



Ireland's Greenhouse Gas Emission Projections

2013-2030

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Ireland's Greenhouse Gas Emission Projections - Overview

- The projections show that Ireland is not on a pathway to a low-carbon economy. Total national greenhouse gas emissions are projected to, at best, decrease by an average of 0.4% per annum up to 2020 if all national policies are implemented and delivered. Furthermore, emissions are projected to increase between 2020 and 2030 (12% in total) with transport a key contributor to this trend in the absence of additional policies and measures.
- There is a significant risk that Ireland will not meet its 2020 EU targets even under the most ambitious emission reduction scenario. These projections shows a cumulative distance to target of 1 – 17 Mt CO₂eq for the period 2013-2020 with Ireland breaching its annual limits in 2016-2017.
- Strong projected growth in emissions from transport and agriculture are the key contributors to non-ETS emissions. In 2020 non-ETS emissions will be 5-12% below 2005 levels compared with a 20% reduction target.

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 fulfil reporting obligations in 2014. These projections update those published in April 2013² by the EPA.

Greenhouse gas emissions are projected to 2030 using two scenarios: *With Measures* or “worst case” scenario and a *With Additional Measures* or “best case” scenario. Much of the discussion in this document focuses on emissions up to 2020 and Ireland’s projected compliance under the EU-2020 targets.

The ‘worst case scenario’ assumes that no additional policies and measures, beyond those already in place by the end of 2012, are implemented (*With Measures* projection). Under this scenario, emissions are projected to increase by 5% 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 decrease by 3% by 2020.

The macroeconomic assumptions used in developing these emission projections are provided by ESRI. Furthermore, forecasted activity data for the agriculture sector (animal numbers, crop areas and fertiliser use) are provided by Teagasc. The key macroeconomic assumptions and a more detailed description of the two scenarios are provided in Appendix I and II. In addition, a comparison with EPA projections published in 2013 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 2012-2020. Environmental Protection Agency (2013)

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 that are outside the EU Emissions Trading Scheme and includes the agriculture, transport, residential and waste sectors.

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 37.2 Mt CO₂eq³. The main findings from the projections are:

- Ireland is expected to exceed its 2020 limit by 5 – 8 Mt CO₂eq which is 5% – 12% below 2005 levels. This compares to a reduction target of 20% on 2005 levels.
- Ireland is expected to exceed its binding annual limit in 2016-2017
- Looking at the 2013-2020 period, Ireland is cumulatively projected to exceed its obligations by 1 – 17 Mt CO₂eq.

The impact of forest sinks are not included in this assessment in line with EU accounting rules which do not allow the use of forest sinks to comply with EU 2020 targets. Member States are, however, permitted to meet their annual targets through a number of mechanisms which include borrowing 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 key contributors to emissions in the non-ETS sectors are transport and agriculture. Both sectors are projected to increase to 2020.

- Agriculture emissions are projected to increase 9% by 2020 on current levels. This reflects the impact of Food Harvest 2020 and removal of milk quota.
- Transport emissions are also projected to show strong growth over the period to 2020 with a 15-23% 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.

³ 69.3 Mt CO₂eq (Total 2005 National Emissions) – 22.4 Mt CO₂ (2005 ETS Emissions without De-minimis) = 46.8 Mt of CO₂eq (2005 non-ETS Emissions) - 20% = 37.5 Mt of CO₂eq. Pursuant to Commission Implementing Decision 2013/634/EU Ireland's linear reduction pathway and 2020 target were adjusted downwards. Ireland's adjusted 2020 target is 37.2 Mt CO₂ eq. This adjustment was undertaken to correct for alterations to the scope of the EU ETS in the period 2013-2020.

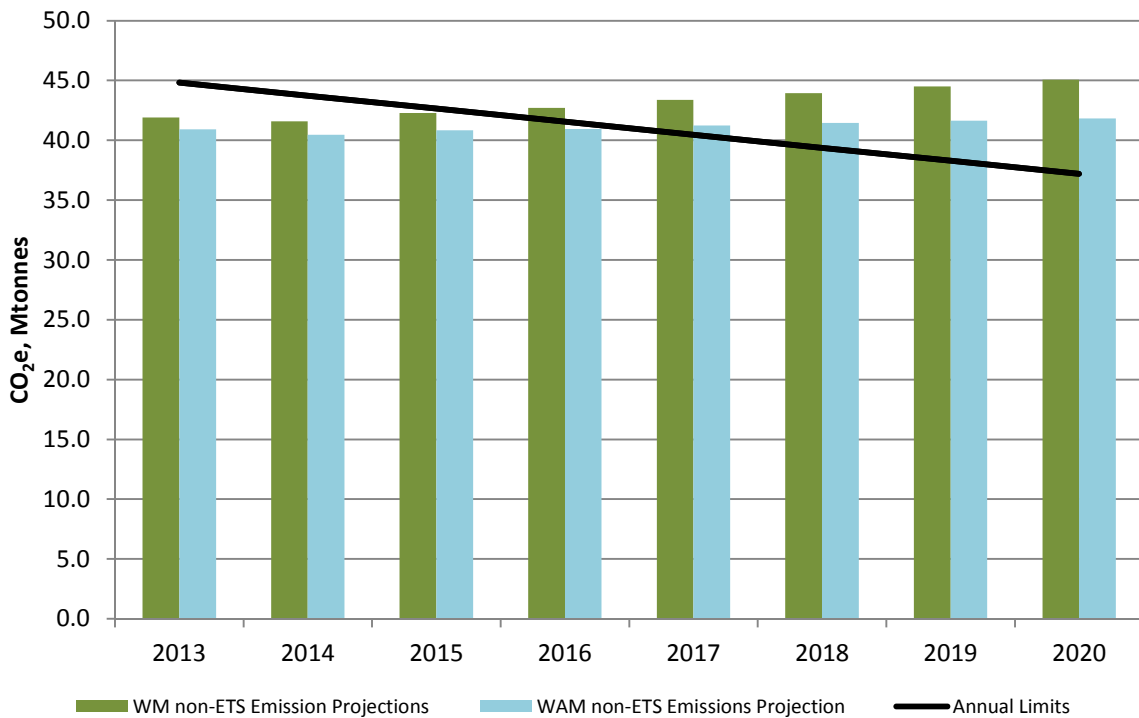


Figure 2. With Measures and With Additional Measures greenhouse gas emissions projections and comparison with the linear reduction pathway required between 2013 and 2020

Table 1 indicates the range of the annual compliance/non-compliance over the period 2013-2020. This is also shown graphically in Figure 3. It is important to note that the ‘best case scenario’ (*With Additional Measures* projection) assumes that all targets in Government policy documents such as the NEEAP⁴ and NREAP⁵ are met. The difficulties associated with meeting these targets should, however, not be underestimated. Failure to meet these targets will result in even higher emissions levels than those projected under this scenario and will 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
	Annual compliance/non-compliance								
Annual Limits	44.8	43.7	42.6	41.6	40.5	39.4	38.3	37.2	
With Measures*	-2.9	-2.2	-0.4	1.2	2.9	4.6	6.2	7.9	17.3
With Additional Measures*	-3.9	-3.3	-1.8	-0.6	0.8	2.1	3.4	4.6	1.2

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

⁴ 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.

⁵ 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

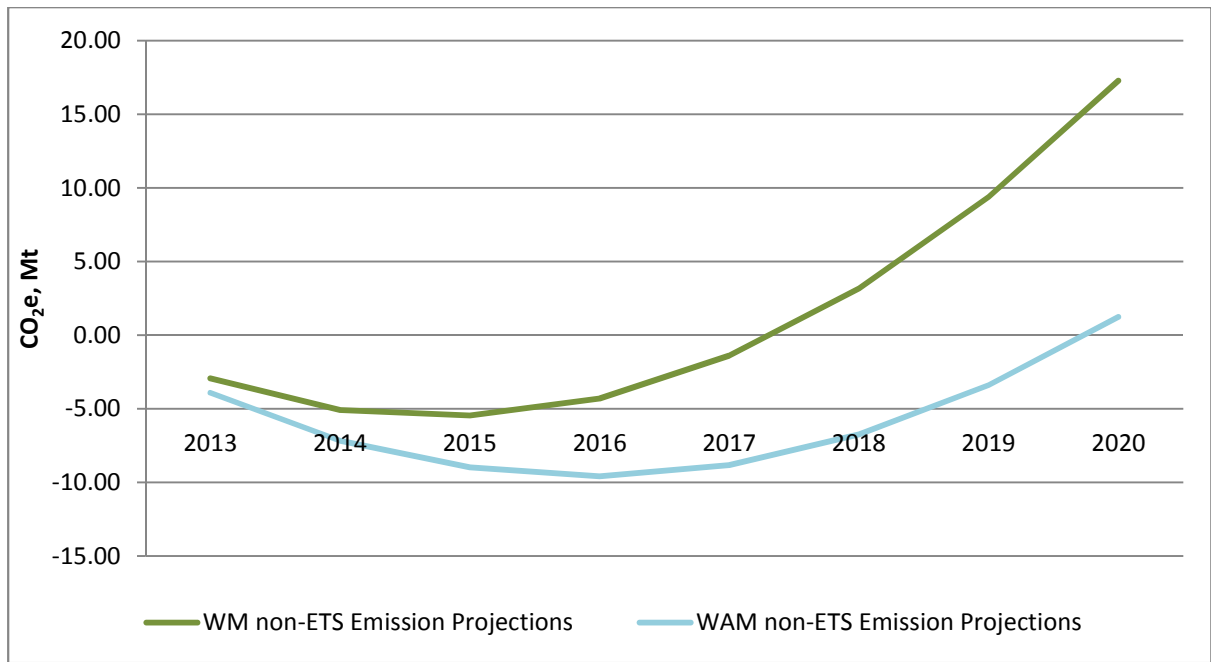


Figure 3. Projected cumulative distance to target for Ireland's Non-ETS emissions 2013 to 2020

Sectoral Emissions to 2020

Transport

- Under the *With Measures* scenario, transport emissions are projected to increase by 23% over the period 2013 – 2020 to 13 Mt 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 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 4% out to 2020 which is supported by the Biofuel Obligation Scheme 2010⁶.
- Under the *With Additional Measures* scenario, transport emissions are projected to increase by 15% over the period 2013 – 2020 to 12.5 Mt 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 Directive⁷. The Biofuels Obligation Scheme 2010⁷ and the rollout of Electric Vehicles (EVs) underpin the achievement of this target.
 - renewable energy penetration accounts for approximately 75% of the emission savings in the transport sector in the *With Additional Measures* scenario.
 - electric vehicle deployment (10% of national car fleet by 2020), more efficient road traffic movements and public transport efficiencies are also included in this scenario.

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 2012 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 decrease by 11% over the period 2013 – 2020 to 11.5 Mt CO₂eq. The decrease in emissions is caused by a projected decrease in the use of peat and increase in the use of natural gas and renewable fuels for electricity generation. Renewables penetration in 2020 is projected to be 26% under this scenario. The emissions savings associated with increased natural gas and renewable fuels in electricity generation is, however, partially offset by the continued combustion of coal

⁶<http://www.dcenr.gov.ie/Energy/Sustainable+and+Renewable+Energy+Division/Biofuels+Obligation+Scheme.htm>

⁷ Renewable Energy Directive of June 2009 (28/EC/2009)

which is projected to be 19% higher in 2020 compared with 2012 in this scenario.

- Under the *With Additional Measures* scenario, total energy sector emissions are projected to decrease by 16% over the period 2012 – 2020 to 11 Mt CO₂eq. In this scenario, it is assumed that renewable energy reaches 40% penetration by 2020. The largest renewable energy contribution comes from wind which is estimated to be 62% above that in the *With Measures* scenario in terms of generation input. This scenario also includes additional expansion of renewable electricity generation from co-firing biomass, the construction of an additional waste to energy incineration plant and the continued development of landfill gas electricity generation and biomass CHP.

Agriculture

- Agriculture sector emissions comprise emissions from enteric fermentation, manure management and nitrogen application to soils. For agriculture emission projections, only one scenario or outlook for the future was provided by Teagasc to the EPA which assumes full achievement of the *Food Harvest 2020* targets by 2020. The data underpinning the projections 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 46%, 28% and 22%, respectively of total emissions from agriculture. Emissions from the combustion of fossil fuels accounts for on average 4% of total emissions from agriculture. Total emissions from agriculture are projected to increase by 9% over the period 2013 – 2020 to 20.4 Mt CO₂eq.
- Agricultural emissions are 0.2 Mt CO₂eq lower in 2020 relative to last year's projections. This is mainly attributable to a reduction in the forecasted fuel combustion in the sector. In terms of livestock production revised animal numbers and revised nitrogen fertiliser application over the projection period result in a small increase in emission from agricultural production of 0.1 Mt CO₂eq compared to last years projections.

Residential

- Under the *With Measures* scenario, emissions from the residential sector are projected to be decrease by 5% to 6.0 Mt CO₂eq between 2013 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 30% between 2013 and 2020 to 4 Mt CO₂eq. Under this scenario, the Better Energy Homes (residential retrofit) accounts for approximately 90% of the emission savings foreseen.

Industry and Commercial Services

- Under the *With Measures* scenario, emissions from the industry and commercial services sector are projected to increase by 3% to 9 Mt between 2013 and 2020. The effect of the increase in cement production in 2012 is included in the projection for this sector with growth maintained for future years in line with economic recovery. 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 9% to 8 Mt between 2013 and 2020. In this scenario, energy demand from industrial and commercial services sectors is 9% 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. The RES-H target is assumed to be met solely by the industrial sector, where the use of renewable fuels more than doubles in the period 2013 to 2020.

Waste

- Two scenarios were developed for the waste sector. The *With Measures* scenario assumes a continued requirement for landfill as the disposal option for residual waste⁸. The *With Additional Measures* scenario assumes that a second waste-to-energy incinerator with a capacity of 600,000 tonne per annum is built and is fully operational and reduces the contribution of landfill as a disposal option for residual waste⁸. Under both scenarios it is assumed that recycling of waste materials increases by 1% per year and that the total municipal solid waste generated increases in line with GDP growth.
- 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.

⁸ Residual waste is defined as the fraction of collected waste remaining after a treatment or diversion step, which generally requires further treatment or disposal

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.

- Under the *With Measures* scenario total waste sector emissions decrease by 25% by 2020. Even though this scenario assumes continued reliance on landfill for the disposal of residual waste, increased recovery (including recycling) of waste materials and adherence to Food Waste Regulations reduces the organic content of landfilled waste and thus its greenhouse gas production potential.
- Under the *With Additional Measures* scenario total waste sector emissions decrease by 31% as a result of increased diversion of residual waste from landfill to waste-to-energy incineration progressively from 2017 onwards.
- Under both scenarios it is assumed that CH₄ capture increases from the current level of 68% of CH₄ generated in 2012 to 75% in 2020.

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

Projected Greenhouse Gas Emissions to 2030

This sector discusses greenhouse gas emissions to 2030. These figures are discussed in the context of EU and national policy developments on climate change and greenhouse gas mitigation.

EU Climate Change Policy

In January 2014 the European Commission presented a framework which seeks to drive continued progress towards a low carbon economy. EU leaders have agreed to decide on the framework by October 2014 at the latest. The centre piece of the framework is a 40% reduction in greenhouse gas emission by 2030 compared to 1990 levels. To achieve this target it is estimated that:

- the sectors covered by the EU ETS would have to reduce emissions by 43% compared to 2005.
- Emissions from the non-ETS sectors would have to reduce by 30% compared to 2005 levels. The effort needed to meet these targets will be shared equitably between Member States.

In addition, an EU-level 2030 target for renewable energy is proposed with, at least, 27% of EU energy consumption to come from renewable sources. This renewable energy target does not, however, place binding targets on Member States and is to be reached by the EU as a whole.

Further improvements in energy efficiency are also foreseen. However, the role of energy efficiency in the 2030 framework is not as yet known until a review of Directive 2012/27/EU on energy efficiency is undertaken in 2014.

National policy

The Department of Environment, Community and Local Government published the National Policy Position and final Heads of the Climate Action and Low-Carbon Development Bill¹⁰ in April 2014. The Bill re-affirms Ireland's commitment to compliance with existing and future greenhouse gas emission reduction obligations with the National Policy Position stating that:

Key issues for consideration in the on-going evolution of national climate policy include:

- *the need to take a long-term view, having regard to*
 - *obligations of the State under the law of the European Union or any international agreement to which Ireland is a Party;*
 - *likely future greenhouse gas mitigation commitments of the State and the economic imperative for early and cost-effective action; and*
 - *the requirement to be able to act quickly in response to economic and environmental occurrences and circumstances;*

¹⁰ <http://www.environ.ie/en/Environment/Atmosphere/ClimateChange/NationalClimatePolicy/News/MainBody,37848,en.htm>

A national low-carbon roadmap (containing sectoral mitigation inputs from government departments) and a national climate change adaptation framework will drive the transition to a low-carbon, climate resilient, environmentally sustainable economy by 2050. It requires the identification of specific policy measures to ensure compliance with any relevant emission reduction obligations.

2030 Trends

Based on current emission projections, it is estimated that by 2030 total non-ETS emissions under the *With Measures* scenario will be 50 Mt CO₂eq and 47 Mt CO₂eq under the *With Additional Measures* scenario. When compared to 2005 this equates to 1-7% above 2005 emission levels. Based on these estimates it is clear that it will be extremely difficult for Ireland to meet more stringent targets post-2020. The estimates out to 2030 assume a worst-case scenario with no new or additional policies and measures implemented beyond 2020.

The trend in emission levels under both the *With Measures* and the *With Additional Measures* scenarios are presented for the non-ETS sectors in Figure 4. Figure 4 includes the required target pathway to Irelands 2020 target and as a reference. To provide an indication of what Ireland’s target non-ETS emission in 2030 may be, it is assumed in Figure 4 that a 30% reduction on 2005 levels is imposed.

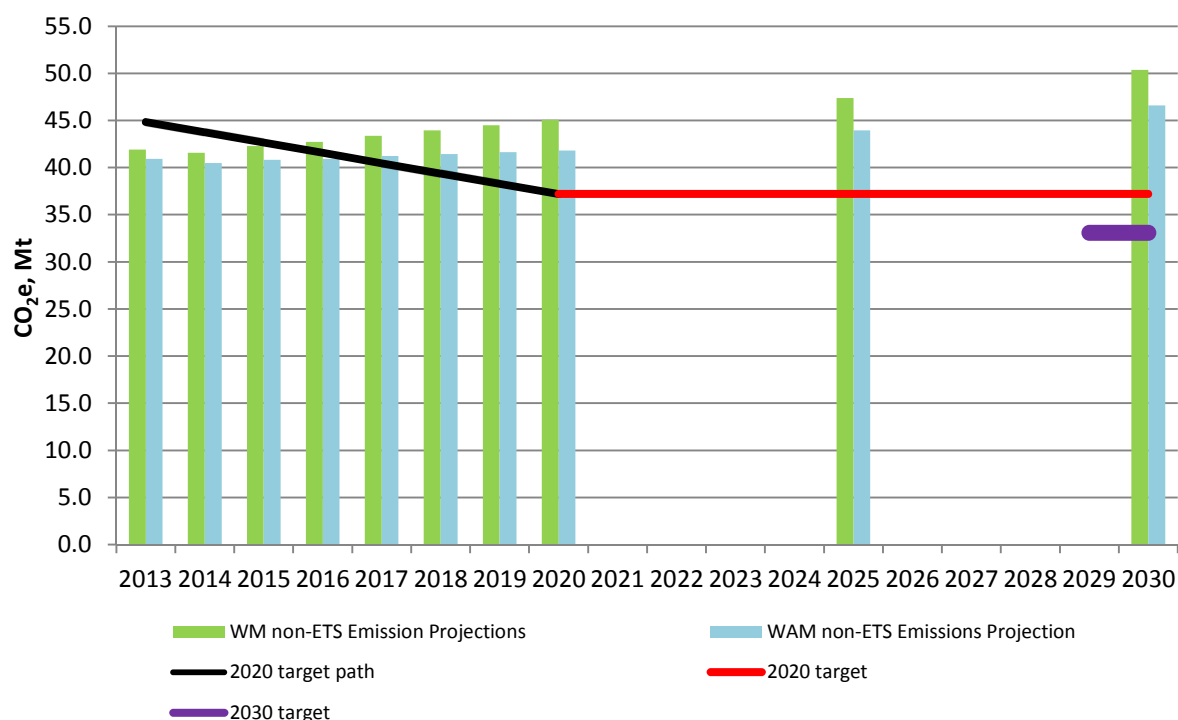


Figure 4. With Measures and With Additional Measures greenhouse gas emissions projections for the non-ETS sectors to 2030

Sectoral contributions to total non-ETS emissions in 2030 remain relatively unchanged compared to 2020 for the residential, waste, industrial and commercial sectors. In addition, the combined contribution of the agriculture and transport sectors remains similar at 80%. There is, however, a substantial growth in emissions from the transport

sector between 2020 and 2030. This increases the transport sector’s contribution to non-ETS emission total from 30% in 2020 to 36% in 2030 in the *With Additional Measures* scenario. Projected sectoral shares in 2030 under the *With Additional Measures* scenario are presented in Figure 5.

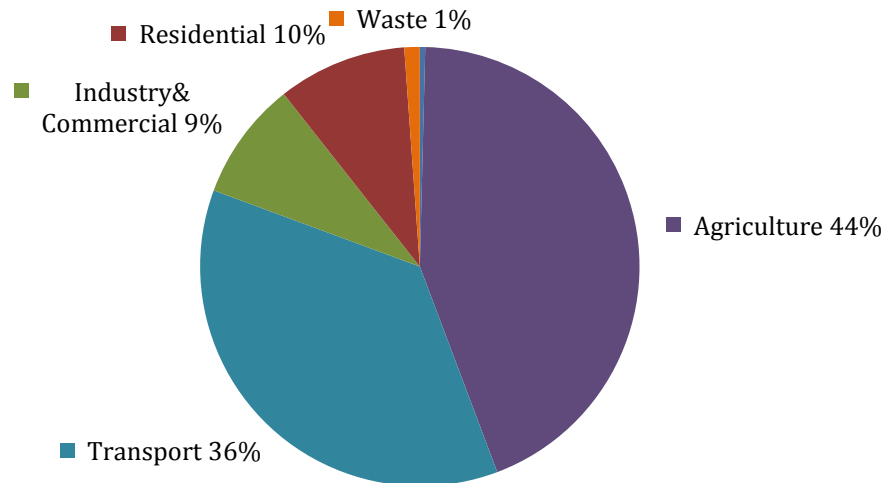


Figure 5. Projected sectoral share of non-ETS greenhouse gas emissions in 2030 for the *With Additional Measures* scenario

Transport sector emissions are projected to increase by 36% as a result of an increase in the national car fleet to 2.4 million in 2030. This increase is underpinned by a projected increase in population to 5.2 million by 2030 and sustained 2-3% annual growth in personal consumption over the period 2020-2030. It is assumed that the renewable energy penetration in both the *With Measures* and *With Additional Measures* scenario is maintained at 2020 levels in percentage terms supported by the Biofuel Obligation Scheme 2010⁷. It assumed that no further policies and measures are implemented post-2020.

As previously discussed total emissions from the agricultural sector, based on data provided by Teagasc to the EPA, are projected to increase by 9% between 2012 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 14% between 2015 and 2020 following the abolition of milk quotas in 2015 as well as a projected increase in fertilizer nitrogen use of 27% by 2020. For 2030 it is estimated that dairy cow numbers will have increased to 1.56 million head (from 1.36 million in 2020) and that fertilizer nitrogen use will remain relatively stable post-2020. On the other hand the beef herd is forecasted to contract by 12% between 2020 and 2030 from 5.3 million head to 4.7 million head. As a result, emissions in 2030 are projected to be similar to those in 2020.

The macroeconomic outlook to 2030 assumes that the national population will reach approximately 5.2 million persons by 2030. As a result the housing stock will increase by 150,000 households between 2020 and 2030 (220,000 households between 2012 and 2030). Substantial growth in the combustion of fossil fuels in the sector is curtailed in the *With Additional Measures* scenario due to assumptions on the increased use of electricity for the provision of heat.

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 2013 which represent one possible view of economic growth. The macroeconomic assumptions are an update of those produced in Autumn 2012 which were used in developing the emission projections published in 2013. Table 1.1 outlines the key macroeconomic assumptions that underpin the current projections.

Table 1.1 Key macroeconomic assumptions underlying the projections

	2012 - 2015	2016 - 2020	2021-2025	2026-2030
	Average Annual % Growth			
GDP	+2.1%	+3.9%	+2.0%	+2.0%
GNP	+2.1%	+3.5%	+2.0%	+2.3%
Personal Consumption	0.0%	+2.9%	+2.4%	+2.8%
	2015	2020	2025	2030
Housing Stock ('000)	1,997	2,065	2,139	2,216
Population ('000)	4,645	4,833	5,003	5,156
EUETS: Carbon €₂₀₁₀/tCO₂	10	17	27	37
Carbon tax €₂₀₁₀/tCO₂	15	17	27	37
Coal \$₂₀₁₀/boe	16.7	19.4	19.3	19.3
Oil \$₂₀₁₀/boe	86.2	87.0	88.6	90.8
Gas \$₂₀₁₀/boe	45.7	47.5	47.2	47.2
Peat \$₂₀₁₀/boe	25	25	25	25

Agriculture emissions projections are based on data from Teagasc's FAPRI-Ireland model which were provided to the EPA in January 2014. 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 2012.

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. 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, ktonnes	2015	2020
Energy	47.8	727.1
Industry	385.0	624.9
Services	249.8	499.7
Residential	795.3	1,591.2
Transport	269.5	889.5
Waste		60.1
Total	1,747.4	4,392.5

Appendix III

Comparison with 2013 EPA Greenhouse Gas Emissions Projections

The EPA produces greenhouse gas emission projections on an annual basis. Previously emissions projections were published in April 2013. 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 2014 GHG Emissions Projections) and those published last year² (called 2013 GHG Emissions Projections) for the *With Additional Measures* scenario.

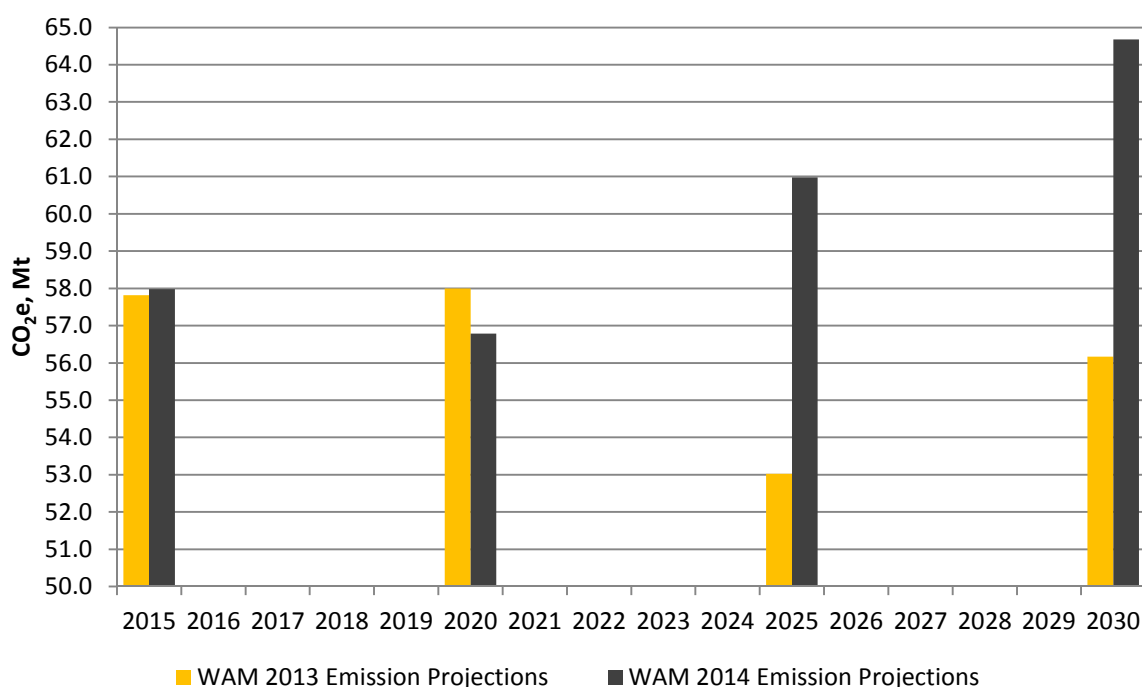


Figure 3.1. Comparison between 2013 and 2014 greenhouse gas emissions projections for the With Additional Measures scenario

Table 3.1. Comparison between 2013 and 2014 greenhouse gas emissions projections for the With Additional Measures scenario

Mt CO ₂ eq	2015	2020	2025	2030
WAM 2014 GHG Emissions Projections	58.0	56.8	61.0	64.7
WAM 2013 GHG Emissions Projections	57.8	58.0	53.0	56.2

The 2013 GHG emissions projections² were based on GDP growth rates of 2.2% between 2011 and 2015, 3.1% between 2016 and 2020, 2.7% between 2021 and 2025 and 2.2% between 2026 and 2030. The assumptions on economic growth rates underpinning this year's projections are marginally lower for the period to 2015 with an average annual GDP growth rate forecast of 2.1%. For the period 2016 – 2020 the

growth rate is higher at 3.9% per annum. Despite lower projected economic growth for the economy post-2020, greenhouse gas emissions are projected to be higher due primarily to higher transport emissions and energy sector emissions.

For 2020, total national emissions are projected to be 2% lower compared with last year's projection, with the main differences as follows:

- agriculture sector (1% lower)
- energy sector (11% lower)
- transport sector (2% lower)
- waste sector (7% lower)
- industry and commercial services sector (18% higher)
- residential sector (14% lower)

For 2030, total national emissions are projected to be 15% higher compared with last year's projection, with the main differences as follows;

- agriculture sector (2% lower)
- energy sector (67% higher)
- transport sector (2% lower)
- waste sector (13% lower)
- industry and commercial services sector (34% higher)
- residential sector (28% higher)

For the agriculture sector, revised animal numbers and nitrogen fertiliser projections have resulted in a decrease in emission levels above those produced in 2013.

For the energy sector in the *With Additional Measures* scenario, it was assumed in 2013 that carbon capture and storage would be used in conjunction with coal combustion for electricity generation post-2020. Carbon capture and storage is not assumed in the current 2014 projections. Furthermore the curtailment of wind energy in the period 2025 to 2030 results in increased use of fossil fuels for electricity generation.

For the transport sector, emissions are projected to be 0.2 Mt CO₂eq lower in 2020 compared with last year's projection due to a reduction in forecasted fuel combustion in the sector. This is also the rationale behind the difference in emission for the sector for 2030.

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 (Mt 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		68.2	
	2005	15.8	7.2	12.0	19.8	13.1	1.5		69.7	
	2006	15.1	7.1	11.8	19.6	13.9	1.6		69.2	
	2007	14.6	6.9	12.0	19.2	14.5	1.2		68.4	
	2008	14.7	7.5	11.9	19.1	13.7	1.1	-2.7	68.0	65.3
	2009	13.1	7.4	9.5	18.7	12.5	1.0	-3.1	62.3	59.2
	2010	13.4	7.8	9.4	18.8	11.6	1.0	-3.4	61.9	58.5
	2011	12.0	6.6	8.7	18.1	11.3	1.0	-3.4	57.7	54.4
	2012	12.8	6.2	9.0	18.7	10.9	1.0	-3.5	58.5	55.1
Projected	<i>With Measures Scenario</i>									
	2015	13.2	6.0	8.9	19.6	11.1	1.0		59.7	
	2020	11.5	5.9	9.3	20.4	13.4	0.8		61.2	
	2025	13.4	6.1	9.5	20.6	15.3	0.7		65.7	
	2030	14.9	6.2	10.0	20.4	18.1	0.7		70.3	
	<i>With Additional Measures Scenario</i>									
	2015	13.2	5.2	8.3	19.6	10.9	1.0		58.0	
	2020	10.7	4.3	8.1	20.4	12.5	0.7		56.8	
	2025	12.6	4.4	8.4	20.6	14.4	0.6		61.0	
	2030	13.5	4.4	8.8	20.4	17.0	0.5		64.7	

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

		Non-ETS sector	ETS sector	Total
Historical	2005	47.3	22.3	69.7
	2006	47.5	21.7	69.2
	2007	47.2	21.2	68.4
	2008	47.6	20.4	68.0
	2009	45.1	17.2	62.3
	2010	44.5	17.4	61.9
	2011	42.0	15.8	57.7
	2012	41.6	16.9	58.5
Projected	<i>With Measures Scenario</i>			
	2015	42.3	17.5	59.7
	2020	45.1	16.1	61.2
	2025	47.4	18.2	65.7
	2030	50.4	20.0	70.3
	<i>With Additional Measures Scenario</i>			
	2015	40.8	17.1	58.0
	2020	41.8	15.0	56.8
2025	43.9	17.0	61.0	
2030	46.6	18.1	64.7	

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.