Second Biennial Report

Malta

2016

The Second Biennial Report of Malta

under the United Nations Framework Convention on Climate Change

January 2016

Report submitted to the UNFCCC according to Decision 1/CP.16 and Decision 2/CP.17

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1 Introduction

At the 16th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) held in Cancun, Mexico, in 2010, it was decided that "*Developed countries should submit* [...] *biennial reports on their progress in achieving emission reductions, including information on mitigation actions to achieve their quantified economy-wide emission targets and emission reductions achieved, projected emissions and the provision of financial, technology and capacity-building support to developing country Parties*"[1].

At the subsequent Conference of the Parties held in Durban, South Africa, in 2011, a decision was taken for Annex I Parties to submit these biennial reports prepared in accordance with guidelines established under Decision 2/CP.17[2].

The Biennial Report is accompanied by data and information submitted electronically in Common Tabular Format (CTF).

[1] Decision 1/CP.16 'The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention', FCCC/CP/2010/7/Add.1.
[2] Decision 2/CP.17 'Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention', FCCC/CP/2011/9/Add.1.

2 Greenhouse Gas Emissions and Trends

The estimation of emissions by sources and removals by sinks of greenhouse gases (GHG) contained in Malta's inventory submission covers the following greenhouse gases:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous Oxide (N_2O);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs); and,
- Sulphur hexafluoride (SF_6).

The sectors for which estimation of emissions or removals is carried out are:

- Energy;
- Industrial Processes;
- Solvents and Other Products Use;
- Agriculture;
- Land Use, Land-Use Change and Forestry (LULUCF); and,
- Waste.

This Biennial Report submission includes data on emissions and removals for the period from 1990 to 2013, as provided in Malta's submission of its national GHG Inventory under the UNFCCC in 2015[3].

2.1 Description and interpretation of emission trends for aggregated greenhouse gas emissions

Annual national emissions of greenhouse gases over the time series covered, are presented in Table 2-1. Emission trends by gas and total annual with- and without-LULUCF estimates are given.

Table 2-1 Greenhouse gas emission trends by gas for 1990-2013

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013
	Gg CO_2 equivalent											
CO_2 (without LULUCF)	1870.04	2216.17	2358.86	2689.74	2659.56	2733.80	2699.00	2620.42	2625.60	2665.41	2799.81	2418.49
CO_2 (with LULUCF)	1867.47	2213.53	2356.22	2687.06	2656.85	2731.05	2696.21	2617.59	2622.70	2662.48	2796.80	2415.52
CH_4	86.96	133.54	149.17	167.33	179.43	188.55	187.90	198.65	209.26	194.82	124.06	105.29
N_2O	43.31	55.69	61.72	57.18	59.48	56.13	52.81	50.85	46.60	46.73	48.15	47.04
HFCs	NO, NA, NE, IE	0.00	2.09	39.18	77.28	94.03	110.31	127.58	142.26	166.10	198.97	214.95
PFCs	NA, NO	NA, NO	NA, NO	NA,NO	NA,NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SF_6	0.01	1.43	1.47	1.56	1.57	1.58	1.75	1.50	1.69	4.59	0.45	2.68
Total (without LULUCF)	**2000.33**	**2414.03**	**2573.32**	**2,955.00**	**2,977.32**	**3,074.09**	**3,051.77**	**2,998.99**	**3,025.43**	**3,077.66**	**3,171.44**	**2,788.44**
Total (with LULUCF	**1997.76**	**2411.39**	**2570.68**	**2,952.32**	**2,974.61**	**3,071.34**	**3,048.98**	**2,996.17**	**3,022.53**	**3,074.72**	**3,168.43**	**2,785.47**

[3] Malta National Emissions Inventory Report 2015. MRA on behalf of MSDEC, 2015

It is pertinent to note here that the discussion in this chapter is restricted to national emissions, that is, not including emissions from the so-called ‘memo items’, unless otherwise indicated in the text or captions.

The change in total emissions between base year and the latest reported year (2013) for the without-LULUCF estimates represents an increase of 39.40%, while for the with-LULUCF estimates this represents an increase of 39.43%.

The general trend for aggregated emissions remains one of increase up until 2012. This trend can be observed in Figure 2-1 and Figure 2-2, which represents the overall trends and trends for each gas (to be discussed in a subsequent section of this chapter) for the without-LULUCF and the with-LULUCF estimations respectively.

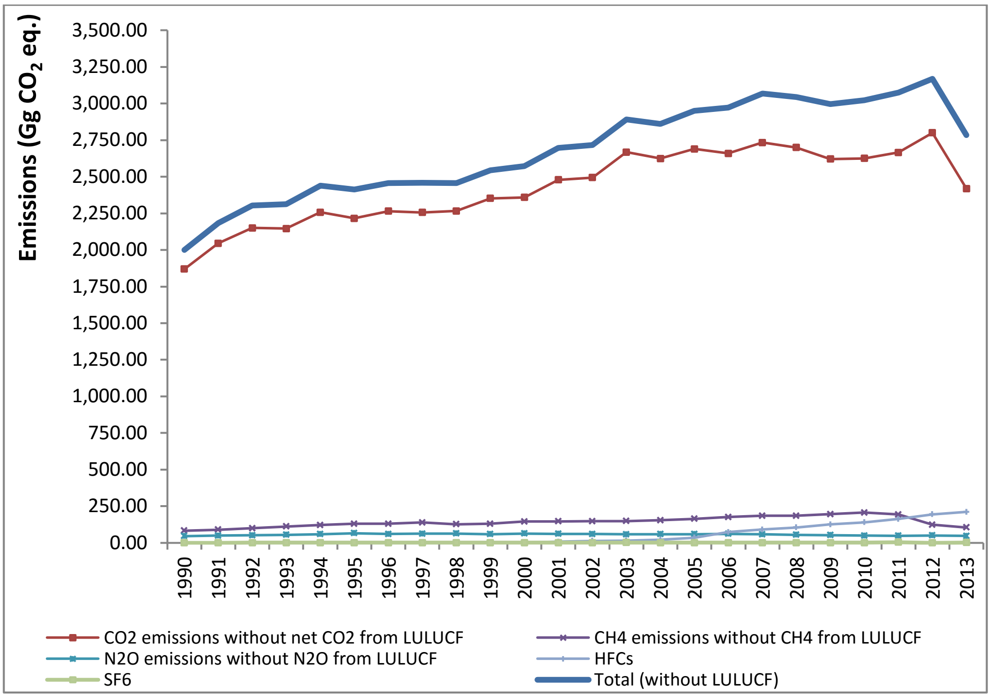

Figure 2-1 Emissions of greenhouse gases, excluding LULUCF (without-LULUCF), differentiated by gas

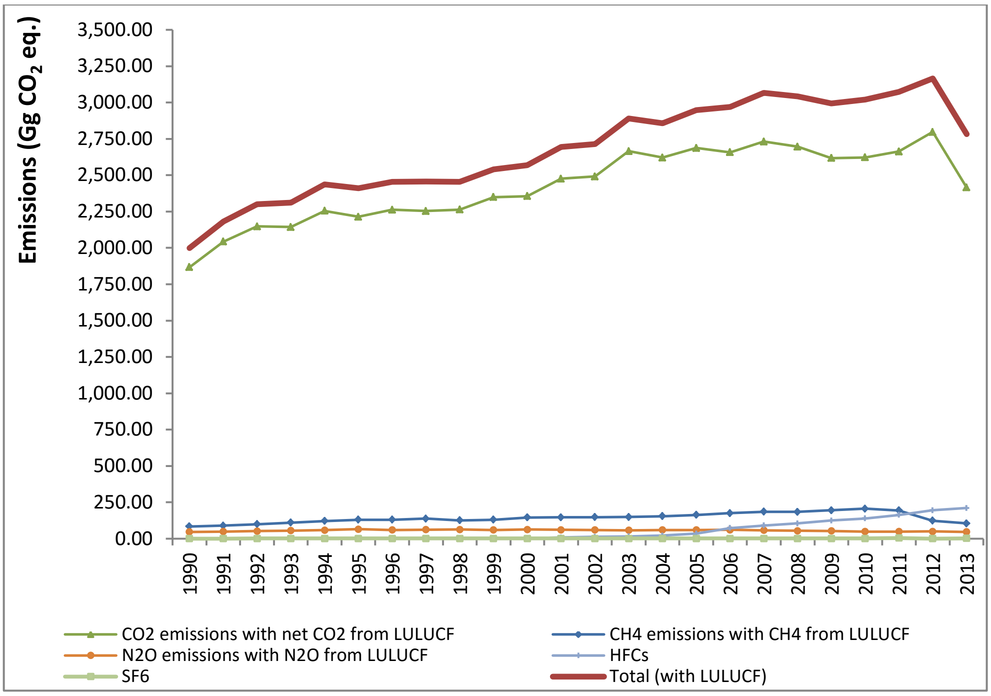

Figure 2-2 Emissions of greenhouse gases, including LULUCF (with-LULUCF), differentiated by gas

2.2 Description and interpretation of emission trends by gas

Emission trends for each greenhouse gas covered by the latest inventory have been presented in Table 2-1 above. This table highlights the major contribution that carbon dioxide has in total national emissions. The status of this greenhouse gas as the highest contributor has been maintained throughout the years. This can also be observed in Figure 2-3 below. The relative contribution of CO_2 emissions to total national emissions represents the strong influence that this gas has on the national emissions trends, to the extent that the trend for national emissions runs almost parallel to the trend for CO_2 emissions (see Figure 2-1 and Figure 2-2). It is noted that with time, the relative contribution of CO_2 tends to decrease, in conjunction with changes in relative contributions of other emitted gases, primarily the substantial increase in the share of emissions of HFCs.

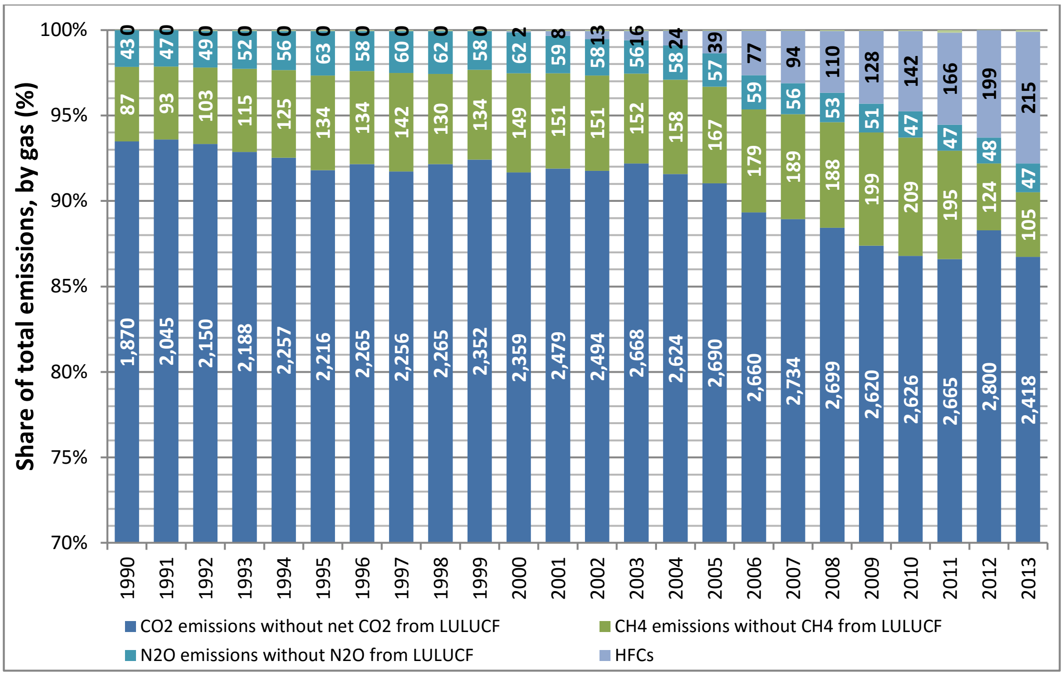

Figure 2-3 Percentage contribution of each greenhouse gas to total national greenhouse gas emissions

Figure 2-3 shows that CO_2 is the greenhouse gas that accounts for the absolute majority of national emissions in Malta. In 2013, it amounted to 86.7% of total national greenhouse gas emissions (in terms of CO_2 equivalent). HFCs and CH_4 respectively have the second and third highest share of total national emissions, followed by N_2O. The sector Energy is responsible for the highest share of emissions among all sectors covered by Malta's inventory, with a share of 87% of gross (i.e. excluding removals of CO_2 by the sector LULUCF) total national greenhouse gas emissions in 2013. This sector includes, among others, source categories 'Energy Industries' and 'Road Transport', themselves the first and second highest contributing source categories to total national greenhouse gas emissions.

The dominance of carbon dioxide in total emissions applies to the whole time series under discussion. One does however note a small, but gradual reduction in the share of carbon dioxide emissions over the time series, with such a trend being sustained after 2003. The reasons for this decline are two-fold; after a long period of practically continued increase in emissions of CO2, especially up until 2003, emissions of this gas over more recent years have tended to stabilize at between 2,550 Gg and 2,650 Gg. This is coupled by an increase in total absolute emissions of other gases, in particular CH_4 and HFCs.

For most of the period under consideration, methane contributed to the second highest share of national total emissions (in terms of CO_2 equivalent). However, this situation changed since 2012, with HFCs surpassing methane and now ranked the second highest contributor to overall national emissions (see Figure 2-5).

The general trend up to 2010 reflected an increase in emissions of methane; this trend however has changed in subsequent years. This change is due to the reduction in emissions of this greenhouse gas from the Waste sector as a result of increased flaring of methane in local managed landfilling activities as opposed to the release of this greenhouse gas in the atmosphere - category Managed Waste Disposal on Land (5A1).

The sector Agriculture is another important emitter of methane through emissions from source categories Enteric Fermentation (4A) and Manure Management (4B). Estimated absolute emissions of methane from this sector peaked in 2000.

Until 2005, nitrous oxide was the third highest contributor to total national emissions (in terms of CO_2 equivalent), and subsequently being superseded by emissions of HFCs (see Figure 2-3). Estimated emissions peaked in 1995. Sectorally, the highest contributor is the Agriculture sector, with emission of this greenhouse gas mainly from source category Agricultural Soils (4D), and, to a lesser extent, source category Manure Management (4B). Further contributions to national total nitrous oxide emission are given by sectors Waste (CRF sector 6), Energy (1) and Industrial processes and other product use (2).

Whereas for a large part of the period covered by this report, fluorinated greenhouse gas emissions had a minimal share in total national emissions, their contribution increased significantly in more recent years, to the extent that the combined share of such gases (in terms of CO_2 equivalent) in total national emissions in 2013 was the second highest after that of carbon dioxide. The main driving force behind this change is the substantial increase observed for hydrofluorocarbons, with the utilisation of such gases as replacements for ozone depleting substances, and increased volumes in refrigeration equipment. The high global warming potentials of fluorinated gases further bolster their overall share in total emissions in CO_2 equivalent.

2.3 Description and interpretation of emission trends by category

This section will discuss sectoral trends in greenhouse gas emissions. Table 2-3 presents the development of greenhouse gas emissions as estimated for the four source sectors that make up a national inventory and net greenhouse gas removals for the sink sector LULUCF. These trends are illustrated in Figure 2-4.

Greenhouse gas emissions from all sectors covered by this inventory (except for Memo Items) over the time series concerned are presented in Table 2-2 and illustrated in Figure 2-4 below.

Table 2-2 Emissions of greenhouse gases by sector (in Gg CO_2 equivalent)

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013
	Gg CO_2 equivalent											
Energy	1878.33	2226.44	2371.39	2704.08	2672.79	2748.49	2713.13	2634.07	2635.12	2675.34	2811.56	2429.03
Industrial Processes and product use	7.49	8.94	10.22	46.33	84.92	101.49	117.61	134.40	148.55	175.67	204.37	222.17
Agriculture	72.30	113.94	114.01	104.25	105.21	105.69	97.28	92.97	91.10	83.07	83.28	83.41
LULUCF	-2.57	-2.64	-2.64	-2.68	-2.71	-2.75	-2.79	-2.82	-2.90	-2.93	-3.01	-2.97
Waste	42.20	64.70	77.70	100.34	114.40	118.42	123.74	137.55	150.65	143.58	72.23	53.83
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF	**1997.76**	**2411.39**	**2570.68**	**2,952.32**	**2,974.61**	**3,071.34**	**3,048.98**	**2,996.17**	**3,022.53**	**3,074.72**	**3,168.43**	**2,785.47**

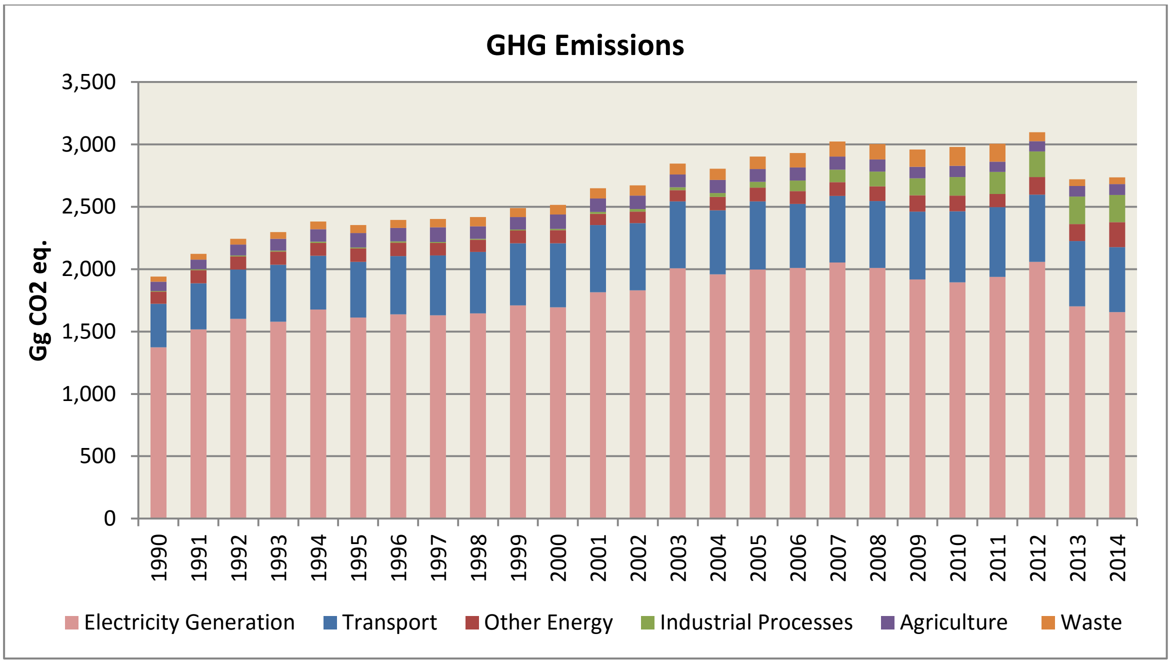

Figure 2-4 Trends in GHG emissions and removals by sector

The clearest feature observed in Table 2-2 and Figure 2-4 is the predominance of emissions from the Energy sector in total national emissions. This has remained the case throughout this period. In fact, there is a strong correlation between the profile of total national emissions and that of emissions from the Energy sector, indicating that the volume of emissions from energy generation and fuel combustion strongly determines the year-to-year trend in total national emissions. A gradual increasing overall trend can be clearly seen up to 2012, with a substantial drop in the two following years. This drop was mainly due to the switch to more efficient turbines for electricity generation. All other source sectors contribute substantially less to overall emissions, while LULUCF is associated with a minor removal effect.

Overall sectoral trends as a percentage change between 1990 and 2013 are provided in Table 2-3. The increase in the sector Industrial Processes and Other Product Use is explained by the substantial increase in emissions of HFCs, as already stated above. The Energy, Agriculture and Waste sectors have experienced a more moderate, though still relevant, overall increase in emissions. The level of net removals from LULUCF has remained relatively stable throughout the time series, rising from -2.57 Gg CO_2 equivalent in1990 and -3.01 Gg CO_2 equivalent in 2012.

Table 2-3 Emissions of greenhouse gases by sector for the years 1990 and 2013 and the corresponding change between the two years

	1990	2013	% change 1990-2013
	Gg CO_2 equivalent		
Energy	1878.33	2429.03	29.3
Industrial Processes and other product use	7.49	222.17	2865.8
Agriculture	72.30	83.41	15.4
LULUCF	-2.57	-2.97	15.7
Waste	42.20	53.83	27.6
Other	NA	NA	---
Total (with LULUCF)	**1997.76**	**2785.47**	**39.4**

Figure 2-5 below focuses on the sectors falling under the Effort Sharing Decision, and hence excludes CO_2 emissions from the power generation sector and civil aviation. In this case, the trend is increasing throughout the time series for all sectors, being particularly steep in the industrial processes, mainly due to the increasing use of equipment and refrigerants that use fluorinated gases.

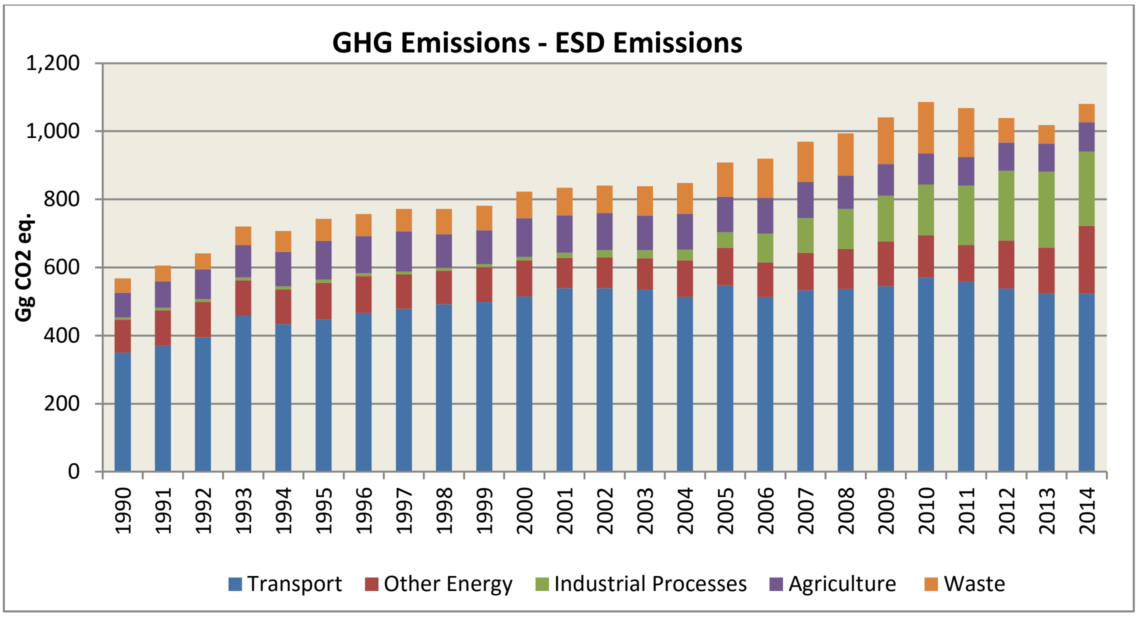

Figure 2-5 Historic GHG Emissions excluding emissions falling under ETS

3 Quantified Economy-wide Emission Reduction Target

In 2010, the EU submitted a pledge to reduce its GHG emissions by 2020 by 20% compared to 1990 levels. Given that this target under the Convention has been submitted by the European Union (representing 28 Member States – EU-28) and not by each individual Member States (MS), there are no specified Convention targets for single MS. Due to this, Malta as part of the EU-28, takes on a quantified economy-wide emission reduction target jointly with all the other 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, equivalent to a split of the reduction effort between ETS and non-ETS sectors of two thirds vs one third (EU, 2009[4]).

Under the revised EU ETS Directive[5], one single EU ETS 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. For further information on the EU ETS and for information on the use of flexible mechanisms in the EU ETS see EU-BR chapter 4.2.

Non-ETS emissions are addressed under the Effort Sharing Decision (ESD)[6]. 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: transport (cars, trucks), buildings (in particular heating), services, small industrial installations, fugitive emissions from the energy sector, emissions of fluorinated gases from appliances and other sources, agriculture and waste. Such sources currently account for about 60 % of total GHG emissions in the EU.

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)[7+8], expressed in Annual Emission Allocations (AEAs). The quantified annual

[4] 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)

[5] Directive 2009/29/EC of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community

[6] Decision No 406/2009/EC

[7] Commission decision of 26 March 2013 on determining Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (2013/162/EU)

[8] Commission Implementing Decision of 31 October 2013 on the adjustments to Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/ EC of the European Parliament and of the Council (2013/634/EU)

reduction targets 2013-2020 of Malta are tightened from 1.168 million AEAs in 2013, decreasing to 1.156 million AEAs in 2020. In the year 2013 verified emission of stationary installations covered under the EU-ETS in Malta summed up to 1.697 Mt CO_2 equivalent. With total GHG emissions of 2.788 Mt CO_2 equivalent (without LULUCF) the share of ETS emissions is 61%.

The monitoring process is harmonized for all European MS, especially laid down in the Monitoring Mechanism Regulation[9]. The use of flexible mechanisms is possible under the EU ETS and the ESD. For the use of CER and ERU under the ETS, please refer to the European BR2.

The ESD allows Member States to make use of flexibility provisions for meeting their annual targets, with certain limitations. There is an annual limit of 3% for the use of project-based credits for each MS. For Malta the amount of credits possible to use is 0.264 Million CERs and ERUs. If these are not used in any specific year, the unused part for that year can be transferred to other Member States or be banked for own use until 2020.

3.1 The EU target under the Convention

In 2010, the EU submitted a pledge to reduce its GHG emissions by 2020 by 20% compared to 1990 levels, in order to contribute to achieving the ultimate objective of the UNFCCC: 'to stabilise GHG concentrations at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system'[10], or, in other words, to limit the global temperature increase to less than 2°C compared to temperature levels before industrialization (FCCC/CP/2010/7/Add.1).

The EU is also committed to raising this target to a 30% emission reduction by 2020 compared with 1990 levels, provided that other developed countries also commit to achieving comparable emission reductions, and that developing countries contribute adequately, according to their responsibilities and respective capabilities. This offer was reiterated in the submission to the UNFCCC by the EU-28 and Iceland on 30 April 2014[11].

The definition of the Convention target for 2020 is documented in the revised note provided by the UNFCCC Secretariat on the ‘Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention’ (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).

The EU clarified that the accounting rules for the target under the UNFCCC are more ambitious than the current rules under the Kyoto Protocol, for example, including international aviation, adding an annual compliance cycle for emissions under the Effort Sharing Decision (ESD, see section 3.2.1) or higher Clean Development Mechanism (CDM) quality standards under the EU Emissions Trading System (EU ETS) (FCCC/TP/2013/7). Accordingly, the following assumptions and conditions apply to the EU's 20% target under the UNFCCC:

[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

[10] First steps to a safer future: Introducing the United Nations Framework Convention on Climate Change http://unfccc.int/essential/_background/convention/items/6036.php

[11] European Union, its Member States and Iceland submission pursuant to par 9 of decision 1/CMP.8' http://ec.europa.eu/clima/policies/international/negotiations/docs/eu_submission_20140430_en.pdf

- The EU Convention pledge does not include emissions/removals from Land Use, Land-Use Change and Forestry, but it is estimated to be a net sink over the relevant period. EU inventories also include information on emissions and removals from LULUCF in accordance with relevant reporting commitments under the UNFCCC. Accounting for LULUCF activities only takes place under the Kyoto Protocol.

- The target refers to 1990 as a single base year for all gases and all Member States.

- Emissions from international aviation to the extent it is included in the EU ETS are included in the target[12].

- A limited number of CERs, ERUs and units from new market-based mechanisms may be used to achieve the target (see section 3.2.2.3): in the ETS, the use of international credits is capped (up to 50 % of the reduction required from EU ETS sectors by 2020). Quality standards also apply to the use of international credits in the EU ETS, including a ban on credits from LULUCF projects and certain industrial gas projects. In the ESD sectors, the annual use of international credits is limited to up to 3 % of each Member State's ESD emissions in 2005, with a limited number of Member States being permitted to use an additional 1 % from projects in Least Developed Countries (LDCs) or Small Island Developing States (SIDS), subject to conditions.

- The Global Warming Potentials (GWPs) used to aggregate GHG emissions up to 2020 under EU legislation were those based on the Second Assessment Report of the IPCC when the target was submitted. In its submission to clarify the 2020 target from 20 March 2012, the EU announced that the implications of the CMP Decision to revise the GWPs to those from the IPCC Fourth Assessment Report (AR4) are under review. This review has been completed and revised GWPs from AR4 were adopted for the EU ETS. For the revision of ESD targets the revised GWPs were taken into account. For the implementation until 2020, GWPs from AR4 will be used consistently with the UNFCCC reporting guidelines for GHG inventories.

- The target covers the gases CO_2, CH_4, N_2O, HFCs, PFCs and SF_6.

[12] In the EU, total emissions covered by category 'international aviation' would go beyond the scope of the EU target, as emissions from international aviation are included in the EU Climate and Energy Package and the EU target under the UNFCCC to the extent to which aviation is part of the EU ETS. As such emissions cannot be separated in the EU inventory nor in the projections for the entire time series, emissions from international aviation have been considered in their entirety throughout the report. Over the period, total emissions from international aviation were between 1.2-2.9% of the annual total EU GHG emissions.

Table 3-1 Key facts of the Convention target of the EU-28

Parameters	Target
Base Year	1990
Target Year	2020
Emission Reduction target	-20% in 2020 compared to 1990
Gases covered	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6
Global Warming Potential	AR4
Sectors Covered	All IPCC sources and sectors, as measured by the full annual inventory and international aviation to the extent it is included in the EU ETS.
Land Use, Land-Use Change, and Forests (LULUCF)	Accounted under KP, reported in EU inventories under the Convention. Assumed to produce net removals
Use of international credits (JI and CDM)	Possible subject to quantitative and qualitative limits.
Other	Conditional offer to move to a 30% reduction by 2020 compared to 1990 levels as part of a global and comprehensive agreement for the period beyond 2012, provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities.

3.2 The EU target compliance architecture

3.2.1 The 2020 climate and energy package

In 2009 the EU established internal rules under its “2020 climate and energy package”[13] - these underpin the EU implementation of the target under the Convention. The 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 the ETS and ESD sectors. These two sub-targets are:

- a 21% reduction target compared to 2005 for emissions covered by the ETS (including domestic and international aviation);
- a 10% reduction target compared to 2005 for ESD sectors, shared between the 28 Member States (MS) through individual national GHG targets.

The distribution of the total target across the ETS and ESD is shown in Figure 3-1.

13 http://ec.europa.eu/clima/policies/package/index_en.htm

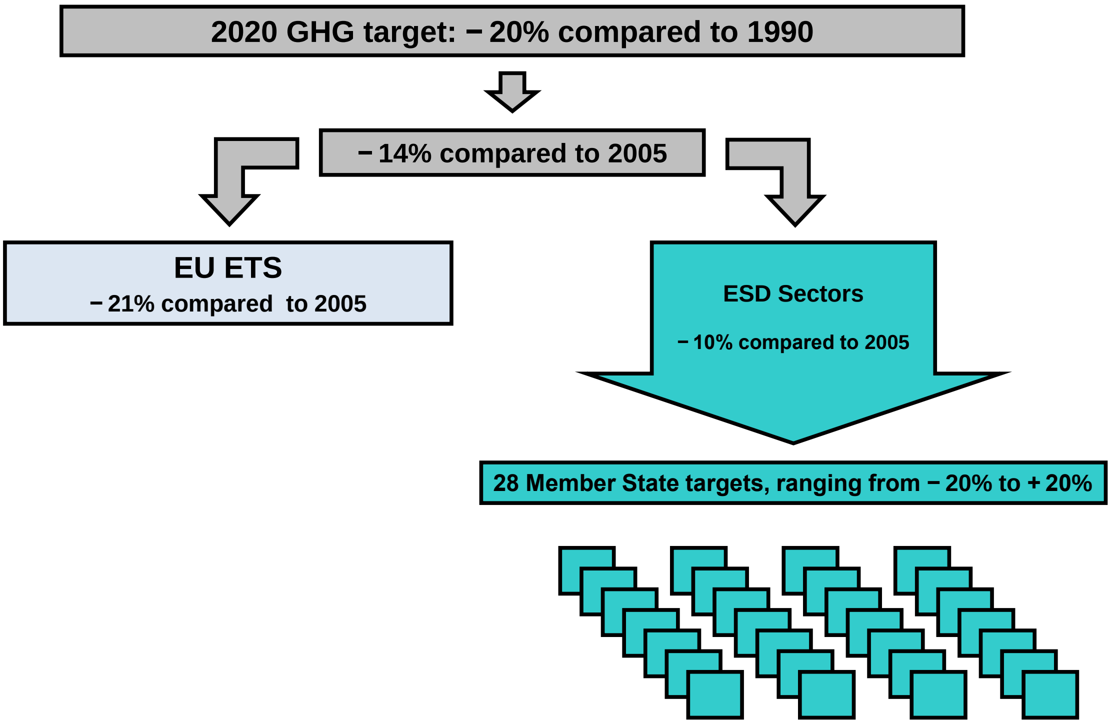

Figure 3-1 GHG targets under the 2020 climate and energy package

Source: European Commission

Under the revised EU ETS Directive (Directive 2009/29/EC), a single ETS cap covers the EU Member States and three participating non-EU countries (Norway, Iceland and Liechtenstein), i.e. there are no further individual caps by country. Allowances allocated in the EU ETS from 2013 to 2020 decrease by 1.74% annually, starting from the average level of allowances issued by Member States for the second trading period (2008–2012).

The three non-EU countries participating in EU ETS (Norway, Iceland and Liechtenstein) are also subject to a similarly defined cap and the same annual decrease in allowance allocation.

For further additional information on recent changes in the EU ETS see section 3.1 of the EU-BR.

The vast majority of emissions within the EU which fall outside the scope of the EU ETS are addressed under the Effort Sharing Decision (ESD) (Decision No 406/2009/EC). The ESD covers emissions from all sources outside the EU ETS, except for emissions from domestic and international aviation (which were included in the EU ETS from 1 January 2012), international maritime, 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: transport (cars, trucks), buildings (in particular heating), services, small industrial installations, fugitive emissions from the energy sector, emissions of fluorinated gases from appliances and other sources, agriculture and waste. Such sources currently account for about 60% of total GHG emissions in the EU.

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 (see Figure 3-1). Under 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 (Commission Decisions 2013/162/EU and 2013/634/EU), denominated in Annual Emission Allocations (AEAs). At country level, 2020 targets under the ESD range from -20% to +20%, compared to 2005 levels. ESD targets for 2020 for each EU Member State are shown in Figure 3-2.

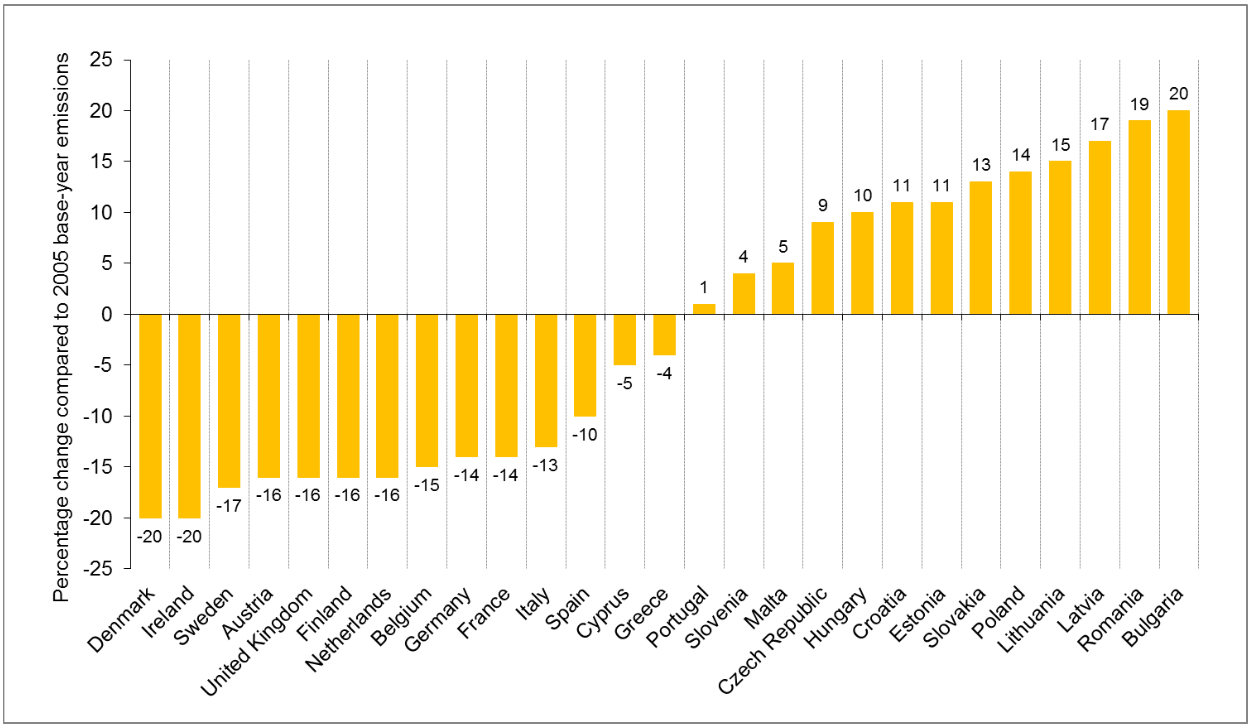

Figure 3-2 National 2020 GHG emission limits under the ESD, relative to 2005 emissions levels

Source: EU Decision No 406/2009/EC, Annex 2

The target levels have been set on the basis of Member States' relative Gross Domestic Product per capita. In addition, different levels of development in the EU-28 are taken into account by the provision of several flexibility options. Up to certain limitations, the ESD allows Member States to make use of flexibility provisions for meeting their annual targets: carry-over of over-achievements to subsequent years within each Member State, transfers of AEAs between Member States and the use of international credits (credits from Joint Implementation and the Clean Development Mechanism). Nevertheless ESD targets are designed in a strict manner: Every year, once MS emissions are reviewed according to strict criteria (described in Chapter III of the Commission Implementing Regulation 749/2014), the European Commission issues an implementing decision on MS ESD emissions in the given year. MS exceeding their annual AEA, even after taking into account the flexibility provisions and the use of JI/CDM credits, will face inter alia a penalty – a deduction from their emission allocation of the following year (excess emissions, multiplied by 1.08).

National Annual Emission Allocations may be revised in late 2016 if the application of new UNFCCC methodologies to determine GHG inventories leads to a significant change of a Member State's past ESD emissions (Regulation No 525/2013 Article 27).

For additional information on recent changes related to the ESD see section 3.1 of the EU-BR.

3.2.2 Monitoring on progress to 2020 targets

For the monitoring of GHG emissions at the EU and the Member State level, the Monitoring Mechanism Regulation has been adopted, see section 3.2.2.1 below. Also for the effective operation of the EU ETS, robust, transparent, consistent and accurate monitoring and reporting of greenhouse gas emissions are essential, therefore an annual procedure of monitoring, reporting and verification (MRV) is implemented. Installations and aircraft operators have to monitor, report and verify their annual emissions in accordance with two EU Regulations, the Monitoring and Reporting Regulation (MRR) and the Accreditation and Verification Regulation (AVR) which are explained in section 3.2.2.2.

3.2.2.1 Monitoring Mechanism Regulation

The Monitoring Mechanism Regulation No 525/2013 (MMR) was adopted in May 2013 and entered into force on 8 July 2013. The main aims of the MMR are to improve the quality of the data reported and assist the EU and Member States with the tracking of their progress towards emission targets for 2013-2020. The mechanism refers to the following reporting elements:

- Reporting on historical GHG emissions and removals, including national and Union inventory systems and approximated inventories;
- Reporting on low-carbon development strategies;
- Reporting on policies and measures and on projections of GHG emissions and removals
- Member States reporting on financial and technology support provided to developing countries;
- Member States' use of revenues from the auctioning of allowances in the EU Emissions Trading System (EU ETS);
- Member States' reporting on adaptation to climate change.

In 2014 the Implementing Regulation (EU No 749/2014) and Delegated Regulation (EU No 666/2014) were adopted to enable the implementation of the Monitoring Mechanism Regulation in several of its provisions, specifying in more detail the structure of the information, reporting formats, and submission procedures.

3.2.2.2 Monitoring and reporting under the EU Emission Trading System

The reform of the EU Emission Trading System in Phase III (2013-2020) has resulted in important changes with regard to domestic institutional arrangements for the monitoring and reporting of GHG emissions under the EU ETS. EU ETS MRV now requires complying with two Commission Regulations, one specific to monitoring and reporting (EU No 601/2012) and the other to verification and accreditation (EU No 600/2012). The latter introduces a framework of rules for the accreditation of verifiers to ensure that the verification of an installation's or an aircraft operator's emission report is carried out by a verifier that possesses the technical competence to perform the entrusted task in an independent and impartial manner and in conformity with the requirements and principles set out. These regulations have direct legal effect in the Member States and their provisions apply directly to operators or aircraft operators, verifiers, and accreditation parties. The regulations provide clarity on the roles and responsibilities of all parties (i.e. industrial installations and aircraft operators are required to have an approved monitoring plan) which will strengthen the compliance chain.[14]

3.2.2.3 Accounting for Flexible Mechanisms under the 2020 target

In general, in the EU the use of flexible mechanisms can take place on the one hand by operators in the EU ETS, on the other hand by governments for the achievement of ESD targets.

As part of phase II of the EU ETS (the period 2008-2012), Member States were required to inform the European Commission in their National Allocation Plans of the limit on JI and CDM credits that could be used by operators. This limit was then assessed according to the principle of supplementarity, and where appropriate approved or revised by the European Commission. The percentages vary from 4% of free allocation in Estonia to 22% in Germany. In total, this adds up to approximately 1.4 billion CERs or ERUs that could have been used by operators for compliance in phase II of the EU ETS.

The amended EU ETS Directive 2009/29/EC (Article 11a(8)) sets the upper limit for credit use for the period from 2008 to 2020 at a maximum of 50 % of the reduction effort below 2005 levels. This is further specified into installation-level limits in the Commission Regulation on International Credit Entitlements (RICE) (EU No 1123/2013). The sum of the installation-level limits is expected to be lower than the upper limit, but higher than the 1.4 billion CERs and ERUs already allowed in the second period. Since some entitlements are expressed as a percentage of verified emissions over the entire period, the overall maximum amount will only be known at the end of third trading period.

Since 2013 it is no longer possible to track the use of flexible mechanisms in the EU ETS directly via information on EUTL public website because CERs and ERUs are no longer surrendered directly but are exchanged into EUAs. These exchanges will become public on installation level after three years, with the first information reflecting the use in 2013 available in 2016.

The ESD allows Member States to make use of flexibility provisions for meeting their annual targets, with certain limitations. In the ESD sectors, the annual use of carbon credits is limited to up to 3% of each Member State's ESD emissions in 2005. Member States that do not use their 3% limit for the use of international credits in any specific year can transfer the unused part of their limit to another Member State or bank it for their own use until 2020. Member States fulfilling additional criteria (Austria, Belgium, Cyprus, Denmark, Finland, Ireland, Italy, Luxembourg, Portugal, Slovenia, Spain and Sweden) may use credits from projects in Least Developed Countries (LDCs) and Small Island Developing States (SIDS) up to an additional 1% of their verified emissions in 2005. These credits are not bankable and transferable. Approximately 750 Mt of international credits can be used during the period from 2013 to 2020 in the ESD.

[14] http://ec.europa.eu/clima/policies/ets/monitoring/documentation_en.htm

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

This section provides a description of policies and measures, from a sectoral perspective, that contribute to national efforts to control emissions, and, as far as possible, achieve targets to which Malta is bound under international treaties or regional (principally EU) policy arrangements. More often than not, one will note that policies and measures described are not specifically intended to address greenhouse gas emissions; it is often the case that the reduction or limitation of emissions from the sector or sectors covered by the particular policy or measure is one of a number of co-benefits of the implementation of the particular policy or measure, albeit an important benefit.

Policy-making in respect of greenhouse gas emission mitigation in Malta is a combination of sectoral action coupled with a more holistic top-down approach starting from a set overarching goal which is then translated into sectoral measures. Policies and measures that directly or indirectly contribute to the mitigation of national greenhouse gas emissions practically cover all sectors, albeit the effectiveness, in terms of actual emission savings (or enhancement of removal potential in the case of the sector LULUCF) varies. The sector Energy shows the highest potential for reducing emissions.

Table 4-1 Summary of greenhouse gas emission mitigation policy approach

Sector	Mitigation action focus
Energy	Conventional energy generation; Energy end-use efficiency; Energy-related cross sectoral; Transport (particularly road transport).
Industrial processes and other product use	Fluorinated greenhouse gases.
Agriculture	Rural development; Nitrates action programme.
Land use, land-use change and forestry	Afforestation.
Waste	Solid waste management; Waste water treatment.

The policies and measures presented in this section include those that are implemented, adopted and/or planned, reflecting the state of play of mitigation policy as at the end of 2014. This timeframe also applies to the discussion of projections of emissions that will be presented in the subsequent section.

4.1 National Policies and Measures

4.1.1 Energy

The energy sector is the largest contributor to gross national GHG emissions and accounts for 87% of total GHG emissions as at 2013.[15] Within the energy sector the two main contributors are electricity generation with a share of 70% of total emissions emanating from the energy sector and transport which accounts for around 22%. Fossil fuel use in the manufacturing industry, the commercial, institutional, residential and agricultural sectors accounts for the remaining 8% of GHG emissions within the energy sector.

4.1.1.1 The National Energy Policy for the Maltese Islands (2012)[16]

The first draft of the National Energy Policy was launched for consultation in 2006. This process ended with the launching of the European Commission 3rd Energy Package, which included the revision of the Internal Electricity Market Directive.

The updated draft of the Energy Policy was re-launched for public consultation in April 2009. It was then subjected to a Strategic Environmental Assessment (SEA) which ensured that the Policy document was in line with national environmental priorities and obligations. The Energy Policy for Malta was published in December 2012.

To this aim, the National Energy Policy takes into account Malta's economic and social development by encouraging a proactive and flexible approach aimed at overcoming the challenges that define the energy sector whilst seeking to exploit the opportunities that may arise through technological advancement.

The Energy Policy is underpinned by five principles. These are:

- Energy efficiency and affordability;
- Security of supply;
- Diversification;
- Flexibility;
- Sustainability.

These five principles give rise to the following policy areas which guide Government action under the National Energy Policy:

1. Energy efficiency;
2. Reducing reliance on imported fuels;
3. Security of supply;
4. Reducing Emissions from the energy sector;

[15] Malta National Emissions Inventory Report 2015. MRA on behalf of MSDEC, 2015.
[16] National Energy Policy, Ministry for Resources and Rural Affairs, 2012.

5. Delivering energy economically efficiently and effectively;
6. Ensuring the energy sector can deliver.

In addressing the Country's energy challenges, Malta's Energy Policy is significantly influenced by a number of EU energy and environmental policies. The targets set by the relevant EU Directives for Malta are as follows:

- Energy End Use Efficiency: 9% by 2016;
- Renewable Energy Target: 10% of final energy consumption by 2020 which includes a 10% Renewable energy target in transport.
- Indicative National Energy Efficiency target 2020: 264,282 toe (equivalent to 27% of the primary energy consumption in 2020 under a BAU scenario).

The National Energy Efficiency Action Plan (NEEAP) (2014) and the National Renewable Energy Action Plan (NREAP) (MRA, 2011) (currently under revision) published by Government pursuant to obligations arising from the EU energy *acquis* provide more detailed information on the approaches being proposed and implemented to increase energy efficiency, particularly from an end-use perspective, and increase the substitution of conventional energy sources with renewable sources. A shift towards more efficient technologies and the use of lower-carbon fuels in the supply of energy, especially in power generation will further contribute significantly towards reducing GHG emissions in the energy sector. With the energy sector being by far the highest contributor to national GHG emissions, this is expected to lead to a reduction in the national carbon footprint. A further important co-benefit of such an approach is a decrease in emissions of other pollutants, particularly those related to air quality. The implementation of energy demand side management and implementation of the energy performance in buildings regulation are also contributors to this reduction.

4.1.1.1.1 Electricity Generation

Malta's electricity generation profile fulfils the definition of a 'small, isolated electricity system' as understood in the context of the EU Directive 2003/54/EC[17], since electricity generation does not exceed 3,000 GWh/annum for the base year of 1996. EU Directive 2003/54/EC has been repealed by 2009/72/EC. The latter does not make reference to the requirement to be a 'small, isolated electricity system' in order to be eligible for derogations. The derogations in 2009/72/EC are Member State specific.

Electricity generation in Malta is largely dependent on the use of imported fossil fuels. All Electricity utilised in the Maltese Islands is provided by a power generation plant situated in Delimara which operates on heavy fuel oil and gas oil, and electricity imported over the interconnector. In previous years, electricity generation also relied on the use of coal, but this was discontinued in the early 1990s. The use of heavy fuel oil shall be phased out as soon as the new 215MW gas-fired CCGT power plant becomes operational and the conversion of the 144MW plant at Delimara (DPS) to run on natural gas is finalized.

[17] Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC.

The total nominal installed capacity including backup is 479 MW. To this one must add the interconnector capacity of 200MW. A small part of the Marsa Power Station (MPS) is kept on cold standby until the new generation capacity comes online during 2016. Both DPS and MPS fall within scope of the EU Emissions Trading Scheme Directive[18] and the Industrial Emissions Directive[19]. A number of inter-linked technical measures are being implemented or are planned by Enemalta to cater for the future demand on the national electricity infrastructure and reduce the greenhouse gases emitted to ensure that obligations under the EU's Climate Change legislation are effectively met.

These measures include the decommissioning of the MPS, the installation of new generating capacity at the Delimara plant to enable more efficient generation, and the introduction of an electrical interconnector with the European grid which helped Malta to diversify its energy sources. Additionally work is underway for the realisation of the infrastructure for the provision of a natural gas supply.

Other measures include improvement in the efficiency of the distribution network in line with a long term distribution plan currently being prepared and demand management measures, such as differentiated tariffs for heavy consumers to decrease the discrepancy between peak and minimum loads. It is observed that there is a continuously increasing discrepancy between winter and summer peak load in Malta.[20]

These measures also help to reduce dependence on one source of energy contributing towards security of supply and reduce the national energy bill, potentially contributing towards strengthening Malta's fiscal situation and enhancing the country's competitiveness.

4.1.1.1.2 Plant Loading and Fuel Switching

With a nominal installed capacity of 267 MW, the plant at MPS used to provide almost half of the national installed electricity generating capacity and eventual load demand. For this installation, Enemalta has availed itself of the derogation available under the Large Combustion Plants Directive (LCPD), wherein the plant continued to be operated for a limited time only. Another measure adopted by Enemalta since 2008, was the better administration in plant dispatch and load management. This was taking effect with a larger proportion of the load shifting from MPS to DPS. This lead to a reduction in the overall GHGs emitted per MWh generated, in view of the higher efficiency of this plant. Most of MPS was closed down in the first quarter of 2015, whereas a small part remained on cold standby for emergency purposes.

4.1.1.1.3 Installation of new and efficient generating capacity to partly replace existing inefficient plant at MPS

Due to the increasing electrical demand and in order to reduce the output from the less efficient plant at Marsa Power Station, Enemalta required additional installed generation capacity located within the DPS site. Hence, 144 MW of generating capacity were installed and commissioned by end 2012. This plant achieves the highest level of efficiency consistent with the meeting of technical and environmental constraints and provides the lowest cost per unit of electricity generated under the

[18] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.
[19] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution, prevention and control).
[20] Data provided by Enemalta Corporation.

specified operating regime. The plant has a net capacity of 144MW and consists of eight diesel engines of 17 MW each, plus a 12MW Steam Turbine in combined cycle mode. The total efficiency is 46.8% at maximum continuous rating.

4.1.1.1.4 Submarine electrical interconnection to the European network (200MW)

The implementation of an electrical interconnection to the European energy grid in conjunction with the retention of significant local electricity generation capacity offers greater flexibility in meeting local demand while providing a potential for considerable reduction in the national CO_2 emissions through the reduction of local emissions from the main contributor of CO_2 emissions. The new interconnection infrastructure is being used in a way to ensure that existing and new generation capacity is utilised in the most efficient manner possible.

The local spare generating plant would serve as a backup in case of a loss of supply from the interconnector. The contract for the turnkey design and build of the 1X200MW 220kV HVAC interconnector was awarded in December 2010. The Interconnector was energised on 24 March 2015, following completion of works and a period of testing and commissioning. Full implementation of the project was completed in April 2015 following satisfactory completion of the necessary testing.

4.1.1.1.5 Supply of natural gas to fuel existing and future generating plants

Natural gas has the lowest emissions of CO_2 per energy produced when compared to the emissions when using fossil fuels (37% less than heavy fuel oil and 33% less than gasoil).

The Government is committed to a plan to switch from heavy fuel to natural gas for the generation of electricity at the Delimara Power Station in the shortest possible term. This plan will involve investment by the private sector in a new 215MW Combined Cycle Gas Turbine unit which will be gas-fired as well as an LNG storage and re-gasification terminal. The new diesel engines at Delimara will also be converted to gas. Part of the Delimara plant will be retained as reserve capacity fired by gasoil. It is envisaged that the older generating units at Delimara will be phased out.

Switching to gas fired generation will be made possible through a power Purchase and Gas Supply Agreement which will be developed in partnership with the Private Sector.

This project is being undertaken in fulfilment of the Government's objectives to switch to a cleaner fuel for power generation and to encourage the entry into the market of another generator with high efficiency generating plant. This project effectively consists of the construction of a new highly efficient generating CCGT Power Plant, an LNG Floating Storage Unit and an onshore Regasification Unit.

Enemalta issued a call for Expressions of Interest and Capability (EoIC) on 11 April 2013 from suitably qualified companies to build, own, operate and maintain these plants within the framework of long term energy supply (electricity and gas) agreements:

- a Gas Supply Agreement (GSA) for natural gas to supply the Enemalta generating plant; and
- a Power Purchase Agreement (PPA) for 180-220MW baseload supply.

In October 2013 ElectroGas Malta Consortium was chosen as the preferred bidder shortlisted in the competitive process for this PP & GSA. Enemalta plc is in final detailed discussions with EletroGas Malta. MEPA permits were issued in March 2014.

The selected energy supplier will be required to provide Enemalta with approximately 215 MW of electricity from the new CCGT plant. The LNG facilities will also supply gas to the existing 144 MW Diesel Engines, which will be converted to run on natural gas.

This new source will reduce Malta's dependence on electricity produced from oil, and will result in corresponding reductions in both electricity costs and environmental emissions, in line with the European Union roadmap. Consequently reductions in electricity costs will reflect in reduced tariffs to the end consumer thus channelling more money into the economy.

4.1.1.1.6 Gas Interconnection

In line with the conclusions of the European Council of 4 February 2011, where the Council noted that *"No EU Member State should remain isolated from the European gas and electricity networks after 2015 or see its energy security jeopardised by lack of the appropriate connections"*, the October 2014 European Council Conclusions where Malta is specifically mentioned as requiring special attention in the context of PCI implementation; the March 2015 European Council conclusions where the Council called for the acceleration of infrastructure projects, 'including interconnections in particular to peripheral regions' and the Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Policy' which calls for the end of energy islands from the main electricity and gas networks, the Government of Malta intends to implement a connection to the trans-European Natural Gas Network to end Malta's isolation by connecting Malta via an approximately 155 kilometer pipeline to Sicily primarily for importation of gas from the Italian Gas network.

The project has been identified as a 'Project of Common Interest' (PCI) under priority corridor 'North-South gas interconnections in Western Europe' in 2013 and its PCI status has been reconfirmed in the 2nd PCI list announced by the European Commission on the 18th November 2015. Projects which are labeled as a PCI benefit from accelerated permit granting, improved regulatory treatment and financial support through grants for both works and studies under the Connecting Europe Facility (CEF).

A comprehensive pre-feasibility study and cost-benefit analysis, 50% co-financed by the European Union in the field of trans-European Energy networks (TEN-E), was completed in April 2015. The study determined the technical and financial viability of the project, including a high-level environmental impact/risk assessment and the legislative/regulatory aspects pertaining to the project. The financial and economic assessment identified a 22 inch diameter gas pipeline between Gela (Sicily) and Delimara (Malta) as the most economically feasible solution to be considered as the first phase of the PCI implementation. The possibility of exporting gas to Italy sourced from an FSRU located approximately 12km offshore from Malta could potentially be considered as a second phase of the project and is subject to further in-depth analysis and market development.

As concluded in the pre-feasibility study, the next stage of the project is to conduct detailed technical studies including the identification of a 1.2km wide route corridor and terminal points in Malta and Sicily, a conceptual design of the infrastructure and the preparation of the necessary documentation for initiating the environmental permitting process. For this scope a contract for this study was awarded to Tractebel Engineering S.p.A on the 9th November 2015 following an open call for tender. The study is expected to take 18 months to complete. In April 2015, the Ministry for Energy and Health submitted a proposal for co-financing this study under the first call for proposals of 2015 contributing to Projects of Common Interest under the 'Connecting Europe Facility' in the field of trans-European energy infrastructure. In July 2015, the proposal was selected by the European Commission and was awarded a maximum grant of 400,000 Euros with a 50% co-financing rate under the first CEF Energy programme call of 2015.

4.1.1.1.7 Intelligent Metering

In 2008, Enemalta awarded a contract for an automated meter reading system, deploying power line communications technology, to provide the required information for the management of the low voltage networks. This measure will give possiblity of an increase in the tariff effectiveness and responsiveness to energy market trends.

Smart meters are being installed for every electricity consumer in Malta. This is expected to lead to a reduction in energy consumption by changing consumer behaviour through information on energy consumption. This project was started in 2009 and it was expected that the complete replacement of all 297,500 electricity meters (originally 245,000 but increased due to new consumers and PV systems) should have been completed within three years. By mid-2015, around 274,500 electricity meters, equivalent to 92.3% of the total number of customer meters, were installed..

4.1.1.2 Malta's National Renewable Energy Action Plan (2010)

As required by Directive 2009/28/EC[21], Malta submitted its first National Renewable Energy Action Plan (NREAP) to the European Commission in July 2010 (MRA, 2010)[22]. This Action Plan outlines measures that Malta intends to adopt to achieve the national targets of 10% renewable energy share of final energy consumption and 10% share of renewable energy in transport. In 2013, Malta submitted its progress report on the implementation of the NREAP.[23]

The Promotion of Energy from Renewable Sources Regulations (LN 538 of 2010, as amended)[24] establishes the target for the share of renewable energy in the final energy consumption by 2020, including the intermediate trajectory, the obligation to submit the NREAP, the eligible sources of renewable energy and the methodology for calculating the contribution of each renewable source to the target.

The Action Plan states that Malta plans to achieve its 2020 renewable energy targets of 10% renewable energy share of final energy consumption by exploiting solar energy, waste-to-energy conversion plants and biofuel blending substitution obligations. However a relatively great share of renewable energy will be generated from a relatively higher number of renewable energy generation plants having smaller capacity which will be distributed across the Maltese Islands. These will be mainly integrated in existing building infrastructures due to Malta's limited space and the conflicting use by other activities.

[21] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.
[22] NREAP was resubmitted in 2011.
[23] http://ec.europa.eu/energy/en/topics/renewable-energy/progress-reports.
[24] Directive 2009/28/EC has been mainly transposed into national legislation by the Legal Notice 538 of 2010, the Promotion of Energy from Renewable Sources Regulations. Provisions related to grid connection and access, and dispatch of electricity from renewable sources are found in the Electricity Market Regulations (LN 166 of 2011 as amended).

4.1.1.2.1 Photovoltaics

The introduction of a feed-in tariff for solar photovoltaic systems (PV) has addressed the financial barrier holding back the further penetration of PV. The September 2010 Feed-in Tariffs Regulations (Legal Notice 422 of 2010) set feed-in tariffs for the electricity generated by photovoltaic installations connected to the grid, including for those systems benefitting from a capital grant. The new tariffs replaced the previous net-metering arrangement. The introduction of the feed-in tariff increased the potential for exploitation of the roof space including that of premises with no consumption of electricity and hence with no incentive for net metering. New feed-in tariffs were published during 2011 (LN70/11), 2012(LN63/12, LN236/12), 2013 (LN71/13, LN139/13, LN253/13, LN271/13), 2014 (LN7/14, LN34/14, LN155/14, LN416/14) and 2015 (LN 171/2015, LN264/2015, LN 365/15) are revised regularly to ensure a reasonable return on investment and avoid overcompensation as market prices of new systems change. The total PV installed capacity by December 2014 was 54.8MWp. These systems are estimated to have generated a total of 68.4GWh during 2014.

A system of fast-track permitting was also adopted by the Malta Resources Authority (MRA) for PV systems not larger than 16 Amps per phase in order to facilitate the installation of these systems and their connection to the grid. Larger PV systems still require an authorisation prior to construction and, once commissioned, a licence to operate before connection to the grid.

4.1.1.2.2 Solar Water Heaters

Over the years, a number of solar water heater grant schemes funding part of the capital cost were introduced by Government to encourage households and the business community to invest in solar technologies.

The penetration of solar water heaters for household as at the end of 2014 was 17,845 installations with an estimated solar (heat) energy capture of 39.36GWh.

4.1.1.2.3 Energy from waste

In October 2011, WasteServ Malta Ltd[25] was granted the license to generate electricity for own consumption and export by means of two combined heat and power units (CHP) at Sant' Antnin Solid Waste Treatment Plant. This plant with a total capacity of 1.737MW is fired by biogas produced onsite by the Mechanical Biological Treatment Plants (MBT) through anaerobic digestion of the organic part of municipal waste.

4.1.1.2.4 Energy from wind

4.1.1.2.4.1 Micro and medium wind

The projected uptake of micro and medium wind has been, as expected, negligible. The main reason for this low uptake is the uncertainty about energy yield, the relatively high cost to install and planning permitting issues.

A set of planning permitting guidelines[26] was published by the Malta Environment and Planning Authority (MEPA) in 2010 for micro wind turbines with capacities up to 20kW. These guidelines indicate the locations and conditions under which wind turbines up to a capacity of 20kW may be

[25] WasteServ Malta Ltd is a government-owned company that operates the main publicly-owned waste management facilities in the Maltese Islands.

[26] Planning Guidance for Micro-wind Turbines, May 2010, MEPA. available at: http://www.mepa.org.mt/LpDocumentDetails?syskey= 1242

permitted. So far the wind turbines that have been approved are for research purpose to assess the environmental impact and yield.

4.1.1.2.4.2 Large wind farms

The NREAP submitted in 2010, projected a significant contribution from Wind Energy to Malta's target of 10% RES in its gross final energy consumption by 2020. These targets were based on three main wind farm proposals:

- Hal Far Onshore Wind Farm to generate 4.25MW by 2013;
- Wied Rini Onshore Wind Farm 10.2MW by 2015;
- Sikka l-Bajda Offshore Wind Farm to generate 95MW in the following year.

Deep offshore technology was also investigated. Developments since then have shown that these projects are not sustainable.

In February 2015, the outline development application for the offshore wind farm at Sikka l-Bajda was rejected based on the conclusion that the detrimental consequential effects on the environmental protection, in particular the avifauna and marine ecology, of the surrounding area override the benefits achieved through the generation of renewable energy from the proposed wind farm.[27]

4.1.1.3 National Energy Efficiency Action Plan (2014)[28]

Since the publication of the first National Energy Efficiency Action Plan (NEEAP) in 2008 and subsequent action plans, efforts on the promotion of energy efficiency have mainly targeted the residential, commercial (mainly tourism) and industrial sectors. This has been updated with the 2nd National Energy Efficiency Action Plan published in 2011 and the third National Energy Efficiency Action Plan published in 2014. Government made substantial investment through support and incentive schemes to achieve the targets set in the Action Plan. The latest National Energy Efficiency Action Plan has been re-designed to look towards the achievement of energy savings of 27% in 2020. It includes estimates of expected savings for the period 2014-2020 as a result of readily quantifiable measures which were included in the previous NEEAPs and which would still result in savings post 2013; end-user measures quantified under Energy Efficiency Directive (EED) Article (7); specific renovation projects which result in net energy savings; and already committed investment in the generation infrastructure.

4.1.1.3.1 Energy Efficiency measures in Industry & SMEs

Malta Enterprise, the Government entity dealing with the promotion of industry, launched a scheme in 2009, under the European Regional Development Fund (ERDF) 2007-2013 programme. Under this scheme, grants to this sector covering expenditures related to energy from renewable sources and energy efficiency measures were provided. Malta Enterprise has also made available to the industry the service of subsidised energy auditing by professionals.

Enterprises in the hospitality sector such as hotels, guesthouses, hostels, snack bars and restaurants could also benefit from a loan financed by Malta Enterprise. Loans approved under this incentive were capped at €400,000 or 80% of the total investment, as approved by Malta Enterprise. The loan

[27] http://mepa.org.mt/news-details?id=989
[28] http://ec.europa.eu/energy/sites/ener/files/documents/2014_neeap_en_malta.pdf

has to be repaid within 5 years at an interest rate of 1.5% over the discount rate charged by local commercial banks.

A feasibility study analysing the potential of co-generation on the Maltese islands carried out by the Malta Resources Authority showed that, at current prices of energy commodities, this technology is feasible in most sectors.

4.1.1.3.2 Energy Efficiency schemes in the Buildings sector

In the residential sector, government grants were provided for the purchase of roof insulation, double glazing and energy efficient appliances. In the latter case, the grant effectively subsidized the purchase of A-rated washing machines, dishwashers, air conditioners and tumble dryers and A+ and A++ rated refrigerators.

A Technical Guidance Document on Minimum Requirements on the Energy Performance of Buildings Regulations 2006 was published which set requirements for all new buildings and buildings undergoing major renovation. Energy Performance certification was started in 2009 following the development of a methodology and software for this purpose, namely the Energy Performance Rating for Dwellings in Malta (EPRDM). Non-dwellings are certified by means of another methodology adapted for Malta, namely the iSBEMmt

Malta published the Energy Performance of Buildings Regulations in 2008, and these have since been repealed and replaced by the Energy Performance of Buildings Regulations 2012 (LN 376/2012).

The refurbishment and transformation of existing buildings into nearly zero-energy building stock will be encouraged. The feasibility of adopting grants, tax deductions and other incentives to achieve this will also be assessed. Such instruments may be applied for those owners entering into a commitment that clearly shows their building will have higher energy efficiency and nearly-zero net energy use. The Energy Performance Certificate will be the main document testifying to this improvement.

Large scale residential and commercial projects are also required to submit energy and water management plans as part of the application procedure for a development planning permit.

Cost-optimality studies were carried out to ascertain that building regulations ensure that buildings are built in such a way that they have the lowest life-cycle cost. Following results from these studies, Malta is undergoing a review of the current Energy Performance Minimum Requirements, in line with cost-optimality studies.

A nearly Zero Energy Plan for Malta has been developed and is pending final approval. This has set targets for the shift towards nearly zero energy new buildings by 2020.

4.1.1.3.3 Action in the Public sector

In the public sector, Government established a scheme for Green Leaders who have been entrusted to encourage and champion energy efficiency in the sector. Government appointed these Green Leaders in 2004, one in each Ministry, in an initiative aimed towards meeting Government’s corporate responsibilities with regards to the environment. Green Leaders are obliged to create environmental awareness within their respective Ministries and act as catalysts for action to promote environmentally friendly practices, including energy efficiency and renewable energy measures. The Green Leaders were coordinated by the Government Environmental Corporate Responsibility Office set up for the purpose within the Office of the Prime Minister. Green focal points were then appointed in departments and sections to provide closer interaction with staff and to create a green network.

A list of all buildings occupied by government ministries or authorities has been compiled and the energy usage for each building has been recorded. Renovation as required under the relevant directive will be directed towards those buildings with high energy use.

The Department of Local Government launched two energy aid schemes to incentivise Local Councils to invest in energy efficient measures or renewable energy. Grants of 80% up to €10,000 were provided to Local Councils for investment in energy savings.

In 2007, the Government published a corporate Environmental Policy which sets targets for energy efficiency in a number of Government-owned organisations, some of which are amongst the major energy consumers in the country (MTCE, 2012). The Water Services Corporation, in particular, accounts for nearly 3.45% of the national electricity demand, and in fact, it has implemented a number of measures to make the production and distribution of water more energy efficient.

The Maltese Islands have limited availability of groundwater sources and it is also difficult to control the quality of this groundwater. In order to meet EU and local standards, groundwater is blended with water produced from three main Reverse Osmosis plants at Pembroke, Lapsi and Ċirkewwa. This has necessitated the extensive use of seawater desalination by reverse osmosis (RO), which accounts for almost 60% of the potable water demand of 31 million cubic metres per annum. The plants were retrofitted with the most efficient energy-recovery system available. In addition to these measures the Water Services Corporation adopted an aggressive leakage detection drive to ensure all avoidable losses are eliminated.

In line with the same corporate Environmental Policy, the Government had set up a program for energy audits targeting buildings used by the public service. Such facilities include but are not limited to: offices, courtrooms, town halls, police and fire stations, schools and community centres.

The national Social Housing sector has also embarked on an energy efficiency program. The Housing Authority has a five year plan that commenced in 2009 to provide for the building of additional social housing residential units that will, incorporate energy saving measures within the building structure over and above those required to comply with the minimum requirements that have since come into force. The objective is to reduce the direct and indirect electrical power demand of social housing from the national grid.

The Foundation for Tomorrow's Schools was set up by the Government of Malta in 2001 and has among its objectives, the management and financing of the development, building, upgrading and refurbishment of State schools. Energy conservation and inclusion of renewable energy sources is a core principle of policy that has been adopted by the Foundation in the design and construction of new schools.

4.1.1.4 Horizontal Cross-Sectoral Measures

4.1.1.4.1 Information and Communication Technology (ICT) and improved energy-efficiency

Through Commission Recommendation of 9 October 2009 on mobilising Information and Communications Technologies to facilitate the transition to an energy-efficient, low-carbon economy, the European Commission identified a number of ways and concrete actions for the ICT industry to achieve improved energy-efficiency across society and the economy. The recommendations aim at ensuring full coherence of ICT policies with national, local and regional approaches to make the transition to an energy-efficient, low-carbon economy. These include:

- minimum functional specification for smart metering that focuses on providing consumers with improved information on, and improved capabilities to manage, their energy consumption together with the setting up of a coherent timeframe by the end of 2012 for the rollout of smart metering;
- monitoring and management of energy consumption in buildings;
- energy efficient work practices such as teleworking, e-government etc;
- delivering of innovative technologies that reduce wasteful consumption of energy in devices; and
- the adoption and implementation of procurement practices that leverage the strength of public sector demand to promote the dematerialisation of ICT goods and services.

Government periodically embarks on energy efficiency campaigns such as the ‘Switch’ campaign, intended to educate and disseminate good practices to save energy and water in the home.

In February 2014, Cabinet endorsed Malta’s new National Research and Innovation Strategy 2020. This document sets out Malta’s research and innovation strategy for the forthcoming seven year period. Recognising the progress made over the last years and acknowledging that there is still a way to go in achieving the objectives set out in the 2007-2010 R&I Strategic Plan, the ultimate goal of this Strategy remains that of embedding research and innovation at the heart of the Maltese economy to spur knowledge-driven and value-added growth and to sustain improvements in the quality of life.

Government will ensure energy efficiency funding that will provide support for energy efficiency activities both through national and EU funding initiatives. This has also been identified as a priority under the European Structural and Investment Funds. Directive 2012/27/EC requires the setting up of energy efficiency obligation schemes achieving new savings each year from January 2014 to 31 December 2020. Malta has outlined the measures that will achieve the required savings by 2020.

4.1.1.4.2 Energy

ARMS Ltd.,[29] on behalf of Enemalta Corporation and Water Services Corporation, are currently implementing an Automatic meter management system complete with Smart Electricity Meters. This will enable ARMS to provide consumers with up-to-date information on their consumption trends.

[29] Automated Revenue Management Services (ARMS) Ltd is a private limited liability company jointly owned by the Enemalta Corporation and the Water Services Corporation. During 2010, the company took over the management of the Customer Care and Billing functions on behalf of both corporations. (ARMS, n.d.)

This will enable consumers to better understand how they can satisfy their electric energy needs most efficiently and hence save on their bills.

4.1.2 Transport

The transport sector is the second largest contributor of GHGs as it produces around 19% of Malta's total emissions. The main contributor is road transport with this category's GHG emissions accounting for 95% of overall transport sector emissions, while national marine transport accounts for around 4.6%, and domestic aviation account for just 0.1% of total sector emissions.

This sector is dominated by emissions from road transport, CO_2 being the gas that accounts for the bulk of overall GHG emissions from road transport fuel combustion. Diesel is the principal fuel for national marine navigation and a small portion of petrol is also used. Jet kerosene (Jet A1) and aviation gasoline are used in domestic aviation. As regards road transport, the market is almost equally shared between petrol and diesel. The use of biodiesel had been on the decline between 2008 and 2010, and thus the MRA introduced a substitution obligation for importers/wholesalers of transport diesel (EN590) and petrol (EN228) in the legislation regulating the importation and wholesale of fuel. The substitution obligation for 2011 was a minimum of 1.5% of the total energy content petroleum placed on the market and current legislation states that the percentage rises in steps of 1% till 2019 to reach 10% in 2020.

Whilst Malta does not have indigenous car manufacturing or indigenous transport fuel manufacturing industries, energy efficiency in the transport sector is encouraged through financial support and initiatives. A number of measures have already been implemented at a local level to curb GHGs and other pollutants, one them was the substitution obligation mentioned in the previous paragraph. Other measures include (i) the introduction of Autogas (LPG) as a fuel available for Maltese drivers; (ii) subsidies to alternative means of transport, such as electric cars and bicycles; (iii) improvement in transport efficiency in particularly through a comprehensive reform of the public transport system; and (iv) the setting up an Intelligent Traffic Management System (ITMS) to monitor traffic on the main road network and manage traffic better so to eliminate congestion and bottlenecks.

Government has also introduced grant schemes for scrappage of private passenger vehicles to replace these by Euro class IV or higher standard vehicles. A scrappage scheme for private cars was introduced in November 2010 to encourage the scrapping of old polluting cars. This led to the scrappage of 5,195 cars (older than 10 years) over the period November 2010 to December 2012. Two more schemes were launched in 2013 and 2014. In 2013, 661 vehicles were scrapped, whereas in 2014, 506 vehicles. The scheme is being renewed in 2015, whereby a one-time grant will be given to every person who scraps an M1 (passenger vehicle) with an age of 10 years or more and registers a New M1 (passenger vehicle) with a CO_2 of not more than 130g/km and having a length of not more than 4,460mm.

A decrease on the registration tax of electric cars has been implemented to encourage cleaner modes of transport and to further support uptake of electric cars, a number of charging points will be installed across the island.

4.1.2.1 National Intelligent Transport Systems Action Plan for Malta 2013-2017 (2013)[30]

The Action Plan is a synthesis of how Transport Malta (TM) intends to roll out Malta's first major ITS deployment which is split in two phases and spanning over an eight year time frame. The first phase will take place between 2013 and 2017 while the second phase will be carried out in the following three years, from 2018 to 2020.

The ITS Action Plan takes into account the important work being carried out at European Union level which aims to achieve European wide harmonisation and interoperability for ITS deployment of road transport and takes into consideration practical deployment guidance emanating from the EasyWay project. Malta's ITS Action Plan has been developed within the framework of the six main priority areas split into a number of actions contained in Directive 2010/40/EU of the European Parliament and of the Council on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport which will be carried out over a seven year time frame.

Phase 1 (2013-2017) of Malta's ITS deployment includes the laying down of the foundation for the national ITS mainframe and open system architecture. The main system is divided into a number of sub-systems that form part of a comprehensive and holistic Urban Traffic Management and Control (UTMC) system that is tailored to the specific needs of the Maltese Islands, focusing at a strategic level on Malta's trans-European transport network (TEN-T) core and comprehensive networks. Innovation in traffic management will help to make transport more sustainable, more efficient, cleaner, safer and seamless. The various sub-systems planned in Phase 1 of the ITS Action Plan will be inter-connected through a centralised communications hub, including:

- a closed-circuit television (CCTV) network;
- a dynamic message sign network;
- an electronic parking guidance system;
- an Urban Traffic Management and Control System (UTMC);
- a road flood alert management system.

All of these sub-systems are pilot projects in their own right which, following deployment, will be monitored to assess their individual and combined effectiveness with a view to the possible further expansion of sub-system components to other areas of the road network. The planned UTMC has been designed to interface with all existing ITS applications used in traffic and vehicle management in public transport services, taxi services, speed cameras, the Controlled Vehicular Access (CVA) and the new National electro-mobility network.

Through this deployment and because of the small and manageable size of the transport network, Malta will be one of the first European countries to have all of its main road network, its transport hubs and termini seamlessly connected in real time at a national level. The roll-out of ITS at national level in the first phase will generate vast quantities of raw travel and traffic data which can be filtered and structured to provide a vital monitoring and assessment tool for transport planners and operators, emergency services, policy makers and control bodies.

[30] http://www.transport.gov.mt/admin/uploads/media-library/files/National%20ITS%20Action%20Plan%20for%20Malta%20_2013%20-%202017_.pdf

4.1.2.1.1 The MODUS Project – encouraging a modal shift in land transportation

The MODUS project will strive to mitigate negative trends in Maltese transport by making public transport more efficient and reliable. This will be carried out through various measures that will minimise road congestion and make public transport more attractive.

The MODUS project is divided into four main components as follows:

- Introduction of new accessible bus interchanges that will connect public transport routes together making it easier for commuters to shift from one route to another without having to go all the way to Valletta as the previous centralised system required;
- Launch of a new Park and Ride facility at Marsa that will enable commuters to park their cars at the new facility and travel using public transport to their end destination;
- The extension and introduction of new bus priority lanes that give priority to public transport vehicles over other vehicular traffic in order to allow buses to avoid congestion on the main bus corridors and arrive at destinations punctually;
- Introduction of an Intelligent Transport Management System (ITS) that will allow Transport Malta (TM) to monitor the traffic situation all on Maltese roads in real time, all day, every day. The system will enable TM to respond quickly to congested areas and divert traffic to alternative routes. The real-time traffic monitoring offered by the system will also allow TM to respond to accidents as they occur as well as any other incidents that happen on Maltese roads, such as flooding. As well as diverting traffic as necessary in real-time, TM will also be able to alert and deploy the personnel necessary to handle the situation at hand without any delay.

4.1.2.2 National Strategy for the Introduction of Electromobility in Malta and Gozo (2012)[31]

The Strategy notes the importance of electric mobility and its relevance to land transport in Malta and Gozo. An indicative target of uptake of 5,000 battery electric vehicles (BEVs) by 2020 has been set. This will contribute to the realisation of targets both with respect to air pollution and mitigation of GHG emissions. The contribution of electric cars is considered as fundamental for Malta to reach its renewable energy target of 10% by 2020.

4.1.2.2.1 The Malta National Electromobility Action Plan (2013)[32]

Making transport in Malta environmentally sustainable is a priority, and the electrification of transport in Malta is one of the main pillars in the transport policy. The uptake of electric vehicles is to be incentivised through a series of measures, one of which is the scrappage scheme which allows a grant for individuals and companies who want to scrap their current car and replace it with a BEV. The government will be leading by example and will gradually be replacing its current vehicle fleet to a more energy-efficient one. The use of electricity in other transport modes including waterborne transport and related maritime infrastructure is also being assessed.

[31] http://www.transport.gov.mt/admin/uploads/media-library/files/National%20Strategy%20for%20the%20Introduction%20of%20Electromobility.pdf
[32] http://www.transport.gov.mt/admin/uploads/media-library/files/The%20Malta%20National%20Electromobility%20Action%20Plan.pdf

The Action Plan foresees the implementation of concrete projects through which Malta will achieve its obligations. The Plan does not only contribute towards increasing the number of BEVs on the road, but also addresses the deployment of the respective different types of infrastructure.

4.1.2.2.2 Demonstrating Electric Vehicles - DemoEV

DemoEV sought to introduce and promote the use of electric vehicles in the Maltese Islands by demonstrating the feasibility of battery electric vehicles and sought to contribute towards the attainment of a carbon neutral road transportation system in Malta by putting into practice, testing, evaluating and disseminating a number of actions related to the implementation of electromobility.
In this respect, DemoEV has contributed towards reaching the 2020 Climate Change and Energy targets. It has also implemented the National Air Quality Plan hence, the logo *Go Clean, Go Silent, Go Electric.*

The project Demo-EV *"Demonstrating the feasibility of electric vehicles towards climate change mitigation"* project code: LIFE10 ENV/MT/088 was funded by the EU and the Maltese Government. DemoEV started in September 2011 and ended in December 2014. It was led by the Ministry for Transport and Infrastructure in collaboration with the Ministry for Gozo, Transport Malta and Enemalta Corporation.

The specific objectives of this project were:

- To determine whether carbon neutrality is possible by recharging electric vehicles using photovoltaic systems installed on buildings;
- To evaluate the actual environmental efficiency of the latest electric vehicles;
- To convince the target audience to switch to electro-mobility (rather than internal combustion engines);
- To study the environmental and economic efficiency of various methods of charging latest electric vehicles.

The principal deliverables of the DemoEV project consisted in the purchase of 24 battery electric vehicles and in the setup and installation of 90 charging points around Malta and Gozo. These were then utilised by over 133 participants from regular households; companies and non-governmental organisations as well as government entities. Almost 300,000 kilometres were clocked around Malta and Gozo in the 18-month period, with an estimated savings of around 67 tonnes CO_2 eq.

Charging a battery electric vehicle from a photovoltaic system on a residential dwelling is possible. This usually takes around 8-9hours for a full battery to be recharged. This is however, not the only way to charge a battery for an electric vehicle. One may top up for an hour or less, which is the recommended procedure for a battery electric vehicle One may also charge a vehicle using renewable energy sources such as photovoltaic plants. It is, however, calculated that a 4.6kWp photovoltaic installation is necessary to generate sufficient electricity for a single charge of 20kWh. Most photovoltaic systems on residential dwellings in Malta are usually rated at 2.3kWp. Furthermore, most photovoltaic systems are grid-connected and therefore, it is more logical to assume that electricity generated by the system is all fed to the grid and then energy used for charging is reabsorbed from the grid.

With the project having ended the DemoEV fleet is now being integrated within the Government vehicle fleet replacing aged vehicles in favour of greener, cleaner and more silent technology.

4.1.2.2.3 Fiscal incentives for the uptake of electric vehicles

Electric vehicles incentives have been put in place in 2014 and will roll on to 2015. The total budget for these incentives in 2014 was €300,000. For 2015, the allocated grant is €250,000. Also for 2015, the grant will be open to private companies and NGOs.

The scheme is as follows:

- €5,000 grant for the purchase of a Battery Electric Vehicle (BEV) in conjunction with a scrappage scheme of an ICE vehicle, or
- €4,000 grant for the purchase of a BEV without a scrappage scheme;
- €1,500 grant for the purchase of an Electric Quadricyle.

Electric vehicles are provided with two privileged parking spaces adjacent to each charging pillar. Currently there are 45 public charging pillars in various locations in Malta and Gozo. Electricity is free of charge while charging BEVs on these pillars for a limited period of time.

BEVs are not charged any charges in controlled vehicular access (CVA) areas, and bus lanes put in place are accessible to BEVs.

With respect to car circulation taxes, BEVs only pay €10 per year. Registration fees of new vehicles are lower than conventional vehicles, whereby the congestion element of the fees (depending on the length of the vehicle) is charged.

4.1.2.3 Promotion of biofuels

4.1.2.3.1 The introduction of a biofuel 'Substitution Obligation'

The use of biofuels up to some years ago had not resulted in a significant decrease in national GHG emissions as its use decreased from 1.75%, by energy, of diesel used in road transport in 2007 to 0.68% in 2009. This triggered the MRA to introduce a substitution obligation on all importers and/or wholesalers of petroleum fuel used for transport. The annual mandatory substitution obligation in 2014 was 4.5% of the total energy content petroleum place on the market. The obligations rise in intervals of 1% to reach 9.5% by 2019 and then 10% by 2020. The increase rate is established in the Sixth Schedule on the Petroleum for the Inland (Wholesale) Market Regulations (LN 68/11).

The maximum amount of biodiesel that may be used in vehicles is currently limited to 7%, as per EN590. The percentage in the EN Standard was increased from 5% to 7% following Directive 2009/30/EU. The gross inland consumption of biodiesel during 2014 was 5,557t[33] up from 2175t in 2011. The biodiesel that is being placed on the market is either produced from locally recycled waste cooking oil, imported with sustainable criteria certification and blended locally with EN590 diesel, or imported ready blended with diesel.

[33] Source:NSO

4.1.2.3.2 The introduction of bio-ETBE

Malta's vehicle fleet composition is unique in that over half of the newly registered vehicles are second hand vehicles[34], mainly imported from the UK and Japan. Fuel compatibility therefore depends on the standards enforced in Japan over the past 10 years or so, rather than current standards being enforced at EU level. The Government of Japan has permitted sales of E10 gasoline and vehicles are designed to use E10 or ETBE[35] fuels since April 2012. However second hand car imports would typically be pre-2012 models and may not be suitable to run on the higher blends. Local importers are exploring the possibility of introducing Bio-ETBE which lacks the environmental problems created by other bio-fuels when blended with petrol. Due to climate conditions in Malta, the blending of bio-ethanol can result in environmentally harmful emissions being emitted since this would result in a blend which exceeds the evaporative emission levels defined by European Standards for Gasoline EN228. The National Renewable Energy Action Plan has projected the introduction of bio-ETBE for blending with gasoline. Its introduction, however depends on this relative additional costs compared to other options such as HVO. A maximum of 22% mix by volume of bio-ETBE as currently allowed, would eventually provide 3.5% of projected road transport energy consumption in 2020.

4.1.2.4 The introduction of Autogas

Autogas is Liquefied Petroleum Gas (LPG) used as a fuel in a vehicle for the traction of a vehicle. In August 2010, with a view to the introduction of autogas for vehicles on the Maltese market, MRA published the Autogas (Installation and Certification) Regulations (LN393/2010), to lay market regulations for retrofitting of motor vehicle engines. Accompanying this legislation the MRA issued Codes of Practice to guide installers on the installation of kits and engineers on the design of autogas service stations.

The first service station that started dispensing autogas was in the second quarter of 2012. By June 2014, eleven technicians[36] were approved to serve as competent installers. The main challenge in the Maltese market will be to promote a culture of new use of LPG.

Owners of petrol cars are being encouraged to convert their vehicle to auto gas through a measure which is offering a rebate on the expense incurred, and by taking into account the lower CO_2 emissions of such certified converted vehicles, becoming eligible to pay lower circulation tax. Liquefied petroleum gas (LPG) vehicles incentives also include free use of bus lanes.

4.1.2.5 Promotion of E-working and Teleworking

In 2008 a teleworking policy was published by Government which took into consideration feedback received from a research project carried out together with the National Commission for the Promotion of Equality (NCPE). The purpose of this policy was to set up a formal framework for the administration of teleworking in the Maltese Public Administration and the policy document outlines the general principles on which teleworking should be administered in the Public Administration of Malta (MPO, 2008).

Several employees within the Public Administration entities are undertaking the opportunity to engage in teleworking. This measure could potentially have a significant impact to reduce emissions

[34] During 2014, 42.6% of newly registered vehicles were new. The rest were imported second hand vehicles – Source NSO.
[35] Ethyl Tertiary Butyl Ether (ETBE) which is produced from ethanol and isobutylene in a catalytic reaction.
[36] http://mra.org.mt/wp-content/uploads/2013/07/4300/List-of-Competent-Persons-in-Autogas-Retrofittng-as-on-June-2014.pdf

from daily journeys to work which in Malta are currently mainly dependant on usage of own vehicle. If 100 employees per year take up the scheme for one day a week and resulting in fuel savings of 100lt/year, the savings for 2010 would be 180MWh. Maximum savings are based on 200 employees resulting in 200lt/year (MRA, 2008).

4.1.2.6 Improving Energy Efficiency in the Transport Sector

A number of actions were drawn up by Transport Malta and the central Government in the bid to reduce the fuel use in transport and creating safer road journeys.

4.1.2.6.1 Vehicle Circulation Fees for more efficient vehicles[37]

Circulation fees are calculated depending on the year of registration, based on engine size, year of make, CO_2 emissions, particulate matter (PM) emissions and fuel type.

For private petrol vehicles this fee ranges between €100 for a new petrol-powered vehicle with between 0-100g per km CO_2 emissions to €1,125 for a vehicle 14 years old or more with over 250g per km CO_2 emissions. For private diesel vehicles, the fee ranges between €100 for a new car with 0-100g per km CO_2 emissions and with particulate matter emissions up to 0.005g per km, to €1,225 for an old vehicle older than 14 years which emits more than 250g per km with particulate matter emissions exceeding 0.035g per km.

These rates have declined over the years. In 2012, the fee on petrol vehicles older than 14 years with over 250g per km CO_2 emissions was €1,474, while the fee on diesel vehicles older than 14 years with 250g per km CO_2 emissions and PM emissions higher than 0.036g per km was €1,706.

The annual circulation license fee also applies to electric and hybrid electric motor vehicles.

Vehicles for disabled persons, vehicles owned by the State or vehicles which belong to official diplomatic staff are exempt from the fee.

4.1.2.6.2 Vehicle Registration Tax System Reform[38]

In the past few years, Government initiated a reform with the aim of having cleaner smaller and new cars on the Maltese roads. In 2009, the registration tax and licensing of vehicles was reformed. Through this reform registration tax and licensing of vehicles are now calculated on carbon dioxide emissions, the length of the vehicle, Euro standard and its value. Incentives are also given to hybrid cars and electric vehicles.

Since 2011, registration taxes for commercial vehicles with emission standards lower than EURO 3 were increased to encourage purchase of newer and less polluting vehicles. In January 2012, this measure was extended to non-commercial vehicles.

Exemptions also apply to special purpose vehicles (such as ambulances) and to vehicles brought into Malta with the intention of being re-exported or exported. From April 2013, hybrid cars (M1 vehicles) are subject to the registration tax, but the CO_2 value included in the Certificate of Conformity is lowered by 30%.

[37] http://www.transport.gov.mt/land-transport/vehicle-registration-and-licensing/renewal-of-road-licence/licence-fees
[38] http://www.transport.gov.mt/land-transport/vehicle-registration-and-licensing/registering-and-licensing-a-motor-vehicle

4.1.2.6.3 Traffic congestion reduction in Valletta

The Maltese Government has taken measures to improve accessibility into the capital city, Valletta, reduce traffic congestion and improve the environment. Such measures include the introduction of Controlled Vehicular Access[39] and the park and ride schemes[40]. The access charging system is limited only to the city of Valletta and covers all types of vehicles. While not decreasing the numbers of individuals travelling to Valletta, these efforts have resulted in a substantial drop in private vehicle traffic in and around Valetta in morning peak hours. Between 1998 and 2010, a modal shift of 9.2% towards non-car modes (as opposed to a national shift of 4.4% towards car modes) was recorded. This system was introduced on 1 May 2007. On 1 December 2013, the system was modified to exempt charges on weekday afternoons and Saturdays. While the change in 2013 has seen increased vehicle numbers accessing Valletta, the impact of this change in terms of Modal Shift and Impact on GHG emissions has yet to be determined.

4.1.2.6.4 Green travel plans at University[41]

The University of Malta has been implementing a Green Travel Plan for a few years in order to decrease the demand for travel which results from a population of approximately 11,000 students and approximately 4000 members of staff, including academic, administrative, and technical staff. The University of Malta has been working to improve transport options which include bike purchasing and rental schemes, public transport fund schemes for students and discounts for staff, an online carpooling application and flexibility and teleworking for staff.

In 2014 a survey was carried out to evaluate the impact of these measures when compared to 2010. This survey assessed changes in behaviour among students, academic and non-academic staff with respect to transport modes, being car driver, car passenger, bus, bicycle, motorcycle, and walking. The student population registered the largest shift from personal car use to greener modes of transport. More efforts are required to bring about change in the behaviour of academic and non-academic staff.

4.1.2.6.5 Provision of advisory services on energy efficient driving

This action is intended to change the attitude and influence behaviour in transport use and will be combined with the information campaign which is aimed to educate the general public on energy efficiency measures in general.

[39] http://www.cva.gov.mt/
[40] http://www.transport.gov.mt/admin/uploads/media-library/files/Park%20%20Ride%20-%20Floriana.pdf
[41] http://www.um.edu.mt/iccsd/greentravel

4.1.3 Industrial Processes and Product Use

In Malta, direct emissions of greenhouse gases from industrial processes and solvent use and account for 8% of national GHG emissions. GHGs emitted by this sector are CO_2, N_2O, HFCs, PFCs and SF_6. Refrigeration and air-conditioning equipment are considered to be the primary source of GHG emissions from this sector. The main measure that is expected to reduce emissions from the sector is the implementation of the F-Gases Regulations, which should also serve to provide more information on the sectoral activity.

4.1.3.1 Implementation of the F-gases Regulations

Regulation (EC) No. 842/2006[42] on certain fluorinated greenhouse gases addresses emission control through the requirement of minimum qualifications for personnel who make use of such substances. This requirement has been implemented through the establishment of sector specific subsidiary regulations which have been published locally as follows:

- Minimum qualification course required by Article 12(3) of implementing Regulation (EC) No. 303/2008[43] and Article 4(2) of implementing Regulation (EC) No. 307/2008[44] (Fixed air conditioning and refrigeration equipment, and vehicle air conditioning);
- Minimum qualification course required by Article 7(1) of implementing Regulation (EC) No. 305/2008[45] (High voltage switchgear);
- Minimum qualifications course required by Article 12(3) of implementing Regulation (EC) No. 304/2008[46] (Fire protection equipment).

In order to further implement the requirements of Regulation (EC) No. 842/2006, these have been further implemented through the publication of the Certain Fluorinated Greenhouse Gases Regulations (LN93/10).

[42] Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases.
[43] Commission Regulation (EC) No 303/2008 of 2 April 2008 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, minimum requirements and the conditions for mutual recognition for the certification of companies and personnel as regards stationary refrigeration, air conditioning and heat pump equipment containing certain fluorinated greenhouse gases.
[44] Commission Regulation (EC) No 307/2008 of 2 April 2008 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, minimum requirements for training programmes and the conditions for mutual recognition of training attestations for personnel as regards air-conditioning systems in certain motor vehicles containing certain fluorinated greenhouse gases.
[45] Commission Regulation (EC) No 305/2008 of 2 April 2008 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, minimum requirements and the conditions for mutual recognition for the certification of personnel recovering certain fluorinated greenhouse gases from high-voltage switchgear.
[46] Commission Regulation (EC) No 304/2008 of 2 April 2008 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, minimum requirements and the conditions for mutual recognition for the certification of companies and personnel as regards stationary fire protection systems and fire extinguishers containing certain fluorinated greenhouse gases.

4.1.4 Agriculture

The Agriculture sector accounts for a very small share of national GHG emissions (3%). CH_4 is the main greenhouse gas emitted by the agricultural sector, from enteric fermentation and manure management. Very small amounts of N_2O are also emitted from manure management and fertiliser use.

Various policies and measures are being implemented or planned in this sector which should also reduce the GHG emissions profile of the local agricultural sector. Addressing Malta's obligations under the EU legislation, particularly the Nitrates Directive (91/676/EC)[47], N_2O emissions from the use of fertiliser is expected to decrease over time as improved cultivation practices are adopted, principally through the application of the Code of Good Agricultural Practice[48] and the Nitrates Action Programme. Furthermore Malta benefited from the European Agricultural Fund for Rural Development, a financial instrument under the reform of the Common Agricultural Policy with the aim of strengthening the EU's rural development policy and simplifying its implementation.

4.1.4.1 Rural Development Programme 2007-2013 (2009)[49]

The European Agricultural Fund for Rural Development (EAFRD) Regulation[50] lays down the general rules governing community support for rural development financed by the EAFRD. The aim of the EAFRD is to contribute to the promotion of sustainable rural development throughout the European Union in a complementary manner to other Community market and income support policies. Its objective is to provide support for rural development that shall contribute to:

- Improving the competitiveness of agriculture and forestry through restructuring, development and innovation;
- Improving the environment and the countryside by supporting land management and;
- Improving the quality of life in rural areas and encouraging diversification of economic activity.

Malta published the Rural Development Programme (RDP) for 2007-2013 which outlines the strategic plan for which EAFRD will be utilised and which comprises a series of priorities and measures agreed upon between Malta and the European Commission.

4.1.4.2 Modernisation of agricultural holdings – Measure 121

This measure was intended to facilitate Maltese farmers to take up investments in production techniques that enable them to meet new market conditions and demands in the face of the inherent structural weakness of the Maltese agricultural market due to the extremely limited real capital expenditure. Through this measure farmers were supported to modernise agricultural holdings so as to improve not only their economic performance but also the environmental, occupational safety, hygiene and animal welfare status of their holdings.

[47] Directive 91/676/EC on the protection of waters against pollution caused by nitrates from agricultural sources.
[48] The Maltese Code of Good Agricultural Practice for the Maltese Islands. Agricultural Services and Rural Development Division, 2003.
[49] https://secure2.gov.mt/mrra-ma/rdpm_20072013?l=1
[50] Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD)

Measure 121 is further divided into three sub-measures:

- General modernisation and improvements in the performance of agricultural holdings (sub-measure 1);
- Environmental investments (sub-measure 2);
- On-farm investments in order to comply with newly introduced Community standards (sub-measure 3).

The third sub-measure dealt with on-farm investments in order to comply with EU standards. Support was granted to achieve compliance with the provisions of the Malta Action Programme regarding the storage capacity for manure and slurry. Through this sub-measure investment for 3196 m^3 of cesspits and 1924 m^3 of manure clamps was availed of. In the case of the Nitrates Directive, the actions eligible for support included the installation of waste storage, management and treatment structures necessary in order to meet the requirements of the Nitrates Action Plan as specified in the Code of Good Agricultural Practice for the Maltese Islands.

A list of relevant investments which were made on the farms is shown in the table below.

Type of expenditure	No. of projects
Cesspit	10
Manure clamp	16
Manure separator	3
Energy saving equipment / machinery	32
Solar water heater	20
Fertigation system	1
Water reservoirs	74
Wind turbines	7
Thermal insulation	7

4.1.4.3 Rural Development Programme (RDP) 2014-2020 (2014)[51]

Malta has recently submitted the new Rural Development Programme (RDP) for 2014-2020 to the European Commission. The RDP focuses on three main cross-cutting objectives namely the environment, climate and innovation. The draft programme focuses and prioritises climate change mitigation and adaptation by introducing various measures. The RDP identified five main themes:

Theme 1; Water, wastes and energy: improving sustainable use and generating renewable energy;

Theme 2; Maltese quality produce: improving quality, traceability, strategic marketing, adding value, branding and promotion;

[51] https://secure2.gov.mt/mrra-ma/con_doc?l=1

Theme 3; Sustainable livestock: improving resource efficiency, competitiveness and productivity, and welfare;

Theme 4; Landscape and environment: managing habitats and features; and

Theme 5; Wider rural economy and quality of life: developing rural tourism, rural skills and promoting social inclusion.

Measures related to climate change were aligned under Theme 1, 3 and 4. Some of the measures include:

- knowledge transfer and information actions;
- advisory services;
- farm management and farm relief services;
- investment in physical assets; Cooperation;
- farm and business development;
- quality schemes for agricultural products, and foodstuffs;
- organic farming; and
- investments improving the resilience and environmental value of forest ecosystems.

Some of the sub-measures under the above mentioned main measures, for instance the promotion of food chain organisation and risk management in agriculture will contribute indirectly to mitigating emissions of GHGs through reduction of fossil fuel used in transport, since this in turn will reduce the need for imports. The measures related to advisory services and training, under Themes 1, 3 and 4 will have beneficial effects through mitigation of emissions, and through making Maltese agriculture more adaptable and resilient to climate change. Training in water management for example will result in reduced water consumption, and possibly some return to dry land farming and other traditional practices. Improved knowledge of nutrient budgeting and management will lead to reduced fertiliser applications, better use of organic waste, which indirectly result in reductions in CO_2 emissions from reduced chemical fertiliser use. Improved soil management as a result of training and skills development will result in reduced energy consumption and decreases in CO_2 emissions from soil. Protection of biodiversity and landscape will have positive benefits for soil carbon storage and CO_2 absorption, and more effective use of Maltese forage will reduce the carbon footprint of Maltese agriculture by reducing its reliance on imports and transportation. Advisory services will also help to support the applicants to RDP schemes understand the impacts of their activities on climate change, and seek to minimise those effects where possible as well as to adapt to climate change.

4.1.4.4 *Nitrates Action Programme (2011)*[52]

One of the most challenging environmental implications of livestock farming is the generation of manure and its management to prevent pollution of water bodies, coastal waters, air and soil resources. The Nitrates Action Programme aims to reduce pollution of ground and surface water by nitrates. Some of the measures identified in the Action Programme regarding manure management

[52] www.agric.gov.mt/file.aspx?f=1224

relate to the type and capacity of on-farm storage of manure and slurry. It requires that manure is stored in leak-proof, covered storage clamps connected to cesspits, which should be leak-proof and covered. Additionally cesspits must have sufficient capacity to collect all urine and washing for at least a period of 15 days. Solid manure must be stored in covered clamps from 15 October to 15 March, thus it must be ensured that livestock farms have a structure that provides sufficient storage capacity throughout this period. Farmers are also obliged to keep records of slurry and manure transport/disposal.

This Action Programme requires users of organic and/or inorganic fertilisers to register with the competent authority responsible for nitrates. This provides better control on the use of such fertilisers. Furthermore, farmers utilising fertilisers are required to attend a course on the use of fertilisers. The Nitrates Action Programme requires that administrative controls are put in place to verify farmers' submissions of records regarding slurry and manure transports, disposal, quantities and their final destination. Proper records of organic fertiliser and livestock manure purchase are being maintained to verify compliance with periods when land application of nitrogen fertiliser is prohibited; to identify risk farmers or/and land users; to conduct inspections; to suggest remedial action in order to enforce measures laid out in the action program on an individual farm basis; and to propose the administration of fines and legal actions.

The implementation and monitoring of the Nitrates Action Programme in Malta during the present reporting period was inter-alia effected through, and supported by, the Rural Development Programme and cross-compliance checks forming part of the implementation of that programme. All farmers and livestock breeders are eligible to apply for funding under the RDP. Several key measures in the RDP directly targeted the measures included in the Nitrates Action Programme.

An informal Inter-Ministerial Committee has been established with the purpose of discussing discharges of farmyard waste into the sewerage network. Following a number of meetings, an inception report has been drafted and a stock taking exercise has been undertaken to give a clear overview of the situation. The inception report provides recommendations on a road map to be considered including a recommendation for the establishment of an Inter-Ministerial Steering Action Committee (IMSAC) that would encompass all entities concerned to propose follow up action necessary to address the problem of management and treatment of livestock waste. The IMSAC held its first meeting during the first quarter 2015. One of the first issues being tackled by the IMSAC is the updating of the current Agricultural Waste Management Plan which was drawn up in 2005 and amended in 2008.

Another project was undertaken in which livestock farms were mapped through a specific GIS model indicating type, size and spatial distribution of farms. The outcome of this project should provide solid groundwork for the IMSAC to be in a position to ensure that an effective system is established for the management of livestock waste.

4.1.4.4.1 InfoNitrates LIFE+ Project

The InfoNitrates LIFE+ project (LIFE 10 INF/MT/000092) focused on the delivery of an extensive information and communication campaign for the proper use and management of nitrates in agriculture and livestock breeding in the Maltese Islands. The principle objectives of InfoNitrates

LIFE+ project were to train and educate the farming community on the Nitrates Action Plan (NAP). This national action plan was drawn up according to the Nitrates Directive.

A post-project action plan was set up by the InfoNitrates managing team and the Directorate of Agriculture, so as to build on the results achieved through the InfoNitrates educational campaign. The project was completed on 30th June 2014, in time for the Nitrates Action Unit (NAU) to take over in the implementation of the NAP with the farming community. This unit was set up purposely by the Directorate of Agriculture to control and monitor farmers and livestock breeders in ensuring that the application, transport and storage of fertilisers is done in compliance with all the provisions laid down in the Nitrates Directive, and more specifically, the transposed national legislation (Legal Notice 321 of 2011 and Nitrates Action Plan for Malta).

During their visits to farmers, who were trained through the InfoNitrates project, the NAU personnel are already accessing fertiliser plans being applied on certain parcels. After being exposed to the application of a fertiliser plan, farmers are in a position to comprehend its dynamics and provide suggestions for technical improvements. Moreover, the NAU bridge the training gap left after the completion of the InfoNitrates campaign by referring farmers to the Farm Advisory Services Consortium (FASC). The latter has been set up for the purpose of providing advice to farmers and livestock breeders in respect to cross compliance and the application of fertiliser plans.

4.1.4.4.2 Nitrates database

Legal Notice 321 of 2011 established the setting up of a Nitrates Database, in which all the parcels not registered on the Integrated Administration and Control System (IACS) are now being registered in this database. The Directorate of Agriculture, being the Competent Authority, has established a centralised system in ensuring that the Nitrates Database could be compiled in its entirety. In this regard a Front Office in which farmers are requested to register their entire holdings has been set up. To date there have been 4,182 holdings that have been registered, covering a total of 17,033 parcels and an area of 2,869 hectares. Throughout the registration process, farmers are briefed on their obligations through the legal provisions of the Nitrates Registry, such as the provision of their information to registered Farm Advisory Service entities.

4.1.5 Waste

The overall share of GHG emissions from the waste sector is equivalent to 2% of the gross national emissions. The main gas emitted is methane, which accounted for 77% of the sector's emissions. Disposal of solid waste to land is the largest contributor of GHGs (77% share of sectoral emissions) followed by wastewater management (accounting for 22%). A minor fraction of the total sector emissions originated from waste incineration. In the past, composting was another minor contributor to GHG emissions from this sector, but the plant carrying out this activity ceased to operate in 2005.

Until early 2004, solid waste was deposited in unmanaged landfills. One of three landfills (Wied Fulija) was closed in 1996, and the other two landfills, Magħtab (in Malta) and Qortin (in Gozo) were closed in 2004.

Between 2004 and 2007, municipal solid waste was disposed of in a managed landfill at Ta' Żwejra, and subsequently in the Għallis managed landfill which started operating in the beginning of 2007. These landfills are operated by WasteServ Malta Ltd., a company set up by the Government of Malta in 2002 to organise, manage and operate national waste management systems.

Malta's waste water handling infrastructure consists of two main networks that collect both domestic and industrial waste water as well as some storm water runoff. The sewerage system has been upgraded with the building of three new sewage treatment plants, which process started in 2006 and ended in 2011. Two of the plants came into operation in 2008, while the third became fully operational in 2011.

4.1.5.1 Waste Management Plan for the Maltese Islands 2014-2020 (2014)[53]

Malta's National Waste Management Plan and National Waste Strategy have been reviewed and amended in accordance with the provisions of Article 28 of Directive 2008/98/EC on waste. Both the plan and strategy have been amalgamated into one document, the "Waste Management Plan for the Maltese Islands – A Resource Management Approach 2014 – 2020" as published in January 2014. The Plan also incorporates Malta's National Waste Prevention Programme. The new plan proposes measures to be implemented over the period 2014 – 2020 to move ahead from the status quo and towards the achievement of national and EU set targets.

The Waste Management Plan for the Maltese Islands (2014-2020) provides a roadmap that Malta is envisaging to follow to move waste management in Malta up the waste hierarchy through increased prevention, re-use, recycling and recovery. The document is divided into two plans. The first deals with waste prevention, which focuses mainly on behavioural aspects, characteristics and habits both of the domestic and the commercial/industrial waste producer and the second part, deals with waste management strategies. This focuses on behavioural aspects as well as waste management strategies of generated waste streams.

Both plans are aimed at addressing key issues and challenges being:

- Low rates of recycling;

[53] http://environment.gov.mt/en/document%20repository/waste%20management%20plan%202014%20-%202020%20-%20final%20document.pdf

- High landfilling rates;
- Unsustainable waste management;
- To break the link between economic growth and waste generation;
- Moving waste up the waste hierarchy;
- Moving towards sustainable waste management through waste prevention, increased recycling and recovery.

This strategy affects emissions of greenhouse gases and low carbon development by putting forward proposals that will lead to sustainable lower waste generation rates thereby and improve Malta's standing vis-a-vis the waste hierarchy.

Although there are no specific measures that go beyond the objectives of the Landfill Directive (Council Directive 1999/31/EC on the landfill of waste) in the Waste Management Plan, such as the complete or partial bans on landfilling biodegradable waste, the following measures identified in the plan should contribute towards the reduction of emissions from the waste sector:

- commissioning of a new Mechanical Biological Treatment Plant for the treatment of municipal waste and cattle and chicken manure;
- introduction of separate collection of bio-waste; and
- energy recovery from residual waste so as to reduce landfilling to a minimum.

A number of other measures, implemented and planned, are aimed at reducing greenhouse gas emissions from the closed solid waste landfilling sites as well as the existing landfills while also seeking to exploit the renewable energy potential of waste, at the same time addressing Malta's obligations under the EU environmental *acquis*, notably the Landfill Directive and Urban Waste Water Treatment Directive[54].

Furthermore, measures are aimed towards diverting waste from landfilling which is achievable through increased recycling and waste-to-energy options. Apart from complying with requirements of EU legislation, this direction is sought to reduce the stress on the land-use capacity of the country. Waste diversion does not have an immediate net saving effect of GHG emissions since emissions from landfills at any point in time are the result of dumping of material in landfills over the previous two or three decades and full closure of a landfill site does not mean immediate ceasing of emissions. However, the reduction of waste going to landfills will bring about savings at a faster rate than would be the case if volumes of landfilled waste remain the same or, even worse, increase.

Government is also working to consolidate as much as possible all the waste streams generated, such as agricultural waste which includes manure. This will have direct effects on the emissions from manure management, the organic fraction of municipal solid waste (MSW) and sewage sludge.

[54] Directive 91/271/EEC of the European Parliament and of the Council of 21 May 1991 concerning urban waste water treatment

4.1.5.1.1 Reduction of Emissions from Open and Closed Landfill sites

4.1.5.1.1.1 Aerial emissions Works at Magħtab and Qortin Landfills

Although the Magħtab and Qortin landfills are now closed since 2004, they are still sources of GHG emissions due to the waste present in the landfills that slowly decays underground for years after closure. In 2008, landfill gas extraction infrastructure was installed to treat odour and noxious gas emissions from these closed sites in a regenerative thermal oxidiser. The works also involved re-contouring works of the landform to improve stability of the waste mass, control emissions and to rehabilitate the sites for eventual alternative uses. Landfill gas extraction is expected to continue until 2028.

On the basis of emissions data from the Magħtab and Qortin sites, and using first order decay methodology to estimate the rate of methane generation from the waste deposited at these site, the net GHG savings from the treatment of methane (which constitutes a small percentage of emissions from these site) have been estimated. The net savings take into account the savings from the combustion of methane generated by the landfills and the CO_2 emissions from combustion process.

4.1.5.1.1.2 Gas Management at Żwejra and Għallis Non-hazardous Landfill

Following the closure of the unmanaged landfills in Malta, solid waste deposition commenced at the engineered landfill at Ta' Żwejra, serving as an interim managed landfill until the larger landfill at Għallis was prepared. The latter started operating in the beginning of 2007.

The management of landfill gas is a condition of the IPPC permit for both facilities, pursuant to the requirement under the Landfill Directive for the management and utilisation, where possible, of landfill gas. Hence, following closure of the specific cells within the site, capping of the waste mass and extraction of gases will be carried out and the extracted gases flared or possibly combusted for energy generation, subject to available budget. It should be noted that emissions from post treatment of the flared/combusted emissions that may be eventually required have not been considered in the estimates.

4.1.5.1.2 Diversion of Biological Waste from Landfills

4.1.5.1.2.1 Sant' Antnin Mechanical and Biological Treatment Plant

Over the years, the quantity of waste being deposited in landfills has gradually decreased due to improved recycling practices and diverting of degradable waste to the Sant' Antnin Composting Plant, in operation since 1993.

Since 2012 the upgraded Sant' Antnin Plant with the aim of improving the technology used and the environmental performance of the plant, to manage waste more efficiently and produce compost while facilitating the recovery of green energy.

To this end, the new Sant' Antnin Waste Treatment Plant includes a biological treatment plant for the production of biogas through the anaerobic digestion of biodegradable municipal solid waste. The biogas produced is to be used for the generation of electricity by combustion in a Combined Heat and Power (CHP) plant, and any excess electricity will be fed to the grid.

The biological treatment plant was inaugurated in 2010. All CO_2 emissions from this plant are considered to be of biogenic origin.

4.1.5.1.2.2 Establishment of new Mechanical Biological treatment Plants in the North of Malta

WasteServ Malta Ltd is planning to reduce, to the extent possible, the amount of waste being deposited in landfills in Malta, and to utilise waste through energy from waste projects. Biodigestion was highlighted as being an ideal solution. A plant to be constructed in the north of Malta will treat municipal solid waste (MSW) and animal manure.

The construction of the plant is near completion and it is expected that the plant shall be fully functional in 2016.

4.1.5.2 Wastewater Management

4.1.5.2.1 Operation of Urban Waste Water Treatment Plants

The three waste water treatment plants were constructed under the Government's Infrastructure Programme for the upgrading of the national waste water infrastructure. These plants are currently struggling with compliance to the Urban Waste Water Treatment Directive due to the ingress of farmyard waste discharges on an unprecedented level.

4.1.5.2.2 Wastewater Sludge treatment

The Malta South Urban Waste Water Treatment Plant (Malta South UWWTP) is the largest of the three waste water plants constructed under the Government's Infrastructure Programme for the upgrading of the national waste water infrastructure and for achieving compliance with the requirements of the Urban Waste Water Treatment Directive.

The Malta South UWWTP features anaerobic sludge digestion facilities with biogas production and reducing the plant's energy demand on the national grid. Biogas produced is combusted in a CHP plant for energy recovery: the electricity output meets a share of the plant's own operating demand, whereas the waste heat is used up in heating up and maintaining the sludge digesters at 37°C.

4.1.5.2.3 Feasibility Study in Respect of the Development of a Waste to Energy Facility

Malta has commissioned a study to assess the feasibility of introducing a Waste-to-Energy facility in Malta. On the basis of the outcome of this study, it will be possible to determine and further consider the development of a facility, which once operational, will impact the emission projections for Malta. The development of such a facility could reduce emissions emanating from landfill waste and increases the extraction/generation of renewable energy from waste whilst potentially presenting an increase in emissions in the initial start-up of the facility, which would need to be taken into account in future projections of emissions. At this stage, the measure is however limited to a study that looks into the possibility of having a waste-to-energy type of facility which apart from being best suited to meet the needs of our local context (as far as capacity and land use policy is concerned), would be also able to treat a wide range of different waste streams including, but not restricted to, mixed municipal solid waste, commercial and industrial waste, waste oils and sludge, abattoir waste, sewage sludge, landfill leachate concentrate, other hazardous solid, liquid and sludge waste and organic /non-organic waste and which is therefore not impacting emissions.

4.1.6 Land Use, Land Use Change and Forestry

In view of the high population density of the islands and the limited land availability, and to a certain extent the local climatic conditions (such as limited rainfall), the potential for further reduction of CO_2 emissions through carbon sequestration in vegetation is envisaged to be minimal. The woodland areas of the Maltese Islands total about 200 hectares. Native forest is all but extinct, cut down by early colonisers for wood and to clear the land for agriculture and building. These residual woodland areas are now protected by legislation.

In recent years afforestation projects have been undertaken, and have had an effect on the area covered by permanent vegetation, particularly trees; however, the CO_2 removals have not been estimated, given that data availability is sparse.

4.1.6.1 Afforestation Projects

A number of afforestation projects are undertaken by a number of entities as further detailed below.

4.1.6.1.1 34U Campaign

The current 34U campaign is being maintained by the Park, Afforestation and Countryside Restoration (PARKS) Department within the Ministry for Sustainable Development, the Environment and Climate Change.

The objectives of the 34U are the planting of indigenous trees, forestation, increase the surface area with permanent vegetation and recreating tracts of Mediterranean woodland, in order to encourage biodiversity in Malta. Afforestation areas include Foresta 2000 in Mellieħa, Buskett woodland, Salina National Park, Ta’ Qali National Park, Xrobb l-Għaġin Park; rehabilitation of Magħtab closed landfill and various other projects in conjunction with Local Councils, schools and other entities. Data from the official statistics of tree planting is as follows:

Year	No. of trees
2004	7,000
2005	13,000
2006	16,000
2007	25,000
2008	20,000
2009	16,820
2010	7,900
2011	3,000
2012	3,000
2013	2,240

4.1.6.1.2 Ministry for Gozo

The Ministry for Gozo conducts various ecological restoration projects. As from 2010 over 6,103 trees and over 60,714 shrubs/climbers/perennials were planted through the Simbiotic EU Project in places such as Chambray Grove, Three Hills Garden, Il-Qortin ta’ Isopu and Nadur.

4.1.6.2 Natura 2000 Management Plan

Measures within the Natura 2000 Management Plans contain a number of actions to increase the habitat coverage of Annex I habitats and to conserve the existing habitats in a good status. These may indirectly apply as through the expected results the land use would mitigate against CO_2 emissions and indirectly ensure that the habitats' footprint is not otherwise used by a CO_2-generating activity.

4.2 National System for Reporting on Policies and Measures and for Reporting on Projections

4.2.1 Policy Context

While the overarching climate action policy process in Malta remains strongly driven by commitments that the state is bound by at a supra-national level , one must also recognise that in many instances, actions taken for reasons other than the explicit fulfilment of such commitments will have a marked positive impact on national GHG emission trends. In this context, sectoral policy normally lies within the domain of the Ministries, Departments, Government Authorities or Agencies under whose remit a particular sector falls. This can be said to be the first level of policy setting that contributes to meeting GHG emission commitments, through a bottom-up sectoral approach. This is complemented by actions taken by individual industrial enterprises, particularly major para-statal organisations.

There are instances where emissions mitigation considerations are included as elements of other overarching national policy frameworks. To mention some examples:

- The national strategy on sustainable development[55] identified the reduction of greenhouse gas emissions as a priority area that warrants particular attention in order to attain sustainable development goals in Malta;
- The National Environment Policy[56] highlighted the reduction of greenhouse gas emissions as an important element of national environment policy;
- The National Energy Policy[57] mainstreams climate mitigation objectives within the framework which underpins planning of the country's energy future.

Earlier this year, a new impetus has being given to climate policy and action, through the enactment of the Climate Action Act, 2015 CAP 543. This Act serves as the main legal framework for climate action in Malta. It aims to provides for action in order to contribute to the mitigation of climate change by limiting anthropogenic emissions of greenhouse gases and protecting and enhancing greenhouse gas sinks and reservoirs, and to contribute to the prevention, avoidance and reduction of the adverse impacts of climate change and the reduction of vulnerability, enhancement of resilience, and adaptation to the adverse effects of climate change.

4.2.2 Towards establishing a national system for reporting on policies and measures and for reporting on projections

Whilst recognizing the benefits of the initiatives mentioned in the previous section, the effectiveness of activities undertaken as a result of those initiatives will also depend on the reliability of the systems used for monitoring emission mitigation actions, and for disseminating information on such emission mitigation actions, including through formal reporting on policies and measures and on projections.

The Monitoring Mechanism Regulation[58] requires Member States to report information on national policies and measures and on implementation of EU policies and measures that limit or reduce GHG

[55] A Sustainable Development Strategy for the Maltese Islands, National Commission for Sustainable Development, 2006.
[56] National Environment Policy, Ministry for Tourism, Environment and Culture, 2012.
[57] National Energy Policy, Ministry for Resources and Rural Affairs, 2012.

emissions or enhance removals. In addition, Member States shall report to the European Commission national projections of greenhouse gas emissions and removals, including quantitative estimates based on a number of scenarios: projections without measures; projections with measures; projections with additional measures.

Member States are also required to, by the middle of 2015, "*set up, operate and seek to continuously improve national* […] *systems* […] *for reporting on policies and measures and for reporting on projections of anthropogenic greenhouse gas emissions by sources and removals by sinks*."[59] Such systems shall include relevant institutional, legal and procedural arrangements for evaluating policy and making projections of anthropogenic greenhouse gas emissions by sources and removals by sinks. Creating such systems should significantly contribute towards improving transparency, accuracy, consistency, completeness and comparability of information reported and ensuring timely reporting.

In light of Malta's obligations, two actions have been taken in recent months which, in conjunction with the new national climate action legislative framework mentioned previously, serve as building blocks for establishing a national system for the coordination of, and reporting on, emission mitigation activities. Firstly, an Inter-Ministerial Committee has been set up to facilitate cooperation in policy making across sectors in areas of relevance to climate action. This Inter-Ministerial Committee is led by the Ministry for Sustainable Development, Environment and Climate Change (MSDEC) and its first main activity is the preparation of Malta's Low Carbon Development Strategy. In parallel, a Steering Committee on Emissions Modelling and Projections has been established under the auspices of the Malta Resources Authority (MRA), to, among others, "[p]*rovide a forum for coordination of activities relevant to the fulfilment of Malta's obligations relating to reporting on policies and measures and projections of emissions by sources and removals by sinks*"[60].

At present, MRA, through its Climate Change Unit, has prime responsibility for compiling the biennial submissions under the Monitoring Mechanism Regulation as relates to policies and measures and projections. To support its work, MRA has also commissioned the development of a modelling system to facilitate the quantitative assessment of policies and measures and the generation of projections.

4.3 Assessment of the economic and social consequences of response measures

Malta as a Member State of the European Union, designs and implements most of its policies in the framework of EC directives, regulations, decisions and recommendations, which are developed and based on impact assessment system in which all proposals are examined before any legislation is passed.

[58] 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.
[59] Article 12(1) of Regulation (EU) No 525/2013.
[60] Steering Committee on Emissions Modelling and Projections – Terms of Reference, Malta Resources Authority, 2015.

5 Projections

This chapter provides an analysis of GHG emissions projections, taking into account current national circumstances ***and*** the suite of mitigation policies and measures discussed in the previous chapter. In the latter case, any revisions to existing measures or new measures that have been proposed since the submission of the Policies & Measures Report for 2015 to the EU are excluded from this analysis.

The projections reflect the first results of a new modelling approach being developed by Malta for the assessment of policies and measures and the generation of projections, as further explained in the next section. New approaches are also being adopted with regards to the estimation of emissions in certain sectors which, amongst others, take into account the recommendations made to Malta in past reviews. Therefore, caution should be exercised when comparing the figures provided hereunder with previous versions of this report.

The historic data feeding into the sectoral models to estimate GHG emissions projections is the same as reported in the National inventory Report submitted to the UNFCCC in November 2015. In the case of 2014 figures, these consist of the figures reported in the 'approximated inventory' and as submitted to the EU Commission in July 2015.

Two main policy scenarios have been modelled, namely **(1)** the 'Baseline' scenario, which assumes that no further measures are implemented after the reference or base year (taken as 2014) and **(2)** the 'with existing measures' (WEM) scenario, which takes into account currently implemented and adopted policies and measures as at end 2014.

The 'with additional measures' (WAM) scenario, i.e. the projected effect of *planned* policies and measures, has been excluded from this report given that the data submitted by the relevant stakeholders indicate that only one measure (large PV Parks) is considered to fall within this classification (as an 'additional' measure) while the rest of the measures are either existing or implemented. Notwithstanding, efforts are being made to address the lack of information, particularly to translate current and planned strategies being drawn up in various sectors, into quantifiable emission reduction policies and measures.

5.1 Description of the Modelling Framework

This section provides a detailed description of the models used to project emissions up to 2030 by sector and by type of greenhouse gas. A secondary function of these models is to estimate the impact of measures aimed at reducing the emissions relative to a baseline scenario.

5.1.1 Energy Industries Model

Underpinning the projections of emission trends for the energy sector is a modelling exercise developed over 2015. This model serves to extrapolate a 'baseline' scenario covering a period from 1990 to 2030. It measures the GHG emissions from fuels used for electricity generation given present conditions and expected future developments. It therefore enables the analysis of the incremental effect between the baseline scenario and the introduction of new measures to reduce GHG emissions when generating electricity.

The developments being foreseen in this sector required that fuel substitution in favour of cleaner alternatives is based on a cost-optimisation modelling approach whereby the cheapest fuel types or more efficient generation alternatives are given priority. This assumption is superseded by policy decision e.g. mandatory use of renewable energy sources, irrespective of their cost.

The fuel switching depends on four factors, namely the potential for renewables capacity, which consists of solar, wind and Waste to Energy (W2E), as well as the supply mix between natural gas (NG) and the interconnector between Malta and Sicily. Moreover, other influencing factors are the NG generation efficiency and final electricity demand.

The final electricity demand is based on a number of exogenous factors, which include GDP, end users' energy efficiency, which is increased by products such as solar water heaters and energy saving light bulbs and energy substitution (the extent to which NG is substituted for electricity), distribution losses (energy lost during the distribution channel) and electricity prices.

Electricity prices depend on the cost of electricity generation from both renewable and non-renewable sources - solar, wind, W2E, gasoil, NG and the interconnector - and on the price of carbon emissions.

The relationships described above are presented in graphical form in Figure 5-1 and are summarized as follows:

(1) An increase in GDP impacts emissions through the following channels:
   a) Increase in final electricity demand;
   b) Increase in use of NG for electricity generation;
   c) Increase in emissions from NG for electricity generation.

(2) The impact of a decrease in the price of solar energy would:
   a) Decrease in the cost of electricity generation;
   b) Decrease in electricity pricing;
   c) Increase in final electricity demand;
   d) Increase in use of NG for electricity generation;
   e) Increase in emissions from NG for electricity generation.

However, the increase in emissions from NG is offset by the increase in solar energy capacity caused by the decrease in the price of solar energy. The effects of an increase in solar capacity would:

   a) Decrease in use of NG for electricity generation;
   b) Decrease in emissions from NG for electricity generation.

(3) An increase in end user energy efficiency impacts on emissions through the following channels:
   a) Decrease in final electricity demand;
   b) Decrease in use of fossils fuels used for electricity generation;
   c) Decrease in emissions from fossil fuels used for electricity generation.

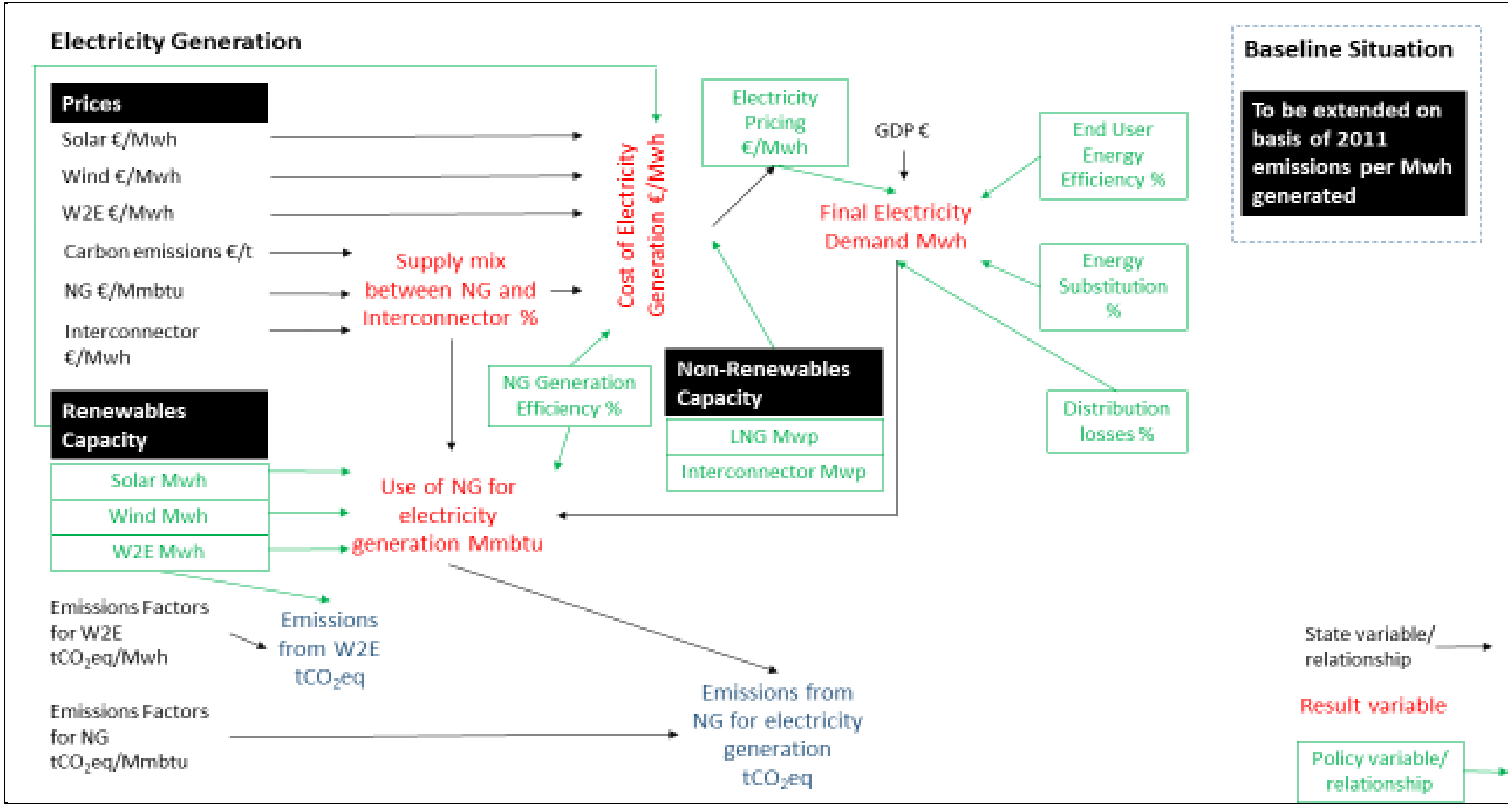

Figure 5-1 Energy Industries Modelling Framework

A brief description of the equations underpinning the key factors making up the 'energy industries' model is presented below.

5.1.1.1 Fossil Fuel in Te

$$\frac{\text{Cost of CO}_2^{\text{Elasticity of fossil fuel in Te}} \times \text{Fossil fuel mix}^{\text{Elasicity of fossil fuel in Te}} \times \text{Interconnector}^{\text{Elasticity of fossil fuel in Te}}}{8}$$

The percentage use of fossil fuel in tonnes of energy (Te) depends on the cost of Carbon Dioxide (CO_2), the cost of fossil fuel mix, cost of interconnector and the elasticity of fossil fuel with respect to the above mentioned variables. In other words the percentage use of fossil fuel in Te depends on the responsiveness of fossil fuel to the cost of CO_2, fossil fuel mix and the interconnector. The numerator is divided by a constant figure, which represents a standardised baseline value to obtain the percentage value use of fossil fuel.

5.1.1.2 Cost of electricity generation

$$\frac{\begin{gathered}[(Cost\ of\ solar\ energy \times Supply\ of\ solar\ energy) + \\ (Cost\ of\ wind\ energy \times Supply\ of\ wind\ energy) + \\ (Cost\ of\ W2E \times Supply\ of\ W2E) \times 8760\ hours] \times \\ [Fossil\ fuel\ mix\ in\ Te \times Cost\ of\ fossil\ fuel\ mix \times Fossil\ fuel\ efficiency + 30] \\ + [IC\ in\ TE \times Cost\ of\ IC]\end{gathered}}{(Supply\ of\ fossil\ fuel\ mix + IC) \times 8760\ hours + Supply\ of\ solar, wind\ and\ W2E}$$

The cost of electricity generation depends on the amount supplied from each energy source and its cost per unit supplied. The total cost of renewables is multiplied by 8760 hours to obtain the total cost of energy generated per annum. The cost of electricity generated from fossil fuel also depends on its efficiency and other operating costs, denoted by 30. The numerator representing the total cost of energy supplied from different source of energy is divided by the total supply of energy mix to obtain the cost of electricity generated per unit of Megawatt hour (MWh).

5.1.1.3 Electricity price

$$Cost\ of\ electricity\ generation \times Electricity\ price\ to\ generation\ cost\ ratio$$

The electricity price depends on the cost of generating electricity (equation 2) and the electricity price to generation cost ratio. This ratio relates the price charged for electricity to consumers to the cost incurred for generating electricity to meet the final electricity demand.

5.1.1.4 Final electricity demand

$$[GDP^{Final\ demand\ to\ GDP\ elasticity} \times Electricity\ price \times 20 \times$$

$$(1 - \frac{End\ use\ Efficiency}{100})\ 0\left(1 + \frac{Efficiency\ distribution\ loss}{100}\right)$$

Final electricity demand depends on GDP and its responsiveness to GDP, the electricity pricing and other variable costs. It also depends on the end users'energy efficiency, which increase as consumption efficiency of electricity increases reducing electricity demand overtime and distribution losses which increase demand for electricity to make up for energy lost along the distribution channel.

5.1.1.5 Use of fossil fuel mix:

$$(Final\ electricity\ demand - Supply\ of\ wind, solar\ and\ W2E) \times$$

$$Fossil\ Fuel\ mix\ in\ Te \times Efficiency\ in\ Million\ mbtu\ Fossil\ Fuel\ primary\ /Mwhe\ final$$

The amount of fossil fuel mix used is dependent on the demand for electricity (equation 4) net energy generation from renewable energy (wind, solar and W2E) since the interconnector is given first priority before fossil fuel for demand exceeding renewable capacity. The use of fossil fuel mix also depends on the percentage use of fossil fuel mix in Te (equation 1) and its efficiency.

5.1.1.6 Emissions from fossil fuels

$$Supply\ of\ fossil\ fuels \times Emissions\ of\ fossil\ fuel\ mix\ in\ tC0_2eq/Mmbtu\ primary$$

The emissions from fossil fuels depends on the amount of fossil fuels used in generation of electricity and its emissions in tonnes of CO_2 equivalent generated per Mmbtu (Million British Thermal Unit) of fossil fuel mix.

5.1.1.7 Emissions from W2E

$$Supply\ of\ W2E \times Emissions\ of\ W2E\ in\ tCO_2eq/Mwhe$$

The emissions from fossil fuels depends on the amount of W2E used in generation of electricity and its emissions in tonnes of CO_2 equivalent generated per MWhe (Megawatt hour of electricity) of W2E.

5.1.1.8 Emissions of CO_2 (HFO):

$$[Final\ electricity\ demand - (Supply\ of\ solar,\ wind,$$
$$W2E)]\ Fossil\ fuel\ mix\ in\ Te \times Weight\ of\ HFO\ in\ mix \times$$
$$Efficiency\ of\ HFO\ in\ Mmbtu\ HFO\ primary\ per\ Mwhe\ final \times$$
$$Emissions\ factor\ of\ CO_2\ from\ HFO \times GHG\ potential\ of\ CO_2$$

The amount of CO_2 emitted from fossil fuel depends on the amount of electricity demand excluding electricity generated from renewable energy (wind, solar and W2E), the amount of fossil fuel used for electricity generation to meet the demand as well as the weight of heavy fuel oil (HFO) in mix, which represents the percentage of HFO used in the total mix of energy used to generate electricity. It also depends on the efficiency of HFO to generate electricity (in Mmbtu/primary MWhe), the amount of CO_2 emitted from the combustion of HFO and its contribution to global warming.

5.1.1.9 Emissions of CH_4 (HFO)

$$[\text{Final electricity demand - (Supply of solar, wind, W2E)}]\ Fossil\ fuel\ mix\ in\ Te \times Weight\ of\ HFO\ in\ mix \times \text{Efficiency of HFO in Mmbtu HFO primary per Mwhe final} \times \text{Emissions factor of } CH_4 \text{ from HFO} \times GHG\ potential\ of\ CH_4$$

The amount of CH_4 emitted from fossil fuel depends on the amount of electricity demand, net renewable energy (wind, solar and W2E), the amount of fossil fuel used as well as the weight of heavy fuel oil (HFO) in mix of energy used to generate electricity. Moreover, it depends on the efficiency of HFO, the amount of Methane (CH_4) generated from HFO and its global warming potential.

5.1.1.10 Emissions of N_2O (HFO)

$$[\text{Final electricity demand - (Supply of solar, wind, W2E)}]\ Fossil\ fuel\ mix\ in\ Te \times Weight\ of\ HFO\ in\ mix \times \text{Efficiency of HFO in Mmbtu HFO primary per Mwhe final} \times \text{Emissions factor of } N_20 \text{ from HFO} \times GHG\ potential\ of\ N_20$$

The amount of N_2O emitted from fossil fuel depends on the amount of electricity demand, net renewable energy (wind, solar and W2E), multiplied by the amount of fossil fuel used as well as the percentage of HFO used in the total mix of energy to generate electricity. It also depends on the efficiency of HFO, the amount of Nitrous Oxide (N_2O) generated from HFO and its global warming potential.

5.1.1.11 Emissions of CO_2 (Gasoil)

$$[\text{Final electricity demand - (Supply of solar, wind, W2E)}]\ Fossil\ fuel\ mix\ in\ Te \times Weight\ of\ gasoil\ in\ mix \times \text{Efficiency of gasoil in Mmbtu gasoil primary per Mwhe final} \times \text{Emissions factor of } CO_2 \text{ from gasoil} \times GHG\ potential\ of\ CO_2$$

The amount of CO_2 emitted from fossil fuel depends on the amount of electricity demand, net electricity generated from renewable energy (wind, solar and W2E), the amount of fossil fuel used as well as the weight of gasoil in mix, which represents the percentage of gasoil used in the total mix of energy to generate electricity. It also depends on the efficiency of gasoil, the amount of CO_2 generated from gasoil and its global warming potential.

5.1.1.12 Emissions of CH_4 (Gasoil)

$$[\text{Final electricity demand - (Supply of solar, wind, W2E)}]\ Fossil\ fuel\ mix\ in\ Te \times Weight\ of\ gasoil\ in\ mix \times \text{Efficiency of gasoil in Mmbtu gasoil primary per Mwhe final} \times \text{Emissions factor of } CH_4 \text{ from gasoil} \times GHG\ potential\ of\ CH_4$$

The amount of CH_4 emitted from fossil fuel depends on the amount of electricity demand, net renewable energy (wind, solar and W2E), multiplied by the amount of fossil fuel used as well as the weight of gasoil in mix of energy to generate electricity. It also depends on the efficiency of gasoil, the amount of CH_4 generated from gasoil and its global warming potential.

5.1.1.13 Emissions of N_2O (Gasoil)

$$[\textit{Final electricity demand - (Supply of solar, wind, W2E)]} \textit{ Fossil fuel mix in Te} \times \textit{Weight of gasoil in mix} \times \textit{Efficiency of gasoil in Mmbtu gasoil primary per Mwhe final} \times \textit{Emissions factor of } N_2O \textit{ from gasoil} \times \textit{GHG potential of } N_2O$$

The amount of N_2O emitted from fossil fuel depends on the amount of electricity demand, net renewable energy (wind, solar and W2E), the amount of fossil fuel used, the weight of gasoil in mix of energy to generate electricity, its efficiency, the amount of N_2O generated from gasoil and its global warming potential.

5.1.1.14 Emissions of CO_2 (NG)

$$[\textit{Final electricity demand - (Supply of solar, wind, W2E)]} \textit{ Fossil fuel mix in Te} \times \textit{Weight of NG in mix} \times \textit{Efficiency of NG in Mmbtu fossil fuel primary per Mwhe final} \times \textit{Emissions factor of } CO_2 \textit{ from NG} \times \textit{GHG potential of } CO_2$$

The amount of CO_2 emitted from fossil fuel depends on the amount of electricity demand, net renewable energy (wind, solar and W2E), multiplied by the amount of fossil fuel used as well as the weight of NG in mix of energy to generate electricity. It also depends on the efficiency of NG, the amount of CO_2 generated from NG and its global warming potential.

5.1.1.15 Emissions of CH_4 (NG)

$$[\textit{Final electricity demand - (Supply of solar, wind, W2E)]} \textit{ Fossil fuel mix in Te} \times \textit{Weight of NG in mix} \times \textit{Efficiency of NG in Mmbtu fossil fuel primary per Mwhe final} \times \textit{Emissions factor of } CH_4 \textit{ from NG} \times \textit{GHG potential of } CH_4$$

The amount of CH_4 emitted from fossil fuel depends on the amount of electricity demand, net renewable energy (wind, solar and W2E), multiplied by the amount of fossil fuel used as well as the weight of natural gas (NG) in mix of energy to generate electricity. It also depends on the efficiency of NG, the amount of CH_4 generated from NG and its global warming potential.

5.1.1.16 Emissions of N_2O (NG)

$$[\textit{Final electricity demand - (Supply of solar, wind, W2E)]} \textit{ Fossil fuel mix in Te} \times \textit{Weight of NG in mix} \times \textit{Efficiency of NG in Mmbtu fossil fuel primary per Mwhe final} \times \textit{Emissions factor of } N_2O \textit{ from NG} \times \textit{GHG potential of } N_2O$$

The amount of N_2O emitted from fossil fuel depends on the amount of electricity demand, net renewable energy (wind, solar and W2E), multiplied by the amount of fossil fuel used as well as the weight of natural gas (NG) in mix of energy to generate electricity. It also depends on the efficiency of NG, the amount of N_2O generated from NG and its global warming potential.

5.1.1.17 Fuel combustion in Energy Industries

Emission projections relating to energy industries take into account additional savings from demand-side measures and renewable energy projects and schemes (over and above efficiency savings occurring directly at the generation source e.g. by switching to a more efficient turbine). These demand-side emission savings include energy usage by waste facilities and waste water treatment plants, emissions due to a waste-to-energy facility, emissions from charging electrical vehicles and savings from energy efficiency measures, which in general will meet or reduce part of the demand that would otherwise have to be met by electricity generated at the power plants or imported from the European grid.

The estimation of emission savings from demand-side measures and measures related to renewable energy sources are calculated on the basis of emissions per unit MWh as estimated for each year, taking into account the contribution of both the local electricity generating plants and electricity imported via the interconnection with mainland Europe.

5.1.2 Road Transport Model

GHG emissions and projections from road transportation were based on a model developed over 2015. This model serves to extrapolate a baseline scenario covering a period from 1990 to 2030. It also identifies the impact of existing or new measures on road transport, when it comes to the generation of GHG emissions. It enables the analysis of the incremental effect between the baseline scenario and the introduction of new measures on GHG emissions from road transport.

This model is divided into two categories, these being passenger vehicles and cargo transport. Each category is further analysed by subdividing into type of transport mode and fuel type. The source data was extracted from the COPERT database, which in turn, is populated by data of each licensed vehicles in Malta.

This calculation of the GHG emissions in road transportation are therefore a direct result of the characteristics of the vehicle fleet and assumption their usage. The main variables that were identified as being key factors are the following:

- Fuel/km;
- Average Number of Passengers or Average Tonnes in the case of cargo vehicles;
- Km/yr;
- Passenger km/yr or Tonne km/yr;
- Fuel/yr.

Data was collected for the year 2012 representing the base year for the road transport model. This was back-casted to 1990 by calibrating the fuel used by type of vehicle with the total fuel sold in the inland market for road transportation. This calibration exercise assumed that the share of fuel by type of vehicle remained constant over the period 1990-2011. This implies that vehicle fuel efficiency was also constant throughout this time series. Notwithstanding, further studies are being carried out with the relevant stakeholders to further refine these assumptions.

Data for fuel/km, average passenger (or average tonnes in the case of cargo) and km/year was extracted from the COPERT database whilst figures for passenger (tonnes) km/yr and fuel/yr are calculated as follows:

$$Passenger\ (tonnes)\ km/yr = km/yr\ /\ Average\ Passengers\ (average\ tonnes)$$

$$Fuel/yr = Passenger\ (tonnes)\ km/yr\ x\ Passenger\ (tonnes)\ Fuel/km$$

A brief description of the equations underpinning the key factors making up the transport model is presented below.

5.1.2.1 CO_2/yr (000t)

$$\frac{Fuel/yr\ (Tj) \times CO_2/TJ}{1{,}000}$$

The amount of CO_2 emitted per annum depends on the amount of fuel used per annum and the amount of CO_2 it emits per terajoule (TJ). This is then converted into thousand tonnes (000t).

5.1.2.2 CH_4/yr (000t)

$$\frac{Fuel/yr\ (Tj) \times\ CH_4/TJ}{1{,}000}$$

The amount of CH_4 emitted per annum is found by multiplying the amount of fuel used per year and the emission of CH_4 from fuel per TJ. This is then converted into thousand tonnes (000t).

5.1.2.3 N_2O/yr (000t)

$$\frac{Fuel/yr\ (Tj)\ \times\ N_2O/TJ}{1{,}000}$$

The amount of N_2O emitted per annum depends on the amount of fuel used per year and its N_2O emissions per TJ which is then converted into thousand tonnes (000t).

5.1.2.4 CO_2eq (000t)

$$CO_2/yr\ (000t) + (CH_4/yr\ (000t) \times GHG\ potential\ of\ CH_4) + (N_2O/yr\ (000t) \times GHG\ potential\ of\ N_2O)$$

The conversion of GHG (CO_2, CH_4 and N_2O) into CO_2 equivalent depends on the amount of GHG used in thousand tonnes multiplied by their global warming potential.

The projected future emissions from road transport take into account existing measures (WEM scenario) against a baseline scenario. For the purposes of this projection, no differentiation is made in respect of emission efficiency of different types of vehicles. It is assumed that autogas will partially substitute petrol, while biogenic emissions from biodiesel and the biogenic part of bio-ETBE are not included.

Public transport modal shift is projected to increase from 1% shift in 2012 to 8% shift by 2019, while the projecting of emission savings due to the public transport reform does not differentiate between efficiencies of the old and new bus fleets; the change in fleet is expected to have a more marked impact on air quality rather than greenhouse gas emissions. With this methodological approach, the fact that the new public transport system covers a total route distance greater than the coverage under the previous bus network, an increase in emissions has been projected for the public transport reform measure.

With regards to the measure related to the introduction of electric vehicles, the overall effect will depend very much on the nature of the source of electricity used. Assuming that electricity will be sourced from conventional local electricity generation plant, the effect of this measure is better described as a displacement of an amount of emissions from the transport sector to the electricity industries sector.

5.1.3 Industrial Processes and Other Product Use (IPPU) Model

Industrial Processes and Product Use (IPPU) covers GHG emissions occurring from industrial processes, from the use of GHG in products, and from non-energy uses of fossil fuel carbon. Industrial processes are the major sources of GHG emissions including CO_2, CH_4, N_2O and HFCs by chemically or physically transform materials like iron and steel, ammonia and other chemical products manufactured from fossil fuels used as chemical feedstock and the cement industry. The abovementioned GHG gases are also used in products such as refrigerators, foams or aerosol cans. Product use are often combined with the industrial process because production and import/export data is required to estimate emissions in a product and product use may also occur as part of industrial activities.

Over 2015, a model was developed to measure the GHG emissions from industrial processes over a time-period covering 1990-2030. The IPPU model includes two scenarios, these being the baseline and WEM scenarios. The base year for this model is taken to be 2014 while projections are estimated thereon. This model allows for the introduction of new measures affecting the generation of GHG emissions in IPPU. The results obtained for the WEM scenario are identical to those obtained from the Baseline with the only difference being the impact of the new measures, and thus allows for the identification of the incremental impact relative to the baseline scenario.

The model takes into consideration five different sectors, namely; residential (domestic), commercial, ships, transport and stationary (includes large exhaust stacks like boilers and furnaces burning fossil fuel typically found in power and industry sectors) sectors. It estimates the stock and imports of a list of gases generated from the abovementioned sectors contributing to global warming from 2014 onwards based on historical data including demand, imports, stock and historic emissions. A brief description of the equations underpinning the key factors making up the IPPU model is presented below.

5.1.3.1 To forecast stock from 2013 onwards

$$\textit{Stock in 2013} \times (1 - \textit{emission factor} + \textit{reuse}) + \textit{imports}$$

The stock forecast depends on the stock in existence from previous year, the amount escaped through emissions and the amount reused. This is then added to the amount imported.

5.1.3.2 To forecast imports from 2013 onwards

Stock in 2013 × (1 + activity growth) × exp(efficiency improvement) – (1 - emission factor + reuse)

The forecast of imports depends on the stock level from the previous year, the sector or activity growth rate and the improvement in efficiency which increases exponentially. It also depends on its emission factor or fugitives which have to be replaced and the amount of gases that will be reused and thus deducted from the amount to be imported.

5.1.3.3 To forecast activity growth from 2013 onwards

The forecast of activity growth depends on the activity indicators and its stock elasticity to the activity indicator.

[Domestic: Private consumption × Elasticity of activity growth to household consumption
Commercial: GDP × Elasticity of activity growth to GDP

In case of the domestic sector, the activity indicator used is private consumption, whilst GDP is used for the commercial sector.

In view of the limited nature of activities under the sectors Industrial Processes and Product Use, the main potential for emission savings is the implementation of the F-gases Regulation. A reliable estimation of the effect of this measure is not yet possible; however, the regulation is expected to influence greatly the manner and extent to which fluorinated gases are used in future, and thus, for the purposes of this discussion, it is assumed that emissions will eventually almost stabilise.

5.1.4 Agriculture Model

In agriculture, future GHG emission trends may be influenced both by measures taken to address directly emissions or measures that indirectly contribute towards decreasing emissions, and by inherent trends in activity in the sector. In animal husbandry for example, the restructuring of the sector to conform to animal welfare, food safety, veterinary and waste management requirements, particularly those arising from EU legislation, will lead directly to a decrease in emissions due to reduced activity or reduction in emissions from the realization of the requirements already mentioned. Land under cultivation is also decreasing and water scarcity could further compound this trend; this could have a beneficial effect in terms of GHG emissions.

A model was developed over 2015 to estimate the projections of activity data from which enteric emissions and manure emissions from agriculture waste are calculated. The activity data consisted of the number of animal heads including cattle, swine, sheep, goats, horses, poultry and rabbits. The projections were based on a five-year moving average taking actual data for 2014 as the base year. These various animal heads were subsequently sub-divided by age group and/or by type, for example cattle was first sub-divided between dairy and non-dairy and subsequently each division was sub-divided again for cattle aged less than 1 year, between 1 and 2 years of age and over 2 years of age. This approach allowed for greater precision in the estimation of emissions from livestock. The model covers projections of GHG emissions over a period spanning 1990 – 2030.

5.1.5 Land Use, Land-use Change and Forestry

The growth in the level of sequestration of carbon by trees is not expected to be major. For the purposes of projecting emissions savings, further tree planting is assumed to be discontinued and the sequestration level is assumed to remain constant.

5.1.6 Waste Model

The approach to projecting future trends for emissions from the waste sector is based on the same methodology used for the estimation of historic sector emissions for the national greenhouse gas inventory, whilst incorporating a number of assumptions, including that current trends in generation of municipal solid waste per capita and industrial waste per unit GDP remain applicable for the projection timeseries, that future landfilling facilities are managed to current standards and that methane generated from biological treatment of waste is flared with all emissions resulting from this being considered as biogenic.

To aggregate the impact of these assumptions, a model was developed over 2015 with the explicit purpose to measure GHG emissions from domestic, commercial and industrial waste. GHG emissions from waste are forecasted up to 2030 using the following regressions.

5.1.6.1 Estimation of MSW (Municipal Solid Waste) generated

$$Ln(MSW/capita) = -\alpha + \beta_1 ln(GDP/capita) - \beta_2 (time)$$

$$ln(MSW/capita) = -6.54 + 1.399\, ln(GDP/capita) - 0.040\, (Time)$$

This means that the municipal solid waste generated per capita depends on the GDP per capita and time. No activity will result into negative generation of waste represented by the negative relationship between MSW and the intercept. However, a percentage change in GDP per capita will cause a rise of 1.4% in MSW per capita but it is expected to decline overtime. Overtime, MSW per capita falls by 0.04%. The MSW generated (000t) annually is forecasted as follows:

$$\textbf{000tIndW generated forecast} = EXP\,(-6.54 + 1.399\, ln\,(Waste/GDP) - 0.040(Time))*GDP$$

5.1.6.2 Estimation of IndW (Industrial waste) generated:

$$Ln(IndW/GDP) = -\alpha + \beta_1(Time) - \beta_2(Dummy)$$

$$Ln(IndW/GDP) = -17.728 - 0.116\, (Time) + 0.959\, (Dummy)$$

The ratio of industrial waste generation to GDP depends on time and a dummy variable to account for variability in the data provided. At time zero and dummy variable zero the activity waste generation is negative. Overtime, as time changes, industrial waste per unit of GDP is expected to decrease by 0.116 tonnes represented by the negative relationship between IndW/GDP and time.

The IndW generated (000t) annually is forecasted as follows:

$$\textbf{000tIndW generated forecast} = EXP\,(-17.728 - 0.116\,(Time) + 0.959(Dummy))*GDP$$

5.2 Assessment of the Sectoral & Aggregated Impact of the Policies and Measures

This section provides a detailed analysis of the impact of the policies and measures in reducing GHG emissions over a time period covering 2015 - 2030 with respect to the baseline scenario. In the first part, an overview of historical emissions as reported in the GHG inventory is presented. Subsequently, a comparative exercise is undertaken between the baseline and WEM scenarios for each sector in order to highlight those sectors that are projected to exhibit the largest change in GHG emissions. Subsequently, a comparison at a more aggregated level is carried out, whereby the total projected net emissions of the ESD and ETS sectors are compared for the WEM and baseline scenarios, respectively. Lastly, a comparison by type of GHG for both scenarios up to a horizon of 2030 is illustrated.

As stated above, the projections build upon a time series of historic emissions covering 1990 to 2013. The figures for 2014 have been used as per the GHG Approximated Inventory.

Efforts continue to be made to update projections of all relevant sectors so as to better reflect the evolving local policy framework and associated actions, with an emphasis on those sectors with a particularly significant impact on overall projected emission trends. These include changes in policy direction, changes in the econometric estimation of a particular sector, the provision of new data and timing in the collection or revisions in the various data streams. This implies that whenever there is a significant update, the probability is that there will be significant movements (either upwards or downwards, as the case may be) in the results as compared to the previous submissions. This issue is further compounded by the small scale numbers inherent in Malta's absolute emissions were a small change in a large contributing sector will have a disproportionate impact on the total emissions. Thus, it is important that updated projections will be duly published when completed.

5.2.1 Impact of the Policies and Measures on GHG Emissions for Malta

Table 5-1 below shows the emission projections split by sector and by gas for the years 2015, 2020, 2025 and 2030, for the WEM scenario while the trends are illustrated in Figure 5-2 to Figure 5-6 underneath. A detailed description of the trends observed in these Figures is presented in the following Section.

Table 5-1 Emission projections (in Gg CO_2 equivalent) split by sector and by gas for the 'with existing measures' scenario

		2015	2020	2025	2030
Energy Industries	CO_2	738.98	754.47	777.19	786.68
	CH_4	0.74	0.75	0.77	0.78
	N_2O	0.55	0.56	0.58	0.59
		740.27	755.79	778.55	788.05
Transport	CO_2	569.45	489.80	432.89	379.47
	CH_4	0.08	0.06	0.06	0.05
	N_2O	0.02	0.02	0.01	0.01
		569.54	489.88	432.96	379.53
Other energy	CO_2	163.49	192.03	220.58	249.13
	CH_4	0.53	0.62	0.71	0.80
	N_2O	0.36	0.42	0.48	0.55
		164.37	193.07	221.77	250.48
Industrial Processes	CO_2	0	0	0	0
	CH_4	0	0	0	0
	N_2O	0	0	0	0
	F-gases	176.35	196.67	215.56	230.00
		176.35	196.67	215.56	230.00
Agriculture	CH_4	59.10	49.53	40.87	34.29
	N_2O	27.90	23.41	20.77	18.72
		87.00	72.94	61.64	53.02
Waste	CO_2	0.39	0.39	0.39	0.39
	CH_4	133.41	156.55	168.11	177.18
	N_2O	0.00	0.00	0.00	0.00
		133.79	156.94	168.49	177.57
LULUCF	CO_2	-2.98	-2.98	-2.98	-2.98
TOTAL BY GAS	CO_2	1472.30	1436.69	1431.05	1415.66
	CH_4	193.84	207.52	210.51	213.11
	N_2O	28.83	24.41	21.85	19.87
	F-gases	176.35	196.67	215.56	230.00
TOTAL EMISSIONS		1871.32	1865.29	1878.97	1878.64

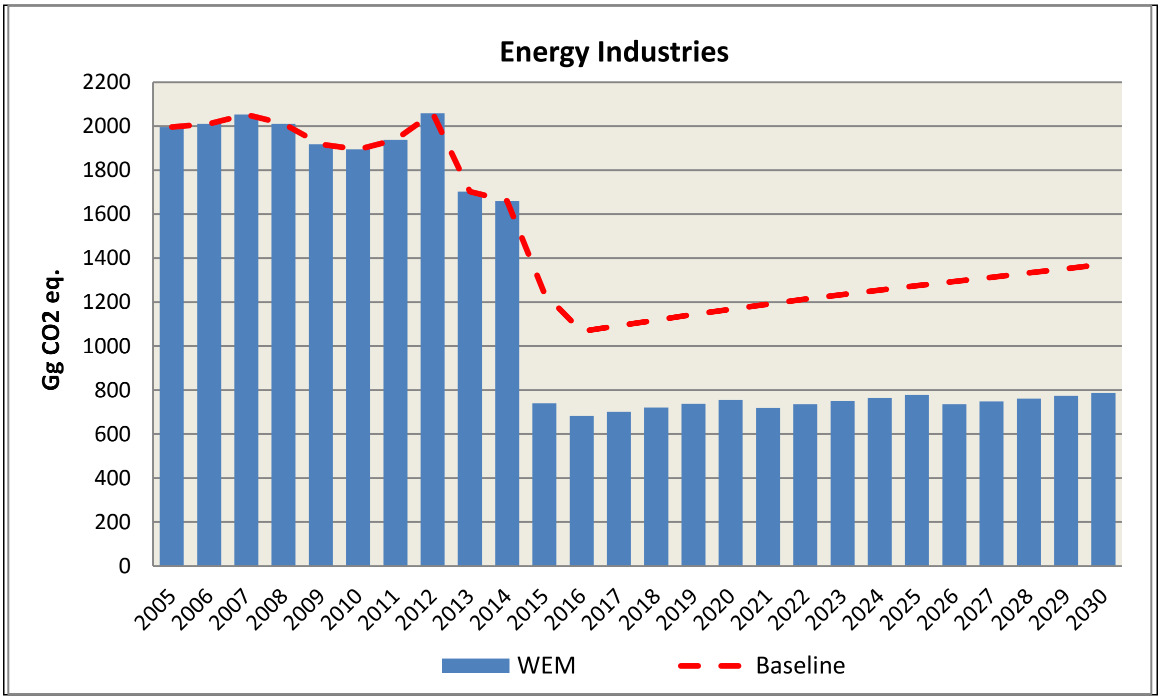

Figure 5-2 Projections of greenhouse gas emissions for energy industries

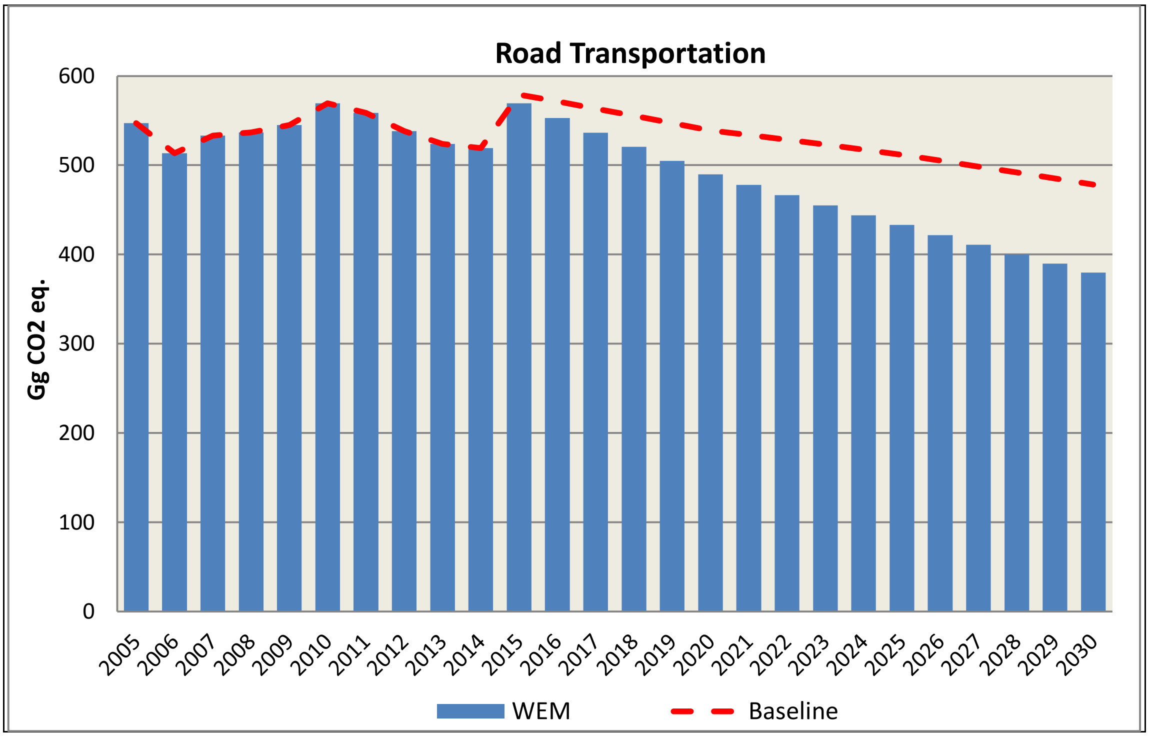

Figure 5-3 Projections of greenhouse gas emissions for road transport

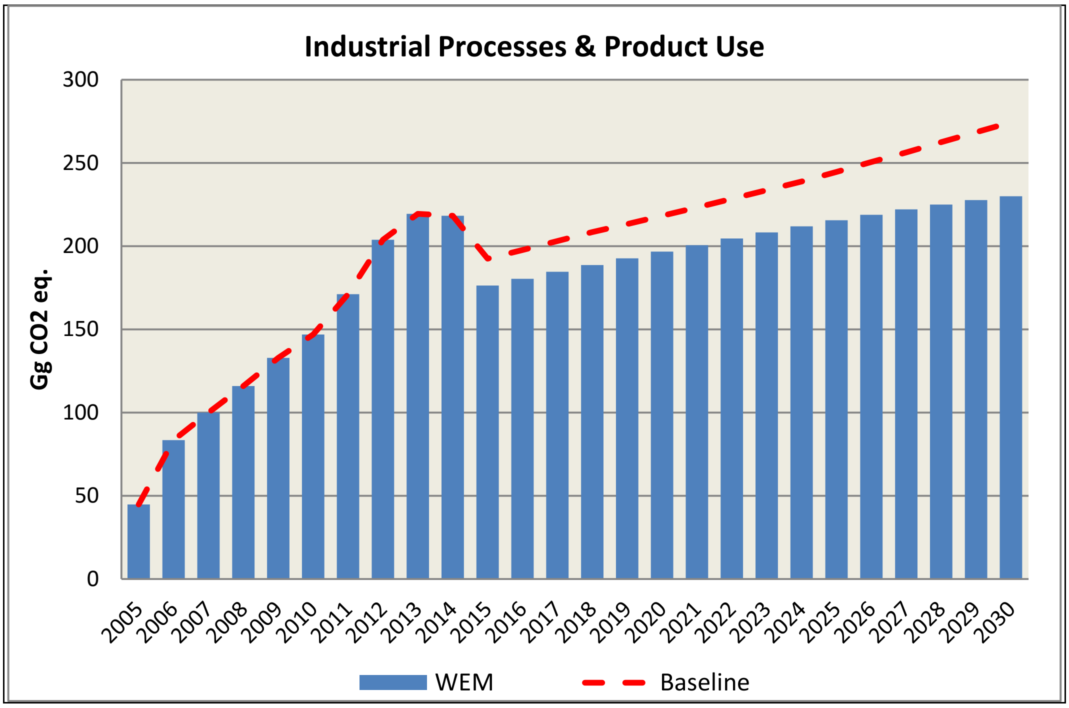

Figure 5-4 Projections of greenhouse gas emissions for industrial processes and product use

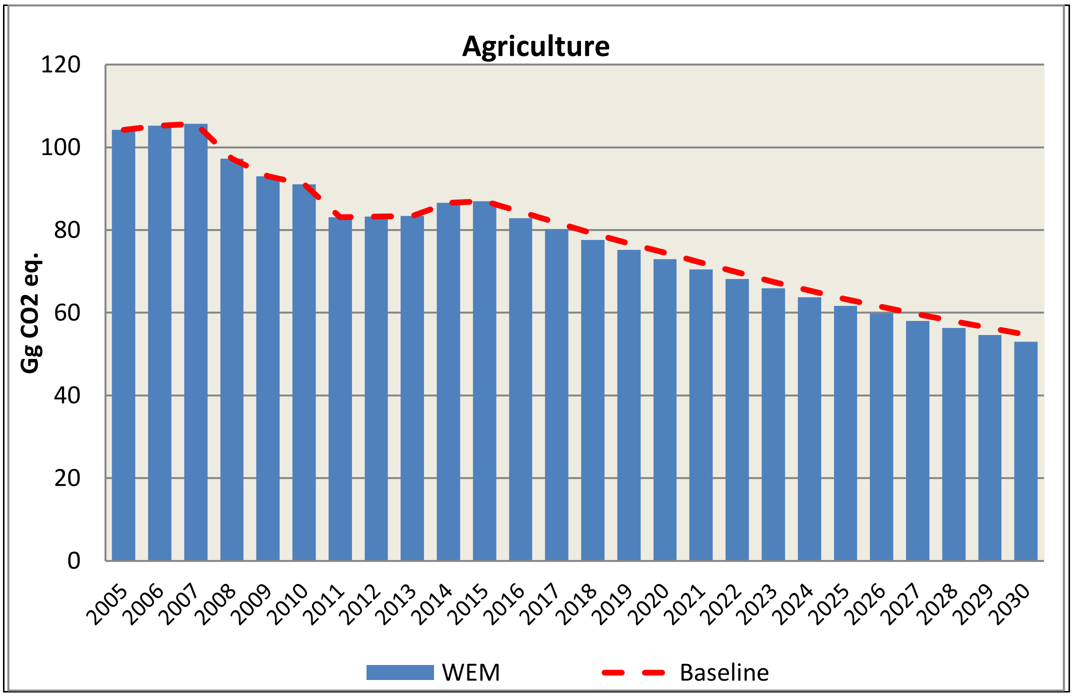

Figure 5-5 Projections of greenhouse gas emissions for agriculture

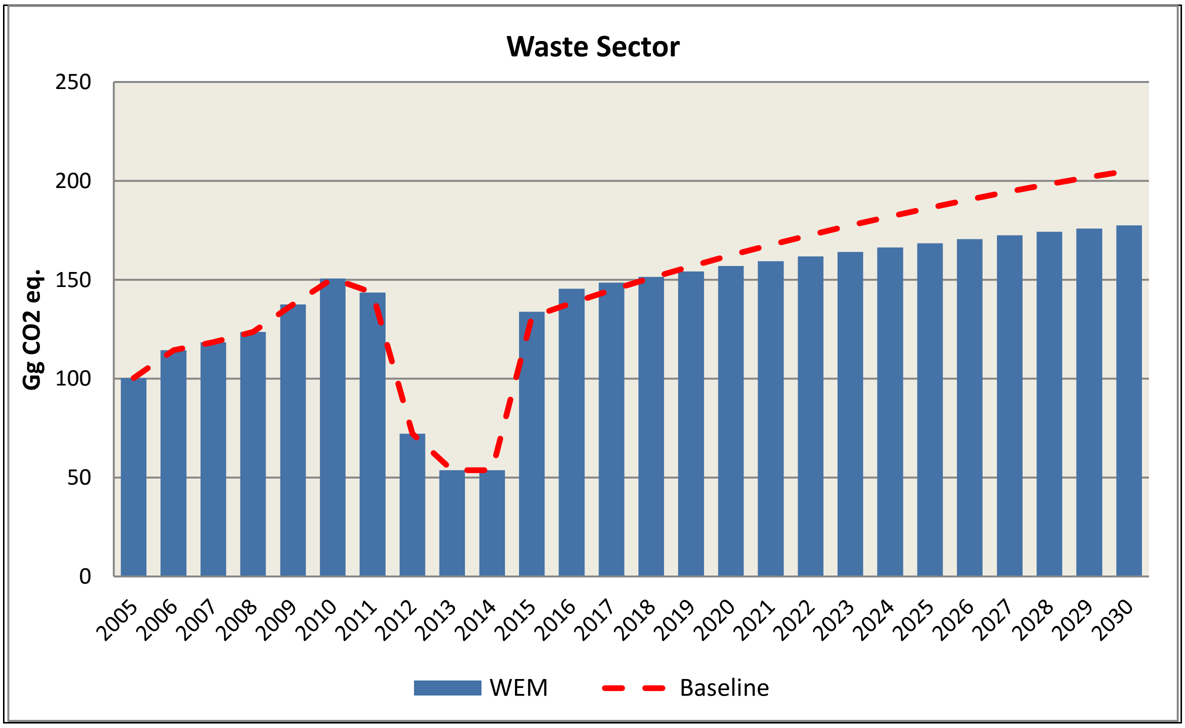

Figure 5-6 Projections of greenhouse gas emissions for waste

The aggregated effect of the policies and measures is illustrated in Figure 5-7 to Figure 5-8 below. The impact of measures implemented in the electricity generation sector have a significant impact on total national net emissions as clearly reflected in the drop in projected emissions from 2015 onwards. This downwards shift in emissions is largely due to the switch to the interconnector, the substitution of heavy fuel oil in favour of natural gas and the switching to more efficient generation turbines, as further detailed in the following section.

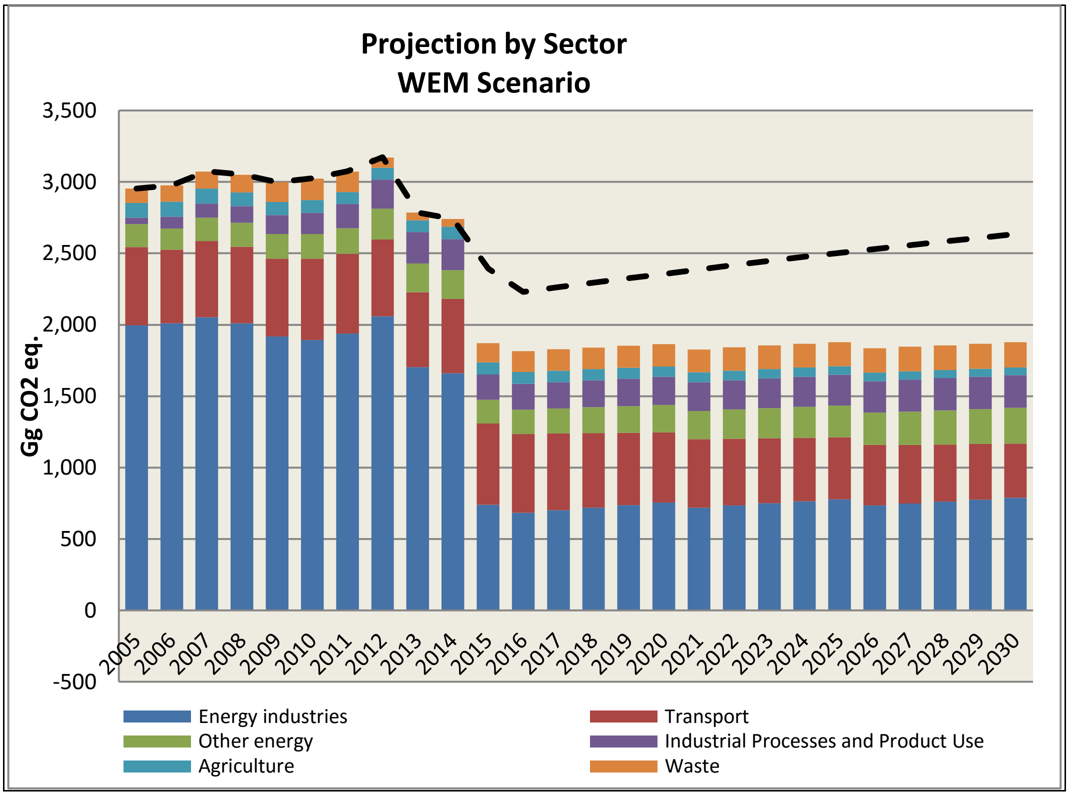

Figure 5-7 Projections (WEM) of total emissions differentiated by sector

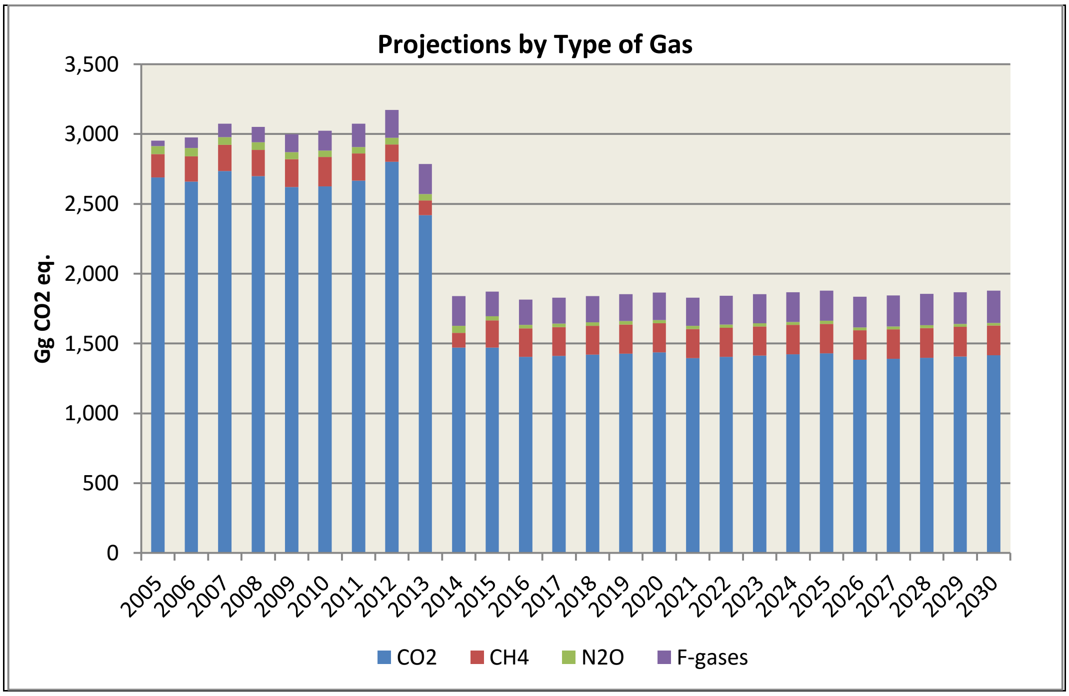

Figure 5-8 Projections (WEM) of total emissions differentiated by gas

5.3 Detailed Analysis of the Policies & Measures on Sectoral GHG Emissions

5.3.1 Fuel Combustion in Energy Industries

The energy sector includes emissions from fuel combustion activities, namely, public electricity and heat production, fuel combustion in manufacturing industries and construction, commercial and institutional, residential, agriculture, forestry and fisheries, and transport.

GHG emissions from electricity generation are the main contributors to national GHG emissions. These emissions follow trends in electricity demand and the supply characteristics (and dispatching) of generation sources. In turn, the major factors influencing electricity demand and which are considered relevant to the assessment of future GHG emissions in this sector are:

- expected growth in economic activity;
- expected developments in electricity retail prices;
- the implementation of electricity efficiency measures.

Changes in weather and climatic conditions can also be expected to have an influence, albeit with an effect that is difficult to predict at this stage.

Figure 5-9 shows the demand of electricity in Malta between 2000 and 2014. The demand has fluctuated under the influences mainly of GDP growth (representing trends in economic activity) and changes in retail electricity tariffs, amongst others.

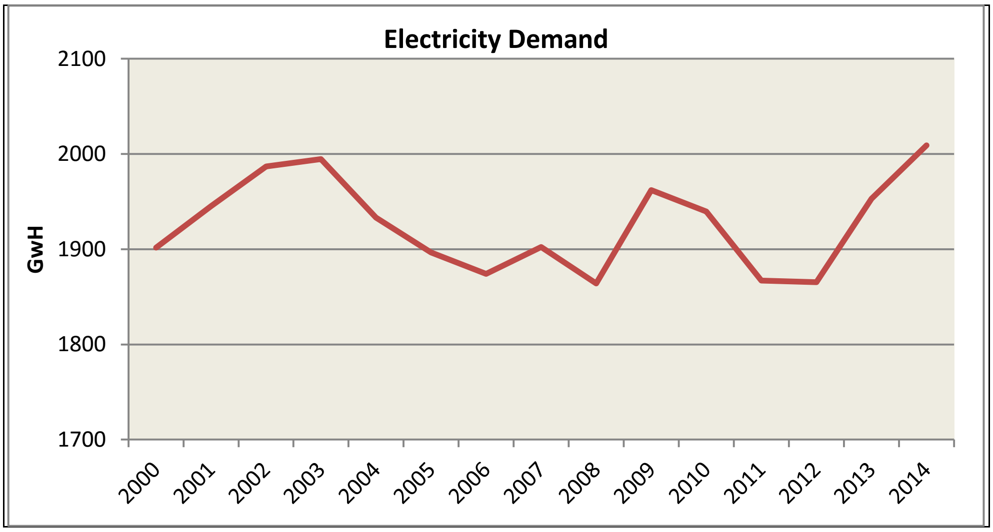

Figure 5-9 Demand for Electricity in Malta

Table 5-2 below presents information about the electricity demand in Malta and its major determinants between 2003 and 2014. The effects of the trend in GDP growth appears to have been offset by the increase in retail tariff prices between 2003 and 2009. The latter effect appears to have been reversed in later years. This information can be synthesised by means of regression analysis with the aim of obtaining the elasticity of demand for electricity with respect to its major determinants.

Table 5-2 Demand and Main Determinants

	Electricity Demand (Mwh)	AVG Tariff (€/kwh)	GDP volume (2003=1)
2003	2,235,541	0.0661	1.0000
2004	2,216,103	0.0644	1.0040
2005	2,240,494	0.0735	1.0422
2006	2,261,225	0.0830	1.0609
2007	2,296,296	0.0942	1.1033
2008	2,275,892	0.1107	1.1398
2009	2,167,640	0.1607	1.1113
2010	2,113,112	0.1752	1.1502
2011	2,168,553	0.1751	1.1766
2012	2,268,627	0.1765	1.2060
2013	2,251,951	0.1763	1.2386
2014	2,240,508	0.1668	1.2819

Source: Enemalta, Eurostat

The regression results have indicated that the elasticity of final demand to GDP is of 0.8 while the price elasticity of (final) demand is of -0.2. In the modelling exercise, these figures were assumed to remain constant until 2020. Subsequently these would depend on the extent, and impact, of energy efficiency measures.

It is expected that the 2015 to 2020 period will be characterised by the implementation of a number of energy efficiency measures a number of which relate to buildings, industry and the production of water. The impact of such measures between 2015 and 2020 is estimated at 2.3% of average baseline demand. They are also estimated to reduce the elasticity of demand to GDP from 0.46 to 0.33. The latter value is retained for forecasts beyond the 2020 period, and applied to a situation where GDP growth is expected at an average annual rate of 2.5%, implying a growth in electricity demand of 0.8% per year.

The conversion to greenhouse gas emissions for the forecasted baseline is based on plant performance for 2013, and this is assumed to remain constant in calculating emissions for the baseline. To ensure consistency with national inventory figures for historic emissions and to facilitate the split of projected emissions for ETS and non-ETS sources (that is, to allow for subtraction of like-from-like), data on CO_2 emissions from the power plants as recorded in the National Inventory have been used rather than verified annual emissions pursuant to Directive 2003/87/EC.[61]

[61] Differences in methodological approaches between national inventories and reporting under the EU ETS Directive can lead to discrepancies in reported emissions, though such discrepancies are relatively small.

Savings from the demand-side and RES measures are calculated on the basis of local emissions per MWh specific to that particular year (i.e. both electricity generated at local plants and electricity imported through the interconnection), and hence include the expected reduction in emissions due to the technical measures related to the electricity-generating infrastructure including the interconnection.

Notwithstanding these energy efficiency improvements, the main drop in emissions observed in Figure 5-2 above is mostly due to a number of supply side factors namely; the improvement in generation efficiency from the new electricity turbines, the switching to natural gas instead of heavy fuel oil and the utilization of the electricity interconnector, albeit at a low capacity.

5.3.2 Fuel Combustion in Road Transport

The projections of emissions from road transport have been developed on the basis of the model mentioned in the previous section. There is no differentiation between cars of varying efficiency in respect of emissions per kilometre travelled. However, the total kilometres travelled have been assumed to increase by 0.53% per year between 2015-2020, to subsequently increase by 0.92% per year between 2021 and 2025 and to decrease to 0.35% per year between 2026 and 2030. A second assumption is the improvement in car efficiency of approximately 2% per year over 2010-2030 in-line with the mandatory shifts in favour of higher Euro car standards required by the EU Commission and as indicated in the EU Reference Scenario 2013.

Specific to the measures themselves, it has been assumed that autogas will partially substitute petrol and that the public transport modal shift will gradually increase from 1% in 2012 to 8% in 2019 and then remains constant. Biogenic emissions from biodiesel and the biogenic part of bio-ETBE are not included in the total emissions reported in line with accepted methodological approaches.

Emissions arising from the public transport reform have been calculated on the basis of projected kilometres covered without, as stated in the previous section, differentiating between the efficiencies of the older and newer buses, especially since this is expected to have a larger impact on air quality rather than emissions of greenhouse gases. In view of this methodological approach and the fact that the total distance covered by the current bus system is greater than that covered under the old bus system, the measure has actually been determined to show an increase in emissions in the initial years of operation rather than a reduction.

As stated in the previous section, the replacement of 5000 cars by electrical vehicles has been included in these projections given that. However, the effect of this measure depends to a large extent on the nature of the electrical source. It has been assumed that electricity used in these cars will be sourced from conventional local electricity generation, leading to a displacement of some emissions from the transport to the energy sector.

5.3.3 Industrial Processes and Product Use

The GHGs identified as being emitted by this sector are CO_2, HFCs and SF_6, as reported in the national inventory under the categories: Soda Ash Production and Use, Carbide Production, Use of N_2O for Anaesthesia and Consumption of Halocarbons and SF_6. The major action envisaged in this sector is the implementation of the F-Gases Regulation. A measure of this nature is not quantifiable with certainty but has a high probability of influencing in a positive manner the way F-gases are utilised. It is thus assumed that emissions from this sector will eventually stabilise with the implementation of this PAM.

5.3.4 Agriculture

The categories within this sector which are applicable to Malta are Enteric Fermentation, Manure Management, Agricultural Soils and Indirect Emissions.

In agriculture, apart from the effect of policies and measures adopted and implemented, one should also bear in mind the effect of certain trends in the activity itself, which are not necessarily directly linked to specific policies and measures. There is a clear trend towards less land being cultivated due to issues related with scarcity of arable land area. The scarcity of water could possibly further compound such a trend. In animal husbandry, the sector has had to restructure to conform with EU legislation applying to animal welfare, food safety, veterinary and waste management, thus reducing the extent to which this activity is practiced, naturally leading to reductions in emissions, or forcing the implementation of practices that inherently reduce emissions.

A related measure is the planned treatment of animal manure at the biological treatment plants in North Malta (39,000 tonnes of manure annually).

5.3.5 Waste

The projections of emissions from the waste sector have been based on the model described in the previous section. It also builds upon a ‘decomposition’ model which ‘assigns’ the expected waste generation to waste treatment plants, incinerator and land-filling, respectively according to their capacity. A number of assumptions have been taken into consideration, including the following:

- The trend in MSW/Capita and Industrial Waste/GDP are maintained throughout the projected time;
- Degradable Organic Carbon (DOC) and MSW composition remains constant to 2011 values;
- Landfilling amounts do not take into consideration whether the specific active landfill is exhausted or not. It is assumed that all future landfills are managed to the same standard as the landfill currently in use;
- All methane generated from biological treatment of waste is flared and all resulting emissions are considered biogenic.

The actual and projected emissions from the waste sector take into account all measures related to this sector, including both solid and liquid waste. It is projected that the biggest saving will be due to saved methane emissions from landfills.

5.3.6 Land Use, Land Use Change and Forestry

For the WEM scenario for this sector, the projected level of carbon sequestration is expected to remain constant after 2015.

5.4 Meeting the National Greenhouse Gas Emission Reduction Commitments

Projected emissions were compared with calculated emission reduction targets applicable for Malta under the Effort-Sharing Decision. This Decision sets a target for Malta limiting emissions to a level not higher that 5% over 2005 levels, by 2020. Furthermore, the Decision establishes a trajectory of interim targets for the years up to 2020, in accordance with the rule that "*each Member State with a positive limit under Annex II* [to the Effort-Sharing Decision] *shall ensure* [...] *that its greenhouse gas emissions in 2013 do not exceed a level defined by a linear trajectory, starting in 2009 on its average annual greenhouse gas emissions during 2008, 2009 and 2010,* [...] *ending in 2020 on the limit for that Member State as specified in Annex II*".

Emissions not falling under the scope of this target include emissions covered by the EU ETS Directive (i.e. CO_2 emissions from the power plants), emissions in the LULUCF sector, and CO_2 emissions from civil aviation. Emissions from international maritime and aviation bunkering are also excluded. Figure 5-10 below compares the total emissions covered by the sectors falling within the Effort-Sharing Decision with the target trajectory under this Decision.

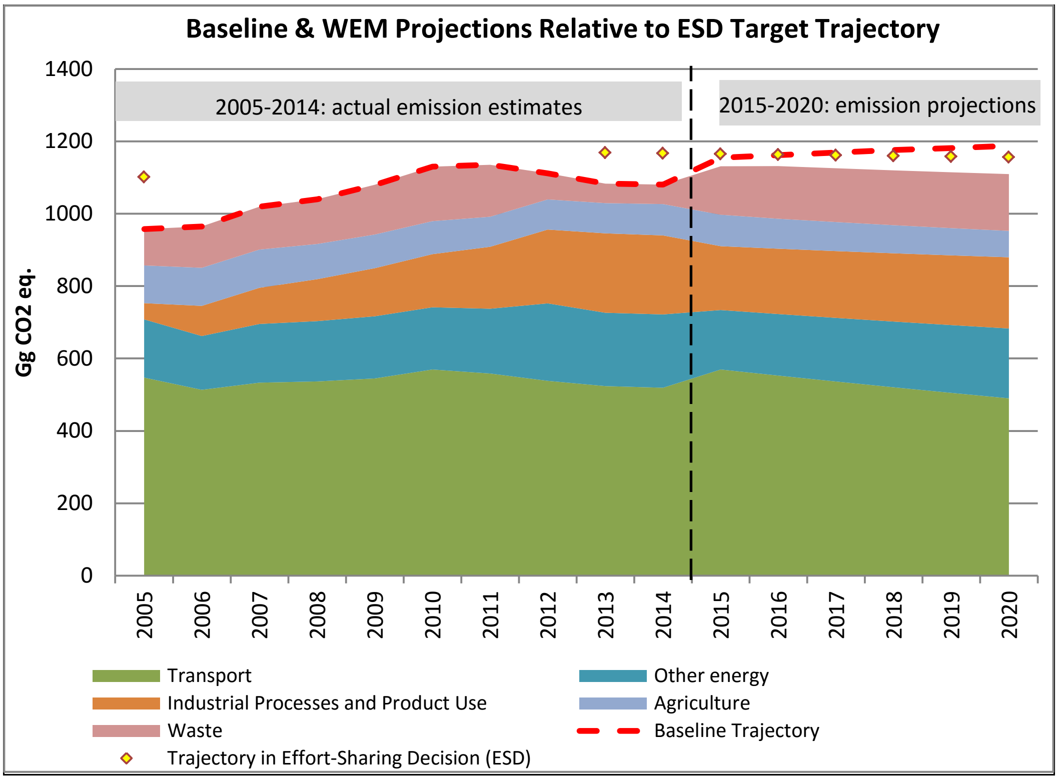

Figure 5-10 Projections of emissions covered by the Effort-Sharing Decision (ESD)

As indicated in Figure 5-10, Malta is on the right trajectory to meet the 2020 target and the interim targets for 2015-2019 when compared with the ESD target trajectory, assuming that the policies and measures are implemented within the reported timeframes and to their full extent.

It is pertinent to note that the WEM scenario trajectory is dependent on a number of factors that highlight the particular situation inherent in small countries when considering emission mitigation policies and measures, wherein a single emission source or, the non-implementation of a particular measure, can have a significant impact on the country's emissions with a concomitant impact on its ability to meet quantified obligations, relative to larger countries. For example; the effect of public transport reform discussed above and as modelled in the projections is based on a projected modal shift from private vehicle use to public transport use of approximately 8% of passenger vehicles. A higher modal shift would result in a substantial further increase in future greenhouse gas emission savings from transport. However, the rate of modal shift depends very much on the transport choices made by the individual citizens and visitors to the country, and thus on the willingness of the general public, or the extent to which the public is incentivized, to shift to modes of transport other than private vehicles. Alternative modes of transport have to offer a substantial improvement in mobility in terms of efficiency and time spent travelling, and also have to be significantly more attractive from a cost perspective than passenger vehicles.

Hence, it is being recognised that the availability of better activity data and closer monitoring of implemented measures will play a very important role in determining the accuracy of these projections.

6 Provision of Financial, Technological and Capacity-building Support to Developing Country Parties

6.1 Provision of Finance

Refer to Tables 7A and 7B of the CTF Tables.

7 Other Reporting Matters

There is currently no further information to report.

Glossary

AEA	Annual Emission Allocation
AR4	Fourth Assessment Report
ARMS	Automated Revenue Management Services
AVR	Accreditation and Verification Regulation
BAU	Business as Usual
BEV	Battery Electric Vehicle
CCGT	Combined Cycle Gas Turbine
CDM	Clean Development Mechanism
CEF	Connecting Europe Facility
CER	Certified Emission Reduction
CH_4	Methane
CHP	Combined Heat and Power
CO_2	Carbon dioxide
CVA	Controlled Vehicular Access
DOC	Degradable Organic Carbon
DPS	Delimara Power Station
EAFRD	European Agricultural Fund for Rural Development
EED	Energy Efficiency Directive
EPRDM	Energy Performance Rating for Dwellings in Malta
ERDF	European Regional Development Fund
ERU	Emission Reduction Unit
ESD	Effort Sharing Decision
ETBE	Ethyl Tert-butyl Ether
ETS	Emission Trading Scheme
EUA	European Union Allowance
EUTL	European Union Transaction Log
FSRU	Floating Storage and Regasification Unit
GDP	Gross Domestic Product
GHG	Greenhouse gas
Gg	Gigagramme
GIS	Geographic Information System
GWP	Global Warming Potential
HFC	Hydrofluorocarbon

IC	Interconnector
ICT	Information and Communication Technology
IMSAC	Inter-Ministerial Steering Action Committee
IPPU	Industrial Processes and Product Use
ITMS	Intelligent Traffic Management System
ITS	Intelligent Transport System
JI	Joint Implementation
kWh	kilowatt hour
kWp	kilowatt peak
LCPD	Large Combustion Plants Directive
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LULUCF	Land Use, Land Use Change and Forestry
MBT	Mechanical Biological Treatment Plant
MEPA	Malta Environment and Planning Authority
Mmbtu	Million British thermal Unit
MMR	Monitoring Mechanism Regulation
MPS	Marsa Power Station
MRA	Malta Resources Authority
MRV	Monitoring, Reporting, and Verification
MS	Member State
MSDEC	Ministry for Sustainable Development, the Environment and Climate Change
MSW	Municipal Solid Waste
MTCE	Ministry for Tourism, Culture and the Environment
MWh	Megawatt hour
N_2O	Nitrous oxide
NAP	Nitrates Action Plan
NAU	Nitrates Action Unit
NEEAP	National Energy Efficiency Action Plan
NG	Natural Gas
NGO	Non-government Organisation
NREAP	National Renewable Energy Action Plan
NSO	National Statistics Office
PAM	Policy and Measure

PCI	Project of Common Interest
PFC	Perfluorocarbon
PM	Particulate matter
PV	Photovoltaic
RO	Reverse Osmosis
RDP	Rural Development Programme
SF_6	Sulphur hexafluoride
TEN-E	Trans-European Energy network
TEN-T	Trans-European Transport network
TJ	Terajoule
TM	Transport Malta
UTMC	Urban Traffic Management and Control
UWWTP	Urban Waste Water Treatment Plant
W2E	Waste to Energy
WAM	With additional measures
WEM	With existing measures
WOM	Without measures