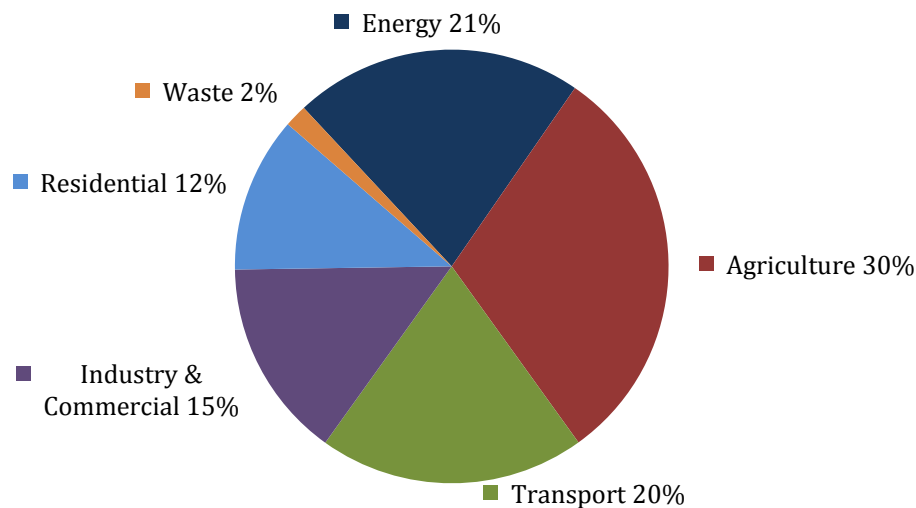


Figure 4. Projected sectoral share of total greenhouse gas emissions over the period 2008 - 2012 for both the *With Measures* and *With Additional Measures* scenarios

In terms of the sectoral contribution to total non-ETS sector emissions in 2020, Figure 5 shows the projected contributions for the *With Additional Measures* scenario. Under this scenario, agriculture and transport sector emissions account for 78% of total non-ETS emissions. This illustrates the important role that both transport and agriculture will play in developing mitigation options for achieving the 2020 targets in relation to non-ETS sector emissions.

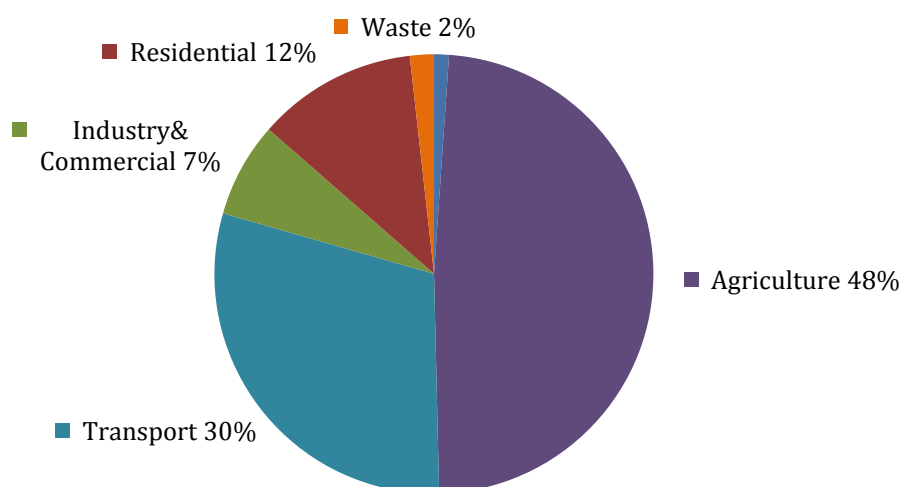


Figure 5. Projected sectoral share of non-ETS greenhouse gas emissions in 2020 for the *With Additional Measures* scenario.

Projected Greenhouse Gas Emissions in 2030

This section presents a first estimate of emissions out to 2030. While Ireland does not have a definite policy direction on reducing greenhouse gas emissions post-2020, the recently published draft heads of the Climate Action and Low Carbon Development Bill 2013¹⁰ aims to provide national policy to help Ireland transition to a low carbon, climate resilient and environmentally sustainable economy over the period to 2050.

In developing emission projections to 2030, the EPA uses additional information from the SEAI energy forecasts. One 'best-case' scenario is presented which assumes that the level of effort required to meet Ireland's energy efficiency and renewable energy targets for 2020 under the NEEAP⁵ and NREAP⁶ is maintained out to 2030. The emission estimates provided for 2030 are thus only representative of one possible likely scenario for future emission trends and is presented in Figure 6. In developing emissions projections to 2030 it is assumed that emissions from the agriculture sector remain at 2020 levels as forecasted activity data for the sector is not available post 2020.

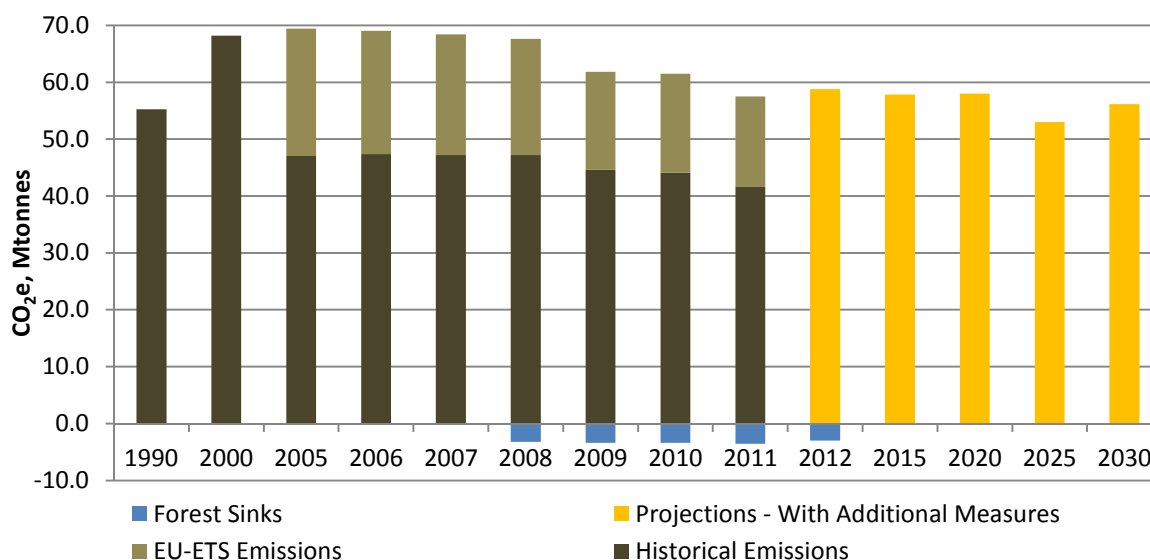


Figure 6. Comparison of the greenhouse gas emissions projections for the With Measures and With Additional Measures scenario to including forest sinks for the Kyoto commitment period

Under this scenario, total national emissions are projected to be 2% higher in 2030 than in 1990, thus returning emission levels to those last seen in the early 1990's. Significant reductions are evident in the energy, residential, industry and commercial services sectors. The gain associated with the reductions in these sectors is however offset by a 47% increase in transport sector emissions relative to current levels.

¹⁰ <http://www.environ.ie/en/Publications/Environment/ClimateChange/FileDownload,32468,en.pdf>

Appendix I

Underlying Assumptions

Energy-related emissions projections are based on energy forecasts provided to the EPA by SEAI. These energy forecasts are based on a set of macroeconomic projections for Ireland produced by the ESRI in Autumn 2012 which represent one possible view of economic growth. The macroeconomic assumptions are an update of those produced in Autumn 2011 which were used in developing the emission projections published in 2012. Table 1.1 outlines the key macroeconomic assumptions that underpin the current projections.

Table 1.1 Key macroeconomic assumptions underlying the projections

	2011 - 2015	2016 - 2020	2021-2025	2026-2030
	Average Annual % Growth			
GDP	+2.2%	+3.1%	+2.7%	+2.2%
GNP	+1.5%	+3.3%	+3.1%	+3.0%
Personal Consumption	-1.1%	+1.0%	+2.3%	+2.0%
	2015	2020	2025	2030
Housing Stock ('000)	1833	1935	2060	2194
Stock of cars ('000)	1805	1913	2058	2164
Population ('000)	4491	4606	4725	4824
EUETS: Carbon €₂₀₁₀/tCO₂	10	17	27	37
Carbon tax €₂₀₁₀/tCO₂	10	17	27	37
Coal \$₂₀₁₀/boe	28.6	29.4	30.8	31.2
Oil \$₂₀₁₀/boe	111.8	115.1	116.0	121.0
Gas \$₂₀₁₀/boe	69.9	80.0	76.6	83.9
Peat \$₂₀₁₀/boe	31.1	31.1	31.1	31.1

Agriculture emissions projections are based on data from Teagasc's FAPRI-Ireland model which were provided to the EPA in January 2013. The FAPRI-Ireland model is a dynamic, partial equilibrium model which is linked both to the FAPRI-EU and world modelling systems. A key assumption underpinning the agriculture emissions projections is that the Food Harvest 2020 targets will be met in full. Teagasc provide updated projected activity data to the EPA on a yearly basis. Projected activity data for the agriculture sector differs from year to year due to changing market forces within the industry and the projected effect that these will have on meeting the targets set out in FH2020.

Appendix II

Description of emissions scenarios

Two emissions projections are presented which show two potential outlooks to 2020 depending on policy development and implementation. These are called

- *With Measures*
- *With Additional Measures*

The *With Measures* scenario is based primarily on SEAI's *Baseline* energy forecast which incorporates the anticipated impact of policies and measures that were in place (and legislatively provided for) by end of 2011.

The *With Additional Measures* scenario is based on SEAI's *NEEAP/NREAP* energy forecast. The *NEEAP/NREAP* energy forecast builds on the *Baseline* energy forecast with additional assumptions included to account for Ireland's NEEAP⁵ and NREAP⁶. Therefore this scenario includes existing *and* planned policies and measures. The key additional measures that are assumed to be achieved in full and are included in the *With Additional Measures* emission projection are that, by 2020, Ireland will have achieved:

- 20% improvement in energy efficiency across all sectors
- 33% energy end-use efficiency savings target for the public sector
- 40% renewable electricity (RES-E) share
- 12% renewable heat (RES-H) share
- 10% renewable transport (RES-T) share (including 10% electric vehicles penetration target)

The difference between the *With Measures* and *With Additional Measures* scenario shows the impact of additional policies and measures and renewables penetration which are assumed to deliver the NEEAP⁵ and NREAP⁶ targets. The total impact of additional policies and measures and renewables penetration is estimated to be 0.5 Mtonnes of CO₂eq for the remaining year of the Kyoto Commitment period (i.e. 2012), 1.9 Mtonnes of CO₂eq in 2015 and 4.8 Mtonnes of CO₂eq in 2020. Table 2.1. shows the sectors where the additional measures are assumed to be implemented and the associated savings.

Table 2.1. CO₂eq savings from additional policies and measures by sector

CO ₂ eq, Mtonnes	2015	2020
Energy	0.3	1.2
Industry	0.2	0.4
Services	0.3	0.6
Residential	0.8	1.6
Transport	0.4	1.0
Total	1.9	4.8

Appendix III

Comparison with 2012 EPA Greenhouse Gas Emissions Projections

The EPA produces greenhouse gas emission projections on an annual basis. Previously emissions projections were published in April 2012 out to 2020. It is instructive to compare the emissions projections presented here with previous work to understand the degree of variability in projecting emissions and where key differences occur. Figure 3.1 and Table 3.1 shows a comparison between the projections presented here (called 2013 GHG Emissions Projections) and those published last year² (called 2012 GHG Emissions Projections) for the *With Additional Measures* scenario.

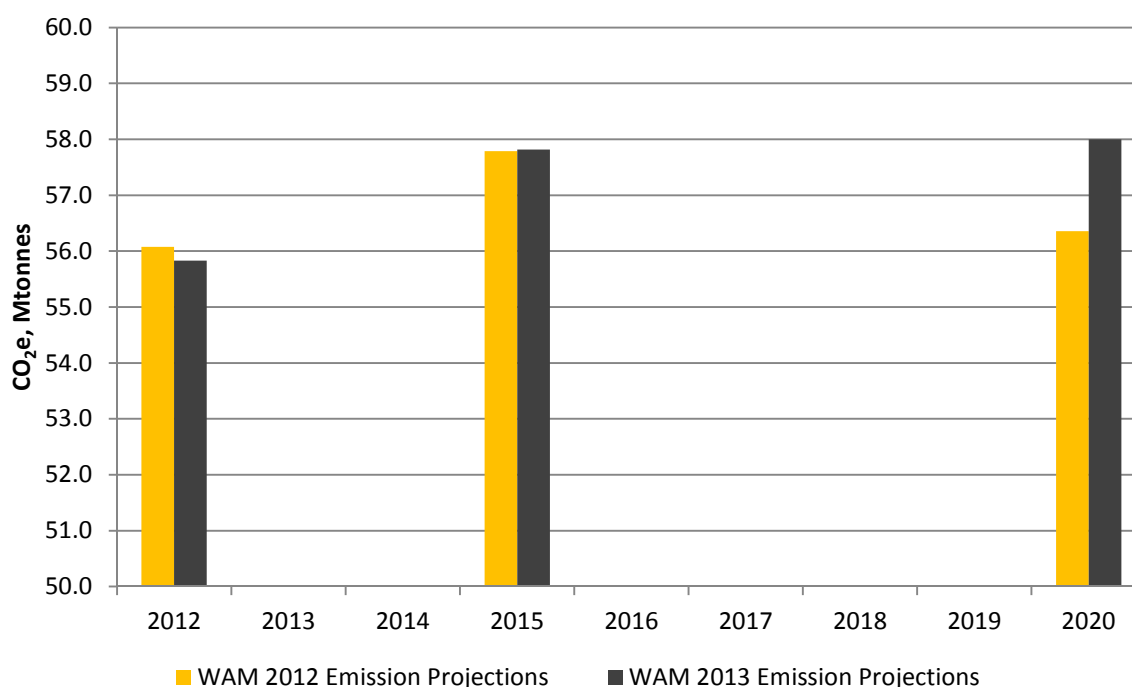


Figure 3.1. Comparison between 2012 and 2013 greenhouse gas emissions projections for the With Additional Measures scenario including forest sinks for the Kyoto commitment period

Table 3.1. Comparison between 2012 and 2013 greenhouse gas emissions projections for the With Additional Measures scenario including forest sinks for the current Kyoto commitment period

Mtonnes of CO ₂ eq	2012	2015	2020
WAM 2013 GHG Emissions Projections	55.8	57.8	58.0
WAM 2012 GHG Emissions Projections	56.1	57.8	56.4

The 2012 GHG emissions projections² were based on GDP growth rates of 3.0% between 2010 and 2015 and 3.3% between 2016 and 2020. The assumptions on economic growth rates underpinning this year's projections are lower for the period 2011-2015 with an average annual GDP growth rate forecast of 2.2%. For the period 2016 – 2020 the growth rate is similar at 3.1% per annum. Despite similar projected economic growth for the economy in 2020, greenhouse gas emissions are projected to be higher due primarily to higher transport emissions and agriculture sector emissions.

Under the *With Additional Measures* scenario for the Kyoto period, total national emissions are projected to be 2% lower compared with last year's projection. The main differences in sectoral emissions projections for the Kyoto period are:

- transport (2% higher)
- energy (2% lower)
- waste sector (7% higher)
- industry and commercial services (3% lower)
- residential (4% lower)

For 2020, total national emissions are projected to be 3.2% higher compared with last year's projection, with the main differences as follows:

- agriculture sector (3% higher)
- energy sector (12% higher)
- transport sector (11% higher)
- waste sector (27% lower)
- industry and commercial services (14% lower)
- residential (3% lower)

For the agriculture sector, revised animal numbers and nitrogen fertiliser projections have resulted in an increase in emission levels above those produced in 2012.

For the energy sector in the *With Additional Measures* scenario, an increase in coal use is forecasted, which displaces the less carbon intensive natural gas for electricity generation.

For the transport sector, emissions are projected to be over 1.2 Mtonnes of CO₂eq higher in 2020 compared with last year's projection. The main reasons behind this are increases in the demand for petrol and diesel which are forecasted to be 10.2% and 13.5%, respectively above the forecasted demand in the 2012 emission projections.

Appendix IV

Units: 1 Mt = 1,000 kilotonnes = 1,000,000 tonnes

CO₂eq: total greenhouse gas emissions expressed as CO₂ equivalents. The CO₂ emission is added to the equivalent emission of methane, nitrous oxide and so-called F-gases which are converted to CO₂ equivalents using their global warming potentials.

F-gases: These gases comprise the following three gases, HFCs (Hydrofluorocarbons), PFCs (Perfluorocarbons) and SF₆ (Sulphur Hexafluoride). They have very much higher global warming potentials than the naturally occurring GHGs (carbon dioxide, methane and nitrous oxide).

Table 4.1. Historical and projected emissions by sector (Mtonnes CO₂eq per annum) for With Measures and With Additional Measures scenarios

	Energy	Residential	Industry & Commercial	Agriculture	Transport	Waste	Forest Sinks	Total (Without forest sinks)	Total (With forest sinks)	
Historical	1990	11.4	7.5	9.6	20.4	5.1	1.4	55.2		
	1995	13.5	6.4	9.8	21.3	6.3	1.7	59.0		
	2000	16.2	6.4	12.4	20.9	10.8	1.5	62.2		
	2005	15.8	7.2	12.0	19.8	13.1	1.5	69.5		
	2006	15.1	7.1	11.7	19.6	13.9	1.6	69.0		
	2007	14.6	6.9	12.1	19.2	14.5	1.2	68.4		
	2008	14.7	7.5	11.5	19.1	13.7	1.1	-3.2	67.6	64.4
	2009	13.1	7.4	9.0	18.7	12.5	1.0	-3.4	61.8	58.4
	2010	13.4	7.8	9.0	18.8	11.6	1.0	-3.4	61.5	58.1
2011	12.0	6.6	8.2	18.4	11.3	1.0	-3.6	57.5	53.9	
Projected	<i>With Measures Scenario</i>									
	2015	12.5	6.8	7.7	19.5	12.3	1.0		59.7	
	2020	13.3	6.6	7.9	20.6	13.7	0.7		62.8	
	<i>With Additional Measures Scenario</i>									
	2015	12.2	6.0	7.3	19.5	12.0	1.0		57.8	
2020	12.1	5.0	6.9	20.6	12.7	0.7		58.0		

Note: Numbers may not sum exactly due to rounding

*Forest sinks have only been officially reported since 2008 (i.e. the first year of the Kyoto Protocol). They are shown here to provide an indication of historical trends in forest sinks.

Table 4.2. Historical and projected emissions for the non-ETS sector (Mtonnes CO₂eq) for With Measures and With Additional Measures scenarios

	Non-ETS Sector	Forest sinks	Total (Without Forest sinks)	Total (With Forest sinks)
Historical	2005	47.1		
	2006	47.4		
	2007	47.2		
	2008	47.2	-3.2	44.0
	2009	44.6	-3.4	41.2
	2010	44.1	-3.4	40.7
	2011	41.7	-3.6	38.1
Projected	<i>With Measures Scenario</i>			
	2015	43.6		43.6
	2020	45.8		45.8
	<i>With Additional Measures Scenario</i>			
	2015	42.1		42.1
2020	42.4		42.4	

Note: Numbers may not sum exactly due to rounding

*Forest sinks have only been officially reported since 2008 (i.e. the first year of the Kyoto Protocol). They are shown here to provide an indication of historical trends in forest sinks.