United Nations FCCC/ARR/2013/IRL

Framework Convention on Climate Change

Distr.: General
16 June 2014

English only

Report of the individual review of the annual submission of Ireland submitted in 2013*

* In the symbol for this document, 2013 refers to the year in which the inventory was submitted, and not to the year of publication.

GE.14-05465 (E)

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Contents

I. Introduction and summary

1. This report covers the review of the 2013 annual submission of Ireland, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 9 to 14 September 2013 in Dublin, Ireland, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Ms. Kristina Saarinen (Finland); energy – Mr. Eilev Gjerald (Norway); industrial processes and solvent and other product use – Mr. Mauro Meirelles de Oliveira Santos (Brazil); agriculture – Ms. Junko Akagi (Japan); land use, land-use change and forestry (LULUCF) – Mr. Mattias Lundblad (Sweden); and waste – Mr. Mark Hunstone (Australia). Ms. Saarinen and Mr. Santos were the lead reviewers. The review was coordinated by Mr. Tomoyuki Aizawa (UNFCCC secretariat).

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1) (hereinafter referred to as the Article 8 review guidelines), a draft version of this report was communicated to the Government of Ireland, which provided comments that were considered and incorporated, as appropriate, into this final version of the report. All encouragements and recommendations in this report are for the next annual submission, unless otherwise specified. The expert review team (ERT) notes that the 2012 annual review report of Ireland was published after the submission of the 2013 annual submission.

3. In 2011, the main greenhouse gas (GHG) in Ireland was carbon dioxide (CO_2), accounting for 65.5 per cent of total GHG emissions[1] expressed in CO_2 equivalent (CO_2 eq), followed by methane (CH_4) (20.2 per cent) and nitrous oxide (N_2O) (13.3 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.0 per cent of the overall GHG emissions in the country. The energy sector accounted for 64.2 per cent of total GHG emissions, followed by the agriculture sector (30.8 per cent), the industrial processes sector (3.1 per cent), the waste sector (1.8 per cent) and the solvent and other product use sector (0.1 per cent). Total GHG emissions amounted to 57,514.53 Gg CO_2 eq and decreased by 3.8 per cent between the base year[2] and 2011. The ERT concludes that the trends for the different gases and sectors, as described in the national inventory report (NIR), are reasonable.

4. Tables 1 and 2 show GHG emissions from sources included in Annex A to the Kyoto Protocol (hereinafter referred to as Annex A sources), emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, elected activities under Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively. In table 1, CO_2, CH_4 and N_2O emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector.

5. Additional background data on recalculations by Ireland in the 2013 annual submission, as well as information to be included in the compilation and accounting database, can be found in annex I to this report.

[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.

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year emissions include emissions from Annex A sources only.

Table 1
Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, by gas, base year[a] to 2011

			Gg CO_2 eq							*Change (%)*
		Greenhouse gas	*Base year[a]*	*1990*	*1995*	*2000*	*2008*	*2009*	*2010*	*2011*	*Base year–2011*
Annex A sources		CO_2	32 423.99	32 423.99	35 232.54	44 689.23	47 018.64	41 726.52	41 340.62	37 664.48	16.2
		CH_4	13 674.13	13 674.13	13 919.68	13 412.20	12 228.17	11 929.81	11 697.10	11 628.82	–15.0
		N_2O	9 112.13	9 112.13	9 620.70	9 482.75	7 633.62	7 543.38	7 825.02	7 621.12	–16.4
		HFCs	54.60	1.31	54.60	259.81	566.66	523.33	559.30	538.61	886.4
		PFCs	75.38	0.09	75.38	305.41	106.20	65.57	37.02	13.20	–82.5
		SF_6	82.93	35.51	82.93	54.35	56.68	38.24	34.51	48.29	–41.8
KP-LULUCF	Article 3.3[b]	CO_2					–3 035.55	–3 306.71	–3 515.18	–3 729.86	
		CH_4					2.36	1.35	9.00	7.64	
		N_2O					0.20	0.12	0.78	0.66	
	Article 3.4[c]	CO_2	NA				NA	NA	NA	NA	NA
		CH_4	NA				NA	NA	NA	NA	NA
		N_2O	NA				NA	NA	NA	NA	NA

Abbreviations: KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

[b] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[c] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation.

Table 2
Greenhouse gas emissions by sector and activity, base year[a] to 2011

			Gg CO_2 eq							*Change (%)*
		Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2008*	*2009*	*2010*	*2011*	*Base year–2011*
Annex A		Energy	30 970.47	30 970.47	33 845.38	42 458.12	45 249.87	40 735.36	40 530.48	36 938.87	19.3
		Industrial processes	3 355.28	3 179.27	3 082.98	4 223.10	3 031.12	2 112.45	1 929.88	1 767.37	–47.3
		Solvent and other product use	80.03	80.03	85.39	79.04	74.30	71.88	71.66	72.49	–9.4
		Agriculture	19 634. 08	19 634.08	20 314.40	19 970.19	18 148.98	17 932.52	17 996.85	17 693.21	–9.9
		Waste	1 383.32	1 383.32	1 657.68	1 473.30	1 107.69	974.62	965.69	1 042.58	–24.6
		LULUCF	NA	–2 662.12	–1 813.19	–1 253.70	–2 707.74	–3 003.42	–4 112.27	–3 701.62	NA
		Total (with LULUCF)	**NA**	**52 585.05**	**57 172.65**	**66 950.04**	**64 902.23**	**58 823.42**	**57 382.30**	**53 812.90**	**NA**
		Total (without LULUCF)	**55 423.17**	**55 247.17**	**58 985.84**	**68 203.75**	**67 609.96**	**61 826.84**	**61 494.57**	**57 514.53**	**3.8**
		Other[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA
KP-LULUCF	Article 3.3[c]	Afforestation and reforestation					–3 059.43	–3 339.79	–3 525.05	–3 751.32	
		Deforestation					26.45	34.56	19.65	29.76	
		Total (3.3)					**–3 032.99**	**–3 305.24**	**–3 505.40**	**–3 721.55**	
	Article 3.4[d]	Forest management					NA	NA	NA	NA	
		Cropland management	NA				NA	NA	NA	NA	NA
		Grazing land management	NA				NA	NA	NA	NA	NA
		Revegetation	NA				NA	NA	NA	NA	NA
		Total (3.4)	**NA**				**NA**	**NA**	**NA**	**NA**	**NA**

Abbreviations: KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NA = not applicable.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

[b] Emissions/removals reported in the sector other (sector 7) are not included in Annex A to the Kyoto Protocol and are therefore not included in national totals.

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2013 annual inventory submission was submitted on 15 April 2013; it contains a complete set of common reporting format (CRF) tables for the period 1990–2011 and an NIR. Ireland also submitted the information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 15 April 2013. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Ireland officially resubmitted CRF tables and its NIR on 10 May 2013 owing to internal checking and correction of errors in the 2013 annual submission.

8. Ireland officially submitted revised estimates on 27 September 2013 in response to the list of potential problems and further questions raised by the ERT during the course of the in-country review. The values used in this report are those submitted by Ireland on 27 September 2013.

9. The full list of materials used during the review is provided in annex II to this report.

2. Overall assessment of the inventory

10. Table 3 contains the ERT's overall assessment of the annual submission of Ireland. For recommendations for improvements related to cross-cutting issues for specific categories, please see the paragraphs cross-referenced in the table.

Table 3
The expert review team's overall assessment of the annual submission

		General findings and recommendations
The expert review team's (ERT's) findings on completeness of the 2013 annual submission		
Annex A sources[a]	Complete	Mandatory: none
		Non-mandatory: "NE" is reported for N_2O from other under solvent and other product use (use of N_2O for anaesthesia and N_2O from aerosol cans) (see para. 47 below)
Land use, land-use change[a] and forestry	Complete	Mandatory: none
		Non-mandatory: "NE" is reported for carbon stock changes in settlements remaining settlements and CH_4 from drainage of soils and wetlands (for forest land and wetlands)

		General findings and recommendations
KP-LULUCF	Not complete	For deforestation, carbon stock changes in soils for conversions to settlements and other land are not reported and it is not demonstrated that these unaccounted pools are not a net source of emissions (see para. 107 below)
The ERT's findings on recalculations and time-series consistency in the 2013 annual submission	Consistent	Recalculations are sufficiently documented in the NIR and CRF tables
The ERT's findings on verification and quality assurance/quality control procedures in the 2013 annual submission	Generally sufficient	The ERT found that some improvements are required in relation to QA/QC activities, as further described in detail under the sectoral findings (see para. 13 below). The ERT recommends that Ireland improve its QA/QC procedures, if necessary by allocating more resources. The ERT also encourages Ireland to move to tier 2 QA/QC
The ERT's findings on the transparency of the 2013 annual submission	Generally transparent	The descriptions of methodologies in the NIR are not always updated or detailed enough (see paras. 25 and 57 below). The NIR does not fully follow the annotated outline of an NIR, which makes it challenging to find information. The ERT recommends that Ireland include more detailed descriptions of the methodologies used for the calculations and further justifications for the selection of methods other than the IPCC default methods and provide more information in the NIR on the drivers behind the emission trends and on source-specific QA/QC activities (in the energy and agriculture sectors). The ERT encourages Ireland to follow the annotated outline of an NIR, in accordance with annex I to decision 14/CP.11, to improve the transparency of the NIR

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, CRF = common reporting format, IPCC = Intergovernmental Panel on Climate Change, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NE = not estimated, NIR = national inventory report, QA/QC = quality assurance/quality control.

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

3. Description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Inventory planning

11. The NIR and additional information provided by the Party during the review described the national system for the preparation of the inventory. The Office of Climate,

Licensing and Resource Use within the Environmental Protection Agency (EPA) is the single national entity with overall responsibility for the annual national GHG inventory.

12. EPA puts in place formal procedures for the planning, preparation and management of the national atmospheric inventory, identifies the roles and responsibilities of all organizations involved in the compilation of the inventory and stipulates memorandums of understanding with key data providers. EPA is responsible for the choice of methods for estimating GHG emissions and removals, data collection and the processing and archiving of the inventory information. EPA also implements the quality assurance/quality control (QA/QC) procedures that were formally established in 2005 through the adoption of a QA/QC plan and manual. EPA also encompasses the unit that provides the inventory team with the information submitted by participants in the European Union Emissions Trading System (EU ETS).

13. Other organizations are also involved in the preparation of the inventory; in particular, the National Council for Forest Research and Development, the Sustainable Energy Authority of Ireland (SEAI) (national energy balance table), the Central Statistics Office (population statistics), the Department of Agriculture, Food and Marine (LULUCF and agricultural statistics), Bord Gais (natural gas analysis), the Marine Institute (offshore gas production), the Department of Communications, Energy and Natural Resources (oil balance as part of the energy balance), the Road Safety Authority (road transport statistics), the Forest Service (afforestation) and Coillte (national forest inventory (NFI)). EPA has signed memorandums of understanding with these organizations detailing their responsibilities and services for the GHG inventory. During the review, the ERT noted that the limited resources allocated to inventory work lead to the need for considerable prioritization in relation to inventory preparation, management and improvement. The ERT commends Ireland for the work carried out, but also recommends that Ireland maintain the quality of the inventory and facilitate further implementation of inventory improvements, if necessary by allocating sufficient resources.

Inventory preparation

14. Table 4 contains the ERT's assessment of Ireland's inventory preparation process.

Table 4
Assessment of inventory preparation by Ireland

		General findings and recommendations
Key category analysis		
Was the key category analysis performed in accordance with the Intergovernmental Panel on Climate Change (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 Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF)?	Yes	
Approach followed?	Tier 1	Tier 2 key category analysis planned for 2014 annual submission. The ERT encourages Ireland to move to tier 2

		General findings and recommendations
Were additional key categories identified using a qualitative approach?	No	
Has the Party identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol following the guidance on establishing the relationship between the activities under the Kyoto Protocol and the associated key categories in the UNFCCC inventory?	Yes	Ireland identified afforestation/reforestation as a key category for activities under Article 3, paragraph 3, of the Kyoto Protocol (corresponding to land converted to forest land under the Convention), but no information is provided in the NIR (chapter 11) on the process to identify key categories under the Kyoto Protocol
Does the Party use the key category analysis to prioritize inventory improvements?	Yes	
Are there any changes to the key category analysis in the latest submission?	Yes	Changes in the order of key categories
Assessment of uncertainty analysis		
Approach followed?	Tier 1	
Was the uncertainty analysis carried out in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF?	Yes	The ERT encourages Ireland to implement a tier 2 uncertainty analysis for its future annual submissions
Quantitative uncertainty (including LULUCF)	Level = 12.5 % Trend = 6.6 %	
Quantitative uncertainty (excluding LULUCF)	Level = 7.1 % Trend = 2.3 %	

Abbreviations: ERT = expert review team, LULUCF = land use, land-use change and forestry, NIR = national inventory report.

Inventory management

15. Ireland has a centralized archiving system, which includes the archiving of disaggregated emission factors (EFs) and activity data (AD), and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements. During the review, the ERT noted that, owing to the limited resources allocated to the inventory work, the maintenance of QA/QC activities and documentation was not always up to date. The ERT recommends that Ireland ensure sufficient resources are available for the management of the inventory.

16. The ERT noted that the transparency of the NIR could be further improved regarding AD, EFs and other parameters, as indicated in the sector-specific chapters below. Ireland uses emission estimates from EU ETS reports; however, the NIR does not provide

information on the methods used to produce those data, or on the QA/QC carried out for those data used in the inventory. The ERT also noted that the description of the models used for the estimation of fluorinated gas (F-gas) consumption in the NIR is not fully transparent. The ERT recommends that Ireland further improve the transparency of the NIR, especially related to the above-mentioned issues.

4. Follow-up to previous reviews

17. The previous review report was published only on 13 August 2013; therefore, the recommendations in that report have not been addressed in the 2013 annual submission. Ireland has implemented almost all of the recommendations made in the 2011 review report, including the estimation of emissions from marine bunkers. Ireland has improved the consistency between the NIR and the CRF tables with regard to reporting recalculations and between the CO_2 emission estimates in the reference and sectoral approaches. However, the ERT found that some inconsistencies still remain between the NIR and the CRF tables, as well as within the NIR and between the reporting under the Convention and under the Kyoto Protocol (see para. 72 below).

18. Also related to recommendations made in the 2011 review report, Ireland has: improved the uncertainty analysis for the LULUCF sector and the documentation of the QA/QC activities for the industrial processes sector; and initiated work to move to a tier 2 key category analysis and provided other additional information requested by the ERT for the energy and industrial processes sectors. The ERT commends Ireland for these improvements. Ireland has provided a table in the NIR listing the recommendations made in previous review reports with details of implemented follow-up actions. The ERT reiterates the encouragement made in the previous review report for Ireland to investigate the possible inclusion of non-mandatory categories currently reported as not estimated ("NE"), such as N_2O use for anaesthesia. The ERT also encourages Ireland to apply tier 2 key category analysis.

5. Areas for further improvement identified by the expert review team

19. During the review, the ERT identified a number of areas for improvement, including some related to specific categories. These are listed in the relevant chapters of this report and in table 8.

B. Energy

1. Sector overview

20. The energy sector is the main sector in the GHG inventory of Ireland. In 2011, emissions from the energy sector amounted to 36,938.87 CO_2 eq, or 64.2 per cent of total GHG emissions. Since 1990, emissions have increased by 19.3 per cent. They increased by 46.1 per cent from 1990 to 2008, but since 2008 have decreased by 18.4 per cent. The key drivers for the fall in emissions since 2008 are the economic recession, along with the reduction in the use of solid, liquid and gaseous fuels in electricity generation and the increasing share of renewables used in the sector, in particular wind power. The sectors driving the downward trend in the total emissions from the energy sector are energy industries (emission reduction of 32.6 per cent), transport (29.5 per cent), other sectors (20.1 per cent) and manufacturing industries and construction (17.5 per cent). Within the sector, 32.3 per cent of the emissions in 2011 were from energy industries, followed by 30.6 per cent from transport, 25.7 per cent from other sectors and 11.4 per cent from manufacturing industries and construction. The remaining 0.1 per cent was fugitive emissions.

21. The ERT noted that Ireland has addressed, in the 2013 NIR, recommendations made in the 2011 review report; for example, emissions from the use of charcoal for cooking in the residential sector have been included in the inventory, as well as CH_4 and N_2O emissions from international marine bunkers. The ERT commends Ireland for these and for the other Party-led improvements in the 2013 annual submission.

22. The ERT noted that Ireland has improved the description of its QA/QC procedures related to the use of EU ETS data for the estimation of emissions from public electricity and heat production. However, the ERT further noted that in its NIR the Party does not provide information on category-specific QA/QC measures applied for other EU ETS data used in the inventory. The ERT considers that this lack of information on QA/QC measures applied in relation to the use of EU ETS data reduces the transparency of the Party's reporting. The ERT therefore recommends that Ireland provide more information on the category-specific QA/QC measures applied in relation to the use of EU ETS data in the NIR.

23. Ireland's inventory for the energy sector is, as referred to in several paragraphs in the NIR, based on emission data reported by plants. As the NIR does not provide transparent information on these data, the ERT met with difficulties in reviewing them. The ERT recommends that Ireland improve the transparency of the emission estimates in the energy sector, for example by providing a table in the energy chapter of the NIR for CO_2 that includes the percentage distribution of emissions based on EU ETS data and calculated emissions, in order to improve the transparency of the reporting and to facilitate future review activities.

24. Plant-specific data (on emissions and energy consumption) play an important role in the compilation of the inventory for fuel combustion for stationary combustion, particularly for the categories energy industries and manufacturing industries and construction, but also in the compilation of the energy balance. The estimates of CO_2 emissions from energy industries for 2005–2011 are derived from EU ETS data. The emission estimates for 1990–2004 are also based on data from the plants, but are not as detailed as those based on EU ETS data. The ERT considers that this approach gives a consistent time series. However, it is not always clear from the NIR for which sectors and to what extent data from plants are included directly in the inventory. The ERT recommends that Ireland clarify this issue in its NIR.

25. The lack of transparency raises the question of the accuracy of the inventory, although the ERT did not find specific indications that the reported emissions were underestimated or overestimated. Detailed descriptions of gaps related to lack of transparency are provided in paragraphs 27–41 below.

26. The national energy balance produced by SEAI is a fundamental data source for the compilation of the Irish GHG inventory for the energy sector. The ERT notes that it is crucial that the energy balance is of high quality and that it is transparently described in the NIR. However, the ERT did not find the description of the energy balance to be sufficiently transparent. During the review week, SEAI gave a presentation on the production of the energy balance and the oil balance, which is compiled by the Department of Communications, Energy and Natural Resources. The ERT strongly recommends that Ireland include in the NIR a detailed and transparent description, including information on the data sources on which the balance is based, and whether the data sources are derived using a top-down and/or a bottom-up approach or based on surveys. The ERT also recommends that Ireland include in the NIR a transparent description of how the oil balance is produced, the basis for dividing diesel oil consumption between road traffic and non-road traffic and the allocation of other gas oils (marine diesel oil and light fuel oil) between the user categories.

27. The choice of EFs is not always well documented and justified in the NIR. For instance, the CO_2 EF for petroleum coke for the earlier years of the time series (1990–2004) is based on average EU ETS data reported for the years 2005–2009, while for the years 2005–2011 Ireland uses an annual country-specific CO_2 EF. This is also the case for the N_2O EF of 28.6 kg/TJ for agricultural mobile machinery, which is taken from the Intergovernmental Panel on Climate Change (IPCC) *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines). The ERT notes that the corresponding EF in the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) is 0.6 kg/TJ. The ERT recommends that Ireland document and justify the choice of EFs in the energy sector in the NIR.

28. The NIR does not provide information on CO_2 EFs applied, net calorific values or densities for all energy carriers for which emissions are calculated. The ERT recommends that Ireland provide this information, if possible in a table, to increase the transparency of the inventory.

29. The ERT found that category-specific QA/QC procedures are not described adequately in the NIR for the use of plant-specific data. The ERT recommends that Ireland include this information in the NIR.

30. Since emissions from all non-road vehicles are not estimated explicitly in the Irish inventory, the ERT concludes that emissions from non-road vehicles can, in principle, be included in the Irish inventory, assuming that the energy balance is complete. The ERT has no information that indicates that this assumption is incorrect. However, the NIR only explicitly explains that the inventory includes emission estimates for tractors and other machinery used in agriculture and forestry. It is not clear from the NIR whether fuels used for other non-road vehicles (e.g. motorized equipment in the construction and building industries and lawn mowers in the residential sector) are included in the inventory. Emissions for these categories should be included in the total for stationary and mobile consumption under the appropriate categories. If the assumption of the ERT is correct, this would mean that, with the exception of machinery used in the agriculture sector, Ireland uses the same EFs for both stationary and mobile equipment. The ERT recommends that Ireland justify this assumption in the NIR. The ERT also recommends that Ireland justify why fuel consumption for non-road vehicles is included in the inventory and further recommends that Ireland improve the reporting on non-road vehicles by preparing a more accurate and transparent inventory for that category.

2. Reference and sectoral approaches

31. Table 5 provides a review of the information reported under the reference approach and the sectoral approach, as well as comparisons with other sources of international data. Issues identified in table 5 are more fully elaborated in paragraphs 33–36 below.

Table 5
Review of reference and sectoral approaches

		Paragraph cross references
Difference between the reference approach and the sectoral approach	Energy consumption: 4.99 PJ, 0.98 % CO_2 emissions: 279.84 Gg CO_2 eq, 0.77 %	

		Paragraph cross references
Are differences between the reference approach and the sectoral approach adequately explained in the NIR and the CRF tables?	Yes	32
Are differences with international statistics adequately explained?	No	35
Is reporting of bunker fuels in accordance with the UNFCCC reporting guidelines?	Yes	
Is reporting of feedstocks and non-energy use of fuels in accordance with the UNFCCC reporting guidelines?	Yes	

Abbreviations: CRF = common reporting format, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

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

32. Ireland has reported the reference and sectoral approaches. The discrepancies between the reference and sectoral approaches for both energy consumption and CO_2 emissions are 0.8 per cent, below the 2.0 per cent threshold set out in the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). The ERT commends Ireland for the work carried out to achieve this consistency between the two approaches.

33. The ERT considers that the data for apparent energy consumption (excluding non-energy use and feedstocks in CRF table 1.A(c)) should be consistent with the figures shown in CRF table 1.A(d). There are some discrepancies between the figures in the two tables, for example for 1990, 2010 and 2011. The ERT recommends that Ireland correct these discrepancies, or explain why these discrepancies occur, in the NIR.

34. The NIR (page 72) states that the reference approach can be used to report national total emissions in cases where the detailed AD required for the sectoral approach are not available. The ERT considers the point of this description to be unclear. The ERT encourages Ireland to clarify the statement in the NIR.

International bunker fuels

35. The ERT identified discrepancies between the energy consumption reported in the International Energy Agency (IEA) statistics and that reported in the CRF tables for domestic aviation, as the figures are generally 20–60 per cent lower in the CRF tables than the international statistics, while energy consumption for domestic navigation reported in the CRF tables is up to twice as high as reported in the IEA statistics for 2000 onwards, owing to a sharp drop in the IEA figures for gas and diesel oil consumption after 1999. The ERT encourages Ireland to provide a discussion on this issue in its NIR.

Feedstocks and non-energy use of fuels

36. The ERT noted that the reporting of feedstocks and non-energy use of fuels is in accordance with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT also noted that Ireland uses the IPCC default carbon storage factors. The methodology used is documented in the NIR.

3. Key categories

Stationary combustion: solid, liquid and gaseous fuels – CO_2

37. According to information provided in the NIR, emissions from manufacturing industries and construction are estimated by multiplying energy consumption from the energy balance by country-specific CO_2 EFs and default CH_4 and N_2O EFs for stationary combustion from the 2006 IPCC Guidelines. It is not clear from the NIR what reference is used in the inventory for the country-specific CO_2 EFs, except for the CO_2 EF for petroleum coke, which is based on EU ETS data. The ERT recommends that Ireland describe the references used for the country-specific CO_2 EFs in the NIR.

38. CO_2 emissions from liquid fuels used for the category agriculture/forestry/fisheries include stationary emissions and mobile emissions from tractors and other agricultural machinery. The total consumption of diesel in the sector is divided into 90 per cent for mobile sources and 10 per cent for stationary consumption. The reference for the assumption is not given in the NIR. The ERT recommends that Ireland improve the description of the methodology and assumptions used in the NIR.

Road transportation: liquid fuels – CO_2, CH_4 and N_2O

39. Ireland uses the COPERT IV model, version 9.1, to estimate CH_4 and N_2O emissions from road transportation. The COPERT model is not described in the NIR. The ERT recommends that Ireland include in the NIR a general description of the COPERT model, for example, that the model is fuel driven (or kilometres driven) and that Ireland describe the relevant national data included in the model.

40. The total consumption of gasoline and diesel oil used in the calculation of CO_2 emissions from road transportation is from the energy balance, but there is no description in the NIR of how the amount of fuel is compiled in the balance. The ERT considers that the lack of this information makes the amount of fuel used in the calculation of CO_2 emissions unclear to some extent. The ERT recommends that Ireland describe in the NIR how fuel consumption for road transportation is estimated.

4. Non-key categories

Oil and natural gas – CH_4

41. Fugitive emissions of CH_4 from offshore gas production are reported under the category fugitive emissions from oil and natural gas, and other sources and emissions from fuel combustion for energy purposes, for example pipeline transportation, are reported under the category other transportation. The ERT notes that it is not clear where emissions from fuel combustion for energy purposes at offshore platforms are reported in the CRF tables, other than for pipeline transportation at the platforms. The ERT recommends that Ireland explain in the NIR the different emission sources in the offshore sector (gas production), the compiling of the energy balance and where in the CRF tables the different emission sources are reported.

C. Industrial processes and solvent and other product use

1. Sector overview

42. In 2011, emissions from the industrial processes sector amounted to 1,767.37 Gg CO_2 eq, or 3.1 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 72.49 Gg CO_2 eq, or 0.1 per cent of total GHG emissions. Since 1990, emissions have decreased by 47.3 per cent in the industrial processes sector

and by 9.4 per cent in the solvent and other product use sector. The key driver for the fall in emissions in the industrial processes sector is the closing of ammonia and nitric acid plants between 2002 and 2003, and emissions have fallen despite an increase in the emissions from consumption of halocarbons and SF_6 and a minor increase in emissions from mineral products. Within the industrial processes sector, 66.0 per cent of the emissions were from mineral products. The remaining 34.0 per cent were from consumption of halocarbons and SF_6. Although, overall, there has been an increase of 4.5 per cent in the emissions from mineral products compared with the base year of the Kyoto Protocol, there was an increase of 131.1 per cent from that year to 2007, followed by a decrease of 54.8 per cent since then, owing to the downturn of the economy, directly affecting the construction industry and cement production, which was the main driver of the emission trend for this subcategory up to 2011.

43. Consumption of halocarbons and SF_6 shows an emission increase of 181.8 per cent since the base year of the Kyoto Protocol. In 2011, the category of refrigeration and air conditioning was responsible for 56.7 per cent of the total emissions for this subcategory.

44. Ireland has carried out improvements to the industrial processes sector inventory since the 2012 annual submission by including more information in the NIR, as required by recommendations made in previous review reports, such as background information in the CRF tables for fire extinguishers, and by correcting the notation keys used in relation to the solvent and other product use sector. The ERT commends Ireland for these improvements. Recalculations have been made only in the time series for F-gas consumption related to foams and fire extinguishers, resulting in changes of ±0.2 per cent for the period 2008–2010. Recalculations have also been made for the solvent and other product use sector, resulting in changes of ±0.1 per cent for the period 2008–2010.

45. Information in the NIR lacks transparency regarding AD, EFs and other parameters. In particular, this relates to emission estimates taken directly from EU ETS reports, which are taken as good-quality data, but which are not followed by justification of their use and further explanations in the NIR regarding the methodology used. In addition, the inventory is not fully transparent, owing to a lack of description of the models used for the estimation of F-gas consumption in the NIR. The ERT recommends that Ireland provide more information to ensure transparency with regard to the EU ETS data used for mineral products.

46. Regarding QA/QC, the ERT identified minor issues related to the use of notation keys, for instance indirect GHG emissions from glass production are reported as "NE", while GHG emissions for that subcategory are reported as not occurring ("NO") for the years after production ceases. The ERT encourages Ireland to use consistent notation keys for the same subcategory.

47. Ireland reported "NE" for N_2O emissions from anaesthesia and aerosol cans in the solvent and other product use sector, for which there is no methodology available in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance; however, many Parties report these emissions. The ERT encourages Ireland to investigate these categories and, if necessary, report the corresponding emissions in the NIR.

2. Key categories

Cement production – CO_2

48. Ireland uses plant-specific AD and EFs from the four plants operating in the country. Since 2004, emission data from EU ETS reports have been used; however, the methodology is not fully explained in the NIR, except that it takes into account the cement kiln dust (CKD) and calcium oxide (CaO) content of the clinker. Following

recommendations made in previous review reports, information on the confidentiality of the CaO and magnesium oxide (MgO) contents of the clinker has been added to the NIR. During the review, Ireland provided AD to the ERT for 2008–2012 from each of the four cement plant operators. Using stoichiometric calculations for CaO and MgO and this information, the ERT found minor discrepancies in the CO_2 emission estimates reported in the CRF tables. To enhance transparency, the ERT recommends that Ireland better explain in the NIR the methodology used to produce the EU ETS data and correct the minor discrepancies.

Consumption of halocarbons and SF_6 – HFCs

49. Ireland reports both actual and potential emissions for two subcategories – mobile air conditioning (MAC) and domestic, commercial, transport and industrial refrigeration, and stationary air conditioning. The emission estimates are calculated using models that were provided to the ERT during the review week. The ERT was also provided with two background reports (Adams et al. (2005) and O'Doherty and McCulloch (2002)), on which the models are based. The ERT considers that the models are not transparently described in the NIR and recommends that Ireland enhance its description of the models employed in its NIR.

50. For MAC, the ERT found that the tier 2a bottom-up methodology was applied instead of the tier 3b bottom-up method, as stated in the NIR. The NIR also states that the new fleet entering each year can be derived from table E-5 of the NIR, which is not the case. The ERT recommends that Ireland provide information on the number of new vehicles that is used for the estimation, as well as confirm that the correct tier is used, in its NIR.

51. During the review week, the ERT found that the model used for estimating emissions from MAC only included the scrapping of vehicles at the end of their lifetime, which is not in line with the IPCC good practice guidance method, and that there was no consideration of the remaining charge at end of lifetime and no indication of whether the new regulations (starting from 2009) on recovering gas at decommissioning are being followed in Ireland. The ERT also found an error in the input data of the 2011 EF for MAC, where the amount of fluid remaining in products at decommission was reported as "NO" although emissions from disposal were estimated. The ERT recommends that Ireland correct the errors in the method by using the methodology provided in the IPCC good practice guidance (section 3.7.5), including default values for those parameters that are not country specific.

52. Regarding HFC consumption in domestic, commercial, transport and industrial refrigeration and stationary air conditioning, Ireland estimates actual emissions using the tier 2 approach, using a proportion of the sales as an indication of the annual leakage. During the review week, with access to the model in Excel spreadsheets, the ERT noticed that one of the gases used in transport refrigeration – refrigerant R-134a – was not included in the calculation of potential emissions of HFC-134a, leading to an underestimation of the potential emissions. The ERT recommends that Ireland estimate the missing potential emissions and include them in its annual submission. The ERT also recommends that Ireland improve the QA/QC procedures, documentation and data collection for the category, and encourages Ireland to investigate the availability of market surveys and industrial association information to ensure that no data are omitted.

53. The ERT noted that Ireland is possibly the only country in Europe estimating HFC-227ea and HFC-23 emissions for the fire protection subcategory for 1990 to 1995, on the basis of a time series since 1984, when HFCs were rarely used. The ERT considers that Ireland might have used other gases instead of these HFC species. The ERT recommends

that Ireland revise the estimation for the whole time series in order to check the proper identification of the gases used in this category and provide further explanations in the NIR.

3. Non-key categories

Lime production – CO_2

54. The NIR indicates that CO_2 emissions from lime production are estimated by lime producers for the development of the first national action plan (NAP1) under European Union directive 2003/87/EC regarding the EU ETS, and that the emissions were calculated in accordance with the methods described in the supporting European Union decision 2004/156/EC. Nevertheless, the NIR does not indicate how this methodology adheres to the IPCC good practice guidance. During the review, Ireland explained that the fluctuation in the annual implied emission factor (IEF) depends on the amount of lime produced at each plant. The ERT considers this explanation to be insufficient and recommends that Ireland provide more detailed information about this methodology in the NIR.

Limestone and dolomite use – CO_2

55. The NIR indicates that CO_2 emissions from limestone and dolomite use are estimated on the basis of the quantity of limestone used by the companies and an EF of 0.44 t CO_2/t limestone, which is the stoichiometric ratio of CO_2 to calcium carbonate. However, the CRF tables include such a value for up to 2000 only and after that the IEF fluctuates. The ERT recommends that Ireland provide more detailed information about this fluctuation in the NIR.

D. Agriculture

1. Sector overview

56. In 2011, emissions from the agriculture sector amounted to 17,693.21 Gg CO_2 eq, or 30.8 per cent of total GHG emissions. Since 1990, emissions have decreased by 9.9 per cent. The key drivers for the fall in emissions are the reduction in the sheep and dairy cattle populations by 44.8 and 19.0 per cent, respectively, and the reduction in the CH_4 IEF for non-dairy cattle for enteric fermentation by 4.5 per cent, as well as the reduction in the amount of nitrogen (N) applied to soils from synthetic fertilizers by 9.7 per cent. Within the sector, 47.7 per cent of the emissions were from enteric fermentation, followed by 37.8 per cent from agricultural soils and 14.5 per cent from manure management. Prescribed burning of savannahs, field burning of agricultural residues and rice cultivation do not occur in Ireland and were reported as "NO".

57. The ERT noted that the methods used in the calculations are not fully described in the NIR and that the publications referred to in the NIR are not publicly available. The ERT therefore recommends that the Party improve the description of the methods used for the estimation of emissions, especially in relation to the reports by O'Mara (2006) and Hyde et al. (2008), because both publications contain detailed background information on country-specific parameters for livestock, which have an influence on all categories reported by the Party and are frequently referred to in the NIR.

58. The agriculture sector inventory is generally consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. Country-specific EFs and parameters were applied for most of the significant categories for which reliable data were available through detailed surveys and research conducted in Ireland.

59. The ERT considered that the inventory for the agriculture sector was complete in terms of categories, gases, geographical coverage and years. However, during the review

week, the ERT noted that the estimates for and the reporting of agricultural soils were not completely in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. In response to the list of potential problems and further questions raised by the ERT during the review week, Ireland submitted revised estimates for agricultural soils in accordance with the IPCC good practice guidance (see para. 64 below).

60. For those categories reported as "NO" (i.e. cultivation of histosols and field burning of agricultural residues), supporting information was provided during the review. For cultivation of histosols, the Party showed two maps indicating where organic soils exist and where cultivation occurs. The ERT found very little overlap of these areas, as tillage farming in Ireland is concentrated in the south and south-east of the country, while the bulk of organic soils occur in the midlands and west, as described in the NIR. For field burning of agricultural residues, the Party provided a report by Zimmerman (2013), which shows that field burning on arable land has not been a common practice in Ireland, and even if a fire event has been detected, it is regarded as a single event, as there is no inter-annual repetition of fires in similar locations. For these reasons, the ERT concluded that the use of "NO" was reasonable for these categories.

2. Key categories

Enteric fermentation – CH_4

61. The EFs for non-dairy cattle were generally higher in the 1990s than in recent years. Ireland provided in the NIR justifications only for male beef cattle more than two years old, but not for the other age classes. The Party explained that this was because of a higher proportion of late maturing breeds, a lower quality of forage and a lower usage of concentrates during the 1990s. This information was also found in O'Mara (2006). Therefore, the ERT recommends that the Party include this information in the NIR or make that publication readily available to readers in order to increase transparency.

62. Ireland has been using the tier 1 method for estimating CH_4 emissions from sheep, although it has been recommended to use tier 2 for estimating these emissions in several previous review reports, taking into account that enteric fermentation has been a key category. The ERT considered that the use of the tier 1 method is still in line with the IPCC good practice guidance, taking into account the significance of emissions from sheep in this subcategory (accounting for 10.8 per cent and 6.8 per cent of the total emissions from enteric fermentation in 1990 and 2011, respectively) and the decision tree in figure 4.2 of the IPCC good practice guidance. Nevertheless, the ERT reiterates the recommendation made in the previous review report that the Party move up to a tier 2 method when reliable data and information become available, because enteric fermentation is a key category, in both the level and trend analyses, and because the Party explained that an increase in CH_4 emissions from sheep is expected in the near future owing to the potential rise in market demand for lamb. The ERT also recommends that the Party correct the description of how the default EF was adjusted for each subcategory of sheep, if the Party continues to use the tier 1 methodology for estimating these emissions.

Manure management – N_2O

63. Fixed N excretion rates have been used for all animals except dairy cattle for the whole time series. In the category manure management, dairy cattle and non-dairy cattle were found to be significant subcategories, accounting for 25.5 per cent and 61.7 per cent, respectively, of the total N excreted by animals in 2011, while the excretion rates for other animals were not significant. The Party explained that the inventory agency was in ongoing discussions with relevant stakeholders to develop dynamic N excretion rates for cattle. The ERT recommends that the Party continue the investigation and apply the results, in

particular for dairy and non-dairy cattle taking into account their significance, when the data become available.

Agricultural soils – N_2O

64. Ireland has reported direct N_2O emissions and indirect N_2O emissions (from leaching and runoff) from sewage sludge application. However, the Party did not report indirect N_2O emissions from atmospheric deposition for the whole time series, even though estimation methodologies for indirect emissions from sewage sludge are provided in the IPCC good practice guidance. The ERT considered that this could lead to a potential underestimation of emissions; therefore, the ERT included this issue in the list of potential problems and further questions raised by the ERT during the review week. In response to the list of potential problems and further questions, the Party submitted revised estimates for the entire time series and provided a description of the method used to calculate the emissions, including all of the parameters used for 2011. Ireland calculated indirect N_2O emissions from atmospheric deposition on the basis of the AD (the amount of N in sewage sludge) reported for direct N_2O emissions from sewage sludge in its original 2013 annual submission, and using the IPCC default fraction of livestock N excretion that volatizes as ammonia and nitrous oxides ($Frac_{GASM}$) and the IPCC default EF for N_2O emissions from atmospheric deposition of N. The ERT confirmed that the calculation was conducted in accordance with the IPCC good practice guidance, and the ERT therefore considers that the potential underestimation has been resolved. As a result, estimated indirect N_2O emissions from atmospheric deposition have increased by 0.10 Gg CO_2 eq, or 0.02 per cent, for 1990 and 2.05 Gg CO_2 eq, or 0.48 per cent, for 2011 compared with the estimates reported in the original 2013 annual submission. The Party explained that it was in the process of investigating the applicability of estimating ammonia emissions from the spreading of sewage sludge on agricultural land. The ERT welcomes the effort and recommends that the Party replace the default $Frac_{GASM}$ data with country-specific data when they become available.

E. Land use, land-use change and forestry

1. Sector overview

65. In 2011, net removals from the LULUCF sector amounted to 3,701.62 Gg CO_2 eq, offsetting 6.4 per cent of Ireland's total GHG emissions. Since 1990, net removals have increased by 39.0 per cent. The key driver for the rise in removals is the increase in carbon stocks in living biomass in areas converted to forest land. Forest land accounted for net removals of 4,206.56 Gg CO_2 eq, followed by net emissions of 377.65 Gg CO_2 eq from cropland, net emissions of 220.16 Gg CO_2 eq from grassland and net removals of 138.19 Gg CO_2 eq from other land. Wetlands accounted for net emissions of 35.76 Gg CO_2 eq and settlements accounted for net emissions of 9.56 Gg CO_2 eq.

66. Ireland has made major revisions in the reporting of the LULUCF sector, mainly in the forest land remaining forest land and land converted to forest land categories. This resulted in large recalculations for the entire LULUCF sector between the 2012 and 2013 annual submissions. The improvements were a response to consecutive recommendations made in the 2010 and 2011 annual review reports to improve the consistency between the reporting of the LULUCF sector under the Convention and under the Kyoto Protocol. The impact of these recalculations on the LULUCF sector is an increase in the estimated net removals of 3,081.87 Gg CO_2 eq, or 299.1 per cent, for 2010.

67. The key driver for the rise in net removals over the reported period is a steadily increasing growth in living biomass on land converted to forest land owing to a continuous programme of afforestation over more than 20 years. The contribution to the emission trend

of categories other than forest land is small in absolute numbers but substantial in relation to the emissions in the categories. Emissions from cropland increased by 1,788.3 per cent over the period owing to an increase in cropland areas that involves the conversion of improved grassland. Emissions from grassland decreased by 55.4 per cent over the period owing to a rapid decline in the extensive grazing of sheep in the early 1990s, ongoing afforestation activities and the intensification of livestock practices. Emissions from wetlands decreased by 29.5 per cent owing to a decrease in demand for peat. Emissions from settlements decreased by 7.1 per cent owing to an abrupt halt to infrastructure planning. Removals from other land increased by 12,980.0 per cent because grassland that is no longer reported under agriculture is reverting to natural grassland and is reported under other land. Ireland provided additional information on the drivers for the emission trends during the review and the ERT recommends that Ireland include this information in the NIRs of its future annual submissions.

68. As indicated in previous review reports, the Party used different versions of the CARBWARE model to estimate emissions and removals from LULUCF sinks and sources under the Convention and under the Kyoto Protocol. In response to recommendations made in previous review reports, Ireland developed an approach to overcome consistency problems. For reporting for 2007 onwards, Ireland uses the same version of the CARBWARE model for reporting under the Convention and under the Kyoto Protocol. The reporting for 1990 to 2006 is based on the FORCARB model. To correct for biases introduced by using different models, the historical time series calculated with the FORCARB model was rescaled using data for 2007 to 2011 for the two models. The ERT commends Ireland for its efforts to make the reporting transparent and consistent, but also notes that the correction made to the historical time series for living biomass and dead organic matter was only based on the relationship between the two methods (CARBWARE and FORCARB) for five years. The ERT recommends that Ireland continue to assess the requirement for the correction of the historical time series when new modelled data and data from the second NFI and other sources become available.

69. The ERT noted the efforts made by the Party to verify estimates by comparing the IEFs for net removals from forest land remaining forest land and land converted to forest land with net removals reported by other Parties and by independent techniques (eddy-flux). However, comparing IEFs for LULUCF may not always be relevant since Parties use different approaches for area accumulation and factors other than the ones of interest may affect the comparison. For instance, net removals are affected by very country-specific parameters (harvest levels). The ERT noted that the Party's IEF for gains in living biomass for land converted to forest land was higher and that the IEF for losses in living biomass for forest land converted to other land-use categories was lower compared with those of other Parties. The ERT recommends that Ireland continuously verify estimates for gains and losses separately for land converted to forest land and forest land converted to other land-use categories and include information in the NIR justifying the deviation in IEFs from those of other countries.

70. In addition to the major revision carried out by implementing a new approach to calculate carbon stock changes in forest land, Ireland also reclassified the 20-year transition period used for land converted to forest land and forest land converted to other land-use categories to comply with the approach used for afforestation, reforestation and deforestation under the Kyoto Protocol. Forests are now classified as pre- and post-1990 forests, while other land-use change categories continue to apply the 20-year transition period. This resulted in a significant change in land-use change trends. The ERT acknowledges this initiative, but also notes that the use of different transition periods and the effects on the accumulated areas for different land-use change categories require further clarification in the NIR. The ERT recommends that Ireland add more information which clearly describes the use of different transition times for different land-use change

categories, including the relationship to the activities reported under the Kyoto Protocol, in the next NIR. To further enhance transparency related to the methods used to estimate land-use changes, the ERT encourages Ireland to improve the description of how annual land-use changes (which is now included in the category-specific sections of the NIR) are estimated by merging it into the section explaining how different data sources are used to estimate land use.

71. The information in the NIR for LULUCF has also undergone major revisions, mainly in order to align with the changes in methods for forest-related categories, but also because of the results of a peer review conducted in 2012. The ERT commends Ireland for these efforts. The NIR is generally well written and includes most of the necessary information for a proper review. However, the NIR could be further improved by including: (a) a table defining the carbon pools reported for each category; (b) a clear description of how notation keys have been used throughout the reporting of the LULUCF sector; (c) more information on the temporal and spatial coverage of the different data sources used for the sector; and (d) a better description of the land-use change matrix. In addition, the numbering and references to equations and tables needs to be checked. The ERT encourages Ireland to improve the NIR by addressing the issues listed above.

72. During the review, the ERT identified inconsistencies between the NIR and the CRF tables, as well as within the NIR and between the reporting under the Convention and under the Kyoto Protocol. As explained to the Party during the review, the identified inconsistencies were mostly to do with typing and transcription errors:

(a) For 2011, estimated net CO_2 removals are 3,821.95 Gg for land converted to forest land and 3,759.62 Gg for afforestation and reforestation (but the reported areas are the same);

(b) For 2011, estimated net CO_2 emissions are 29.76 Gg for deforestation and net CO_2 removals are 29.81 Gg for forest land converted to other land as reported in CRF table 5 (but the reported areas are the same);

(c) According to the NIR, the EF used for limestone is 0.12 Mg CO_2-carbon (C)/Mg, but in CRF table 5(IV) the reported IEF for cropland is 0.11 Mg CO_2-C/Mg;

(d) The estimated CO_2 emissions from biomass burning for afforestation and reforestation in 2011 (83.42 Gg) are four times higher than the estimated emissions from biomass burning for land converted to forest land (21.09 Gg);

(e) The area of managed wetlands (peatland) reported in CRF table 5.D (52.48 kha) is smaller than the area reported under peatland in CRF table 5(II) (52.95 kha) for 2011.

73. The ERT recommends that Ireland strengthen its QA/QC procedures to avoid transcription and typing errors in the NIR and the CRF tables. The ERT also recommends that Ireland explain any real differences between related categories in the LULUCF sector under the Convention and activities under the Kyoto Protocol.

2. Key categories

Land converted to forest land – CO_2

74. As also noted in the previous review report, Ireland reports carbon stock changes in the soil organic carbon (SOC) pool (mineral soils) for land converted to forest land as "NO". Ireland states and verifies in chapter 11 of the NIR that the pool is not a source according to the requirements of the annex to decision 16/CMP.1, although this provision is only applicable to activities under the Kyoto Protocol. Since default methods to estimate carbon stock changes in mineral soils for this category are available in the IPCC *Good*

Practice Guidance for Land Use, Land-Use Change and Forestry (hereinafter referred to as the IPCC good practice guidance for LULUCF), and considering that land converted to forest land is a key category for Ireland, the ERT recommends that Ireland report carbon stock changes in the SOC pool (mineral soils for land converted to forest land).

3. Non-key categories

Forest land converted to other land-use categories – CO_2

75. Ireland does not report carbon stock changes in the SOC pool (mineral soils for grassland) for forest land converted to other land-use categories (to grassland, settlements and other land), mentioning that the mineral SOC pool is verified not to be a source (grassland) and that there is no documentation of methods in the IPCC good practice guidance for LULUCF (settlements and other land). As mentioned in paragraph 74 above, the 'not a source' provision is only applicable to activities under the Kyoto Protocol. The ERT reiterates the recommendation made in the previous review report that Ireland report carbon stock changes in mineral soils for forest land converted to other land-use categories for categories for which estimation methods are provided in the IPCC good practice guidance for LULUCF.

Other land – CO_2

76. As indicated in previous review reports, the ERT noted that the areas of natural grassland that are not grazed in the inventory year are reported under the land-use category other land. During the review, Ireland informed the ERT that existing data were explored to establish a robust methodology for the determination of the extent of natural grassland for inclusion within the land-use category grassland. The ERT reiterates the recommendation made in the previous review report that Ireland introduce natural grassland areas as a subdivision of the land-use category grassland.

Biomass burning – CH_4 and N_2O

77. The ERT found that Ireland uses different units for the reporting of AD for biomass burning under the Convention (area burned) and under the Kyoto Protocol (mass burned). Using different units makes the assessment of consistency between the Convention and the Kyoto Protocol reporting of LULUCF difficult. Therefore, the ERT recommends that Ireland use and report the same units for AD for biomass burning under the Convention and under the Kyoto Protocol (see para. 105 below).

F. Waste

1. Sector overview

78. In 2011, emissions from the waste sector amounted to 1,042.58 Gg CO_2 eq, or 1.8 per cent of total GHG emissions. Since 1990, emissions have decreased by 24.6 per cent. The key driver for the fall in emissions is the increase in CH_4 recovery from solid waste disposal sites, which has increased from 9.1 per cent of emissions generated in 1996 to 67.2 per cent in 2011. Within the sector, 79.7 per cent of the emissions were from solid waste disposal on land, followed by 15.1 per cent from wastewater handling. The remaining 5.2 per cent were from waste incineration (incineration of solvents).

79. The inventory for the waste sector is complete. The ERT welcomes the inclusion of emissions from solvent and clinical waste incineration for the first time in the 2013 annual submission.

80. The description of emissions and methods for the waste sector in the NIR and the CRF tables is generally transparent; however, further steps could be taken to improve transparency. These steps are addressed in the following sectoral discussion regarding AD (see para. 90 below), key model parameters (see para. 88 below), waste composition data (see para. 87 below), uncertainties (see para. 82 below) and QA/QC (see para. 84 below).

81. The ERT encourages Ireland to maintain an ongoing watch on commercial composting and consider introducing the calculation of corresponding emission estimates when appropriate.

82. Ireland has provided an aggregate uncertainty for emissions from solid waste disposal on land but not for wastewater handling or incineration in the waste section of the NIR. While the overall inventory uncertainty does include uncertainty for incineration and wastewater, the ERT encourages Ireland to expand the discussion of uncertainty in the waste chapter to include the aggregate uncertainty for wastewater and incineration in its next annual submission.

83. Recalculations are quantified and well documented in the NIR. These recalculations have resulted in an increase in the estimated emissions throughout the time series, ranging from 81.54 Gg CO_2 eq for 1990 to 76.95 Gg CO_2 eq for 2011. Recalculations have occurred as a result of revised data for landfill gas flared, revisions to organic product input in wastewater treatment, revised per capita protein consumption data from the statistics of the Food and Agriculture Organization of the United Nations (FAOSTAT) and the inclusion of emissions from incineration of solvents and clinical waste.

84. QA/QC procedures are generally well documented in the NIR. However, discussions during the review week confirmed that some recent sector-specific QA activities have not been documented. The ERT encourages Ireland to fully document these activities in the NIR of its next annual submission.

2. Key categories

Solid waste disposal on land – CH_4

85. Ireland uses the tier 2 method of the IPCC good practice guidance, first-order decay (FOD) model, to estimate emissions from managed waste disposal on land, which is consistent with the 2006 IPCC Guidelines. Ireland provided justification for the use of the 2006 FOD model in the NIR. AD to support this model are obtained from the national waste database published by EPA on a yearly basis since 2001 and periodically prior to 2001. The model is run separately for larger landfills and aggregations of smaller landfills, as well as for sewage sludge and street sweepings. This provides a good degree of flexibility to reflect operational circumstances at individual landfills and groupings of similar landfills. The ERT encourages Ireland to continue to review structural changes in the landfill sector and model additional individual landfills when circumstances and data availability permit.

86. The Party confirmed that each model covers a different historical time period, with the oldest extending back to 1956. Ireland provides information about each of the 15 model runs in annex I to the NIR.

87. Ireland provides information on waste composition in annex I to the NIR. The ERT noted the recommendation made in previous review reports that Ireland provide further information on the composition of "organic waste" in the NIR to improve the transparency of the inventory. This information has not been provided in the 2013 annual submission. Therefore, the ERT reiterates this recommendation and also recommends that Ireland report on the composition of street sweepings and other municipal solid waste (MSW) to support the degradable organic carbon (DOC) values reported in the NIR.

88. The ERT noted that some model parameters used in the FOD model are not discussed in the NIR. For example, the time lag between disposal and methanogenesis, oxidation and the fraction of CH_4 in landfill gas are not explicitly discussed. The ERT recommends that Ireland include a discussion of these model parameters in its next NIR, including the values used and justification for their use.

3. Non-key categories

Wastewater handling – CH_4 and N_2O

89. Ireland estimates emissions from industrial sludge treatment according to the method set out in the Revised 1996 IPCC Guidelines. AD in the form of biochemical oxygen demand (BOD) are derived from the quantity of dry solids of sludge and an assumed BOD content of 60 kg BOD/t dry solids. Default EFs are applied, assuming 3.0 per cent of BOD in sludge is treated anaerobically.

90. The ERT finds that the information in the NIR on industrial wastewater is limited and should be expanded to better describe the source and derivation of AD and the industrial sectors contributing to the BOD load. The ERT encourages Ireland to include AD on wastewater in annex I to the NIR.

91. Ireland estimates emissions from domestic and commercial wastewater treatment according to the method set out in the Revised 1996 IPCC Guidelines. AD are based on an estimate of population equivalent connected to the sewerage system taken from periodic urban wastewater reports. Ireland uses the default EF adjusted for the fraction of organic material treated anaerobically.

92. Ireland reports that all wastewater treatment plants employ aerobic processes, but that a small proportion of sludge is treated anaerobically. The fraction of BOD in sludge that is treated anaerobically is applied consistently throughout the whole time series and amounts to 3 per cent, based on data in O'Leary and Carty (1998). Publications provided to the ERT which pre- and post-date that publication show some variation in this value (e.g. O'Leary et al. (1997) suggests a value of 8 per cent and O'Leary et al. (2000) suggests a value of 6 per cent). The ERT recommends that Ireland review this assumption in the light of structural changes in the wastewater treatment network that have occurred since the publication in 1998 and report thereon in the NIR.

93. Ireland reports in the NIR that one wastewater treatment plant in Ringsend processes sludge for reuse and captures the resulting CH_4 emissions for use on site. However, this site is not accounted for in the AD for 2005 onwards, when CH_4 collection commenced. Rather, a quantity of BOD is deducted from the total BOD to effectively remove this plant from the system. The ERT concludes that this is not transparent and recommends that Ireland include BOD from Ringsend in the total BOD and provide a deduction as CH_4 captured in CRF table 6.B. Furthermore, the ERT recommends that Ireland review and provide additional justification for the estimate of population equivalent covered by this plant, in order to enhance transparency.

94. During the review, Ireland confirmed that the quantity of CH_4 consumed at Ringsend for production of on-site electricity is captured in the energy balance and reported appropriately in the energy sector. The ERT encourages Ireland to document this in the next NIR and to cross-check this value with the CH_4 capture reported in CRF table 6.B.

Waste incineration – CO_2, CH_4 and N_2O

95. Ireland has included emissions from solvent and clinical waste incineration in its 2011 submission. These emissions are estimated according to the tier 1 method in the 2006 IPCC Guidelines. AD are sourced from the national waste database. While there are no appropriate EFs for the incineration of solvents and clinical waste in the Revised 1996

IPCC Guidelines or the IPCC good practice guidance, the ERT encourages Ireland to include a discussion in its NIR on the applicability of EFs from the 2006 IPCC Guidelines to its incinerator units.

96. The ERT found a small instance of double counting in the quantity of clinical waste incinerated reported in CRF table 6.C for the years 1990–1997. This double counting is limited to AD and has occurred because the total value of clinical waste incinerated is reported against both biogenic and non-biogenic waste. The ERT recommends that Ireland correct this double counting in the CRF tables by disaggregating the AD into biogenic and non-biogenic components.

G. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

1. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Overview

97. Table 6 provides an overview of the information reported and parameters selected by the Party under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

98. Ireland has made major revisions in the reporting of the KP-LULUCF sector. These mainly affect afforestation and reforestation owing to the modification of the model used (CARBWARE), which resulted in large recalculations between the 2012 and 2013 annual submissions. The impact of these recalculations on the KP-LULUCF sector is an increase in the estimated net removals for afforestation and reforestation of 540.16 Gg CO_2 eq, or 18.1 per cent, for 2010. Recalculations for deforestation owing to the inclusion of the reporting of carbon stock changes in organic soils resulted in an increase in the estimated net emissions of 0.11 Gg CO_2 eq, or 0.6 per cent, for 2010.

99. Ireland has identified CO_2 emissions from afforestation and reforestation under Article 3, paragraph 3, of the Kyoto Protocol as a key category for 2011. The ERT recommends that Ireland include a paragraph explaining the assessment of key categories for the KP-LULUCF activities in its NIR (in chapter 11 on supplementary information under Article 7, paragraph 1, of the Kyoto Protocol).

100. The ERT notes and commends Ireland for the efforts made to verify estimates by comparing IEFs for net removals from afforestation and reforestation (land converted to forest land) with net removals reported by other Parties and by independent techniques (eddy-flux). However, comparing IEFs for LULUCF may not always be relevant because Parties use different approaches for area accumulation and factors other than the ones of interest, which may affect the comparison. For instance, net removals are affected by country-specific parameters (harvest levels) and net removals in afforestation and reforestation are mainly driven by gains. The ERT notes that the Party's IEF for gains in living biomass for afforestation and reforestation was very high and that the IEF for losses in living biomass for forest land converted to other land-use categories was low compared with those of other Parties. During the review, Ireland provided information justifying these differences, including evidence for the high yields in Sitka spruce plantations. The ERT assessed and accepted the justification. The ERT recommends that Ireland continuously verify estimates for gains and losses separately for afforestation, reforestation and deforestation and include information on the justification of the deviation in IEFs from those of other countries in its NIR.

101. During the review, the ERT identified inconsistencies between the NIR and the CRF tables, as well as within the NIR and between the reporting under the Convention and under the Kyoto Protocol in the CRF tables. The identified inconsistencies were mostly because

of typing and transcription errors. In addition to the errors listed in paragraph 72 above, Ireland reports different areas for deforestation in the CRF tables for 2011 (8.50 kha) and in the NIR (page 235) (8.49 kha). The ERT recommends that Ireland strengthen its QA/QC process to avoid transcription errors and typing errors in the NIR and the CRF tables, and explain the real differences between related categories and activities, if necessary, in future annual submissions.

102. As pointed out in previous annual review reports, the ERT noted that the areas for afforestation and reforestation at the end of a reported year do not match the areas for afforestation and reforestation at the beginning of the next reporting year, as shown in CRF table NIR-2. The problem relates to how the table is interpreted and exclusively concerns Parties that include land under deforestation that was previously reported under afforestation and reforestation. The problem was solved through discussion and consideration between the Party and the ERT during the review. The ERT recommends that Ireland correct the reported areas in CRF table NIR-2, and in the upper left cell of CRF table NIR-2 include the part of the existing afforestation and reforestation area at the beginning of the reported year that is not deforested during the reported year and in the upper second left cell include the deforested area during the reported year previously reported as afforestation and reforestation. Deforested areas during the reported year that have not previously been reported under afforestation and reforestation should be reported as "other" in the column deforestation. Land areas afforested during the reported year should be included under "other" in the column afforestation and reforestation.

Table 6
Supplementary information reported under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

		Findings and recommendations
Has the Party reported information in accordance with the requirements in paragraphs 5–9 of the annex to decision 15/CMP.1?	Insufficient	Ireland does not provide proper justification that the soil organic carbon pool (mineral soil) is not a source for some of the categories included under deforestation, currently not reported
Identify any elected activities under Article 3, paragraph 4, of the Kyoto Protocol	None	
Identify the period of accounting	Commitment period accounting	
Assessment of the Party's ability to identify areas of land and areas of land-use change	Sufficient	

Activities under Article 3, paragraph 3, of the Kyoto Protocol

Afforestation and reforestation – CO_2, CH_4 and N_2O

103. Ireland tracks afforestation on a spatially explicit basis using IPCC approach 3. Afforested areas are identified via data obtained from the Forest Service Grant and Premiums Scheme, supporting the planting and establishing of forests since 1990. Afforestation areas are verified using a strict process and can be considered as being

directly human induced. Afforestation is reported using the boundaries of the entire territory of Ireland.

104. Ireland provides information in the NIR verifying that the SOC pool (mineral soils) is not a net source. The ERT found the information to be mostly relevant to justifying the exclusion of the SOC pool from the reporting. However, some of the information provided was not relevant to justifying the exclusion of the SOC pool from the reporting. The ERT strongly recommends that Ireland strengthen its arguments to justify that the mineral SOC pool is not a source under afforestation and reforestation by only including very specific information in the NIR.

105. The ERT found that Ireland uses different units for the reporting of AD for biomass burning under the Convention (area burned) and under the Kyoto Protocol (mass burned). Using different units makes the assessment of consistency difficult and the ERT therefore recommends that Ireland use the same units for reporting AD for biomass burning under the Convention as used under the Kyoto Protocol (see para. 77 above).

Deforestation – CO_2

106. Deforestation areas are identified using IPCC approach 2 on the basis of legally binding licence applications for harvest under the Forestry Act. These provisions fulfil the requirement to demonstrate that deforestation is directly human induced. Deforestation is reported using the boundaries of the entire territory of Ireland. The Party explained that, since AD for deforestation is considered very uncertain, the deforested area will be verified using the second NFI, which ended in 2012. The ERT acknowledges this initiative and recommends that Ireland provide information on this verification.

107. Ireland does not report SOC changes in mineral soils for deforestation. The ERT considers that, if no evidence can be provided to justify that the pool is not a source following conversion, SOC changes need to be reported. Ireland includes some information justifying that conversions to grassland may not result in emissions, but there is no justification for omitting conversions to settlements and other land. The ERT strongly recommends that Ireland report carbon stock changes in the SOC pool (mineral soils) for deforestation if it cannot be justified that the pool is not a source.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

108. Ireland has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings and recommendations included in the standard independent assessment report (SIAR) on the SEF tables and the SEF comparison report.[3] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings and recommendations contained in the SIAR.

109. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with decision 15/CMP.1, annex, chapter I.E, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements referred to in decision 22/CMP.1, annex, paragraph 88(a–j). The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the

[3] The SEF comparison report is prepared by the international transaction log (ITL) administrator and provides information on the outcome of the comparison of data contained in the Party's SEF tables with corresponding records contained in the ITL.

requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. No discrepancy has been identified by the ITL and no non-replacement has occurred. The national registry has adequate procedures in place to minimize discrepancies.

Calculation of the commitment period reserve

110. Ireland has reported its commitment period reserve in its 2013 annual submission. The Party reported that its commitment period reserve has not changed since the initial report review (282,765,845 t CO_2 eq) as it is based on the assigned amount and not the most recently reviewed inventory. The ERT agrees with this figure.

3. Changes to the national system

111. Ireland reported that there are no institutional changes in its national system since the previous annual submission. Two current agreements between the inventory agency and the Department of Agriculture, Food and Marine were revised and drafted into one new agreement in 2012 to include key statistics under both sectors. In addition, the agreement between the inventory agency and the Central Statistics Office was revised to facilitate the free and timely exchange of data between the organizations. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

4. Changes to the national registry

112. Ireland reported in the NIR that there are changes in its national registry since the previous annual submission. The changes are because of the integration of the national registry into the consolidation of European national registries and include: cooperation agreements; database capacity; conformance to technical standards; procedures employed in the registry to minimize discrepancies; security measures; the Internet address of the registry; data integrity measures; and the results of the test procedures. The changes did not have an impact on the functions of the registry in relation to the Kyoto Protocol and did not affect the database capacity.

113. The national registry of Ireland successfully passed all recertification tests and completed a full certification procedure in the Consolidated System of European Union Registries (CSEUR) in June 2013 and thorough testing against the Data Exchange Standard (DES) has been successfully carried out prior to the relevant major release of the version to production. The ERT concluded that, taking into account the confirmed changes in the national registry, Ireland's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol.

114. The SIAR, part II, states that Ireland is not fully reporting changes in the national registry related to the description of database structure. Although the Party resubmitted a simplified data model during the assessment cycle, the information contained within the model is not sufficient. This is evidenced by the lack of descriptions of each entity in the diagram and the omission of some diagram entities mandated in the DES. The recommendation contained in the SIAR, part II, is that, following major changes, the Party provide a data model that contains all entities required by the DES complete with descriptions in its NIR. The ERT recommends that Ireland include this information.

5. Minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol

115. Ireland reported that there are no changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol since the previous annual submission. The ERT concluded that the information provided continues to be complete and transparent and commends Ireland for the detailed information.

116. Actions reported by the Party include, for example, the use or removal of subsidies associated with environmental technologies with the final aim of reducing GHG emissions, and projects to support developing countries in coming up with technological solutions for reducing GHG emissions and in strengthening the capacity for tackling environmental efficiency issues. As a member State of the European Union, the actions in this area are largely dictated by the European Commission's policy on climate change and by its policies and programmes affecting developing countries.

III. Conclusions and recommendations

A. Conclusions

117. Table 7 summarizes the ERT's conclusions on the 2013 annual submission of Ireland, in accordance with the Article 8 review guidelines.

Table 7
Expert review team's conclusions on the 2013 annual submission of Ireland

		Paragraph cross references
The ERT concludes that the inventory submission of Ireland is complete (categories, gases, years and geographical boundaries) and contains both an NIR and CRF tables for 1990–2011		
Annex A sources[a]	Complete	
LULUCF[a]	Complete	
KP-LULUCF	Not complete	107
The ERT concludes that the inventory submission of Ireland has been prepared and reported in accordance with the UNFCCC reporting guidelines	Yes	
The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1	No	107
The Party's inventory is in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*	Yes	
The Party has reported information on Article 3, paragraphs 3 and 4, of the Kyoto Protocol	Yes	104 and 107

		Paragraph cross references
The Party has reported information on its accounting of Kyoto Protocol units in accordance with decision 15/CMP.1, annex, chapter I.E, and used the required reporting format tables as specified by decision 14/CMP.1	Yes	
The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1	Yes	
The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions	Yes	112–114
Did the Party provide information in the NIR on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol?	Yes	
Ireland provided comprehensive and clear information on activities under Article 3, paragraph 14, of the Kyoto Protocol regarding the use of subsidies, projects and capacity strengthening activities		

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, CMP = Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol, CRF = common reporting format, ERT = expert review team, IPCC = Intergovernmental Panel on Climate Change, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

B. Recommendations

118. The ERT identified the issues for improvement listed in table 8. All recommendations are for the next annual submission, unless otherwise specified.

Table 8
Recommendations identified by the expert review team

Sector	*Category*	*Recommendation*	*Paragraph cross references*
Cross-cutting	General	Maintain the quality of the inventory and facilitate further implementation of inventory improvements, if necessary by allocating sufficient resources	13
	QA/QC	Ensure sufficient resources for the management of the inventory	15
	Transparency	Further improve the transparency of the NIR, especially related to transparency of the NIR regarding AD, EFs and other parameters, as indicated in the sector-specific chapters	16

Sector	*Category*	*Recommendation*	*Paragraph cross references*
Energy	General	Provide more information on the category-specific QA/QC measures for EU ETS data in the NIR	22
		Improve the transparency of the emission estimates in the energy sector, for example by providing a table in the energy chapter of the NIR for CO_2 with the percentage distribution of emissions based on EU ETS data and calculated emissions, in order to improve the transparency of the reporting and to facilitate future review activities	23
		Clarify for which sectors and to what extent data from plants are included directly in the inventory	24
		Include in the NIR a detailed description of the energy balance, including the data sources that the energy balance is based on and whether the data sources are derived from a top-down and/or a bottom-up approach or based on surveys, in a transparent manner	26
		Include a description of how the oil balance is produced, the basis for dividing diesel consumption between road traffic and non-road traffic and the allocation of other gas oils (marine diesel oil and light fuel oil) between the user categories, in the NIR in a transparent manner	26
		Document and justify the choice of EFs in the energy sector in the NIR	27
		Provide information on CO_2 EFs applied, net calorific values and densities for all energy carriers in a table, to increase the transparency of the inventory	28
		Include information on category-specific QA/QC procedures for the use of plant-specific data	29
		Justify why fuel consumption for non-road vehicles is included in the inventory	30
		Improve the reporting on non-road vehicles by preparing a more accurate and transparent inventory for the category	30
		Correct the discrepancies between CRF tables 1.A(c) and 1.A(d)	33
	Stationary combustion: solid, liquid and gaseous fuels – CO_2	Describe the references for the country-specific CO_2 EFs in the NIR	37
		Improve the description of the methodology and assumptions used for the category agriculture/forestry/fisheries in the NIR	38
	Road transportation: liquid fuels – CO_2, CH_4 and N_2O	Include in the NIR a general description of the COPERT model, for example that the model is fuel driven (kilometres driven), and describe the relevant national data included in the model	39
		Describe in the NIR how fuel consumption for road transportation is estimated	40

Sector	*Category*	*Recommendation*	*Paragraph cross references*
	Oil and natural gas – CO_2, CH_4 and N_2O	Explain in the NIR the different emission sources in the offshore sector (gas production), the compiling of the energy balance and where in the CRF tables the different emission sources are reported	41
Industrial processes and solvent and other product use	Cement production – CO_2	Better explain in the NIR the methodology used to produce EU ETS data and correct minor discrepancies	48
	Consumption of halocarbons and SF_6 – HFCs	Enhance the description of the models employed in the NIR	49
		Provide in the NIR the information on numbers of new vehicles that is used for the estimation, as well as confirm that the correct tier method is used	50
		Correct the method regarding mobile air conditioning by using the methodology provided in the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (section 3.7.5), including default values for those parameters that are not country specific	51
		Estimate the missing potential emissions and include them in the annual submission	52
		Improve QA/QC procedures, documentation and data collection	52
		Revise the estimation for the whole time series in order to check the proper identification of the gases used in the category and provide further explanations in the NIR	53
		Provide more detailed information about the methodology in the NIR	54
		Provide more detailed information about the fluctuation in the NIR	55
Agriculture	General	Improve the description of the methods used for the estimation of emissions, especially in relation to the reports by O'Mara (2006) and Hyde et al. (2008), because both publications contain detailed background information on country-specific parameters for livestock, which have an influence on all categories reported by the Party and are frequently referred to in the NIR	57
	Enteric fermentation – CH_4	Include information on why EFs for non-dairy cattle were generally higher in the 1990s than in recent years in the NIR or make O'Mara (2006) readily available to readers to increase transparency	61
		Move to a tier 2 method when reliable data and information become available, because enteric fermentation is a key category, in both the level and trend analyses, and because the Party explained that an increase in the CH_4 emissions from sheep is expected in the near future owing to the potential rise of market demand for lamb	62

Sector	*Category*	*Recommendation*	*Paragraph cross references*
		Correct the description of how the default EF was adjusted for each subcategory of sheep, if the Party continues to use the tier 1 methodology for estimating these emissions	62
	Manure management – N_2O	Continue the investigation of the development of dynamic nitrogen excretion rates and apply the results, in particular for dairy and non-dairy cattle, taking into account their significance, when data become available	63
	Agricultural soils – N_2O	Replace the default FracGASM data with country-specific data when they become available	64
Land use, land-use change and forestry	General	Include information on drivers for emission trends in the NIRs of future annual submissions	67
		Continue to assess the requirement for the correction of the historical time series when new modelled data and data from the second national forest inventory and other sources become available	68
		Continuously verify estimates for gains and losses separately for land converted to forest land and forest land converted to other land-use categories	69
		Include information in the NIR justifying the deviation in IEFs from those of other countries	69
		Add more information that clearly describes the use of different transition times for different land-use change categories, including the relationship to the activities under the Kyoto Protocol, in the NIR	70
		Strengthen QA/QC procedures to avoid transcription and typing errors in the NIR and in the CRF tables	72
		Explain real differences between related categories in the LULUCF sector under the Convention and activities under the Kyoto Protocol	72
	Land converted to forest land – CO_2	Report carbon stock changes in the SOC pool (mineral soils for land converted to forest land)	74
	Forest land converted to other land-use categories – CO_2	Report carbon stock changes in mineral soils for forest land converted to other land-use categories for categories for which methods are provided in the IPCC good practice guidance for LULUCF	75
	Other land – CO_2	Introduce natural grassland areas as a subdivision of the land-use category grassland	76
	Biomass burning – CH_4 and N_2O	Use and report the same units for AD for biomass burning under the Convention and under the Kyoto Protocol	77
Waste	Solid waste disposal on land – CH_4	Report on the composition of street sweepings and municipal solid waste (MSW) to support the degradable organic carbon (DOC) values reported in the NIR	87
		Include a discussion of first-order decay model parameters	88

Sector	*Category*	*Recommendation*	*Paragraph cross references*
		in the NIR, including the values used and justification for their use	
	Wastewater handling – CH_4 and N_2O	Review assumptions in the light of structural changes in the wastewater treatment network that have occurred since O'Leary and Carty (1998) and report thereon in the NIR	92
		Include BOD from Ringsend in the total BOD and provide a deduction as methane captured in CRF table 6.B	93
		Review and provide additional justification for the estimate of population equivalent covered by the wastewater treatment plant in Ringsend	93
	Waste incineration – CO_2, CH_4 and N_2O	Correct the double counting in the CRF tables by disaggregating the AD into biogenic and non-biogenic components	96
KP-LULUCF	General	Include a paragraph explaining the assessment of key categories for the KP-LULUCF activities in the NIR (in chapter 11 on supplementary information under Article 7, paragraph 1, of the Kyoto Protocol)	99
		Continuously verify estimates for gains and losses separately for afforestation, reforestation and deforestation and include information on the justification of the deviation in IEFs from those of other countries in the NIR	100
		Strengthen the QA/QC processes to avoid transcription errors and typing errors in the NIR and in the CRF tables, and explain real differences between related categories and activities, if necessary, in future annual submissions	101
		Correct the reported areas in CRF table NIR-2, and in the upper left cell of CRF table NIR-2 include the part of the existing afforestation and reforestation area at the beginning of the reported year that is not deforested during the reported year, and in the upper second left cell include the deforested area for afforestation and reforestation during the reported year	102
	Afforestation and reforestation – CO_2	Strengthen the arguments justifying that the mineral SOC pool is not a source under afforestation and reforestation by only including very specific information in the NIR	104
	Afforestation and reforestation – CH_4 and N_2O	Use the same units for reporting AD for biomass burning under the Convention as under the Kyoto Protocol	105
	Deforestation – CO_2	Provide information that the deforested area will be verified using the second national forest inventory, which ended in 2012	106
		Report carbon stock changes in mineral soils for deforestation if it cannot be justified that the pool is not a source	107

Sector	*Category*	*Recommendation*	*Paragraph cross references*
National registry		Following major changes, provide a data model that contains all entities required by the DES complete with descriptions in the NIR	114

Abbreviations: AD = activity data, BOD = biochemical oxygen demand, CRF = common reporting format, EF = emission factor, EU ETS = European Union Emissions Trading System, IEF = implied emission factor, IPCC = Intergovernmental Panel on Climate Change, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NIR = national inventory report, SOC = soil organic carbon, QA/QC = quality assurance/quality control.

IV. Questions of implementation

119. No questions of implementation were identified by the ERT during the review.

Annex I

Background data on recalculations and information to be included in the compilation and accounting database

Table 9
Recalculations in the 2013 annual submission for the base year and the most recent year

	1990	*2010*	*1990*	*2010*	
Greenhouse gas source and sink categories	*Value of recalculation (Gg CO_2 eq)*		*Per cent change*		*Reason for the recalculation*
1. Energy	4.02	20.06	0.01	0.05	Revised EF and AD and methodological change
A. Fuel combustion (sectoral approach)	4.02	20.06	0.01	0.05	
1. Energy industries	NA	5.27	NA	0.04	
2. Manufacturing industries and construction	NA	NA	NA	NA	
3. Transport	3.90	–2.74	0.1	–0.02	
4. Other sectors	0.12	–2.44	0.001	–0.02	
5. Other	NA	NA	NA	NA	
B. Fugitive emissions from fuels	NA	NA	NA	NA	
1. Solid fuels	NA	NA	NA	NA	
2. Oil and natural gas	NA	NA	NA	NA	
2. Industrial processes	NA	–3.74	NA	–0.2	Revised AD
A. Mineral products	NA	NA	NA	NA	
B. Chemical industry	NA	NA	NA	NA	
C. Metal production	NA	NA	NA	NA	
D. Other production	NA	NA	NA	NA	
E. Production of halocarbons and SF_6	NA	NA	NA	NA	
F. Consumption of halocarbons and SF_6	NA	–3.74	NA	–0.6	
G. Other	NA	NA	NA	NA	
3. Solvent and other product use	NA	0.07	NA	0.09	Revised AD
4. Agriculture	–0.99	87.16	–0.01	0.5	Revised AD
A. Enteric fermentation	NA	46.46	–0.02	0.5	
B. Manure management	NA	23.97	NA	0.9	
C. Rice cultivation	NA	NA	NA	NA	
D. Agricultural soils	–0.99	16.73	–0.01	0.2	
E. Prescribed burning of savannahs	NA	NA	NA	NA	
F. Field burning of agricultural residues	NA	NA	NA	NA	
G. Other	NA	NA	NA	NA	
5. Land use, land-use change and forestry	–2 863.49	–3 081.87	–1 422.0	299.1	Methodological

Greenhouse gas source and sink categories	*1990*	*2010*	*1990*	*2010*	*Reason for the recalculation*
	Value of recalculation (Gg CO_2 eq)		*Per cent change*		
					change and revised AD
A. Forest land	–2 864.60	–3 046.54	772.1	222.2	
B. Cropland	NA	39.26	NA	15.6	
C. Grassland	−0.003	–89.97	–0.001	–43.2	
D. Wetlands	0.04	–0.08	0.1	–0.2	
E. Settlements	1.07	0.11	11.7	0.5	
F. Other land	0.003	15.36	–0.3	–8.4	
G. Other	NA	NA	NA	NA	
6. Waste	81.54	76.95	6.3	8.7	Revised AD
A. Solid waste disposal on land	NA	27.22	NA	3.7	
B. Wastewater handling	–2.29	–4.33	–1.8	–2.7	
C. Waste incineration	83.84	54.06	NA	NA	
D. Other	NA	NA	NA	NA	
7. Other	NA	NA	NA	NA	
Total CO_2 equivalent without LULUCF	84.57	180.50	0.2	0.3	
Total CO_2 equivalent with LULUCF	–2 778.92	–2 901.37	–5.0	–4.8	

Abbreviations: AD = activity data, EF = emission factor, LULUCF = land use, land-use change and forestry, NA = not applicable.

Table 10
Information to be included in the compilation and accounting database in t CO_2 eq for 2011, including the commitment period reserve

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Commitment period reserve	282 765 845			282 765 845
Annex A emissions for 2011				
CO_2	37 664 479			37 664 479
CH_4	11 628 821			11 628 821
N_2O	7 619 076	7 621 124		7 621 124
HFCs	538 612			538 612
PFCs	13 198			13 198
SF_6	48 293			48 293
Total Annex A sources	**57 512 478**	**57 514 525**		**57 514 525**
Activities under Article 3, paragraph 3, for 2011				
3.3 Afforestation and reforestation on non-harvested land for 2011	–3 595 865			–3 595 865
3.3 Afforestation and reforestation on harvested land for 2011	–155 453			–155 453
3.3 Deforestation for 2011	29 765			29 765
Activities under Article 3, paragraph 4, for 2011[c]				
3.4 Forest management for 2011				
3.4 Cropland management for 2011				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2011				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2011				
3.4 Revegetation in the base year				

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 11
Information to be included in the compilation and accounting database in t CO_2 eq for 2010

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2010				
CO_2	41 341 618			41 341 618
CH_4	11 697 096			11 697 096
N_2O	7 823 011	7 825 022		7 825 022
HFCs	559 299			559 299
PFCs	37 022			37 022
SF_6	34 511			34 511
Total Annex A sources	**61 492 558**	**61 494 569**		**61 494 569**
Activities under Article 3, paragraph 3, for 2010				
3.3 Afforestation and reforestation on non-harvested land for 2010	–3 434 858			–3 434 858
3.3 Afforestation and reforestation on harvested land for 2010	–90 192			–90 192
3.3 Deforestation for 2010	19 646			19 646
Activities under Article 3, paragraph 4, for 2010[c]				
3.4 Forest management for 2010				
3.4 Cropland management for 2010				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2010				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2010				
3.4 Revegetation in the base year				

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 12
Information to be included in the compilation and accounting database in t CO_2 eq for 2009

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2009				
CO_2	41 726 520			41 726 520
CH_4	11 929 808			11 929 808
N_2O	7 541 403	7 543 378		7 543 378
HFCs	523 326			523 326
PFCs	65 570			65 570
SF_6	38 236			38 236
Total Annex A sources	**61 824 864**	**61 826 838**		**61 826 838**
Activities under Article 3, paragraph 3, for 2009				
3.3 Afforestation and reforestation on non-harvested land for 2009	–3 429 552			–3 429 552
3.3 Afforestation and reforestation on harvested land for 2009	89 759			89 759
3.3 Deforestation for 2009	34 556			34 556
Activities under Article 3, paragraph 4, for 2009[c]				
3.4 Forest management for 2009				
3.4 Cropland management for 2009				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2009				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2009				
3.4 Revegetation in the base year				

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 13
Information to be included in the compilation and accounting database in t CO_2 eq for 2008

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2008				
CO_2	47 018 644			47 018 644
CH_4	12 228 169			12 228 169
N_2O	7 631 679	7 633 619		7 633 619
HFCs	566 660			566 660
PFCs	106 197			106 197
SF_6	56 676			56 676
Total Annex A sources	**67 608 024**	**67 609 964**		**67 609 964**
Activities under Article 3, paragraph 3, for 2008				
3.3 Afforestation and reforestation on non-harvested land for 2008	–3 230 809			–3 230 809
3.3 Afforestation and reforestation on harvested land for 2008	171 376			171 376
3.3 Deforestation for 2008	26 446			26 446
Activities under Article 3, paragraph 4, for 2008[c]				
3.4 Forest management for 2008				
3.4 Cropland management for 2008				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2008				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2008				
3.4 Revegetation in the base year				

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Annex II

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>.

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

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.htm>.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

"Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention". FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

"Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol". Decision 19/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Decision 15/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>.

"Guidelines for review under Article 8 of the Kyoto Protocol". Decision 22/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

Status report for Ireland 2013. Available at <http://unfccc.int/resource/docs/2013/asr/irl.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2013. Available at <http://unfccc.int/resource/webdocs/sai/2013.pdf>.

FCCC/ARR/2012/IRL. Report of the individual review of the annual submission of Ireland submitted in 2012. Available at <http://unfccc.int/resource/docs/2013/arr/irl.pdf>.

UNFCCC. *Standard independent assessment report*, parts I and II. Available at <http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Paul Duffy (Irish Environmental Protection Agency), including additional material on the methodologies and assumptions used. The following documents[1] were also provided by Ireland:

Adams, M., Wagner, A., Goodwin, J., O'Leary, E., Creedon, M., McHugh, M and Gibson, C. 2005. Compiling Emission Inventories of HFCs, PFCs and SF_6 for inclusion in Ireland's greenhouse gas submissions to the EU under Decision 280/2004/EC under the United National Framework Convention on Climate Change. Netcen/ ED48411/R1, AEA Technology UK.

COPERT (2011) 4 v9.0, Emisia SA Report 11.RE.005.V1, EMISIA. 2011

Hyde, B., Carton, O.T. and Murphy, W.E. (2008). Farm Facilities Survey – Ireland 2003. Report prepared for the Department of Agriculture by Teagasc, Johnstown Castle, Co. Wexford.

Ireland's HFC's models in excel sheets.

O'Doherty, S. and McCulloch, A. 2002. Emission Inventories of HFC, PFC and SF_6. RTDI Project L.S.-5.1.3(a) Final Report. Environmental Protection Agency, Johnstown Castle, Wexford.

O'Leary, G. and Carty, G. Urban Waste Water Discharges in Ireland 1998. A Report for the years 1996 and 1997. Environmental Protection Agency, Johnstown Castle, Wexford, Ireland.

O'Leary, G., Fanning, A. and Carty, G. 2000. Urban Waste Water Discharges in Ireland. A Report for the years 1998 and 1999.

O'Leary, G., Meaney, B. and Carty, G. 1997. Urban Waste Water Discharges in Ireland. A report for the years 1994 and 1995. Environmental Protection Agency, Johnstown Castle, Wexford, Ireland. O'Leary et al 00

O'Mara, F., 2006. Development of Emission Factors for the Irish Cattle Herd. Environmental Protection Agency, Johnstown Castle, Wexford, Ireland.

Zimmermann, J., 2013, A Review of Crop Residue Burning MODIS Fire Detection Archive for Ireland. School of Natural Sciences, Dept. of Botany, Trinity College Dublin.

[1] Reproduced as received from the Party.

Annex III

Acronyms and abbreviations

AD	activity data
CH_4	methane
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
EF	emission factor
ERT	expert review team
F-gas	fluorinated gas
FOD	first-order decay
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
HFCs	hydrofluorocarbons
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
kg	kilogram (1 kg = 1,000 grams)
KP-LULUCF	land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
Mg	megagram (1 Mg = 1 tonne)
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10^{15} joules)
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
TJ	terajoule (1 TJ = 10^{12} joules)
UNFCCC	United Nations Framework Convention on Climate Change