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Report of the individual review of the inventory submission of Malta submitted in 2011*

* In the symbol for this document, 2011 refers to the year in which the inventory was submitted, and not to the year of publication.

Contents

I. Introduction and summary

A. Overview

1. This report covers the centralized review of the 2011 inventory submission of Malta, coordinated by the UNFCCC secretariat, in accordance with decision 19/CP.8. The review took place from 29 August to 3 September 2011 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Paul Duffy (Ireland) and Mr. Dario Gomez (Argentina); energy – Ms. Ana Carolina Avzaradel (Brazil) and Ms. Songli Zhu (China); industrial processes – Ms. Elsa Hatanaka (Japan) and Ms. Deborah Schaefer Ottinger (United States of America); agriculture – Mr. Daniel Bretscher (Switzerland) and Mr. Kohei Sakai (Japan); land use, land-use change and forestry (LULUCF) – Mr. Atsushi Sato (Japan) and Mr. Harry Vreuls (Netherlands); and waste – Mr. Keith Brown (United Kingdom of Great Britain and Northern Ireland) and Mr. Sabin Guendehou (Benin). Mr. Duffy and Mr. Gomez were the lead reviewers. The review was coordinated by Mr. Tomoyuki Aizawa (UNFCCC secretariat).

2. In accordance with the "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (hereinafter referred to as the UNFCCC review guidelines), a draft version of this report was communicated to the Government of Malta, which made no comment on it.

B. Emission profiles and trends

3. In 2009, the main greenhouse gas (GHG) in Malta was carbon dioxide (CO_2), accounting for 87.6 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by methane (CH_4) (9.4 per cent) and nitrous oxide (N_2O) (1.5 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.5 per cent of the overall GHG emissions in the country. The energy sector accounted for 87.9 per cent of total GHG emissions, followed by the waste sector (7.6 per cent), the agriculture sector (2.9 per cent), the industrial processes sector (1.5 per cent) and the solvent and other product use sector (0.1 per cent). Total GHG emissions amounted to 2,866.31 Gg CO_2 eq and increased by 38.8 per cent between 1990 and 2009.

4. Tables 1 and 2 show GHG emissions under the Convention, by gas and by sector, respectively. In table 1 CO_2, CH_4 and N_2O emissions do not include emissions and removals from the LULUCF sector.

[1] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of CO_2 eq excluding LULUCF, unless otherwise specified.

Table 1
Greenhouse gas emissions by gas, 1990 to 2009

	Gg CO_2 eq							
Greenhouse gas	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Change 1990–2009 (%)*
CO_2	1 847.08	2 188.32	2 320.69	2 611.74	2 697.21	2 652.84	2 510.66	35.9
CH_4	166.97	203.80	231.72	243.52	259.49	263.07	269.08	61.2
N_2O	43.84	51.95	53.02	47.10	48.37	44.83	43.45	–0.9
HFCs	7.50	17.76	7.07	23.18	41.08	46.13	41.55	454.0
PFCs	NA, NO	NA, NO	0.00	0.00	0.00	0.00	0.00	NA
SF_6	0.01	1.51	1.54	1.64	1.66	1.83	1.57	13 988.6

Abbreviation: NA = not applicable, NO = not occurring.

Table 2
Greenhouse gas emissions by sector, 1990 to 2009

	Gg CO_2 eq							
Sector	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Change 1990–2009 (%)*
Energy	1 854.60	2 195.10	2 329.12	2 620.75	2 706.72	2 662.33	2 519.55	35.9
Industrial processes	7.85	20.95	8.91	25.24	43.04	48.15	43.37	452.3
Solvent and other product use	2.48	2.48	3.01	2.26	2.71	2.10	1.60	–35.6
Agriculture	87.81	93.83	102.95	92.68	95.04	86.45	83.29	–5.1
LULUCF	–56.97	–56.97	–57.83	–59.00	–60.78	–60.78	–60.76	6.7
Waste	112.67	150.96	170.06	186.25	200.31	209.67	218.51	93.9
Other	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	**2 008.44**	**2 406.36**	**2 556.21**	**2 868.18**	**2 987.03**	**2 947.92**	**2 805.55**	**39.7**
Total (without LULUCF)	**2 065.41**	**2 463.33**	**2 614.04**	**2 927.18**	**3 047.81**	**3 008.70**	**2 866.31**	**38.8**

Abbreviations: LULUCF = land use, land-use change and forestry, NA = not applicable.

II. Technical assessment of the inventory submission

A. Overview

1. Inventory submission and other sources of information

5. The 2011 annual inventory submission was submitted on 13 April 2011; it contains a complete set of common reporting format (CRF) tables for the period 1990–2009, except table 7. The national inventory report (NIR) was submitted on 14 April 2011. The CRF tables were resubmitted on 26 May 2011. The submission was submitted in accordance with the UNFCCC reporting guidelines.

6. During the review, Malta provided the expert review team (ERT) with additional information and documents, which are not part of the inventory submission.

Completeness of inventory

7. The inventory is incomplete in terms of categories, the following of which are identified as incomplete:

(a) Fugitive emissions from fuels are reported as "NA" (not applicable), "NE" (not estimated) or "NO" (not occurring);

(b) Estimates of emissions from aviation bunkers are not complete and only cover landing and take-off (LTO), and no emissions from international flights during the cruise phase are reported (see para. 36 below);

(c) The activity data (AD) for domestic navigation do not cover all navigation activity in the country (see para. 41 below);

(d) Regarding HFC emissions from foam blowing, information on imports of closed-cell foam is not taken into account in the estimation (see para. 54 below);

(e) Parts of the rabbit and poultry populations are not included in the livestock population census (see para. 61 below);

(f) N_2O emissions from manure management is not complete because only cattle, swine and poultry are included in the estimation, and sheep, goats, and mules and asses are not included in the estimation (see para. 63 below);

(g) Carbon stock changes in dead organic matter (DOM) and soils are reported as "NE" for forest land remaining forest land; cropland remaining crop land and settlements remaining settlements (see para. 73 below);

(h) Carbon losses in living biomass are not estimated for forest land remaining forest land; cropland remaining crop land and settlements remaining settlements (see para. 78 below).

2. A description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Overview

8. The ERT concluded that the institutional arrangements are performing their functions. However, bearing in mind that the 2011 inventory submission was Malta's first official inventory submission, the ERT identified some issues for improvement in the

context of the institutional arrangements for inventory preparation and provided recommendations on how such improvements could be made (see paras. 12, 15, 16 and 18 below).

9. The Party described the changes made to the institutional arrangements since 2010 when the inventory was submitted to the European Commission, which are discussed in chapter I of its NIR.

10. Malta reported an LULUCF inventory for the first time in this submission, and the Party's estimation and reporting of the LULUCF sector is not always in line with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). The ERT also notes a general lack of transparency in Malta's reporting of the LULUCF sector. The ERT recommends that Malta strengthen its capacity for inventory preparation of the LULUCF sector.

Inventory planning

11. The NIR described the institutional arrangements for the preparation of the inventory. The Malta Environment and Planning Authority (MEPA) had overall responsibility for the national inventory up to 2009. Since 2010, the Malta Resources Authority (MRA) has taken over the role of MEPA. The National Emissions Inventory Team within the Climate Change Unit at MRA has the main responsibility for managing the inventory compilation system and for preparing the relevant submissions. Other agencies and organizations, such as the National Statistics Office (NSO), Transport Malta, Malta International Airport and the Malta Maritime Authority, are also involved in the preparation of the inventory as data providers.

12. Malta has provided in its NIR information on the overall procedure and workflow of the inventory preparation and submission. The ERT commends Malta for providing this information in the NIR.

13. In each category, category-specific areas for improvement are described. The ERT commends Malta for having provided this information even though it was the first official submission of its inventory to the secretariat. However, the ERT noted that Malta has not prioritized such improvements as part of its inventory planning.

Inventory preparation

Key categories

14. Malta has reported a key category tier 1 analysis, level assessment, as part of its 2011 inventory submission. The key category analysis performed by the Party and that performed by the secretariat[2] produced similar results. Malta has included the LULUCF sector in its key category analysis, which was performed in accordance with the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC good practice guidance for LULUCF.

[2] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

15. Malta has not conducted a trend assessment. The ERT recommends that Malta conduct a trend assessment for its next inventory submission.

Uncertainties

16. Malta used a tier 1 uncertainty analysis, mainly based on expert judgement, and estimates an uncertainty in total emissions of 3.75 per cent, including LULUCF; this is mainly influenced by the CO_2 emissions from energy industries, which is the largest emission source in Malta's inventory. Uncertainties are reported for all categories, but generally without documentation on the rationale for uncertainties. The ERT recommends that Malta document the rationale for uncertainties for all categories when expert judgement is used, take into account the results of the uncertainty analysis in its inventory improvement plan, and update uncertainty estimates for categories that are recalculated.

Recalculations and time-series consistency

17. Recalculations have not been performed because the 2011 inventory submission is the first official inventory submission of Malta to the secretariat.

Verification and quality assurance/quality control approaches

18. Malta has stated in its NIR that quality assurance/quality control (QA/QC) procedures have been established. Malta has also provided a brief description of the current QA/QC system in the country, and of the data verification process. According to the UNFCCC reporting guidelines, the Party should elaborate a QA/QC plan; however, the ERT noted that Malta did not provide detailed information on the QA/QC plan in its NIR. The ERT recommends that Malta develop a QA/QC plan, in particular tier 1 QC procedures such as that described in the IPCC good practice guidance, and provide information on the developed QA/QC plan in the NIR of its next inventory submission.

Transparency

19. Malta has provided most of the information on the estimation of GHG emissions and removals in the NIR of its first official inventory submission under the Convention. However, the ERT noted that the following areas are not transparently reported:

(a) For fuel combustion, the oxidation factor is not discussed in the NIR nor is it included in the CRF tables (see para. 32 below);

(b) For consumption of halocarbons and SF_6, data on equipment used are not clearly described in the NIR (see para. 50 below);

(c) For the agriculture sector, general background information on agriculture and general practice of agriculture activities in Malta is not provided in the NIR (see para. 64 below);

(d) For the LULUCF sector, land-use classification is not clearly explained in the NIR (see para. 74 below);

(e) For solid waste disposal on land, information on the distribution of generated solid waste is not clearly described in the NIR (see para. 88 below).

Inventory management

20. Malta stated that all data are archived in order to ensure the traceability of the estimation process in its NIR. The ERT noted that the information in the NIR on archiving is limited. The ERT recommends that Malta provide in the NIR of its next inventory submission further information on archiving, such as internal documentation on QA/QC

procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements.

3. Follow-up to previous reviews

21. A follow-up to previous reviews has not been performed as the 2011 inventory submission is the first official inventory submission of Malta to the secretariat.

4. Areas for further improvement

Identified by the Party

22. The NIR of the 2011 inventory submission identifies several areas for improvement as follows:

(a) Using more detailed emission factors (EFs) and AD for CH_4 emissions from enteric fermentation;

(b) Estimating N_2O emissions from nitrogen-fixing (N-fixing) crops and crop residues;

(c) Develop land-use change information, especially for settlements converted to forest land.

Identified by the expert review team

23. During the review, the ERT identified cross-cutting issues for improvement. These are listed in paragraph 103 below.

24. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

B. Energy

1. Sector overview

25. The energy sector is the main sector in the GHG inventory of Malta. In 2009, emissions from the energy sector amounted to 2,519.55 Gg CO_2 eq, or 87.9 per cent of total GHG emissions. Since 1990, emissions have increased, by 35.9 per cent. The key drivers for the rise in emissions were transport (+57.8 per cent), energy industries (+37.5 per cent) and manufacturing industries and construction (+11.9 per cent). Emissions from other sectors (mainly residential) decreased by 51.5 per cent during the time period.[3] Within the sector, 74.0 per cent of emissions were from energy industries, followed by 21.5 per cent from transport and 2.6 per cent from manufacturing industries and construction. Other sectors accounted for 1.9 per cent. Fugitive emissions are reported as "NO", "NA" and/or "NE" during the whole period 1990–2009.

26. Generally, tier 1 and default EFs from the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) were used for all categories except aviation bunkers, which are estimated using a tier 2 method taking into account the LTO cycle. To keep in line with the IPCC good practice guidance, the ERT recommends that Malta use higher-tier methodologies for key categories in future inventory submissions, if possible.

27. The inventory completeness has been improved significantly since the previous submission to the European Commission. However, fugitive emissions from oil and gas

[3] One reason is AD reallocation among categories, as explained in paragraph 30 below.

systems in the whole time series are all reported as "NE", "NO" and/or "NA" with the explanation "no data available". Since the share of energy consumption is dominated by liquid fuels in Malta, the fugitive emissions from the transmission and distribution of these fuels might not be negligible. Therefore, the ERT recommends that Malta estimate these emissions, applying at least the tier 1 method and default EFs, and report them in its next inventory submission.

28. Emissions from fuel combustion in the category commercial/institutional are reported included elsewhere ("IE") and are included under manufacturing industries and construction for 2005–2009, resulting in time-series inconsistency for both categories. The ERT recommends that Malta solve this time-series inconsistency and report these emissions in line with the category definition in the Revised 1996 IPCC Guidelines in its next inventory submission.

29. An uncertainty analysis was carried out using the tier 1 method. Generally, it seems that the Party underestimated the uncertainty of the energy sector, while using only default EFs and no country-specific data, particularly for CH_4 and N_2O emissions. For example, the EF uncertainty of CH_4 and N_2O from road transportation is estimated as 15 per cent, lower than the default data given in the IPCC good practice guidance (40–50 per cent). During the review, Malta explained that the uncertainty values are based on a single expert opinion and further in-depth uncertainty calculations are to be carried out for CH_4 and N_2O. The ERT recommends that the Party implement the planned improvements as a first step. The ERT recommends that Malta provide the basis of expert judgement for uncertainty assessments in its NIR in its next inventory submission.

30. There is no clear description in the NIR of specific QA/QC procedures for the energy sector. The ERT recommends that Malta start to conduct tier 1 QC activities, particularly for consistency checking between the CRF tables and the NIR with regard to the use of notation keys, AD and emissions, and data consistency between CRF tables 1.A(b) and 1.(C), and that it report the results in the NIR of its next inventory submission.

31. Liquefied petroleum gas (LPG) was reported as gaseous fuel throughout the inventory submission. In accordance with the Revised 1996 IPCC Guidelines, and since LPG is one of the refining products deriving from crude oil, the ERT recommends that Malta report emissions from LPG under liquid fuels in its next inventory submission. Malta stated during the review that for the next inventory submission it will report LPG under liquid fuels in all categories.

32. The oxidation factor for fuel combustion is not mentioned in either the CRF tables or the NIR. The ERT recommends that Malta provide in the NIR of its next inventory submission information on the oxidation factor used.

2. Reference and sectoral approaches

Comparison of the reference approach with the sectoral approach and international statistics

33. The reference approach is estimated only for the year 2009. The ERT recommends that Malta provide estimates of the reference approach for the complete time series.

34. For 2009, there is a difference of 2.9 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations are provided in the NIR, including: a small amount of uncounted fuel consumption occurs due to confidentiality; the statistical difference between both approaches; and the use of mixed liquid fuels. The ERT encourages Malta to investigate the reason for these differences in detail in its future inventory submissions.

International bunker fuels

35. For marine bunkers, data are reported for the period from 2001 onwards, while for aviation bunkers they are provided from 2003 onwards. The ERT recommends that Malta ensure that it provides estimates for the whole time series.

36. The ERT noted that coverage of emissions from aviation bunkers is not complete. Only emissions from the LTO cycle are reported, and no emissions from international flights during the cruise phase are reported. The ERT recommends that Malta estimate cruise emissions from aviation bunkers collecting further data as needed, and include them in the estimate, in order to improve completeness.

37. AD of aviation bunkers are reported as "NE" in both the NIR and the CRF tables, whereas emissions are reported and International Energy Agency (IEA) statistics show 3,827 TJ (jet kerosene) in 2009 for Malta's aviation bunkers. The ERT recommends that Malta provide the AD in the CRF tables. In addition, as a QA/QC measure, the ERT recommends that Malta compare the IEA data and national energy statistics to improve the estimation of aviation bunkers in future inventory submissions. Data on navigation bunker given in the CRF tables are close to IEA statistics.

38. The ERT believes that the Party may have underestimated the CH_4 and N_2O emissions from navigation bunkers; the EFs (3.0 kg/TJ for CH_4 and 0.6 kg/TJ for N_2O) are lower than the IPCC default EFs (for ocean-going ships (table 1-48 on p.1.90), 7.0 kg/GJ for CH_4 and 2.0 kg/TJ for N_2O). The ERT recommends that Malta provide an explanation as to why the EFs used are lower than the default EFs of the Revised 1996 IPCC Guidelines

3. Key categories

Stationary combustion: all fuels – CO_2

39. Under manufacturing industries and construction, iron and steel is the only subcategory containing emission estimates; the subcategories non-ferrous metal and chemicals are reported as "NA" and the subcategories pulp, paper and print and food processing, beverage and tobacco are reported as "NO". Malta explained during the review that AD for manufacturing industries and construction were so far not able to be disaggregated for the estimation of emissions. The Party has been working with different entities to improve the quality of these data in order to provide data by subcategory. The ERT recommends that Malta, as a first step, and for the next inventory submission, report all emissions under other (manufacturing industries and construction), with an explanation in its NIR, and make efforts to report with more disaggregated data.

40. Emissions from all fuel combustion in manufacturing industries and construction have fluctuated significantly, even taking into account that during the period of 2005–2009 the AD of commercial/institutional were reallocated to this subcategory. For example, from 2008 to 2009, fuel consumption decreased by 33.7 per cent, as well as CO_2 emissions (34.5 per cent). Malta explained during the review that work on collecting more data for this category has started and more accurate data for the years 2009 and 2010 would be provided in its next inventory submission. The ERT recommends that Malta correct the values in its next inventory submission.

Domestic navigation: liquid – CO_2

41. The ERT noted that Malta's NIR states that AD for domestic navigation are not complete because data from some operators are not available owing to issues of confidentiality. The ERT recommends that Malta investigate a way to include the relevant emissions in some other category to ensure confidentiality, and check the national total fuel consumption compared with the reference approach estimation.

4. Non-key categories

Domestic aviation – CO_2

42. In CRF table 1.A(a), the AD of aviation gasoline are reported as "NE", but the CO_2 emissions are reported as 1.58 Gg. During the review, Malta explained that emissions are calculated on the basis of the LTO cycle, not fuel consumed. The ERT noted emissions from domestic cruise traffic are not included in the estimates. The ERT recommends that Malta estimate cruise emissions from domestic aviation and collect further data on fuel use of domestic aviation.

Road transportation: liquid fuels –N_2O

43. A tier 1 approach is used to estimate N_2O emissions from road transportation. Malta uses the default EF given by the Revised 1996 IPCC Guidelines (N_2O: 0.6 kg/TJ), which is updated in the IPCC good practice guidance (1.4–12.0 kg/TJ). The ERT considers that the Party may have underestimated the N_2O emissions from road transportation. As the basic tier 3 approach has been used for indirect GHG emissions estimation, the ERT recommends that Malta use this approach instead of tier 1 to estimate N_2O emissions from this category in its next inventory submission.

C. Industrial processes and solvent and other product use

1. Sector overview

44. In 2009, emissions from the industrial processes sector amounted to 43.37 Gg CO_2 eq, or 1.5 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 1.60 Gg CO_2 eq, or 0.4 per cent of total GHG emissions. Since the base year, emissions have increased by 452.3 per cent in the industrial processes sector, and decreased by 35.6 per cent in the solvent and other product use sector. The key driver for the rise in emissions in the industrial processes sector is the increase in emissions from consumption of halocarbons and SF_6, primarily air-conditioning and refrigeration equipment. Within the industrial processes sector, 99.4 per cent of the emissions were from consumption of halocarbons and SF_6, followed by 0.4 per cent from mineral products and 0.2 per cent from the chemical industry.

45. Malta appears to have made an effort to provide a complete industrial processes inventory using methods consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The Party has conducted useful research, together with QA/QC activities, in several of the more important categories, obtaining data on refrigerant imports for several years and consulting experts regarding trends in consumption of N_2O used as an anaesthetic. However, in some cases, emission estimates are still incomplete (e.g. HFCs, PFCs and SF_6 from semiconductor manufacture, CO_2 from lime production in the period 1990–1994) or underestimated (e.g. CO_2 from soda ash use and CO_2 from lime production in the period 1995–1998). The most serious omission is likely to be process emissions of HFCs, PFCs and SF_6 from semiconductor manufacturing, which could be at the same level as Malta's emissions from all other categories of the industrial processes sector.

46. Moreover, transparency could be improved in many cases in the NIR (e.g. the role of equipment sales data in refrigeration and air-conditioning equipment estimates, derivation of the lime production EF) and in the CRF tables. In particular, CRF table 2(II).F does not include any values for gas stocks, emission rates or emissions. The ERT recommends that Malta include this information in the sectoral background tables in its next inventory submission.

47. Malta has included estimates of potential emissions in both the NIR and the CRF tables, but the transparency of the CRF tables is hampered by Malta's incorrect use of notation keys. For example, although CRF table 2(II) provides actual emissions of individual HFCs, it shows "NO" for bulk imports of those HFCs potential emissions and provides an aggregate figure for bulk imports of unspecified HFCs. Similarly, although CRF table 2(II) provides actual emissions of SF_6, it indicates "NE" for equipment imports and "NO" for bulk imports. The ERT recommends that Malta revise CRF table 2(II) to provide imports of HFCs and SF_6 both in equipment and in bulk for each chemical compound. If this is not practicable (e.g. because of confidentiality concerns), the ERT recommends that Malta correct its notation keys for bulk imports of individual HFCs to "IE" (included elsewhere), and for bulk imports of SF_6 to "NE." It is unlikely that bulk imports are "NO" because there must be a supply of bulk chemicals to replace leaked gas. These comments also apply to the use of the "NO" rather than "IE" notation keys for potential emissions for particular categories in CRF table 2(I). To the extent that Malta uses sales of pre-charged equipment as a surrogate for imports of this equipment, the Party should provide these data in CRF table 2(II) rather than indicating that these imports are "NE".

2. Key categories

Consumption of halocarbons and SF_6 – HFCs, PFCs and SF_6

48. Malta uses the tier 1 approach specified in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) to estimate emissions from air conditioning and refrigeration. This approach permits the modelling of refrigerant banks and emissions based on gas consumption (i.e. potential emissions) estimates. The approach assigns a constant, standard leak rate of 15.0 per cent and a standard lifetime of 15 years to all types of air-conditioning and refrigeration equipment.

49. Malta obtained refrigerant import data for 2005 to 2008 and extrapolated the 2005–2008 growth rate to estimate imports before and after this period. Based on the information in CRF table 2(II), these import data included bulk refrigerants but not pre-charged equipment, which is likely to contribute a substantial share to Malta's refrigerant supply. Malta also assumed that the identities and proportions of the refrigerants imported from 2005 to 2008 represented the identities and proportions before and after this period. In response to a question raised by the ERT during the review, Malta noted that it did not obtain import data in 2009 because it is now focusing on implementing the legal requirements for reporting the amounts of refrigerant imports, exports, production and destruction. Malta's estimated emissions show the same trend as refrigerant imports, except that they show a decline between 2008 and 2009 while imports do not. The NIR attributes this decline to a decrease in sales of new equipment. In response to a question from the ERT during the review, Malta clarified that this decrease in sales was observed by its NSO and not estimated based on gas import data.

50. The ERT commends Malta for collecting refrigerant import data and using it to model refrigerant emissions throughout the period 1990–2009. However, given the importance of the air-conditioning and refrigeration category to Malta's inventory for the industrial processes sector, the ERT recommends that Malta use a higher-tier approach, supplementing its refrigerant import data with data on equipment stocks and their refrigerant contents, at least for equipment types with large charge sizes (e.g. commercial refrigeration). Ideally, this effort could also include data gathering on country-specific emission rates. This would help to more accurately characterize Malta's refrigerant banks and emissions.

51. The ERT also notes that it may not be appropriate to assume that the refrigerant bank contains the same gases as were imported between 2005 and 2008, since refrigerant substitution patterns have changed over time, driven both by the identities of the gases being replaced (i.e. chlorofluorocarbons (CFCs) and then hydrochlorofluorocarbons (HCFCs)) and by the changing ratio of the different alternatives of CFCs and HCFCs. Based on its response to the question raised by the ERT during the review regarding equipment sales, Malta appears to be using some equipment data already.

52. The ERT concludes that the reporting of the methodology used for this category is not transparent. Therefore, the ERT recommends that Malta increase the transparency of its inventory by discussing how it uses these equipment data in conjunction with the refrigerant import data to estimate equipment stocks, refrigerant banks and refrigerant emissions. The ERT notes that in general, refrigerant banks (and therefore emissions) are expected to increase; the only time they will decrease is when the nameplate capacity of the equipment decommissioned during a year exceeds the nameplate capacity of the new equipment installed during the year. Based on the default lifetime of 15 years given in Malta's NIR and the absence of HFC emissions in 1994, no equipment should have been decommissioned in 2009. Thus, the ERT recommends that Malta either revise its emission estimates to reflect the expected trend or explain in the NIR exactly how it developed its emission estimates.

53. In addition to emissions from air-conditioning and refrigeration equipment, Malta reports emission estimates from foam blowing, fire extinguishers, metered dose inhalers, semiconductor manufacture and electrical equipment. Malta bases its estimates of emissions from metered dose inhalers on importer reports; its per capita emissions for this category appear to be in line with those of other European countries.

54. Malta bases its estimates of emissions from foam blowing, fire extinguishers, semiconductor manufacture and electrical equipment on reports from local businesses that engage in relevant activities and use relevant equipment. To estimate emissions from foam blowing, Malta contacted businesses involved in foam preparation and use. Because emissions from closed-cell foams occur during the lifetime of the foam, and because such foams are widely used (e.g. to insulate appliances), this survey may have overlooked some emissions for this category. The ERT recommends that Malta check the completeness of this category and if necessary consider gathering information on imports of closed-cell foam in appliances and other applications to ensure that its inventory for this category is complete.

55. In its NIR, Malta states that local electronics manufacturers reported no direct use of PFCs. This is surprising because most electronics manufacturing involves the use of HFCs, PFCs, SF_6 and nitrogen trifluoride to etch wafers and to clean chemical vapour deposition chambers. In addition, most electronics manufacturers use heat transfer fluids for process cooling and device testing, which are often comprised of PFCs that are liquid at room temperature. In recognition of these facts, the 2006 IPCC Guidelines include tier 1 EFs for HFCs, PFCs and SF_6 based on the quantity of substrate processed. One manufacturer reported small emissions of a refrigerant, R-508A, which Malta included in the CRF tables for the electronics category; however, the ERT notes that these emissions should actually be included in the air-conditioning and refrigeration category. In response to a question raised by the ERT during the review, Malta stated that this manufacturer made semiconductors, whose production typically involves the use and emission of fluorinated gases. Thus, it appears quite likely that Malta has underestimated emissions from this category. The ERT strongly recommends that Malta contact its electronics manufacturers and obtain data on their consumption and emissions of HFCs, PFCs, and SF_6 and that Malta include this information in its next inventory submission. The inventory for SF_6 from electrical equipment is generally thorough, including explanations of the category of

information on equipment stocks and emission rates, the types and uses of the equipment, the methods used to extrapolate emissions (when necessary), and any anomalous trends (unusually large emissions in 2003 are explained as the result of a lightning strike on a substation). The NIR states that emission rates are provided by the manufacturers of the equipment, but neither the NIR nor the CRF tables identifies those emission rates. In response to a question raised by the ERT during the review, Malta supplied a spreadsheet that included this information. The spreadsheet showed a detailed accounting of individual pieces of electrical equipment, with different rates applied to equipment depending on information supplied by the users or manufacturers. Some of these rates are below those recommended by the IPCC good practice guidance, for example, 0.5 per cent for some closed pressure equipment in the 1990s. However, variations in estimated emissions from this equipment indicate that this manufacturer-supplied leak rate is occasionally supplemented by information on measured emissions from users. The ERT commends Malta for its explanation of the trends and sources of SF_6, but recommends that the Party identify the emission rates applied to equipment, at least as averages for closed pressure and sealed pressure, and their basis (e.g. service records from equipment users).

3. Non-key categories

Lime production – CO_2

56. Malta's inventory is not transparent with respect to lime production, but the information provided indicates that Malta may have underestimated emissions from this category for the years when emissions are reported (1995–1998). In addition, although lime production also occurred from 1990 to 1994, emissions are not reported at all for these years because of confidentiality concerns, raising completeness and consistency issues.

57. In its NIR, Malta states that it uses a CO_2 EF of 0.712 t/t of quicklime produced. This is lower than the default EF 0.750 t/t of quicklime produced of the IPCC good practice guidance. In response to a question raised by the ERT, Malta explains its use of the lower EF by noting that the default EF in the Revised 1996 IPCC Guidelines assumes that the conversion of calcium carbonate to calcium oxide (CaO) is 100 per cent effective or the assumption that quicklime consists 100 per cent of CaO. Malta's NIR does not provide information on the CaO and magnesium oxide contents of the lime. In response to a question raised by the ERT during the review, Malta noted that its EF was based on expert judgment, and that dolomitic lime was not produced in Malta. Malta also stated that it never received lime production estimates for the years 1990 to 1994 owing to "industrial secrecy".

58. The ERT recommends that Malta either revise its lime EF to be consistent with that in the IPCC good practice guidance or that it provide country-specific data and calculations (e.g. relatively low CaO contents) to justify its country-specific EF. The ERT also recommends that Malta note in the NIR that only quicklime, not dolomitic lime, was produced. Finally, the ERT recommends that Malta, in order to achieve consistency in the time-series, estimate and report emissions from lime production that occurred from 1990 to 1994, for example, by using data on production capacity or by extrapolating production levels from later years.

Soda ash use – CO_2

59. Malta may be underestimating CO_2 emissions from soda ash use because it assumes, for the entire time series (1990–2009), that only 95.0 per cent of annually produced soda ash is processed. In response to a question raised by the ERT during the review, Malta stated that this estimate was based on expert judgment. The ERT recommends that Malta either revise its estimate of emissions from soda ash use to reflect processing of 100 per

cent of the amount produced or that it substantiate its use of a lower percentage using country-specific data.

D. Agriculture

1. Sector overview

60. In 2009, emissions from the agriculture sector amounted to 83.29 Gg CO_2 eq, or 2.9 per cent of total GHG emissions. Since the base year, emissions have decreased by 5.1 per cent. The key drivers for the fall in emissions are reduced numbers of dairy and non-dairy cattle and decreasing use of manure-based fertilizers for crop production. Within the sector, 38.4 per cent of the emissions were from manure management, followed by 38.2 per cent from enteric fermentation and 23.4 per cent from agricultural soils. Emissions from rice cultivation and prescribed burning of savanna were reported as "NA" and "NO", respectively. The NIR states that both these categories are considered not relevant in Malta.

61. In the NIR, Malta states that part of the livestock populations may not have been included in the statistics based on a farm census because they are held on farms that are not registered. In response to a question raised by the ERT, Malta explained that it is mainly the rabbit population that is concerned and that further advice in this respect is being sought from the Agriculture Department. The ERT welcomes these efforts and encourages the Party to estimate the share of rabbits and poultry not included in the statistics and to ascertain whether there are any other animals not included in the census data.

62. Before the year 2000 all non-dairy cattle are reported as "IE"; however, no clear information is found on the reallocation of the respective animals in the NIR. The ERT recommends that Malta provide information on all activities included elsewhere in the NIR and in CRF table 9(a).

63. The NIR states that N_2O emissions from manure management have been estimated for cattle, swine and poultry only. No information for the other livestock (sheep, goats, horses, and mules and asses) is provided. Additionally, the ERT noted that sub-categories N-fixing crops and crop residues are reported as "NE" owing to unavailable data. Field burning of agricultural residues is reported as "NO". Furthermore, numerous parameters in the CRF tables are reported as "NE". However, for a number of these parameters the NIR suggests that some data would be available. The ERT recommends that Malta:

(a) Report N_2O emissions from manure management for all animal categories;

(b) Estimate N_2O emissions from N-fixing crops and crop residues;

(c) Estimate emissions from field burning of agricultural residues or justify that emissions are 'NO";

(d) Provide all relevant data in the CRF tables and the NIR as far as possible.

64. The ERT noted a general lack of transparency in the agriculture sector. Additionally, reporting is not always consistent between the NIR and the CRF tables. The ERT recommends that Malta improve the reporting in the NIR and/or the CRF tables as follows:

(a) Provide more information on general agricultural structures in Malta, practices and the respective developments during the inventory time period;

(b) Report consistently the references to methodologies and EFs in the NIR;

(c) Provide transparent information on the assessment and composition of AD such as livestock populations and synthetic and manure-based fertilizers;

(d) Include more detailed information on livestock characteristics, particularly for the most important categories such as cattle, sheep, swine and poultry. Specifically, information on animal weight, weight gain, feeding situation, milk yield, gross energy intake, distribution of animal waste management systems (AWMS), grazing activities and excretion of volatile solids (VS) and nitrogen (N_{ex}) should be addressed;

(e) Provide the figures of the EFs used for N_2O emissions from manure management and agricultural soils;

(f) Report all relevant information for the estimation of the sectoral background data contained in CRF table 4.D.

65. The ERT noted that uncertainty estimates are provided in table A2-0-1 in annex 7 to the NIR. Uncertainty of the AD is 5 per cent and uncertainty of the EF is 15 per cent for all categories in the agriculture sector. As a result, the uncertainty estimates for N_2O emissions are relatively low compared with default values suggested in the IPCC good practice guidance. The ERT encourages Malta to provide a reason for the low uncertainty estimates of all categories in the agriculture sector.

66. The ERT noted that the time series of populations of dairy cattle, non-dairy cattle, sheep and poultry as well as the time series for use of synthetic fertilizers demonstrate considerable fluctuations and ruptures. These fluctuations and ruptures are partially explained by the lack of consistent data, particularly in the years 1990 to 2000. For fertilizer use Malta states that the data are based on the Food and Agriculture Organization of the United Nations (FAO) database FAOSTAT (1990–1994) and import statistics (1995–2009; NSO). The ERT recommends that Malta make efforts to improve time-series consistency using methodologies suggested in the IPCC good practice guidance (e.g. interpolation, trend extrapolation, overlap and surrogate).

67. No category-specific information on QA/QC activities are provided in the NIR. The ERT encourages Malta to improve reporting of all cross-cutting issues (time-series consistency, QA/QC, recalculations) in the respective category-specific chapters of the NIR.

2. Key categories

Enteric fermentation – CH_4

68. A tier 1 approach and default IPCC EFs are used to estimate CH_4 emissions from enteric fermentation for all animal categories. Given that enteric fermentation is a key category, this is not in line with the IPCC good practice guidance. Malta reports in its NIR that improvements for applying a higher tier are planned, including the use of more detailed EFs and AD. The ERT welcomes these planned improvements and recommends that the Party undertake efforts to assess country-specific information in order to move to a higher-tier method for the relevant animal categories (i.e. dairy and non-dairy cattle).

Manure management – CH_4

69. CH_4 emissions from manure management has been identified as a key category in the base year (1990). However, the ERT found that Malta applies a tier 1 method for all animal categories. The ERT recommends that Malta undertake efforts to move to a higher-tier method for the significant animal categories (i.e. dairy and non-dairy cattle, swine).

3. Non-key categories

Agricultural soils – N_2O

70. N_2O emissions from agricultural soils are not complete. N_2O emissions from N-fixing crops and crop residue are reported as "NE". The ERT found that if all emissions from the missing subcategories were estimated, direct and/or indirect soil emissions could become a key category. The ERT recommends that Malta estimate all subcategories and report N_2O emissions from agricultural soils in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance in the next inventory submission.

71. The ERT noted that Malta reported indirect emissions from soils for the first time in its 2011 inventory submission. The ERT commends Malta for these improvements and recommends that the Party transparently report all details on the methods and data applied in the NIR and the CRF tables.

E. Land use, land-use change and forestry

1. Sector overview

72. In 2009, net removals from the LULUCF sector amounted to 60.76 Gg CO_2 eq. Since the base year, net removals have increased by 6.7 per cent. The key driver for the rise in removals is the carbon stock changes in cropland remaining cropland. Within the sector, net removals of 48.69 Gg were from forest land followed by net removals of 10.16 Gg from cropland and net removals of 1.91 Gg from settlements. Estimates of emissions/removals for other categories are reported as "NO".

73. Malta reported increases in carbon stock changes in living biomass for forest land remaining forest land, cropland remaining cropland and settlements remaining settlements, while DOM and mineral soils are reported as "NE" for forest land remaining forest land owing to non-availability of data and as "NO" for cropland and settlements. The Party also reported the following categories as "NO" without any information: direct N_2O emissions from nitrogen fertilization, N_2O emissions from disturbance associated with land-use conversion to cropland, carbon emissions from agricultural lime application and GHG emissions from biomass burning for forest land and settlements, and the optional reporting category of non-CO_2 emissions from drainage of soils. Malta explained during the review that the country is working on the categories which did not have clear information for reporting in the near future. The ERT recommends that Malta improve completeness of reporting in the LULUCF sector and improve transparency by including clear information about the methodologies applied in its next inventory submission. In addition, the ERT recommends revising the use of notation keys, using "NE" for the categories not estimated at present but for which emissions/removals are expected and using "NO" for the categories where no emissions or carbon stock changes occur.

74. Malta reported the areas of the land-use categories forest land remaining forest land, cropland remaining cropland and settlements remaining settlements only and did not report any land-use change area. The sum of the reported areas was about 2.33 kha in 2009 and was inconsistent with the total area of Malta according to an external data source and fluctuated through the time series. The land-use definitions were not provided either. Malta provided information about the land area data as well as land-use definitions in response to the question raised by the ERT during the review. Malta explained that the total national area is 31.60 kha and the difference between the total national area and the sum of the reported areas, which was equal to 29.27 kha, was categorized under other land. The ERT notes that other land accounts for 91.5 per cent of the total national area and the reported areas in the 2011 inventory submission were the actual AD which were directly used in the

calculation, while the definition of each land-use category in the IPCC good practice guidance for LULUCF covers not only real AD but also the land which is not always used for calculation. The ERT recommends that Malta improve its land-use categorization such as the other land category and report in the NIR of its next inventory submission relevant information transparently, including the land use definition.

75. Malta stated in the NIR that the CORINE Land Cover (CLC) was the data source of land-use classification in the country except for AD for cropland. The summary data of CLC 2006[4] represents agricultural areas, urban areas, forest land areas, coastal wetlands, natural vegetation and other human-induced area as 16.15 kha (51.2 per cent), 7.04 kha (22.3 per cent), 0.21 kha (0.7 per cent), 0.03 kha (0.1 per cent), 5.78 kha (18.3 per cent) and 23.31 kha (7.4 per cent), respectively. The ERT notes that these figures are different from those which the Party reported in its GHG inventory, even if the land definitions are not always consistent between the CLC and the GHG inventory. Regarding the difference in forest areas, Malta explained during the review that the forest land in the GHG inventory includes shrubland (sclerophyllous vegetation), which is not included in the forest area in the CLC. The ERT recommends that Malta include in its next inventory submission transparent information on how the Party matches each land category under the CLC with the land-use category under the IPCC good practice guidance for LULUCF.

76. Malta provided a tier 1 uncertainty estimate for the categories forest land remaining forest land and cropland remaining cropland. No uncertainty estimate was provided for settlements remaining settlements, which is an optional reporting category. The ERT encourages Malta to assess uncertainty for the settlements category.

2. Key categories

Forest land remaining forest land – CO_2

77. Malta calculated an average annual increment in living biomass in forest land using the default values provided in the IPCC good practice guidance for LULUCF for coniferous wooded land and mixed forest, using values derived from an Italian study for shrubland as country-specific values. The ERT notes that the calculation covers above-ground biomass only. Equation 3.2.5 on page 3.26 of the IPCC good practice guidance for LULUCF requires expanding the estimation from above-ground biomass to whole living biomass (including below-ground biomass) by using a root-to-shoot ratio (R). The default R values are provided in the IPCC good practice guidance for LULUCF (table 3.A.1.8). The ERT recommends that Malta apply the suitable R values in the calculation and estimate the whole living biomass increment in its next inventory submission.

78. Malta calculated gains of carbon in living biomass but reported loss of carbon in living biomass as "NE" because data were unavailable. The ERT recommends that Malta collect information about loss of carbon in living biomass in forest land and report the progress made or a plan of future improvement in its next inventory submission.

3. Non-key categories

Cropland remaining cropland – CO_2

79. Malta calculated carbon stock changes in living biomass for perennial woody crops only with a default EF from the IPCC good practice guidance for LULUCF in cropland remaining cropland. The area data were obtained by the Agricultural Census of Malta for the period 1990 to 1998 and by the area data published by the NSO for 1999 onward. The area fluctuated a little in the time series and this fluctuation directly reflected the fluctuation

[4] <http://www.globserver.com/en/malta/land-use>.

of removals from cropland remaining cropland. The ERT notes that a decrease of AD (area) for perennial woody crops may mean a loss of carbon in woody biomass and no specific carbon stock changes occurred through management practices. The ERT encourages Malta to consider the cause of the fluctuation of AD and the adequacy of the application of these AD for emissions/removals calculation.

Settlements remaining settlements – CO_2

80. The area of settlements was reported as 40.6 ha from 1990 to 1995 and as 181.0 ha from 1996 onward. In response to a question raised by the ERT during the review, Malta explained that the value in 1995 was taken from the CLC report of 1990 and the value in 1996 was taken from the CLC report of 2000. Malta also provided the definition of settlements which was "areas with vegetation within the urban fabric, including parks and cemeteries". The ERT notes that the definition of settlements in chapter 2 of the IPCC good practice guidance for LULUCF states that all developed land including transportation infrastructure and human settlements of any size are categorized as "settlements" land use. The ERT recommends that Malta include both the vegetated settlements area and the non-vegetated settlements area in the settlements category and establish a subcategory for vegetated and non-vegetated areas under the broad land-use category of settlements.

81. Malta estimated carbon stock changes in living biomass in settlements remaining settlements based on the default crown cover area-based growth rate (CRW) provided in the appendix to the IPCC good practice guidance for LULUCF. The ERT notes that this default CRW factor applies to the total crown cover area, but during the review the ERT could not conclude whether the AD used by the Party were the data of crown cover area or the area of total vegetated settlements land use or also including non-crown cover area. The ERT encourages Malta to clarify the definition of AD and report the relevant information in its next inventory submission.

F. Waste

1. Sector overview

82. In 2009, emissions from the waste sector amounted to 218.51 Gg CO_2 eq, or 7.6 per cent of total GHG emissions. Since the base year, emissions have increased by 93.9 per cent. The key driver for the rise in emissions is the increase in the amount of waste sent to landfills and the progressive conversion of unmanaged landfills to managed landfills. Within the sector, 87.6 per cent of the emissions were from solid waste disposal on land, followed by 12.0 per cent from wastewater handling and 0.3 per cent from waste incineration.

83. The overview section of the waste sector is not well described in the NIR. The ERT recommends that Malta provide in its next inventory submission more information on the overview of the waste sector, including, for instance, emission trends existing and planned waste management practices and policies and how this affects emissions in the sector.

84. The inventory covers all categories and gases for the time series 1990–2009. No information on uncertainty and QA/QC for the waste sector is provided in the NIR. The ERT recommends that Malta include in its next inventory submission information on uncertainty estimates (uncertainty associated with AD and EFs and how they are combined) and the QA/QC activities implemented in the waste sector.

85. Even though the inventory is reported in a transparent manner, Malta should provide more information on data generation and handling. Malta reported some recalculations to take into account exclusion from the inventory of CH_4 flared included in the previous submission of Malta to the European Union, and of the biogenic fraction of incinerated

waste, and to include more accurate country-specific data on the amount of waste sent to landfills and on generated and treated sewage. The ERT commends Malta for providing information on the recalculations.

86. Insufficient information is provided on waste management practices in Malta's NIR. The ERT recommends that Malta report in the NIR of its next inventory submission detailed information on the distribution of generated solid waste between existing management practices such as managed and unmanaged landfills, incineration and recycling. Malta indicated during the review that no CH_4 is recovered and used for energy purposes. The ERT recommends that Malta include this information in the NIR of its inventory next submission.

2. Key categories

Solid waste disposal on land – CH_4

87. Malta used the first-order decay (FOD) model and spreadsheet from the 2006 IPCC Guidelines and the approach based on bulk waste to estimate CH_4 emissions from landfills. During the review, Malta indicated that because studies on waste composition data are not currently available, the approach based on waste by composition was not used. The ERT recommends that Malta collect information on waste composition and use the approach based on waste composition in its future inventory submissions as this will give a more accurate emission estimate.

88. Country-specific AD (e.g. amount of waste sent to landfill) and default parameters, including degradable organic carbon (DOC), oxidation factor, and fraction of CH_4 in landfill gas, were used. Malta did not provide information in the NIR on the distribution of generated solid waste (municipal solid waste (MSW) and industrial solid waste) between different landfill types. But in the weighted average methane correction factor (MCF) worksheet calculation (contained in the FOD model), the Party reported distribution by waste management type (unmanaged shallow, unmanaged deep, managed, managed semi-aerobic, uncategorized). The ERT recommends that Malta identify and describe the management types existing in the country and document the distribution of waste amount (MSW and industrial solid waste) between these management types in the NIR of its next inventory submission.

89. The MCFs reported in the NIR for managed deep and unmanaged deep landfills were 0.6 and 0.9, respectively, and are not supported in any studies, while the IPCC default values are 0.8 and 1, respectively. The ERT recommends that Malta justify the country-specific values or use in the next inventory submission MCF values for existing landfill types in line with the IPCC good practice guidance. Moreover, in CRF table 6.A, Malta reported DOC and MCF as "IE". The ERT recommends that, in its next inventory submission, Malta replace the notation keys in the CRF tables with the values used.

90. To generate a historical time series on the amount of waste produced for the period 1977–1989, Malta reported in the NIR that it used an extrapolation based on existing data for 1990 onwards. In response to a request raised by the ERT during the review, Malta provided the spreadsheet used for the calculations. From this spreadsheet, the ERT identified that Malta has data on the amount of waste landfilled for the periods 1990–1996 (based on the number of trucks filled with waste recorded entering the landfill sites) and 1997–2007 (based on weighbridges used to calculate the quantities of waste entering the landfill sites). The ERT also found that Malta multiplied the average per capita amount of waste sent to landfills for the period 1990–1996 with the population figures of the period 1977–1989 to derive the historical amount of waste sent to landfills. Furthermore, total waste sent to landfills, as reported by Malta, includes both MSW and industrial waste. For the next inventory submission, the ERT recommends that Malta apply AD extrapolated

based on both population and gross domestic product using data for the period 1990–2007 to derive the historical amount of waste sent to landfills. The ERT also recommends that Malta explain in the next inventory submission how data for 2008 and 2009 were collected.

91. Malta indicated in the NIR that CH_4 emissions from wastewater sludge were accounted for in emissions from solid waste disposal on land. However, when using the bulk waste option in the FOD model Malta has selected DOC for MSW and DOC for sewage sludge was not taken into account in the emission estimations. During the review, Malta clarified that sewage sludge was accounted for in industrial waste. The ERT recommends that when applying the bulk waste option, Malta consider sewage sludge and industrial waste separately in its next inventory submission as these two types of waste have different default DOC values, as indicated in the model spreadsheets.

Wastewater handling – CH_4

92. Malta uses the default method from the 2006 IPCC Guidelines to estimate CH_4 emissions from domestic and industrial wastewater. The sewage generation rate (71.39 m^3/capita/year) of 1992 was kept constant during the period 1990–2000 and that of 2005 (55.41 m^3/capita/year) constant for 2001–2006. After 2006, the water service cooperation (producing and distributing potable water to the Maltese Islands) provided those rates. The ERT recommends that Malta collect data for this period because keeping the values constant for six to 10 years is not in line with the IPCC good practice guidance.

93. The biochemical oxygen demand (BOD) should be in the unit of "g/person/day" to be able to apply the IPCC method. However, the BOD reported by Malta is 520.43 g/m^3. During the review, in response to questions raised by the ERT, Malta provided the calculation sheets used to derive the BOD. From these sheets, the ERT identified that while the approach used is provided, the reported BOD of 101.78 g/capita/day (over the period 1990–2000), 79.01 g/capita/day (for 2001–2006), 80.29 g/capita/day (for 2007), 81.66 g/capita/day (for 2008), 84.84 g/capita/day (for 2009) were higher than the default value (50 g/capita/day) from the Revised 1996 IPCC Guidelines. The ERT recommends that Malta collect and improve data on BOD in order to improve the accuracy of emission estimates in its next inventory submission.

94. To account for the additional industrial BOD discharged into the wastewater treatment system, Malta used the default correction factor (1.25) contained in the 2006 IPCC Guidelines.

95. Furthermore, the degradable carbon is reported as "NA" in CRF table 6.B. The ERT recommends that Malta include the value in the CRF table. In CRF table 6.B, Malta has reported wastewater handling systems as "NO" for industrial wastewater and sludge and "NA" for domestic wastewater, but in the NIR, Malta calculated CH_4 emissions from domestic and industrial wastewater. The ERT recommends that Malta correct this reporting with notation keys in the NIR and the notation in the CRF table, describe the wastewater handling systems that exist in the country and justify why the MCF is 0 for treated fraction and 0.1 for untreated sewage.

3. Non-key categories

Wastewater handling – N_2O

96. Malta used the method and the default parameters (e.g. fraction of nitrogen in protein) contained in the Revised 1996 IPCC Guidelines to estimate N_2O emissions from human sewage. However, the per capita protein consumption (35.55 kg/capita/day) used by Malta is lower than that provided by the FAO (43.10 kg/capita/day). In response to a question raised by the ERT during the review, Malta provided a reference for these country-

specific data. The ERT recommends that Malta provide a clear explanation of the difference between FAO data and national data or use the protein consumption in line with the FAO data in the NIR of its next inventory submission.

Waste incineration – CO_2, CH_4 and N_2O

97. Malta estimates and reports emissions from incineration of MSW, industrial and clinical waste using country-specific AD and default EFs from the 2006 IPCC Guidelines. However, the use of some default EFs was not explained, for example, the default CH_4 EF applicable to open burning of waste was used to estimate CH_4 emissions from incineration. During the review, Malta explained that the incineration process carried out during the period 1900–2003 was comparable to open burning as the facility at the time was not a regulated or standardized facility. The ERT recommends that Malta include this information in the NIR of its next inventory submission.

98. The ERT identified that data on incinerated MSW were reported as "NO" for the period 2004–2007, while for the other years emission estimates were reported. Malta indicated during the review that no facility for incineration of MSW was licensed during this period. The ERT believe during the period 2004–2007 emissions from MSW occurred. The ERT recommends that Malta report the emissions for this period using interpolation in line with the IPCC good practice guidance or clarify there were no incineration on the period.

III. Conclusions and recommendations

99. Malta made its inventory submission on 13 April 2011, and its NIR was submitted on 14 April 2011. The inventory submission contains the GHG inventory (comprising a complete set of CRF tables and an NIR). This is in line with the UNFCCC reporting guidelines.

100. The ERT concludes that the inventory submission of Malta has been prepared and reported in accordance with the UNFCCC reporting guidelines. The Party has submitted a complete set of CRF tables for the years 1990–2009 and an NIR; these are complete in terms of geographical coverage, but generally incomplete in terms of years, categories and gases. Some of the categories, particularly in the energy sector (fugitive emissions from fuels, CO_2 emissions estimated using the reference approach for 1990–2008, and emissions from aviation bunkers and domestic navigation), the industrial processes sector (emissions from closed-cell foam), the agriculture sector (some livestock) and the LULUCF sector (carbon stock change in DOM and carbon losses in living biomass), were reported incompletely (see paras. 27, 33, 36, 41, 61, 63, 73 and 78 above). The ERT recommends that the Party provide estimates for these categories in its next inventory submission, in order to improve completeness.

101. The Party's inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF, except for the categories reported incompletely (see para. 100 above) and categories not transparently reported (see para. 19 above).

102. The institutional arrangements implemented by Malta for the preparation of the inventory are performing their required functions; however, the ERT identified some issues for improvement in the context of the institutional arrangements for inventory preparation and provided recommendations on how such improvements could be made (see paras. 12, 15, 16 and 18 above).

103. The ERT identifies the following cross-cutting issues for improvement:

(a) Conducting a trend key category analysis (see para. 15 above);

(b) Documenting the rationale for uncertainties for all sectors when expert judgement is used, taking into account the results of the uncertainty analysis in its inventory improvement plan, and updating uncertainty estimates for categories that are recalculated (see para. 16 above);

(c) Developing a QA/QC plan, especially tier 1 QC procedures such as those described in the IPCC good practice guidance, and providing the information in the NIR of its next inventory submission on the QA/QC plan developed (see para. 18 above);

(d) Developing a priority list of its inventory development along key category analysis and report it in the NIR of its next inventory submission (see para. 13 above).

104. In the course of the review, the ERT formulated a number of recommendations relating to the completeness and transparency of the inventory submission. The key recommendations are that Malta:

(a) Estimate fugitive emissions from oil and gas systems applying the tier 1 method and default EFs, and report these emissions in its next inventory submission (see para. 27 above);

(b) Provide information in the NIR of its next inventory submission on the oxidation factor used for fuel combustion(see para. 32 above);

(c) Comply with the standard format of the reference approach to improve consistency and comparability (see para. 33 above);

(d) Estimate cruise emissions from aviation bunkers with further data collection in order to improve completeness (see para. 36 above);

(e) Investigate the way to include emissions from domestic navigation in some other category to ensure confidentiality, and check the national total fuel consumption comparing with the reference approach estimation. (see para. 41 above);

(f) Increase the transparency of its inventory by discussing exactly how it uses equipment data in conjunction with the refrigerant import data to estimate equipment stocks, refrigerant banks and refrigerant emissions (see para. 50 above);

(g) Consider gathering information on imports of closed-cell foam in appliances and other applications to ensure that its inventory for foam blowing is complete (see para. 54 above);

(h) Report N_2O emissions from manure management for all animal categories, estimate N_2O emissions from N-fixing crops and crop residues, estimate emissions from field burning of agricultural residues and provide all relevant data in the CRF tables and the NIR as far as possible (see para. 63 above);

(i) Use notation key “NE” for the categories not estimated at present in the LULUCF sector and use “NO” for the categories clarified as no emissions or carbon stock changes occur (see para. 73 above);

(j) Improve the land-use categorization and report in the NIR of its next inventory submission relevant information transparently, including definition of the land-use (see para. 74 above);

(k) Collect information about loss of carbon in living biomass in forest land and report in its next inventory submission the progress made or a plan for future improvement. (see para. 78 above);

(l) Identify and describe the management types of waste existing in the country and document the distribution of waste amount (MSW and industrial solid waste) between these management types (see para. 88 above).

Annex I

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

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Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html>.

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Status report for Malta 2011. Available at <http://unfccc.int/resource/docs/2011/asr/mlt.pdf>.

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B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Simone Borg (Malta Resources Authority), including additional material on the methodology and assumptions used.

Annex II

Acronyms and abbreviations

AD	activity data
BOD	biochemical oxygen demand
CaO	calcium oxide
CFCs	chlorofluorocarbons
CH_4	methane
CLC	CORINE land cover
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
CRW	crown cover area-based growth rate
DOC	degradable organic carbon
DOM	dead organic matter
EF	emission factor
ERT	expert review team
FAO	Food and Agriculture Organization of the United Nations
FOD	first-order decay
Gg	gigagram (10^9 grams = 10^3 kg)
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HCFCs	hydrochlorofluorocarbons
HFCs	hydrofluorocarbons
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram (1 kg = 1,000 grams)
LPG	liquefied petroleum gas
LTO	landing and take-off
LULUCF	land use, land-use change and forestry
m^3	cubic metre
MEPA	dead organic matter
MRA	Malta Resources Authority
MSW	municipal solid waste
N	nitrogen
NA	not applicable
NE	not estimated
NMVOC	non-methane volatile organic compounds
NO	not occurring
N_2O	nitrous oxide
NIR	national inventory report
NSO	National Statistics Office
PFCs	perfluorocarbons
R	root-to-shoot ratio
QA/QC	quality assurance/quality control
SF_6	sulphur hexafluoride
TJ	terajoule (1 TJ = 10^{12} joule)
UNFCCC	United Nations Framework Convention on Climate Change