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Report of the individual review of the inventory submission of Kazakhstan submitted in 2012*

* In the symbol for this document, 2012 refers to the year in which the inventory was submitted, and not to the year of publication.

Contents

I. Introduction and summary

1. This report covers the centralized review of the 2012 inventory submission of Kazakhstan, coordinated by the UNFCCC secretariat, in accordance with decision 19/CP.8. The review took place from 17 to 22 September 2012 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Ms. Batimaa Punsalmaa (Mongolia) and Mr. Michael Gytarsky (Russian Federation); energy – Ms. Veronika Ginzburg (Russian Federation) and Mr. Glen Whitehead (Australia); industrial processes – Mr. Vladimir Danielik (Slovakia) and Ms. Detelina Petrova (Bulgaria); agriculture – Ms. Yauheniya Bertosh (Belarus) and Ms. Sumaya Zakieldeen (Sudan); land use, land-use change and forestry (LULUCF) – Mr. Vladimir Korotkov (Russian Federation) and Mr. Yusuf Serengil (Turkey); and waste – Mr. Gábor Kis-Kovács (Hungary) and Mr. Davor Vešligaj (Croatia). Ms. Batimaa and Mr. Gytarsky were the lead reviewers. The review was coordinated by Ms. Inkar Kadyrzhanova (UNFCCC secretariat).

2. In accordance with the "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention", a draft version of this report was communicated to the Government of Kazakhstan, which provided comments that were considered and incorporated, as appropriate, into the final version of the report.

3. In 2010, the main greenhouse gas (GHG) in Kazakhstan was carbon dioxide (CO_2), accounting for 74.5 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by methane (CH_4) (19.6 per cent) and nitrous oxide (N_2O) (5.3 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 0.7 per cent of the overall GHG emissions in the country. HFC emissions are reported as not applicable ("NA") and not occurring ("NO") for 1990–1994, PFC emissions are reported as "NA" and "NO" for 1990–2006 and SF_6 emissions are reported as "NA" and "NO" for 1990–2003 and not reported for 2010. The energy sector accounted for 82.2 per cent of total GHG emissions, followed by the agriculture sector (10.4 per cent), the industrial processes sector (5.5 per cent) and the waste sector (1.8 per cent). Removals from the LULUCF sector were equal to 6,032.84 Gg CO_2 eq (i.e. an offset of 2.3 per cent of the Party's total emissions). Emissions from the solvent and other product use sector are reported as "NA" and not estimated ("NE"). Total GHG emissions amounted to 262,718.26 Gg CO_2 eq and decreased by 27.0 per cent between 1990 and 2010, owing mainly to the decrease in fossil fuel consumption in the energy sector, the reduction in the livestock population, the use of synthetic fertilizers on agricultural soils and a reduction of activities in the metal production and mineral products industries. The emission trends are described in the national inventory report (NIR) and are reasonable.

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

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

Table 1
Greenhouse gas emissions, by gas, 1990 to 2010

	Gg CO_2 eq							
Greenhouse gas	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*Change 1990–2010 (%)*
CO_2	268 290.30	161 474.97	139 850.80	180 845.44	178 192.37	197 483.47	195 807.97	–27.0
CH_4	75 649.01	45 786.69	35 530.66	40 518.86	48 010.42	47 570.88	51 445.41	–32.0
N_2O	16 166.53	18 103.72	13 797.07	12 700.76	14 692.15	15 099.61	13 808.37	–14.6
HFCs	NA, NO	0.21	164.19	237.12	415.22	416.26	455.00	NA
PFCs	NA, NO	NA, NO	NA, NO	NA, NO	567.27	678.93	1 201.50	NA
SF_6	NA, NO	NA, NO	NA, NO	0.15	0.11	3.31	–	NA

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

Table 2
Greenhouse gas emissions by sector, 1990 to 2010

	Gg CO_2 eq							
Sector	*1990*	*1995*	*2000*	*2005*	*2008*	*2009*	*2010*	*Change 1990–2010 (%)*
Energy	299 132.34	180 550.49	152 242.31	192 253.47	195 439.21	214 956.90	216 064.49	–27.8
Industrial processes	17 916.83	8 144.59	10 226.43	13 258.11	14 144.15	13 310.47	14 565.55	–18.7
Solvent and other product use	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA
Agriculture	38 538.64	32 301.95	22 477.39	24 159.24	27 641.80	28 246.06	27 257.31	–29.3
LULUCF	18.16	323.83	–14 375.70	–15 327.14	–9 635.24	–7 841.08	–6 032.84	–33 314.3
Waste	4 518.03	4 368.56	4 396.59	4 631.50	4 652.38	4 739.03	4 830.90	6.9
Other	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	**360 124.01**	**255 689.43**	**174 967.02**	**218 975.15**	**232 242.30**	**253 411.38**	**256 685.42**	**–28.7**
Total (without LULUCF)	**360 105.52**	**225 365.59**	**189 342.72**	**234 302.32**	**241 877.54**	**261 252.46**	**262 718.26**	**–27.0**

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

II. Technical assessment of the inventory submission

A. Overview

1. Inventory submission and other sources of information

5. The 2012 annual inventory submission contains a complete set of common reporting format (CRF) tables for the period 1990–2010 submitted on 13 April 2012 and an NIR submitted on 18 July 2012. The inventory submission was submitted in accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines). The expert review team (ERT) noted that Kazakhstan submitted the NIR of its 2012 inventory submission much later than the due date required by decision 18/CP.8 and later than it submitted the NIR of its 2011 inventory submission (30 May 2011). The ERT therefore strongly recommends that Kazakhstan submit its NIR by 15 April each year, together with the CRF tables, as required by decision 18/CP.8.

6. The ERT also used the previous year's submission during the review. During the review, Kazakhstan provided the ERT with additional information and documents, which are not part of the inventory submission but are in many cases referenced in the NIR. The full list of information and documents used during the review is provided in annex I to this report.

Completeness of inventory

7. The inventory of Kazakhstan is complete in terms of years and generally complete in terms of geographical coverage, sectors, categories and gases. The inventory does not cover all source and sink categories for the period 1990–2010. The ERT noted that Kazakhstan has made some improvements to the completeness of its reporting, as recommended in the previous review report (see para. 25 below).

8. However, the ERT also noted that the following categories have not been estimated or reported using notation keys in the CRF tables: CO_2, N_2O and CH_4 emissions from oil exploration, from oil flaring and from gas flaring; CO_2 and CH_4 emissions from natural gas exploration, from gas venting, from oil venting and from combined oil and gas venting; HFCs, PFCs and SF_6 emissions from consumption of halocarbons and SF_6 (except for HFC-134a emissions from refrigeration and air-conditioning equipment); and CH_4 emissions from enteric fermentation and from manure management for buffalo and mules and asses (see paras. 33, 81 and 91 below).

9. Furthermore, the ERT noted that the following categories have been reported using the notation key "NE": fugitive CO_2 emissions from natural gas transmission, from natural gas distribution and from other leakage (in the residential and commercial sectors); fugitive CO_2 emissions from oil transport; fugitive CO_2 and CH_4 emissions from solid fuel transformation; CO_2 emissions from coke under iron and steel production; and indirect N_2O emissions from nitrogen leaching and run-off (see paras. 34, 62, 78 and 108 below). Several mandatory categories in the LULUCF sector (e.g. land converted to forest land, land converted to grassland, land converted to wetlands, land converted to settlements and N_2O emissions from disturbance associated with land-use conversion to cropland) have been reported using the notation keys "NE" and "NO" (see para. 114 below). The ERT noted that estimation methods and emission factors (EFs) for these categories are available in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC

Guidelines), the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). Therefore, the ERT strongly reiterates the recommendation made in the previous review report that Kazakhstan estimate emissions in accordance with the available IPCC methodologies and/or EFs for the categories currently not estimated or not reported and include the emission estimates, together with the relevant documentation supporting the estimates, in its next inventory submission.

10. The ERT further noted that Kazakhstan has not reported estimates for nor used notation keys to report the following categories, for which there are no IPCC estimation methodologies or EFs available: fugitive N_2O emissions from oil refining and storage; fugitive CO_2 and CH_4 emissions from distribution of oil products and from other (oil); and CO_2 emissions from food and drink (see paras. 35 and 69 below). Furthermore, the ERT noted that Kazakhstan reported the following categories, for which there are no IPCC estimation methodologies or EFs available, using the notation key "NE": CO_2 emissions from asphalt roofing and from road paving; and CO_2 and N_2O emissions from the solvent and other product use sector (see para. 68 below). The ERT encourages Kazakhstan to make efforts to estimate emissions for these categories for its next inventory submission. If this is not possible, the ERT strongly recommends that Kazakhstan use the notation keys to report these categories and/or provide, in CRF table 9(a) and in the NIR of its next inventory submission, the rationale for not estimating emissions for these specific categories.

11. The ERT noted that CO_2 emissions and removals from wetlands remaining wetlands and from settlements remaining settlements are reported using the notation keys "NE" and "NO". It noted that there are no IPCC methodologies to estimate emissions for these categories. The ERT therefore encourages Kazakhstan to make efforts to estimate and report these emissions in line with the IPCC good practice guidance for LULUCF in its next inventory submission. Net CO_2 emissions and removals and CH_4 and N_2O emissions from land converted to settlements were reported as "NE" and "NO". The ERT noted that there are IPCC methodologies to estimate emissions for these categories. The ERT therefore recommends that Kazakhstan estimate these emissions and removals for its next inventory submission (see para. 112 below).

12. The ERT also noted that emissions of all gases from international aviation bunkers are reported using the notation key "NE" and emissions of all gases from international marine bunkers are reported using the notation key "NA". The ERT recommends that Kazakhstan provide emission estimates for these categories in its next inventory submission together with the appropriate supporting documentation in the NIR, and, if this is not possible, the ERT encourages Kazakhstan to fill in the CRF tables with the relevant notation keys as appropriate, in line with the UNFCCC reporting guidelines.

13. The ERT further noted that there was no improvement in the completion of documentation boxes for this inventory submission compared with the previous inventory submission (e.g. explanatory information in the documentation boxes in CRF tables 8(a) and 8(b) is missing for the entire time series). In addition, CRF table 7 (key categories) is not reported. Thus, the ERT strongly reiterates the recommendation in the previous review report that Kazakhstan improve the completeness of its next inventory submission by providing information in all of the above-mentioned CRF tables. The ERT noted that Kazakhstan has not included in its NIR certain elements relating to reporting under the Convention as required by the UNFCCC reporting guidelines, namely a general assessment of the completeness (annex 1 on the outline of the NIR and section 1.8 on general assessment of the completeness), information on recalculations and improvements

(chapter 10 of the outline) and annexes 2–7. This is not in accordance with the requirements of the UNFCCC reporting guidelines. The ERT recommends that Kazakhstan improve completeness by reporting information in all chapters of and relevant annexes to the NIR, as required by the UNFCCC reporting guidelines, and follow the outline of the structure of the NIR.

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

Overview

14. The ERT concluded that the institutional arrangements for inventory preparation established by Kazakhstan continued to perform their required functions, but not in a fully efficient and coordinated way. Kazakhstan has described the changes in the institutional arrangements since the previous inventory submission, providing some additional information in the NIR regarding the orders of the Ministry of Environmental Protection (MoEP): No. 193 "On State Greenhouse Gas National Inventory System", No. 194 "On National System for Estimation of Greenhouse Gas Emissions and Sinks" and No. 197 "On Establishment of State Greenhouse Gas Inventory". All three orders were issued on 23 July 2010 and are part of the legal framework for the inventory preparation process that has been put in place in Kazakhstan.

Inventory planning

15. The NIR described the institutional arrangements for the preparation of the inventory. MoEP, as Kazakhstan's focal point for the UNFCCC, has the overall responsibility for organizing and coordinating the inventory preparation process and submitting the annual inventory to the UNFCCC secretariat, whereas the Kazakhstan Scientific Research Institute of Ecology and Climate (KazNIIEK) has the overall responsibility for planning, preparation and management of the national inventory. Nine other ministries and two agencies, such as the Agency for Statistics and the Agency for Land Resources Management, are also involved in the preparation of the inventory, mostly as data providers. The ERT noted the inconsistencies in the description of institutional arrangements reported in the NIRs of the previous and current annual submissions, which have not been explained in the NIR. The ERT recommends that Kazakhstan, in its next inventory submission, update and describe the institutional arrangements for the inventory preparation in more detail, including the roles and responsibilities of all participating institutions and changes occurred and that may occur.

16. Kazakhstan described the quality assurance and quality control (QA/QC) procedures and QA/QC plan in section 1.6 of the NIR (see para. 21 below).

Inventory preparation

Key categories

17. Kazakhstan has reported a tier 1 key category analysis, both level and trend assessment, as part of its 2012 inventory submission. The key category analysis performed

by Kazakhstan and that performed by the secretariat[2] produced different results owing to different levels of disaggregation of the categories included. For example, Kazakhstan does not include specific fuel types for the categories in the energy sector for the key category analysis. Kazakhstan also has not included the LULUCF sector in its key category analysis; therefore the ERT considers that it was not performed in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT therefore reiterates the recommendation made in the previous review report that Kazakhstan include the LULUCF sector in the key category analysis in its next inventory submission (see para. 117 below).

18. Kazakhstan has not explained whether it uses the results of the key category analysis to prioritize the development and improvement of the inventory. The ERT recommends that Kazakhstan include information in the NIR of its next inventory submission to explain whether the results of the key category analysis are used for planning further improvements to the inventory.

Uncertainties

19. The ERT noted that the NIR does not provide a sufficiently transparent description of the uncertainty assessment. There is only a very short paragraph in chapter 1 of the NIR (section 1.7 on uncertainties), which states that the explanation of uncertainties is provided in annex 1 to the NIR, but the ERT noted that annex 1 is on key category analysis, whereas the uncertainty estimates are provided in annex 2 to the NIR. According to annex 2 to the NIR, Kazakhstan used the IPCC tier 1 method to perform the uncertainty analysis. However, information provided in annex 2 to the NIR was limited only to uncertainty values at the individual category level and there was no information on the overall uncertainty for the inventory for 2010 (see paras. 44, 71, 95 and 119 below). The ERT recommends that Kazakhstan provide information on estimates of total uncertainty for the inventory in its next inventory submission. The ERT also reiterates the recommendations made in the previous review report that Kazakhstan use the uncertainty analysis as a driving factor to prioritize the improvements of its inventory and, in its next inventory submission, report on how it is doing this.

Recalculations and time-series consistency

20. The ERT noted that the recalculations reported by Kazakhstan for the years 1990-2009 have been made to take into account the improvements in activity data (AD) and methodologies in all sectors. However, the rationale for these recalculations is not provided in the NIR in a separate chapter, as required by the outline of the NIR provided in annex 1 to the UNFCCC reporting guidelines. The ERT also noted that very limited explanation was provided in the sectoral chapters of the NIR and there was no explanatory information provided in CRF table 8(b) (see paras. 31, 65, 89, 113 and 136 below). According to CRF table 8(a), the recalculations had the following impact: the estimate of total GHG emissions without LULUCF for 1990 decreased by 4.4 per cent and the corresponding estimate for 2009 decreased by 9.8 per cent; while the estimate of total GHG emissions with LULUCF for 1990 decreased by 2.6 per cent and that for 2009 decreased by 9.0 per cent. The ERT reiterates the recommendation made in the previous review report that Kazakhstan report,

[2] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance for LULUCF. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

in the NIR and the relevant CRF tables of its next inventory submission, detailed information on the rationale for and the impact of the recalculations performed.

Verification and quality assurance/quality control approaches

21. Kazakhstan reported limited descriptive information on its QA/QC plan and on the QA/QC procedures implemented during the preparation of the inventory in chapter 1.6 of the NIR. As stated in the NIR, Kazakhstan used the IPCC tier 1 method for QA/QC procedures. According to the NIR, in July of each year a schedule of QA/QC procedures for the inventory is prepared and included in the NIR. The QC procedures are undertaken mainly by the inventory team with the possible involvement of independent experts. Also, the NIR states that a person is designated to prepare a QA/QC calendar plan for the inventory year and that the QA/QC plan is renewed every year. The ERT commends Kazakhstan for the well-structured QA/QC procedures and plan. In response to questions raised by the ERT during the review, Kazakhstan provided additional information on the procedures for approving the QA/QC plan. The ERT found out that the QA/QC plan is approved by the same order that approved the institutional arrangements for the inventory preparation (order No. 194 of MoEP). Thus, it is unclear whether the QA/QC plan is fixed for all cycles or it is to be prepared every year. Also, there was no clear information on how the QA/QC plan was implemented in the preparation of the 2012 inventory submission. The ERT therefore reiterates the recommendation made in the previous review report that Kazakhstan provide more transparent information on the QA/QC plan and its implementation in the NIR of its next inventory submission.

22. The ERT identified inconsistencies between the information reported in the NIR and the CRF tables in almost all sectors, and also identified typing errors that show that the implementation of the QA/QC plan is not fully in place (see paras. 51, 62, 104, 115 and 139 below). The ERT also noted that, according to the Party's response to questions raised by the ERT during the review, the quality check sheets are stored only in hard copy. The ERT therefore recommends that Kazakhstan improve the implementation of its QA/QC plan and provide information in its next inventory submission on the implemented QA/QC procedures. Furthermore, the ERT encourages Kazakhstan to archive supporting documents electronically.

Transparency

23. The ERT noted that the information contained in the NIR is not sufficiently detailed. In particular, there is almost no explanatory information on improvements, general assessment of the completeness, recalculations and uncertainties, and there is very limited description of methodologies and information on other parameters used for the emission estimates. For example, the estimate of CO_2 emissions from cement production for 2009 increased by 32.9 per cent due to recalculations, but there is no explanation of the rationale for this recalculation (i.e. whether it is due to the improved AD and EFs or methodology changes) (see para. 74 below). Furthermore, the use of different data sources for a number of categories in the energy sector and recalculations in the LULUCF sector are not described with sufficient transparency (see paras. 42 and 113 below). The ERT therefore reiterates the recommendation made in the previous review report that Kazakhstan improve the transparency of its inventory by including more information on methods, EFs and AD.

Inventory management

24. The NIR states that Kazakhstan has a centralized archiving system, which includes the archives of EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. It also reports that the archived information includes internal documentation on QA/QC procedures. However, the

ERT noted that there is no information to explain whether the archiving includes external and internal reviews, and there is no documentation on annual key categories and key category identification and on planned inventory improvements. There is also no information on which entity maintains the archive (MoEP or KazNIIEK). In response to a question raised by the ERT during the review, the Party informed the ERT that the entity responsible for archive maintenance is KazNIIEK. The ERT reiterates the recommendation made in the previous review report that Kazakhstan provide more precise information on: the archiving system, including the responsibilities of different institutions for the flow of data and archiving; whether the archiving system includes information generated through external and internal reviews; documentation on annual key category analysis, key category identification and planned inventory improvements; and how this system is maintained by KazNIIEK.

3. Follow-up to previous reviews

25. As recommended in the previous review report, Kazakhstan has developed country-specific EFs for the estimation of emissions from cattle based on feed intake estimates; reported land-use change matrices; and removed CO_2 emissions from solid waste disposal on land (see paras. 98, 115 and 136 below). The ERT commends Kazakhstan for these improvements but noted that many issues still remain to be addressed. The issues that still remain to be addressed include: the completeness of the reporting (see paras. 8–10 above); key categories (see para. 17 above); uncertainty estimates (see para. 19 above); QA/QC procedures (see para. 21 above); the transparency of reporting (see para. 23 above); and the archiving of information (see para. 24 above).

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

26. During the review, the ERT identified a number of areas for improvement. These are listed in table 3 below.

27. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report and in table 3 below.

B. Energy

1. Sector overview

28. The energy sector is the main sector in the GHG inventory of Kazakhstan. In 2010, emissions from the energy sector amounted to 216,064.49 Gg CO_2 eq, or 82.2 per cent of total GHG emissions. Since 1990, emissions have decreased by 27.8 per cent. The key driver for the fall in emissions is the large reduction of fossil fuel consumption during the process of the establishment of a new independent State (associated with a deep economic crisis) in the early 1990s and the accompanying social and economic reforms in the period 1992–1999. Following the recovery from the economic crisis, a stable growth of the energy sector emissions can be observed since 2000. A relative decrease in fuel production and consumption was observed in 2008 followed by a slight increase during the following two years and a further increase (nearly up to the level of 2007) that was reached in 2010. The changes between 2007 and 2008 (–11.4 per cent) and between 2008 and 2009 (10.0 per cent) are very significant; however, the NIR does not provide any explanation for these fluctuations in the emission trend.

29. Within the sector, in 2010, 43.2 per cent of the emissions were from energy industries, followed by almost equal shares of emissions for the categories other (11.9 per cent), manufacturing industries and construction (11.8 per cent) and fugitive emissions from solid fuels (11.5 per cent). Transport accounted for 9.2 per cent and other sectors

accounted for 7.8 per cent. The remaining 4.5 per cent were fugitive emissions from oil and natural gas.

30. The ERT noted that the estimates of both total GHG emissions as well as CO_2 emissions from the energy sector reported in the NIR (page 50, table 3.1 and graph 3.1) were not consistent with the data in CRF table Summary 2 for the years 2008–2010. The data in the NIR are closer to the estimated emissions from fuel combustion than to the estimate of total emissions from the energy sector, but still do not match the data in CRF table Summary 2. In the same CRF table, CH_4 and NO_2 emissions from fuel combustion are reported not in CO_2 eq but in absolute mass units for the entire time series. The ERT recommends that Kazakhstan convert all non-CO_2 emissions into CO_2 eq and report the correct emission estimates in the NIR and the CRF tables of its next inventory submission.

31. Kazakhstan has made recalculations for the energy sector between the 2011 and 2012 inventory submissions following changes in AD, which were reallocated between the energy categories, and improvements in methodology. The impact of these recalculations on the energy sector is a decrease in the estimate of emissions for 2009 of 12.6 per cent and of 3.9 per cent for 1990. The main recalculations took place in the following categories:

(a) CO_2 emissions from energy industries;

(b) CO_2 emissions from manufacturing industries and construction;

(c) CO_2 emissions from the category other.

32. However, the NIR does not provide sufficient information on the reasons for and substance of the recalculations and no explanatory information is reported in CRF table 8(b), which hindered the ERT in judging the correctness and necessity of the recalculations. The ERT therefore reiterates the strong recommendation made in two previous review reports that Kazakhstan report in the NIR and CRF table 8(b) all the information required on recalculations, in accordance with the IPCC good practice guidance.

33. The inventory for the energy sector is not complete in terms of categories, but it is complete in terms of years, geographical coverage and gases. The ERT noted that a few categories are not estimated and no notation keys are used in the CRF tables. These categories are: fugitive CO_2, N_2O and CH_4 emissions from oil exploration, from oil flaring and from gas flaring; and fugitive CO_2 and CH_4 emissions from natural gas exploration, from gas venting, from oil venting and from combined oil and gas venting.

34. Furthermore, the ERT noted that the following categories are reported using the notation key "NE": fugitive CO_2 emissions from natural gas transmission, from natural gas distribution and from other leakage (in the residential and commercial sectors); fugitive CO_2 emissions from oil transport; and fugitive CO_2 and CH_4 emissions from solid fuel transformation. The ERT also noted that IPCC estimation methods and/or EFs are available for these categories. Therefore, the ERT strongly reiterates the recommendation made in the previous review report that Kazakhstan estimate emissions in accordance with the IPCC methodologies for the categories currently not estimated or not reported and include the emission estimates, together with the relevant documentation supporting the estimates, in its next inventory submission.

35. The ERT further noted that Kazakhstan did not report estimates nor use notation keys to report the following categories, for which there are no IPCC estimation methodologies or EFs available: fugitive N_2O emissions from oil refining and storage; and fugitive CO_2 and CH_4 emissions from distribution of oil products and from other (oil and natural gas). The ERT encourages Kazakhstan to make efforts to estimate emissions for these categories. If this is not possible, the ERT recommends that Kazakhstan use the notation keys for these categories, as appropriate, and provide the rationale for not estimating the emissions for these specific categories in CRF table 9(a).

36. The ERT noted that emissions of all gases from international aviation bunkers are reported using the notation key "NE" and emissions of all gases from international marine bunkers are reported using the notation key "NA" (see paras. 49 and 50 below).

37. The ERT considers that the reporting of the energy sector is not sufficiently transparent. For example, Kazakhstan uses country-specific CO_2 EFs, but information documenting these EFs provided in the NIR is insufficiently complete and transparent. In response to questions raised by the ERT during the review, Kazakhstan provided documents justifying the use of country-specific EFs for estimating CO_2 emissions from coal mining and handling, and for combustion of liquid fuels (diesel oil, residual fuel oil and gasoline), natural gas, coke oven gas and blast furnace gas. The ERT commends Kazakhstan for providing this information and recommends that Kazakhstan include this information and supporting documentation in the NIR of its next inventory submission.

38. The data on energy consumption in the specific categories are provided in the NIR only at an aggregated level for solid, liquid and gaseous fuels and not for individual fuels. The parameters used for estimates are only partly described for specific fuels. The ERT therefore reiterates the recommendation made in the previous review report that Kazakhstan improve the transparency of its reporting on methodologies used and the presentation of data used in the NIR of its next inventory submission. For instance, the documentation should include details of the analysis used for AD assessment or emission estimation, how often it is performed and what QA/QC procedures are applied.

39. The ERT noted that the AD in the NIR are reported in different units (t coal eq, TJ or t) and considers that this hinders a comparative analysis and the review process. In response to a question raised by the ERT during the review, Kazakhstan provided the conversion factors used for the conversion from t coal eq to TJ developed by the Agency for Statistics and used in the inventory. The ERT recommends that Kazakhstan provide conversion factors for t coal eq for each fuel in the NIR of its next inventory submission.

40. The ERT noted that the chapter on the energy sector in the NIR does not contain some parts of the information required by the UNFCCC reporting guidelines, such as the sections on transport and on planned improvements. In response to a question raised by the ERT during the review, Kazakhstan provided a detailed description of emissions from transport. The ERT reiterates the recommendation made in the previous review report that Kazakhstan improve its reporting of these elements in the NIR of its next inventory submission and prepare the NIR in accordance with the outline recommended in the UNFCCC reporting guidelines, including complete descriptions of all categories with specifications of the planned improvements.

41. Kazakhstan included all fuels reported as losses in the national fuel balance under the category other (stationary). The ERT noted that this is not in line with the Revised 1996 IPCC Guidelines. According to the UNFCCC reporting guidelines, the category other should include all remaining emissions from non-specified fuel combustion, whereas in the Party's NIR the category other comprises a mixture of fuels used for combustion, feedstock and non-energy purposes. In response to a question raised by the ERT during the review, Kazakhstan clarified that all losses are reported together as one value in the energy balance. The ERT recommends that Kazakhstan investigate the possibility of separating combusted fuels from other losses, including feedstocks and non-energy use of fuels, and report related emissions in the appropriate category of the energy sector (emissions from fuel combustion or fugitive emissions) and, as appropriate, in other sectors in its next inventory submission (see paras. 51 and 52 below).

42. The ERT noted that the time series are not always consistent in the inventory; for example, AD on stationary combustion used for emission calculations are taken from different sources. For 1990 and 1999–2010, AD are from the national fuel balance; while

for 1991–1998, AD are from the International Energy Agency (IEA) database. The interpolation methodology and the description of the economic indicators used as drivers for the estimates are not provided in the NIR. In addition, Kazakhstan also used economic indicators as drivers to disaggregate AD for iron and steel and non-ferrous industries, which are reported together in the national statistics. The ERT reiterates the recommendation made in the previous review report that Kazakhstan explain the underlying assumptions and the degree of expert judgement used and report final data sets of AD used for 1990–2010 in the NIR of its next inventory submission. The ERT also recommends that Kazakhstan ensure the consistency of the entire time series and provide comparisons of AD obtained from different sources in the NIR of its next inventory submission.

43. Emissions of indirect GHGs, including the precursors nitrogen oxides (NOx), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC) and sulphur dioxide (SO_2), are reported only for the categories under stationary combustion. The ERT encourages Kazakhstan to include estimates of these gases for all categories currently not reported (e.g. emissions from transport and fugitive emissions) and ensure the completeness of its reporting as recommended by the UNFCCC reporting guidelines in its next inventory submission.

44. Uncertainty estimates have been reported in annex 2 to the NIR. The ERT noted that this is the first time that the Party has provided this information and commends Kazakhstan for this improvement. However, the ERT also noted that uncertainties are provided for CO_2, N_2O and CH_4 emissions at the category level only and that documentation on the uncertainty values used for AD and EFs is provided in the NIR only for the fuel combustion category in total. The ERT further noted that uncertainties have been provided for the estimates of CH_4 emissions from coal mining and handling and fugitive CH_4 emissions from oil and gas. The ERT reiterates the recommendation made in the previous review report that Kazakhstan extend its documentation on uncertainties to cover all categories.

45. The NIR provides limited information on the general application of the QA/QC procedures in the energy sector. The ERT strongly reiterates the recommendation from the previous review report that Kazakhstan perform checks for the correctness of the methods, data input and calculations, implement all QC procedures recommended in the IPCC good practice guidance and verify the information and studies delivered by external organizations and institutions for the preparation of the inventory in its next inventory submission. The ERT also recommends that, in its next inventory submission, Kazakhstan perform QC procedures of the NIR before its submission to avoid some structure gaps, inaccuracies and mistakes.

2. Reference and sectoral approaches

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

46. CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 2010, there is a difference of 6.4 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. The explanations of this difference are not provided in the documentation box of CRF table 1.A(c). The ERT noted that this difference varies widely from year to year, from 0.3 per cent (2005) to 29.5 per cent (1997) and is above 2.0 per cent for almost all years. Since the previous inventory submission, the differences between the reference approach and the sectoral approach calculations have changed significantly and became positive for all years, while previously they were negative for almost all years after 2000. The ERT considers that the explanations provided in the NIR on the differences between the reference and the sectoral approaches, as well as on changes made since the previous inventory submission, are limited and insufficient. The ERT noted that the reference approach calculations were

improved for the entire time series since the previous inventory submission because of the correction of AD on natural gas, the accounting of lubricants under non-energy use and the improvements in the completeness of data on fuels reported in the category feedstocks and non-energy use of fuels. The ERT recommends that Kazakhstan include an annex to the NIR explaining the difference between the reference and the sectoral approaches in the next NIR, in accordance with the outline provided in the UNFCCC reporting guidelines.

47. The ERT noted that table 3.2 of the NIR lists the calorific values and EFs used for the reference approach, most of which are indicated as default IPCC values. However, compared with the IPCC default values, the values used by Kazakhstan for lignite, other bituminous coal and coke oven gas are different. It was not clear to the ERT which EFs were really used for the inventory. The ERT reiterates the relevant recommendations made in the previous review reports, specifically that:

(a) The Party include a detailed analysis of the results of the comparison between the reference and the sectoral approaches (reported in CRF table 1.A(c));

(b) The Party provide further analysis of the parameters used to calculate CO_2 emissions by the reference approach.

48. The Party's reporting of apparent consumption in the reference approach for the year 2010 does not correspond closely to the IEA data, with discrepancies within 10 per cent for all the available years, except for 2002 (15 per cent) and 2010 (18.8 per cent). The growth rate for 1990–2010 for the total apparent consumption is –20 per cent (CRF) versus 4 per cent (IEA). For the year 2010, the total apparent consumption in the IEA data is 19 per cent higher than that reported in the CRF table. Large discrepancies exist between the production and export data for crude oil, natural gas and bituminous coal (just exports). The ERT noted that no explanations of the difference in apparent consumption data in the Kazakhstan reference approach and IEA data are given in the NIR. The ERT reiterates the recommendation made in the previous review report that Kazakhstan apply a specific analysis to reduce the discrepancies between the energy consumption data reported in the inventory submission and the data reported to the IEA and provide explanations in the NIR of its next inventory submission.

International bunker fuels

49. In CRF table 1.C, AD for aviation bunkers are not reported and emissions are reported as "NE". At the same time, jet kerosene and gasoline bunkers in CRF table 1.A(b) are reported as "NA". No explanations were provided in either the documentation boxes of CRF table 1.C or in the NIR of the 2012 inventory submission. The ERT noted that in the previous inventory submission the documentation box of CRF table 1.C and the NIR explained that, based on a new cooperation with the airlines, background information and AD for the international air transportation are available for 2009 and will be reported in the 2012 inventory submission. However, in the current inventory submission emissions from bunker fuels are still not estimated. The ERT therefore strongly reiterates the recommendations made in the previous review reports that Kazakhstan obtain the required data on fuel consumption for these activities, based on available statistics and expert judgement, if necessary, and report on these emissions in its next inventory submission.

50. The ERT noted that Kazakhstan did not estimate and did not use the notation keys to report emissions from various fuels used in international marine bunkers. In CRF table 1.C, AD and emissions for marine bunkers are reported as "NA". The ERT reiterates the finding detailed in the previous review report that, according to the available international statistics (e.g. IEA data), domestic navigation does occur in Kazakhstan for national and international purposes. The ERT therefore strongly reiterates the recommendation made in the previous review report that Kazakhstan obtain relevant navigation statistics, correctly

allocate fuel consumption to international and domestic navigation, and use the appropriate EFs for reporting emissions in its next inventory submission.

Feedstocks and non-energy use of fuels

51. Kazakhstan reported the use of crude oil, cooking coal, natural gas, lubricants, gasoline, diesel fuel, residual fuel, liquefied petroleum gas, bitumen, coal oils and tars, petroleum coke and solid biomass as feedstock and for non-energy purposes. Addressing a recommendation made in the previous review report, Kazakhstan improved the completeness of the fuels reported in this category compared with in the previous inventory submissions. However, the ERT noted some inconsistencies between the feedstock fuels reported under the energy and industrial processes sectors. The ERT noted that it is reported in the NIR that the estimated CO_2 emissions from coke have been moved to under the industrial processes sector, while under the industrial processes sector they are reported as "NE" in CRF table 2(I).A-G, with a comment stating that the AD are included under the energy sector. The ERT reiterates the recommendation made in the previous review report that Kazakhstan provide consistent information on how emissions are allocated between the energy and industrial processes sectors.

52. The national energy balance of Kazakhstan provides information about feedstocks and the non-energy use of a number of fuels for which the IPCC guidelines do not provide default values for the fraction of carbon stored. Kazakhstan assumed that all carbon contained in these fuels is stored and applied a fraction of 100 per cent carbon stored for coal, coke, crude oil and solid biomass; however, the ERT noted that the use of a country-specific fraction of carbon stored is not justified in the NIR. The ERT commends Kazakhstan for the complete reporting of feedstocks and non-energy use of fuels in this inventory submission, but recommends that Kazakhstan explain and justify in the NIR all country-specific parameters developed by the Party as well as the reasons for the use of default values for the fraction of carbon stored.

3. Key categories

Stationary combustion: solid fuels – CO_2

53. Kazakhstan uses the IPCC default EFs to estimate CO_2 emissions from lignite and coal for this category. However, it is mentioned in the NIR that country-specific EFs are available for coals from different mining fields. In response to the questions raised by the ERT during the review, Kazakhstan explained that the IPCC default EFs were used because statistical data on coal combustion are presented in the national statistics in an aggregated form only for two coal types: lignite and sub-bituminous coal. The ERT recommends that Kazakhstan investigate the possibility of calculating country-specific CO_2 EFs for lignite and sub-bituminous coal as a weighted average value based on information on specific coal production and a CO_2 EF for each mining field.

54. According to the explanations provided in the NIR, the AD for coking coal used for iron and steel and non-ferrous metals were reallocated from the energy sector to the industrial processes sector in order to avoid double-counting of CO_2 emissions. In response to a question raised by the ERT during the review, Kazakhstan explained that a mistake occurred in the NIR and that not coking coal but coke AD were used. At the same time, the ERT noted that in the chapter on the industrial processes sector of the NIR it is stated that emissions from coke use are included in the energy sector (see para. 78 below). The ERT recommends that Kazakhstan carefully investigate the reallocation of AD from the energy sector to the industrial processes sector, correct all misallocations and provide a carbon balance for the iron and steel production and the non-ferrous industries in the NIR of its next inventory submission.

Stationary combustion: liquid fuels – CO_2

55. The NIR reported that CO_2 emissions from residual fuel oil, gasoline and diesel oil were combined together under diesel fuel because the levels of fuel aggregation in the IPCC methodology and in the national fuel balance are different. In response to questions raised by the ERT during the review, the Party clarified that CO_2 emissions from these fuels were calculated separately but then aggregated together under diesel oil in the NIR. The ERT recommends that Kazakhstan report emissions from these fuels separately in the NIR of its next inventory submission.

Coal mining and handling: solid fuels – CH_4

56. The trend in the CH_4 implied emission factor (IEF) for the subcategory underground mines is unstable and the value increases over the time series (i.e. the 2010 value (31.03 kg/t) is 37.2 per cent higher than the 1990 value (22.61 kg/t)). The ERT noted that the CH_4 IEF values reported by Kazakhstan are above the IPCC default EF range (4.5 kg/t–16.75 kg/t) and are the highest values reported by all Parties for 1990–1997 (ranging from 22.58 kg/t to 23.01 kg/t) and 2005–2010 (ranging from 22.88 kg/t to 31.05 kg/t). The 2010 value (31.03 kg/t) is the highest reported value for all Parties for 2010. In the previous review report it was recommended that Kazakhstan include information on the origin of the IEFs in its NIR; however, this recommendation was not addressed in the 2012 inventory submission. In response to a question raised by the ERT during the review, Kazakhstan provided the results of the original research, including a deep investigation and analysis of the CH_4 content and IEFs specified for different mining fields. The ERT found that the use of country-specific CH_4 EFs was well justified by these studies and recommends that Kazakhstan include the information provided in the NIR of its next inventory submission, as well as reiterating the recommendation made in the previous review report that Kazakhstan explain the underlying reasons for the fluctuation in the trend in the IEFs and emissions for this category in its next inventory submission.

57. As noted in the previous stages of the review, the CH_4 IEF values for surface mines for 1990–2010 are kept constant (8.30 kg/t), above the IPCC default range (0.2–1.34 kg/t) and the highest values of all reporting Parties (0.01–8.30 kg/t). Sufficient information and documentation on the origin of the IEFs used and their relevance to the national conditions are not provided in the NIR. In response to a question raised by the ERT during the review, Kazakhstan provided the results of the original research, including a deep investigation and analysis of the CH_4 content and IEFs specified for different mining fields. The ERT found that the use of country-specific CH_4 EFs was well justified by these studies and it reiterates the recommendation made in the previous review report that Kazakhstan include a summary of the documents used for justification purposes in its next inventory submission.

58. Kazakhstan reports the improvements in the reallocation of CH_4 emissions from reclaimed mines for the years 2009–2010 included in energy industries. No specific details are provided in the NIR of the current inventory submission. Kazakhstan did not explain the reasons and justification for this reallocation and did not report the specific subcategory where the CH_4 emissions are included. The ERT therefore recommends that Kazakhstan clarify this issue and provide a transparent explanation in its next inventory submission.

4. Non-key categories

Road transportation: liquid fuels – CH_4 and N_2O

59. Kazakhstan undertook a detailed investigation of the road transportation structure (vehicle fleet and structure of fuel consumption) and, using expert judgement, separated gasoline and diesel oil used for road transportation and for off-road transportation and used

these data for the estimates. The ERT commends Kazakhstan for its efforts. However, the ERT also noted that the explanations provided in the NIR about the rationale, assumptions and results of this allocation were not transparent. In response to a question raised by the ERT during the review, Kazakhstan explained that the corrections in AD for road and off-road transportation were made only for 2009 and 2010. The ERT noted that this leads to an inconsistent time series and recommends that Kazakhstan expand this improvement for the entire time series and report the complete time series using the corrected AD in its next inventory submission.

60. The IEFs for N_2O reported by Kazakhstan for gasoline are constant (0.1 kg/TJ) over the entire time series, except for 2008–2010, for which the value changes to 0.33 kg/TJ. These values are the lowest values among all reporting Parties (ranging from 0.1 kg/TJ to 21.8 kg/TJ). The NIR does not provide an explanation for this change or the use of low values. Usually, IEF for N_2O would change over the time series because of an increase in the use of cars equipped with catalytic converters. The ERT noted that in all other reporting Parties, IEFs changed significantly over time. The ERT therefore reiterates the recommendation made in the previous review reports that Kazakhstan, in its next inventory submission, improve the accuracy of its N_2O emission estimates from this category, taking into account the pollution control technologies introduced over time in the vehicle fleet or provide a well-documented justification for the use of low constant values for the period of time indicated above. This improvement could be implemented by using internationally recognized models for the estimation of emissions from road transportation.

61. The IEFs for CH_4 for gasoline are constant over the entire time series (28.3 kg/TJ), except for 2008–2010, for which the value changes to 32.4 kg/TJ. The NIR does not provide an explanation for this change. Usually, the IEF for CH_4 would show a decrease over time due to an increase in the use of cars equipped with catalytic converters. The ERT noted that for all other reporting Parties the IEFs decreased by between 50 and 80 per cent between 1990 and 2009. Only Kazakhstan's value for 2010 is higher than its 1990 value. The ERT therefore reiterates the recommendation made in the previous review reports that Kazakhstan, in its next inventory submission, improve the accuracy of its CH_4 emission estimates from this category, taking into account the pollution control technologies introduced over time in the vehicle fleet.

Solid fuel transformation – CO_2 and CH_4

62. The ERT noted that Kazakhstan does not estimate CO_2 and CH_4 emissions for this category (cells are left blank in CRF table 1.B.1). Explanations were not provided in the NIR or the CRF tables, including the documentation boxes. This was also noted in the previous review report. The ERT also noted that the IEA data indicate that Kazakhstan is one of the 10 biggest emitters of GHGs from solid fuel transformation. In response to a question raised by the ERT during the review, Kazakhstan explained that the only solid fuel transformation industry in Kazakhstan is coke production, which uses less than 6 per cent of national apparent coal consumption. The ERT also noted that there is no methodology in the Revised 1996 IPCC Guidelines for this category. The ERT recommends that Kazakhstan include, in its next inventory submission, explanations of the inconsistencies identified between the IEA and national data and, if possible, report emissions for this category. If this is not possible, the ERT recommends that Kazakhstan include the rationale for the exclusion of these emissions from its estimates in the NIR of its next inventory submission. The ERT also recommends that Kazakhstan ensure the correct use of notation keys and report information in the documentation boxes in the CRF tables of its next inventory submission.

C. Industrial processes and solvent and other product use

1. Sector overview

63. In 2010, emissions from the industrial processes sector amounted to 14,565.55 Gg CO_2 eq, or 5.5 per cent of total GHG emissions. Emissions of CO_2 and N_2O from the solvent and other product use sector were reported as "NE" and "NA" for the entire time series. Since 1990, emissions have decreased by 18.7 per cent in the industrial processes sector. This overall decreasing emission trend results from an initial period of significant decrease in emissions caused by the country's economic crisis of 1992–1999 owing to the disintegration of the Soviet Union, and a later slight increase in emissions from 2000 to 2010 is due to the improved economic situation of Kazakhstan. The key drivers for the fall in emissions in the industrial processes sector are the declines in activities in relation to the metal production and mineral products categories.

64. Within the industrial processes sector, in 2010, 67.1 per cent of emissions were from metal production, followed by 28.4 per cent from mineral products, 3.1 per cent from consumption of halocarbons and SF_6 and 1.4 per cent from chemical industry.

65. Kazakhstan has made recalculations for the industrial processes sector between the 2011 and 2012 inventory submissions following changes in AD and EFs in order to improve the inventory. The impact of these recalculations is a decrease in the estimate of emissions for 2009 of 7.0 per cent. The recalculations have not affected the estimate of emissions for the base year. The main recalculations took place in the following categories:

(a) CO_2 emissions from cement production;

(b) CO_2 and PFC emissions from aluminium production.

66. The ERT noted that descriptions of and justifications for recalculations are not provided in the NIR and it recommends that Kazakhstan provide a detailed description of the recalculations made, including the rationale and the changes in AD, EFs and methods, in its next inventory submission (see paras. 74 and 80 below).

67. Kazakhstan reports emissions for all years of the time series and all geographical locations. The CRF tables include estimates of emissions covering most gases, with the exception of actual and potential SF_6 emissions, which are reported without any value for 2010 and as "NA" and "NO" for the period 1990–2003, and for most categories of the industrial processes sector for which methodologies and EFs are available in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT noted that CO_2 emissions from coke under the iron and steel production category were reported as "NE" for all reported years (see para. 79 below). The ERT also noted that HFCs, PFCs and SF_6 emissions are not reported (no value or notation key is provided) for all subcategories of consumption of halocarbons and SF_6, except for the subcategory refrigeration and air-conditioning equipment, for which only emissions of HFC-134a are reported, whereas all the other species are reported as "NO" (see paras. 81 and 86 below). The ERT strongly reiterates the recommendations made in the previous review reports that Kazakhstan collect AD and estimate emissions for all categories for which there are IPCC methodologies and/or EFs available, in order to improve completeness in its next inventory submission, in particular emissions for the missing subcategories under consumption of halocarbons and SF_6.

68. The ERT noted that CO_2, CO and NMVOC emissions from asphalt roofing and CO_2, CO, NOx, NMVOC and SO_2 emissions from road paving with asphalt were reported as "NE". In response to a question raised by the ERT during the review, Kazakhstan informed the ERT that AD are not available, but emission estimates will be provided as soon as data become available from the Agency for Statistics. The ERT commends Kazakhstan for its

effort and encourages Kazakhstan to make efforts to provide emission estimates for these categories in its next inventory submission. The ERT also commends Kazakhstan for reporting NMVOC emission estimates for the solvent and other product use sector for the first time, but it noted that CO_2 and N_2O emissions were reported as "NE" for that sector. The ERT encourages Kazakhstan to estimate such CO_2 emissions on the basis of the carbon content of NMVOCs for its next inventory submission. The ERT also encourages Kazakhstan to provide information on such N_2O emissions based on the use of N_2O for anaesthesia and other purposes (e.g. on the basis of sales and/or import of N_2O gas).

69. The ERT noted that Kazakhstan reported CO_2 emissions from food and drink using the notation key "NE". The ERT encourages Kazakhstan to collect AD and estimate emissions from the category. CO_2 emissions from glass production and CH_4 emissions from coke production under iron and steel production (see para. 85 below) are reported as included elsewhere ("IE"), without specifying the category in which they are included. The ERT recommends that, in its next inventory submission, Kazakhstan provide clear and consistent information as to where emissions for the categories reported as "IE" are included.

70. The ERT noted that an improvement in transparency was made in the 2012 inventory submission. For most categories the detailed descriptions of methods used, ADs and EFs are missing in the NIR, as noted in the previous review reports. However, Kazakhstan has provided a few new justifications and explanation for the assumptions made and the choice of AD, EFs and methods used for key categories that were not reported in the previous inventory submissions. Nevertheless, the ERT still noted that the information and explanations provided are insufficient for the ERT to fully assess the data and the methodologies used. The ERT therefore reiterates the recommendation in the previous review reports that, in the NIR of its next inventory submission, Kazakhstan improve the overall transparency of the inventory by including clear and concise information on methods, EFs and AD used as well as other additional information, in order to fully adhere to the requirements of the UNFCCC reporting guidelines.

71. The ERT noted that a tier 1 method was used for the uncertainty analysis. The unusually high uncertainties (30 per cent) for the PFC emission estimates for aluminium production reported by Kazakhstan for 2010 are due mainly to the uncertainty of the number of anode effects and their duration. The ERT noted that sector-specific QC procedures consist mainly of an analysis of time-series consistency and comparison of the IPCC default EFs with country-specific EFs. It is not clear what the Party is doing with the results of these checks. Most of the categories are reviewed following the above-mentioned sector-specific QC procedure. The ERT therefore recommends that Kazakhstan provide a clear description of the sector-specific QC checks and the sector-specific QA procedures for key categories.

72. The ERT noted that improvements are planned for most categories in the sector. The ERT commends the Party for this effort and recommends that, in general, Kazakhstan increase the transparency of the inventory by providing detailed descriptions of AD, EFs and methods used in all categories for this sector. The ERT further recommends that Kazakhstan provide detailed descriptions of the recalculations (the rationale and changes in AD, EFs and methods) for this sector in its next inventory submission.

2. Key categories

Cement production – CO_2

73. There are five cement production plants in Kazakhstan. AD, EFs for clinker and cement kiln dust (CKD) correction factor are received directly from these plants. The ERT noted that Kazakhstan is planning to apply plant-specific data for the lime (CaO) content of

clinker and for the CKD correction factor, both of which are in the process of being validated for official use for the territory of Kazakhstan for its next inventory submission. In response to a question raised by the ERT during the review, Kazakhstan provided background information about the lime content of clinker (i.e. that it is in the range of 62 to 68 per cent). The ERT reiterates the recommendation made in the previous review reports that, in its next inventory submission, Kazakhstan provide a detailed description of the technological process of cement production in the country, together with AD, EFs and CKD correction factors used, in order to improve the transparency of the inventory.

74. The ERT noted that Kazakhstan recalculated CO_2 emission estimates for 2000–2009, however, it was not mentioned in the NIR. The ERT noted that the impact of the recalculations is a decrease in emissions by 32.9 per cent in 2009. The decrease is accompanied by a decrease in clinker production (by 28.9 per cent) and a decrease in the EF (from 0.52 t/t to 0.49 t/t in 2009). During the review, Kazakhstan did not provide information on the rationale for these changes. The ERT strongly recommends that Kazakhstan provide detailed information about the recalculations, including the rationale of the recalculation and the changes in AD, EFs or methods used in its next inventory submission.

Limestone and dolomite use – CO_2

75. The NIR states that Kazakhstan estimated emissions based on AD from national statistics, plant-specific data and default IPCC EFs. However, the applied calculation methods and AD used are not reported in the NIR. The ERT therefore reiterates the recommendation made in the previous review reports that Kazakhstan provide a detailed description of the AD, EFs and methods used in its next inventory submission in order to improve the transparency of the inventory. The ERT noted and commends Kazakhstan for its plans to develop country-specific EFs for calculating emissions from dolomite and limestone production for its next inventory submission.

Carbide production – CO_2

76. Kazakhstan reported a very low IEF for calcium carbide production (1.29 t/t) in 2010 that is below a theoretical minimum EF (1.37 t/t – when decomposition of limestone and reduction step is included in the EF) according to the Revised 1996 IPCC Guidelines. The 2010 value is lower by 56.3 per cent than the 1990 value. Information about the methods and EFs used for the estimates is not reported in the NIR. In response to the questions raised by the ERT during the review, Kazakhstan provided background information about coke used in the process and the content of carbon in coke. The ERT notes that CO_2 emission estimates were calculated only from the reduction by coke. The emissions from decomposition of limestone and the uses of the product were not included in the emission estimates, which is not in line with the Revised 1996 IPCC Guidelines. The ERT therefore recommends that Kazakhstan revise its emission estimates and provide a detailed description of the method, AD and EFs used in its next inventory submission.

77. In response to questions raised by the ERT during the review regarding the EFs and methodology used, Kazakhstan stated that it will improve emission estimates using information on limestone quantity in calcium carbide production. It also mentioned that its inventory team is not quite clear which default EF should be used. The ERT considers that Kazakhstan may calculate CO_2 emissions for this category in three steps. The first step is to estimate emissions from decomposition of limestone to CaO and CO_2; then, when the amount of limestone used is known, use a default EF of 0.44 t CO_2/t limestone; otherwise, use a default EF for this step of 0.76 t CO_2/t calcium carbide (CaC_2). The second step is to estimate emissions from the reduction with coke. Kazakhstan may use a default EF of 1.09 t/t CaC_2. There is also the possibility of calculating CO_2 emissions directly from these

two steps together (in which case the default EF is 1.8 t CO_2/t CaC_2). The third step is to estimate emissions from the use of CaC_2. When the amount of CaC_2 used for acetylene production in the country (including import/export data) is known, Kazakhstan may use a default EF of 1.1 t CO_2/t of CaC_2. CO_2 emissions from this category are calculated as a sum of the emissions calculated from all three steps. Therefore, the ERT recommends that Kazakhstan use a method that is in line with the Revised 1996 IPCC Guidelines and include the estimates in its next inventory submission.

Iron and steel production – CO_2

78. Kazakhstan applied a tier 2 methodology to estimate CO_2 emissions for this category, using plant-specific AD and EFs. The ERT noted that the CO_2 IEFs reported in the CRF tables for pig iron increased from 1.41 t/t in 1990 to 1.87 t/t in 2010 (by 26.2 per cent). An explanation of the increase (changes in AD, EFs or methodology) was not provided in the NIR. The ERT recommends that Kazakhstan provide the explanation about the increase in the IEF for pig iron in the NIR of its next inventory submission. The ERT noted that CO_2 emissions for the coke subcategory are reported as "NE", with a reference in the CRF tables that the AD are included under the energy sector. However, in CRF table 1.A(a) it is reported that these emissions are included under the industrial processes sector. The ERT therefore reiterates the recommendation made in the previous review reports that Kazakhstan develop a complete carbon balance for iron and steel production in order to avoid CO_2 emissions being not estimated or double counted under the energy and industrial processes sectors. The ERT further recommends that Kazakhstan provide precise information about the allocation of all emissions from coke production (see para. 85 below).

Ferroalloys production – CO_2

79. Kazakhstan reports CO_2 emissions for this category in the CRF tables, but descriptions of the methods, EFs and AD used are not included in the NIR. The ERT noted that Kazakhstan plans to collect data to apply a tier 3 methodology for calculating emissions from ferroalloys production, as reported in the previous inventory submissions. The ERT reiterates the recommendation made in the previous review reports that Kazakhstan provide a detailed description of the AD, EFs and methods used in its next inventory submission in order to improve the transparency of the inventory, and encourages Kazakhstan to implement its plans to use a tier 3 method for its estimates.

Aluminium production – PFCs

80. Kazakhstan reports PFC emissions, such as tetrafluoromethane and hexafluoroethane, in the CRF tables, but no descriptions of the AD, EFs and methods used are included in the NIR. The ERT noted that AD and emissions are reported for 2007–2010, because aluminium production started in Kazakhstan only in 2007 and hence for all other years "NO" is used in the CRF tables. The ERT also noted that the recalculations of PFC emissions from aluminium production have been undertaken for 2008–2009. An explanation of the reasons for the recalculation (changes in ADs, EFs or methodology) was not provided in the NIR. During the review, the Party did not provide an answer to a question raised by the ERT about the rationale for the recalculation. The ERT could not assess the recalculations made and therefore strongly recommends that Kazakhstan provide a detailed description of the AD, EFs and methods used and provide explanations and rationale for the recalculations in its next inventory submission.

Consumption of halocarbons and SF_6 – HFCs

81. Actual emissions of HFCs are reported only for HFC-134a in the subcategory refrigeration and air-conditioning equipment. The assumptions made in estimating actual emissions for HFC-134a are not well documented in the NIR. No actual emissions or notation keys for other gases, species or subcategories are reported in this category; potential emissions of all gases are reported as "NO". Therefore the ERT strongly reiterates the recommendation made in the previous review reports that Kazakhstan collect AD and provide estimates of actual and potential emissions for all subcategories and species occurring in the country and a detailed description of the methods, AD and EFs used as well as of the occurrence of different activities under this category in the country in the NIR of its next inventory submission.

82. The ERT noted an inconsistency in the reporting between the NIR and the CRF tables for 2010. In the NIR, under stationary air-conditioning, emissions are reported as 355 t HFC-134a and, under mobile air-conditioning, emissions are reported as 15.05 t HFC-134a. However, in CRF table 2(II) a total of 350 t HFC-134a is reported under refrigeration and air-conditioning equipment. The ERT therefore reiterates the recommendation made in the previous review reports that Kazakhstan provide, in the NIR of its next inventory submission, a precise explanation, supporting documentation and a validation of the assumptions used for the estimates, especially for refrigeration equipment and mobile air-conditioning equipment, and correct the inconsistency identified above, as well as improve its QC procedures.

3. Non-key categories

Lime production – CO_2

83. The ERT noted that the CO_2 IEFs reported in the CRF tables for the period 1990–1997 were stable (ranging from 0.764 to 0.771 T/t), while the CO_2 IEF was practically constant (0.766 t/t) for the period 1998–2008. The value for 2009 decreased to 0.762 t/t and finally the value for 2010 was reported as 0.764 t/t. The 2010 value is 0.9 per cent lower than the 1990 value. The NIR states that, in general, a national ratio of quicklime and dolomitic lime of 85/15 (default IPCC value) is used together with default EFs for each type of lime. However, by using the default values the ERT cannot assess the rationale for changes in IEFs. The ERT recommends that Kazakhstan provide more detailed information about the methodology used to estimate these emissions.

84. The ERT noted that Kazakhstan is planning to calculate emissions from lime production using plant-specific AD for its next inventory submission. The ERT welcomes this effort and reiterates the recommendation made in the previous review reports that Kazakhstan use country-specific data to estimate emissions for this category and provide detailed descriptions of the method, AD and EFs used for the estimates in its next inventory submission in order to improve the transparency of the inventory.

Iron and steel production – CH_4

85. The ERT noted that CH_4 emissions for the coke subcategory are reported as "IE" without specifying the category where they are included. It is not clear whether they are included in the category other (chemical industry). The ERT recommends that Kazakhstan specify the allocation of these CH_4 emissions in its next inventory submission.

Consumption of halocarbons and SF_6 – PFCs and SF_6

86. No actual emissions or notation keys for any gases, species or subcategories are reported for this category, except for the refrigeration and air-conditioning equipment

subcategory, for which the notation key "NO" is used. Potential emissions of all gases are reported as "NO". Therefore, the ERT strongly reiterates the recommendation made in the previous review reports that Kazakhstan provide estimates of actual and potential emissions for all subcategories and species occurring in the country and a detailed description of the methods, AD and EFs used, as well as a detailed description of the occurrence of different activities under this category in the country, in the NIR of its next inventory submission.

87. In CRF table 2(II), no actual emission values or notation keys are reported for SF_6 in the category electrical equipment for 2010 (potential emissions were reported as "NO"), whereas for 2009 SF_6 emissions (0.14 t) are reported. However, the NIR states that the sources of SF_6 emissions exist in Kazakhstan. The ERT strongly recommends that Kazakhstan provide information about consumption of SF_6 from electrical equipment and include these emissions in its next inventory submission.

D. Agriculture

1. Sector overview

88. In 2010, emissions from the agriculture sector amounted to 27,257.31 Gg CO_2 eq, or 10.4 per cent of total GHG emissions. Since 1990, emissions have decreased by 29.3 per cent. The key drivers for the fall in emissions are a reduction in the livestock population, a reduction in the use of synthetic fertilizers applied on agricultural soils and reductions in the area of cultivated land caused by the country's economic crisis of 1990–1999. Within the sector, in 2010, 49.1 per cent of the emissions were from enteric fermentation, followed by 33.2 per cent from agricultural soils, 17.3 per cent from manure management. The remaining 0.4 per cent were from rice cultivation.

89. Kazakhstan has made recalculations for the agriculture sector between the 2011 and 2012 inventory submissions for 1990–2009 following the application of country-specific CH_4 EFs to estimate emissions from enteric fermentation for cattle (based on feed intake estimates) and the update of AD and relevant parameters for the estimation of emissions from manure management and agricultural soils. The impact of these recalculations on the agriculture sector is an increase in the estimate of emissions for 2009 of 20.7 per cent and an increase in the estimate of emissions for 1990 of 7.1 per cent. The main recalculations took place in the following categories:

(a) CH_4 emissions from enteric fermentation;

(b) CH_4 and N_2O emissions from manure management;

(c) N_2O emissions from agricultural soils.

90. Prescribed burning of savannas and field burning of agricultural residues are reported in the CRF tables as "NA" and "NO", respectively, because there are no savannas and burning of agricultural residues has not been practiced for the two last decades. The ERT noted that the use of the notation keys in CRF table 4.E for prescribed burning of savannas is not correct, and recommends that Kazakhstan use the notation key "NO" for prescribed burning of savannas in its next inventory submission.

91. The ERT also noted that Kazakhstan does not estimate and report CH_4 emissions from enteric fermentation and from manure management for buffalos and mules and asses and explains in the NIR that this is because of the unavailability of population data for these animals in the statistical yearbooks owing to the small numbers of animals. The ERT noted that the Food and Agriculture Organization of the United Nations (FAO) provides data on the populations of buffalos (29,000–45,000 heads for the reporting period) and mules and asses (9,000–12,000 heads for the reporting period). The ERT therefore reiterates the recommendation made in the previous review report that Kazakhstan include all missing

animal species for the estimation of emissions in its next inventory submission using the IPCC methodologies and FAO data on livestock population, if such data are not available from the official statistical data of Kazakhstan.

92. In addition, in the 2012 inventory submission, Kazakhstan reports indirect N_2O soil emissions from nitrogen leaching and run-off as "NE", but the NIR does not provide any explanation for this (see para. 108 below).

93. The ERT noted that, since the previous inventory submission, the transparency of the reporting on the agriculture sector has slightly improved because the Party has included information on the methods, EFs and AD used for the estimation of emissions. However, the ERT noted that the reporting still needs to be enhanced; for example, the NIR does not provide sufficient information on the sources and references of AD and other relevant parameters used for the calculations, the description of methodologies used for estimation and the assumptions used for the selection of EFs. The ERT therefore recommends that Kazakhstan improve the transparency of its reporting and include, in its next inventory submission, all detailed information on AD, methodologies, EFs and parameters in the NIR and the CRF tables as required by the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the UNFCCC reporting guidelines.

94. The ERT noted that inconsistencies between the data provided in the NIR and the CRF tables, as well as the inappropriate use of notation keys noted in the previous review reports, still remain in the 2012 inventory submission; for example, the data on the allocation of animal waste management systems (AWMS) for sheep, goats and horses (see para. 104 below).

95. A tier 1 method was applied for the uncertainty analysis of the sector; however, the NIR does not provide information on the sources and references of uncertainty values for AD and EFs. The ERT reiterates the recommendation made in the previous review report that Kazakhstan provide the sources and references for uncertainty values used in the analysis of the agriculture sector in its next inventory submission.

96. The ERT noted that the QA/QC chapter for the agriculture sector contains information on the uncertainty analysis and recalculations but does not contain information on source-specific QA/QC procedures implemented for the 2012 inventory submission for the agriculture sector. The ERT recommends that Kazakhstan follow more closely the UNFCCC reporting guidelines and the IPCC good practice guidance and also recommends that Kazakhstan implement the QA/QC plan and provide information in the NIR of its next annual submission on the category-specific QA/QC activities performed for the agriculture sector.

2. Key categories

Enteric fermentation – CH_4

97. For the 2012 inventory submission, Kazakhstan used an IPCC tier 2 approach and country-specific EFs for the first time for dairy and non-dairy cattle based on feed intake estimates. For other animals the default IPCC tier 1 method and default EFs were used. This is in line with the IPCC good practice guidance.

98. The ERT noted that the CH_4 IEF for dairy cattle reported by Kazakhstan is within the range of 83.4–86.5 kg/head/year and that this range is higher than the IPCC default value for Eastern Europe (81 kg/head/year), and that the CH_4 IEF for non-dairy cattle is within the range of 44.82–50.53 kg/head/year, which is lower than the IPCC default value (56 kg/head/year). In response to a question raised by the ERT during the review, Kazakhstan explained how country-specific EFs for dairy and non-dairy cattle were derived. The ERT noted that in calculating estimates of feed intake Kazakhstan did not take

into account the net energy needed by young animals for growth. In addition, the feeding situation for dairy and non-dairy cattle used for the calculations was incorrectly reported.

99. The ERT also noted that the activity coefficient corresponding to the feeding situation for animals (C_a) has been reported as "0" for stalling animals for dairy cattle. On the basis of the data on allocation of AWMS in the CRF tables and the NIR, the ERT noted that dairy cattle spend 10 per cent of the year on pasture; therefore C_a should be adjusted according to the feeding situation (stall/pasture).

100. The ERT welcomes the efforts made by Kazakhstan to improve its inventory since the previous inventory submission by using higher tiers for the estimation of emissions from significant animal species and recommends that Kazakhstan revise the feed intake estimates for cattle, providing accurate estimates for this category according to the IPCC good practice guidance, and provide all supporting data and parameters used for the calculations in the NIR and the CRF tables in order to improve the transparency of the reporting in its next inventory submission.

101. Emissions from goats and sheep were reported together in the 2012 inventory submission because the national statistics report these populations together, as noted in the NIR. However, the ERT noted that FAO provides separate data on the goat and sheep populations for Kazakhstan. The ERT reiterates the recommendation made in the previous review reports that Kazakhstan provide separate estimates for goats and sheep in its next inventory submission.

Manure management – CH_4 and N_2O[3]

102. Kazakhstan uses a tier 1 method and default EFs for the cool climatic condition of Eastern Europe to estimate CH_4 emissions from manure management for all animals, which is in line with the IPCC good practice guidance. Considering that Kazakhstan used feed intake estimates to calculate country-specific EFs for dairy and non-dairy cattle, the ERT encourages the Party to estimate CH_4 emissions using higher-tier methods and country-specific EFs for significant animal species using corresponding data on feed intake estimates for the categories enteric fermentation and manure management for its next inventory submission.

103. In addition, the ERT noted that the CH_4 conversion factors used in calculations were not provided in the NIR and CRF tables. The ERT reiterates the recommendations made in the previous review report that Kazakhstan provide CH_4 conversion factors in its next inventory submission in order to improve the transparency of its reporting.

104. The ERT noted some inconsistencies between data on the allocation of AWMS in CRF table 4.B(a) and the NIR (table 6.16, p. 147), as well as inconsistencies throughout CRF tables 4.B(a) and 4.B(b). For example, CRF table 4.B(a) reports that 90 per cent of dairy cattle manure was allocated to solid storage systems, but in CRF table 4.B(b) solid storage was reported as "NO" for the period 1990–1992. The same situation occurs for non-dairy cattle. The ERT considers that the use of inaccurate data on the allocation of manure per AWMS leads to an underestimation of N_2O emissions from manure management and incorrect estimates of emissions from manure deposited during grazing. The ERT recommends that Kazakhstan verify and correct the data on the allocation of manure per AWMS and revise the estimates of N_2O emissions from manure management and agricultural soils for its next inventory submission. The ERT also reiterates the recommendation made in the previous review report that Kazakhstan improve the consistency of its reporting between the NIR and the CRF tables.

[3] Not all emissions related to all gases under this category are part of the key category, particularly CH_4 emissions.

Agricultural soils – N_2O

105. To estimate direct N_2O emissions from agricultural soils Kazakhstan uses a combination of the IPCC 1a and 1b methods and default EF for direct N_2O emissions from managed soils (0.01 N_2O-N/kg N) from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines). However, the ERT noted that the default EFs from the 2006 IPCC Guidelines are lower than the default EF (0.0125 N_2O-N/kg N) from the IPCC good practice guidance. The NIR does not provide any supporting rationale for the use of the EFs from the 2006 IPCC Guidelines and how their use better corresponds to the national circumstances. The ERT recommends that Kazakhstan provide a justification for the use of the default EFs from the 2006 IPCC Guidelines in the NIR of its next inventory submission.

106. Kazakhstan reported the fraction of livestock nitrogen excreted and deposited onto soil during grazing for 1990 (0.29) and 2010 (0.60) in CRF table 4.D. However, the ERT noted that, according to the calculations made using the data provided in CRF table 4.B(b) regarding the allocation of manure per AWMS, the fraction of manure excreted on pasture, range and paddock is 0.85 in 1990 and 0.53 in 2010. The ERT therefore reiterates the recommendation made in the previous review report that Kazakhstan correctly report the fraction of manure excreted on pasture in CRF table 4.D in its next inventory submission.

107. The ERT noted that, in the calculation of direct N_2O emissions from application of fertilizers to soils, the amount of nitrogen applied to soils with synthetic and organic fertilizers has not been adjusted on the basis of the fractions that volatilize as ammonia and N_2O. The ERT considers that this leads to double counting of indirect N_2O emissions from atmospheric deposition. The ERT therefore recommends that Kazakhstan follow the recommendations of the IPCC good practice guidance and revise the estimates of N_2O emissions from agricultural soils for its next inventory submission.

108. In its 2012 inventory submission, Kazakhstan reported indirect N_2O emissions from nitrogen leaching and run-off as "NE", and the fraction of nitrogen input to soils that is lost through leaching and run-off is reported as "0" in the additional information of CRF table 4.D. The ERT also noted that, in the previous inventory submission, Kazakhstan estimated and reported indirect N_2O emissions from nitrogen leaching and run-off. The NIR and CRF tables do not include any clarification of the reasons for the exclusion of this category from the inventory for the agriculture sector. In response to a question raised by the ERT during the review, Kazakhstan explained that there is no verifiable information on the areas with run-off surface as well as leached soils and no verifiable information on the areas subject to leaching. Hence the fraction of nitrogen that is leached and run-off and indirect emissions from the corresponding areas are not estimated. The ERT recommends that Kazakhstan follow the IPCC good practice guidance and the Revised 1996 IPCC Guidelines to estimate indirect N_2O soil emissions from nitrogen leaching and run-off and report them in its next inventory submission.

109. For its 2012 inventory submission, Kazakhstan estimated for the first time N_2O emissions from mineral soils as a result of loss of carbon in the soils, on the basis of the results of national soil monitoring data on carbon losses, and reported these emissions under N_2O emissions from managed soils in the category agricultural soils. The ERT noted that, according to the IPCC good practice guidance for the LULUCF, N_2O emissions from mineralization of soil organic matter should be reported in the land converted to cropland categories in CRF table 5(III). The ERT welcomes the improvements in completeness made since the previous inventory submission; however, the ERT recommends that Kazakhstan allocate N_2O emissions from mineralization of soil organic matter to the LULUCF sector in the relevant categories, as required by the IPCC good practice guidance for LULUCF.

110. In addition, the ERT noted that N_2O emissions from mineral soils fluctuate during the reporting period (ranging from 8.38 Gg to 34.99 Gg). The 2010 value reported by Kazakhstan is 82.0 per cent higher than the 1990 value. Furthermore, the inter-annual changes have been identified as large throughout the entire time series (ranging from –44.9 to 113.1 per cent). The reasons for the fluctuations in the trend are not described in the NIR. The ERT recommends that Kazakhstan verify the soil monitoring data, as well as describe the reasons for the fluctuations in the trend in the NIR of its next inventory submission, and report these emissions under the LULUCF sector as is recommended in paragraph 109 above.

E. Land use, land-use change and forestry

1. Sector overview

111. In 2010, net removals from the LULUCF sector amounted to 6,032.84 Gg CO_2 eq. The LULUCF sector offset 2.3 per cent of the emissions from other sectors in Kazakhstan in 2010. Since 1990, net removals have increased by 33,314.3 per cent. The sector was a net source of emissions from 1990 to 1995 and since 1996 has been a net sink. The key drivers for the rise in removals are an increase in carbon accumulation in living biomass in forest land remaining forest land and a decrease in emissions from grassland and cropland.

112. Within the sector, in 2010, 6,568.17 Gg CO_2 eq of net removals were from forest land, followed by 51.33 Gg CO_2 eq of net removals from cropland. The remaining 586.67 Gg CO_2 eq of net emissions were from grassland. Net CO_2 emissions and removals from wetlands remaining wetlands were reported as "NE" and "NO"; and net CO_2 emissions and removals and CH_4 and N_2O emissions from settlements remaining settlements were reported as "NE" and "NO". The ERT noted that there are no IPCC methodologies to estimate emissions for these categories. The ERT encourages Kazakhstan to make efforts to estimate and report these emissions in line with the IPCC good practice guidance for LULUCF in its next inventory submission. Net CO_2 emissions and removals and CH_4 and N_2O emissions from land converted to settlements were reported as "NE" and "NO". The ERT noted that there are IPCC methodologies to estimate emissions for these categories. The ERT therefore recommends that Kazakhstan estimate these emissions and removals for its next inventory submission.

113. Kazakhstan has made recalculations for the LULUCF sector between the 2011 and 2012 inventory submissions. The impact of these recalculations on the LULUCF sector is a decrease in the estimate of removals for 2009 of 30.8 per cent and a significant decrease in the estimate of removals for 1990 of 100.3 per cent. Information on the reasons for recalculations is not reported in the NIR or in the CRF tables. The main recalculations took place in the following categories:

(a) CO_2 emissions from forest land;

(b) CO_2 emissions from cropland;

(c) CO_2 emissions from grassland;

(d) CO_2 emissions from settlements.

114. The ERT noted that the reporting for the LULUCF sector is incomplete in terms of categories, but it is complete in terms of gases, years and geographical coverage. Several mandatory categories (e.g. land converted to forest land, land converted to grassland, land converted to wetlands, land converted to settlements and N_2O emissions from disturbance associated with land-use conversion to cropland) were reported using the notation keys "NE" and "NO". The ERT recommends that Kazakhstan improve the completeness of the

inventory by collecting appropriate data and reporting all mandatory categories in its next inventory submission.

115. Kazakhstan reported annual land-use change matrices for 1990–2010 in its 2012 inventory submission, as recommended in the previous review reports. However, several inconsistencies have been found by the ERT in the land-use change matrix reported in annex 3 to the NIR and table 7.4 of the NIR regarding the identification of lands: for example, protective forest stands were included in cropland and a part of grassland was included in forest land. Also, the ERT noted some inconsistencies between the NIR and the CRF tables. In particular, estimates for wetlands remaining wetlands are reported using the notation keys "NE" and "NO" in the CRF tables but in annex 3 to the NIR the area of wetland was reported as 8,886.2 kha in 1990 and 8,817.1 kha in 2010. Some areas, such as forest land remaining forest land, lands converted to forest land, cropland remaining cropland, grassland remaining grassland and lands converted to grassland, reported in the NIR (annex 3) are not consistent with the areas provided in the CRF tables. The ERT recommends that Kazakhstan improve the consistency of its reporting for land representation according to the IPCC good practice guidance for LULUCF and report these data consistently in its next inventory submission.

116. The ERT also reiterates an encouragement from the previous review report that Kazakhstan consider the use of geographic information system technology to achieve a consistent representation of land use and land-use changes. The ERT further recommends that Kazakhstan make efforts to convert existing statistics into the IPCC land-use categories, considering, among other issues, that:

(a) Even if a land use results in no emissions, it is good practice to report its data and use appropriate notation keys for IEFs;

(b) Where relevant, forest land, grassland, wetlands and other land should be divided into "managed" and "unmanaged", although emissions of unmanaged lands do not need to be reported, reporting the area would allow the consistency of data to be checked;

(c) The definitions of land categories in the IPCC good practice guidance for LULUCF are rather flexible, and this should facilitate the use of available statistics, with the help of proxy data, expert judgement and justified assumptions, which should be documented in the NIR;

(d) For the purposes of reporting, Kazakhstan may report aggregate estimates for all land conversions to a particular land use, when data are not available to report them separately, which should then be clearly stated in the documentation boxes and documented in the NIR;

(e) The category other land remaining other land is intended to allow the total reported land area to match the total national area.

117. The ERT noted that a key category analysis including LULUCF was not reported by Kazakhstan in its 2012 inventory submission.

118. The ERT noted that the NIR is not sufficiently transparent, although Kazakhstan provided some relevant descriptions, references and sources of information for the specific methods, assumptions, EFs and AD. The documentation boxes in the CRF tables were not filled in and the drivers of emission trends in key categories, such as forest land and grasslands, were not clearly explained. The ERT recommends that Kazakhstan report all information required in the UNFCCC reporting guidelines to ensure a full transparency of the reported estimates in its next inventory submission.

119. In the 2012 inventory submission, uncertainties were reported separately for forest land remaining forest land, cropland remaining cropland and grassland remaining

grassland, and for the LULUCF sector as a whole. The uncertainties provided in the 2012 inventory submission were based mainly on expert judgement and were not verified against information from independent sources. Although the NIR included a section on uncertainties, it was limited to basic information on the errors associated with different parameters in the national forest inventory and to the reproduction of default values given in the IPCC good practice guidance for LULUCF. The ERT reiterates the recommendation made in the previous review report that Kazakhstan provide a complete set of uncertainty estimates for carbon stock changes and other emissions covering all mandatory categories, using country-specific values, where possible, in its next inventory submission.

120. The ERT noted that specific QA/QC procedures have not been implemented by Kazakhstan in its 2012 inventory submission for the LULUCF sector. The ERT identified some inconsistencies in the reporting, for example inconsistencies in the land areas reported between the NIR and the CRF tables (see para. 115 above). The ERT considers that this could be avoided by applying the necessary QC procedures. The ERT therefore strongly reiterates the recommendation made in the previous review reports that Kazakhstan implement its QA/QC plan for the sector in accordance with the IPCC good practice guidance for LULUCF. Further, the ERT encourages Kazakhstan to consider the implementation of any available tools, including software tools if appropriate, for performing inventory calculations and QC procedures for the LULUCF sector. This would improve the consistency in the representation of land use and minimize the risks of errors in data processing and reporting.

2. Key categories

Forest land remaining forest land – CO_2

121. Kazakhstan reported in the CRF tables and the NIR a time series of the areas of forest land remaining forest land. These data significantly differ from the data reported to FAO. The ERT noted, for example, that Kazakhstan reported to FAO[4] the following areas of forest land (including forests and other wooded lands): for 1990, 16,471 kha; for 2000, 18,130 kha; and for 2005, 18,959 kha. At the same time, in the CRF tables for those years Kazakhstan reported the following areas of forest land: for 1990, 15,527.1 kha; for 2000, 15,643.5 kha; and for 2005, 15,668.3 kha. The NIR does not provide any explanation of these differences. The ERT encourages Kazakhstan to explain these differences in its next inventory submission and improve, as far as is possible, the consistency of the data on forest land used for reporting to the UNFCCC and to FAO.

122. Carbon stock changes in forest land remaining forest land were estimated using a tier 2 method, using data from the national forest inventory. Carbon stock changes in living biomass were estimated by the stock change method. Net carbon stock changes in dead organic matter and in mineral soils were reported as "NE". The ERT recommends that Kazakhstan report carbon stock changes in all missing pools (net carbon stock changes in dead organic matter, in both mineral and organic soils) of this category.

123. According to the NIR, areas of forest land include forest (about 20 per cent of forest land) and other wooded land. The ERT noted that these subcategories of forest land differ significantly in their carbon stock of living biomass, deadwood, litter and soil. In order to improve the transparency of the NIR, the ERT encourages Kazakhstan to subdivide forest land into two subcategories (e.g. forests and other wooded areas) and report carbon stock changes separately for these subcategories.

124. The ERT noted that biomass carbon stock gains and losses were not reported separately in the CRF tables for 1990–2010. In some cases, losses were reported using the

[4] <http://www.fao.org/forestry/country/32185/en/kaz/>.

notation key "NO", while gains were reported with a value; and in other cases, gains were reported using the notation key "NO", while losses were reported with a value. The ERT considers that reporting separately gains and losses improves the transparency of the inventory, and that if gains and losses are not separately reported in the CRF tables, the notation key "IE" should be used for any carbon stock changes that are not explicitly reported, together with a clear explanation of where these carbon stock changes are reported. The ERT reiterates the recommendation made in the previous review report that Kazakhstan report both biomass gains and biomass losses separately in its next inventory submission.

Grassland remaining grassland – CO_2

125. For grassland remaining grassland Kazakhstan reported values only for carbon stock changes in living biomass. Net carbon stock change in mineral soils was reported as "NE", and net carbon stock change in dead organic matter and in organic soils was reported as "NO". To calculate carbon stock changes in living biomass Kazakhstan used an average value of net primary production and the areas of grasslands with different degree of degradation. Kazakhstan used the same ratio of grassland to grassland under different types of degradation for the entire time series. The ratio was defined according to the aero-photometric studies conducted in Kazakhstan in 1989. However, the ERT considers that the degree of grassland degradation will have changed considerably according to the livestock population since 1990. The ERT therefore recommends that Kazakhstan check the reliability of the AD for the degree of grassland degradation for the entire time series for its next inventory submission.

126. The ERT noted the inconsistency in the reporting of areas of grassland in table 7.3 of the NIR, annex 3 to the NIR and CRF table 5. The ERT reiterates the recommendations made in the previous review report that Kazakhstan implement the procedures included in its QA/QC plan for this key category in order to improve both the consistency and accuracy of the reporting in its next inventory submission.

3. Non-key categories

Land converted to forest land – CO_2

127. The ERT noted that although the area of land converted to forest land was reported separately from the area of forest land remaining forest land, the associated carbon stock changes were reported as "NO" for carbon stock change in living biomass, "NE" and "NO" for net carbon stock changes in dead organic matter and in mineral soils, and "NO" for net carbon stock change in organic soil. The ERT recommends that Kazakhstan provide complete estimates of carbon stock changes for each carbon pool and other emissions separately for lands converted to forest land with a full description of the methods and EFs used for the estimation.

Cropland remaining cropland – CO_2

128. The ERT noted that net carbon stock changes in soils were reported using the notation key "NO" in the CRF tables. The ERT also noted that Kazakhstan reported in the NIR significant net CO_2 emissions from mineral soils ranging from 19.539 Gg CO_2 in 1990 to 37.654 Gg CO_2 in 2010. Estimated emissions correspond to arable lands and abandoned lands. In response to a question raised by the ERT during the review, Kazakhstan provided information to the ERT which explained that CO_2 emissions from soils of arable land reported in the NIR were preliminary estimates using the data from the national soil monitoring conducted by Kazakhstan's scientific centre, Agrokhimsluzhba, in 1989 and 2000–2010. However, due to the fact that there is high uncertainty in the calculation of

these emissions, Kazakhstan did not include these data in the CRF tables. The Party also informed the ERT that after verification of the emission calculations Kazakhstan will report emissions from soils in the CRF tables in its next inventory submission. The ERT recommends that Kazakhstan apply the necessary procedures for the verification of emissions from soils, including any procedures in accordance with the QA/QC plan and include these emissions in its next inventory submission.

129. Kazakhstan has reported significant areas of abandoned land for the period 1992-2010 as cropland. The ERT considers that these areas are not cropland and should be allocated to cropland converted to grassland. Also, abandoned lands have higher levels of carbon stock per area in comparison with cropland. The ERT therefore recommends that Kazakhstan exclude abandoned lands from cropland and report this category under cropland converted to grassland in order to improve the transparency of the NIR in its next inventory submission.

Forest land converted to grassland – CO_2

130. In the land-use matrices included in annex 3 to the NIR, Kazakhstan reported the area of forest land converted to grassland as follows: –1.3 kha in 1990, –4.9 kha per year in 1991–1995, –4.6 kha per year in 1996–2000 and –4.5 in 2004. However, for these years in CRF table 5.C for forest land converted to grassland Kazakhstan reported areas, carbon stock changes in living biomass and net carbon stock change in organic soils as "NO" and net carbon stock changes in dead organic matter and in mineral soils as "NE". The ERT noted that this may imply an underestimation of emissions for this category owing to deforestation. The ERT recommends that Kazakhstan include AD in the CRF tables and estimate carbon stock changes in all pools for its next inventory submission. Also, in order to improve transparency, the ERT encourages Kazakhstan to subdivide forest land converted to grassland into two categories, such as forest and other wooded areas with different carbon stock changes per area in all pools, and report carbon stock changes separately for these categories in its next inventory submission.

Biomass burning – CO_2, CH_4 and N_2O

131. The ERT noted that Kazakhstan reported biomass burning in grassland using the notation key "NO". During the review in response to a question raised by the ERT, Kazakhstan informed the ERT that only scattered information on wildfires in grasslands is available; therefore, in the 2012 inventory submission Kazakhstan could not collect data for the entire time series of 1990–2010. The ERT encourages Kazakhstan to make efforts to collect systematic data on wildfires in grassland and reflect the results of these emission calculations in its next inventory submission.

132. The ERT noted that an independent source[5] provides information regarding burnt areas of grassland (2.6 to 4.7 million ha/year for the period 2002–2006) for Kazakhstan. In view of this, the ERT considers that the remote data on wildfires on grassland could be collected from different sources for the entire time series 1990–2010 and used for the inventory preparation in future inventory submissions. The ERT therefore recommends that Kazakhstan collect AD and report emissions from wildfires on grassland in its next inventory submission.

133. The ERT also noted that Kazakhstan reported biomass burning in wetlands using the notation key "NO". In response to a question raised by the ERT during the review, Kazakhstan informed the ERT that only scattered information on wildfires in wetlands is

[5] Remote sensing observations by the Institute of Space Investigation of the Russian Academy of Science, available at <http://terranorte.iki.rssi.ru>.

available. In response to a question raised by the ERT during the review, Kazakhstan provided information that Kazakhstan's floodplains are burned.

134. The ERT also noted that the independent source mentioned in paragraph 132 above also provides information about burnt areas of wetlands (2.6 to 4.7 thousand ha/year for the period 2002–2006) for Kazakhstan. In view of this, the ERT considers that remote data on wildfires on wetlands could be collected from different sources for the entire time series 1990–2010 and used for the inventory preparation in future inventory submissions. The ERT therefore recommends that Kazakhstan collect AD and report emissions from wildfires on wetlands in its next inventory submission.

F. Waste

1. Sector overview

135. In 2010, emissions from the waste sector amounted to 4,830.90 Gg CO_2 eq, or 1.8 per cent of total GHG emissions. Since 1990, emissions have increased by 6.9 per cent. However, emissions decreased by 3.3 per cent between 1990 and 1995, owing to the decrease in population during these years, and then emissions increased by 9.9 per cent between 2000 and 2010 following the population increase by 10.7 per cent over this period and consequently an increase in waste generation per capita. The ERT noted that Kazakhstan used constant EFs in most categories in the waste sector and therefore the abovementioned trend is influenced mainly by the AD used. Within the sector, 82.3 per cent of the emissions were from solid waste disposal on land, followed by 17.5 per cent from wastewater handling. The remaining 0.2 per cent were from waste incineration.

136. Kazakhstan has made recalculations for the waste sector between the 2011 and 2012 inventory submissions. The impact of these recalculations on the waste sector is a decrease in the estimates of emissions for 1990 and 2009 of 24.4 and 23.3 per cent, respectively. These recalculations took place in the category solid waste disposal on land in response to a recommendation made in the previous review report, whereby CO_2 emissions were removed, which is in accordance with the Revised 1996 IPCC Guidelines. The ERT welcomes this improvement.

137. The emission estimates reported for the sector are complete in terms of geographical coverage, years, categories and gases. The ERT noted, however, that information reported in the CRF tables and the descriptions of methodologies and recalculations reported in the NIR are not fully complete, transparent or consistent. For example, data on population, waste generation rate, annual municipal solid waste (MSW) disposed at unmanaged waste disposal sites are missing in CRF table 6.A for 2010, and the explanatory information on recalculations is missing in CRF table 8(b). Missing information on some parameters used to estimate emissions from wastewater handling does not allow the ERT to fully assess the calculations. Therefore, the ERT recommends that Kazakhstan improve the transparency and completeness of the reporting by including complete information on the methodologies, parameters and the rationale of their choice, including recalculations, in its next inventory submission. The ERT also recommends that Kazakhstan enhance its QC activities to ensure the completeness of the CRF tables in its next inventory submission.

2. Key categories

Solid waste disposal on land – CH_4

138. Kazakhstan reported in the CRF table summary 3 that a tier 2 method was used to estimate CH_4 emissions from solid waste disposal on land. However, the ERT noted that the methodological description in the NIR contains very limited information on specific

parameters used for the estimates (e.g. methane generation constant). In contrast, equation 8.2 in the NIR makes a reference to the default method of the IPCC good practice guidance. In addition, the IEF for CH_4 is reported as constant throughout the entire time series. The ERT considers that it is unusual that a first order decay (FOD) method would result in a constant IEF, and is unprecedented among reporting Parties applying a tier 2 method. In response to a question raised by the ERT during the review, Kazakhstan confirmed that the FOD method was not applied because of a lack of information. The ERT concludes that Kazakhstan used the default method of the IPCC good practice guidance and recommends that, in its next inventory submission, Kazakhstan correctly describe the methodologies used and ensure the consistency of information on the method in the CRF tables and the NIR. In addition, the ERT recommends that Kazakhstan make further attempts to obtain the necessary AD and to apply the FOD method for its next inventory submission.

139. The ERT also found some inconsistencies between the CRF tables and the NIR. For example, in CRF table 6.A, under additional information, a value of 0.00 is reported for the fraction of degradable organic carbon (DOC) in MSW, whereas in the NIR a value of 0.21 is reported. Many values are missing in the additional information table of CRF table 6.A, but also some of the AD are missing, such as annual MSW for unmanaged waste disposal sites. The ERT recommends that Kazakhstan improve the completeness of its reporting and fill the gaps in the CRF tables in its next inventory submission.

140. The ERT noted that the IEFs reported by Kazakhstan are the same for managed and unmanaged waste disposal for the entire time series (0.0476 t/t MSW), although different methane correction factors (MCFs) are applied. Moreover, the MCF used for managed waste disposal on land (0.6) is significantly lower than the default value (1.0) and is more typical for unmanaged waste disposal sites. The ERT recommends that Kazakhstan provide a justification for the use of the same IEFs for managed and unmanaged waste disposal, as well as for the MCF used deviating from the default parameter, in the NIR of its next inventory submission.

141. CH_4 emissions from solid waste disposal on land increased steadily by 13.7 per cent between 1994 and 2010, except for a sudden drop of 6.4 per cent between 2006 and 2007 caused by legal reclassification of some parts of the population from urban to rural. The ERT encourages Kazakhstan to analyse the consistency of the time series of the underlying AD in its next inventory submission.

142. As reported in the NIR, owing to the recent economic recovery and growth in the population, the amount of municipal waste generated in the country has increased, and its composition has changed towards an increasing share of plastics disposed. The ERT recommends that Kazakhstan collect more data on the changes in the amount and composition of disposed waste, especially from disposal sites near to large cities such as Almaty and Astana, and use these data for its estimations for its next inventory submission.

3. Non-key categories

Wastewater handling – CH_4 and N_2O

143. Kazakhstan used a default method from the Revised 1996 IPCC Guidelines for estimating CH_4 emissions from wastewater handling. For domestic and commercial wastewater, AD were derived from the total population, using the default value for per capita biochemical oxygen demand of 0.05 kg/capita/day. The amount of total industrial organic wastewater was determined using average specific chemical oxygen demand (COD) (kg COD/m^3) data. In this respect, Kazakhstan has enhanced its reporting on sectoral background data in CRF table 6.B by including more industry-specific information. The ERT commends Kazakhstan for this improvement. However, the industry-specific DOC values in the CRF tables for the categories food and drink, and organic chemicals are

outside the typical COD range, as presented in table 5.4 of the IPCC good practice guidance. The ERT encourages Kazakhstan to present, in its next inventory submission, more information in the NIR on the chosen values for COD, especially in cases when they significantly differ from the default values.

144. The ERT noted that the IEFs reported by Kazakhstan are constant throughout the time series for both industrial (0.03) and domestic and commercial (0.06) wastewater handling. The share of aerobic handling systems is reported as 90 per cent consistently, except for 2010, when the additional information table of the CRF table 6.B contains the value of 0.00 for domestic wastewater. In the NIR, no information was given on the MCFs used. The ERT encourages Kazakhstan to implement its planned improvement reported in the NIR to collect statistical data on the availability of public sanitation in rural and urban areas, which would contribute to the specification of the appropriate MCF values. The ERT recommends that Kazakhstan increase the transparency of its reporting by providing more detailed information on the parameters used in its next inventory submission.

145. The ERT noted that a default method is applied for the calculation of N_2O emissions from human sewage. The N_2O IEF for human sewage reported in CRF table 6.B fluctuates around the default value (0.01 kg N_2O-N/kg N) with a minimum of 0.008 kg N_2O-N/kg N in 2002 and a maximum of 0.011 kg N_2O-N/kg N in 1999. Kazakhstan used protein consumption data from FAO for up to 2003, whereas the values of consumption (35 kg/capita/year) were reported for the period 2002–2010, which are based on expert judgement, with the explanation that this was due to a lack of other information. However, the ERT noted that, based on the food balance sheets from FAOSTAT, protein supply increased from 32.3 kg/capita/year in 2002 to 37.7 kg/capita/year in 2009. The ERT encourages Kazakhstan to use the FAO statistics for verification, and implement its planned improvement (as reported in the NIR) to revise the time series of protein consumption with the involvement of the Institute of Nutrition of the Ministry of Health.

III. Conclusions and recommendations

A. Conclusions

146. Kazakhstan submitted its CRF tables on 13 April 2012 and its NIR on 18 July 2012. The inventory submission contains the GHG inventory comprising CRF tables and an NIR. This is in line with the UNFCCC reporting guidelines.

147. The ERT concludes that the inventory submission of Kazakhstan has been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete, as Kazakhstan has submitted a complete set of CRF tables for the years 1990–2010 and an NIR, and these are complete in terms of years, as well as generally complete in terms of geographical coverage, sectors, categories and gases. The inventory does not cover all source and sink categories for the period 1990–2010. The ERT noted that the following categories were not estimated and no notation keys are used in the CRF tables: CO_2, N_2O and CH_4 emissions from oil exploration, from oil flaring and from gas flaring; CO_2 and CH_4 emissions from natural gas exploration, from gas venting, from oil venting and from combined venting; HFCs, PFCs and SF_6 emissions from consumption of halocarbons and SF_6 (except for HFC-134a from refrigeration and air-conditioning equipment); and CH_4 emissions from enteric fermentation and from manure management for buffalo and mules and asses. Furthermore, the ERT noted that the following categories are reported using the notation key "NE": fugitive CO_2 emissions from natural gas transmission, from natural gas distribution and from other leakage (in the residential and commercial sectors); fugitive CO_2 emissions from oil transport; fugitive CO_2 and CH_4

emissions from solid fuel transformation; CO_2 emissions from coke under iron and steel production; and indirect N_2O emissions from nitrogen leaching and run-off. Several mandatory categories in the LULUCF sector were reported using the notation keys "NE" and "NO", such as land converted to forest land, land converted to grassland, land converted to wetlands, land converted to settlements and N_2O emissions from disturbance associated with land-use conversion to cropland.

148. The ERT also noted that net CO_2 emissions and removals from wetlands remaining wetlands and from settlements remaining settlements were reported using the notation keys "NE" and "NO".

149. The ERT further noted that Kazakhstan did not report estimates nor use notation keys to report the following categories, for which there are no IPCC estimation methodologies or EFs available: fugitive N_2O emissions from oil refining and storage; fugitive CO_2 and CH_4 emissions from distribution of oil products and from other (oil); and CO_2 emissions from food and drink. The ERT noted that Kazakhstan reported using the notation key "NE" the following categories, for which there are no IPCC estimation methodologies or EFs available: CO_2 emissions from asphalt roofing and from road paving; and CO_2 and N_2O emissions from the solvent and other product use sector.

150. The ERT also noted that emissions of all gases from international aviation bunkers were reported using the notation key "NE" and emissions of all gases from international marine bunkers were reported using the notation key "NA".

151. Kazakhstan's inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF.

152. Kazakhstan has made recalculations for the inventory between the 2011 and 2012 inventory submissions following changes in AD and methodologies. The impact of these recalculations on the national totals is a decrease in the estimate of emissions for 2009 of 9.8 per cent. The main recalculations took place in the following categories:

(a) CO_2 emissions from energy industries;

(b) CO_2 emissions from manufacturing industries and construction;

(c) CO_2 emissions from cement production;

(d) CO_2 and PFC emissions from aluminium production;

(e) CH_4 emissions from enteric fermentation;

(f) N_2O emissions from agricultural soils;

(g) CO_2 emissions from forest land;

(h) CO_2 emissions from grassland.

153. The institutional arrangements implemented by Kazakhstan for the preparation of the inventory continue to perform their required functions. MoEP, as Kazakhstan's focal point for reporting under the Convention, has the overall responsibility for organizing and coordinating the inventory preparation process, and submitting the inventories to the UNFCCC secretariat, whereas the KazNIIEK has the overall responsibility for planning, preparation and management of the national inventory. Nine other ministries and two agencies, such as the Agency for Statistics and the Agency for Land Resources Management, are also involved in the preparation of the inventory, mostly as data providers.

154. During the review, Kazakhstan provided information on changes in the institutional arrangements, but the NIR does not include this information in its description of the institutional arrangements for inventory preparation.

B. Recommendations

155. The ERT identifies issues for improvement as listed in table 3 below.

Table 3
Recommendations identified by the expert review team

Sector	*Category*	*Recommendation*	*Paragraph reference*
Cross-cutting	Timeliness	Submit the national inventory report (NIR) by 15 April each year, together with the common reporting format (CRF) tables, as required by decision 18/CP.8.	5
	Completeness	Estimate emissions in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) for the categories currently not estimated or not reported and include the emission estimates, together with the relevant documentation supporting the estimates, in the next inventory submission.	9
		Use the notation keys to report the categories for which there are no IPCC estimation methodologies or emission factors (EFs) available and/or provide, in CRF table 9(a) and in the NIR, the rationale for not reporting emissions for those specific categories.	10
		Estimate net CO_2 emissions and removals and CH_4 and N_2O emissions from land converted to settlements for its next inventory submission	11
		Provide estimates of emissions for international aviation and marine bunkers in the next inventory submission, together with the appropriate supporting documentation in the NIR.	12
		Improve completeness by reporting information in all chapters of and relevant annexes to the NIR as required by the UNFCCC reporting guidelines and follow the outline of the NIR.	13
		Update and describe the institutional arrangements for the inventory preparation in more detail, including the roles and responsibilities of all participating institutions and changes occurred and that may occur.	15
	Key categories	Include the land use, land-use change and forestry (LULUCF) sector in the key category analysis for the next inventory submission.	17
		Include information in the NIR of the next inventory submission to explain whether the results of the key category analysis are used for planning further improvements to the inventory.	18
	Uncertainty	Provide information on estimates of total uncertainty for the inventory and use the uncertainty analysis as a driving factor to prioritize the improvements to the inventory and, in the next inventory submission, report on how this is being done.	19

Sector	*Category*	*Recommendation*	*Paragraph reference*
	Recalculations and time-series consistency	Report, in the NIR and the relevant CRF tables of the next inventory submission, detailed information on the rationale for and the impact of the recalculations performed.	20
	Verification and quality assurance/quality control (QA/QC)	Provide more transparent information on the QA/QC plan and its implementation in the NIR of the next inventory submission.	21
		Improve the implementation of the QA/QC plan and provide information, in the next inventory submission, on the implemented QA/QC procedures (e.g. supporting documents archived electronically).	22
	Transparency	Improve the transparency of the inventory by including more information on methods, EFs and activity data (AD).	23
	Inventory management	Provide more precise information on the archiving system, including: the responsibilities of different institutions for the flow of data and archiving; whether the archiving system includes information generated through external and internal reviews; documentation on annual key category analysis, key category identification and planned inventory improvements; and how this system is maintained by KazNIIEK.	26
Energy	Sector overview	Convert all estimates of non-CO_2 emissions into CO_2 eq and report correct emission estimates in the NIR and the CRF tables.	30
		Report in the NIR and CRF table 8(b) all the information required on recalculations, in accordance with the IPCC good practice guidance.	32
		Estimate emissions in accordance with the IPCC methodologies for the categories currently not estimated or not reported and include the emission estimates, together with the relevant documentation supporting the estimates, in the next inventory submission.	34
		Use the notation keys for the following categories, for which there are no IPCC estimation methodologies or EFs available: fugitive N_2O emissions from oil refining and storage; and fugitive CO_2 and CH_4 emissions from distribution of oil products and from other (oil and natural gas), as appropriate, and provide the rationale for not estimating the emissions for these specific categories in CRF table 9(a).	35
		Include the information and supporting documentation justifying the use of country-specific EFs for estimating CO_2 emissions from coal mining and handling, and for combustion of liquid fuels (diesel oil, residual fuel oil and gasoline), natural gas, coke oven gas and blast furnace gas in the NIR of the next inventory submission.	37
		Improve the transparency of the reporting on methodologies used and the presentation of data used in the NIR of the next inventory submission.	38
		Provide conversion factors for t coal eq for each fuel in the NIR of the next inventory submission.	39

Sector	*Category*	*Recommendation*	*Paragraph reference*
		Improve the reporting of emissions from transport and on planned improvements in the NIR of the next inventory submission and prepare the NIR in accordance with the outline recommended in the UNFCCC reporting guidelines, including complete descriptions of all categories with specifications of the planned improvements.	40
		Investigate the possibility of separating combusted fuels from other losses, including feedstocks and non-energy use of fuels, and report related emissions in the appropriate category of the energy sector (emissions from fuel combustion or fugitive emissions) and, if appropriate, in other sectors in the next inventory submission.	41
		Explain the underlying assumptions and the degree of expert judgment used and report final data sets of AD used for 1990-2010 in the NIR.	42
		Ensure the consistency of the entire time series and provide comparisons of AD obtained from different sources in the NIR of the next inventory submission.	
		Extend the documentation on uncertainties to cover all categories.	44
		Perform checks for the correctness of the methods, data input and calculations, implement all QC procedures recommended in the IPCC good practice guidance and verify the information and studies delivered by external organizations and institutions for the preparation of the inventory in the next inventory submission. In addition, perform QC procedures on the NIR before its submission to avoid any structural gaps, inaccuracies and mistakes.	45
	Reference and sectoral approaches	Include an annex to the NIR explaining the difference between the reference and the sectoral approaches in the next NIR in accordance with the outline recommended in the UNFCCC reporting guidelines.	46
		Include a detailed analysis of results of the comparison between the reference and the sectoral approaches (reported in CRF table 1.A(c)).	47
		Provide further analysis of the parameters used to calculate CO_2 emissions by the reference approach.	
		Apply a specific analysis to reduce the discrepancies between the energy consumption data reported in the inventory submission and the data reported to the International Energy Agency (IEA) and provide explanations in the NIR of the next inventory submission.	48
	International bunker fuels	Obtain the required data on fuel consumption for international aviation bunkers, based on available statistics and expert judgement, if necessary, and report on these emissions in the next inventory submission.	49
		Obtain relevant navigation statistics, correctly allocate fuel consumption to international and domestic navigation, and use the appropriate EFs for reporting emissions in the next inventory	50

Sector	*Category*	*Recommendation*	*Paragraph reference*
		submission.	
	Feedstocks and non-energy use of fuels	Provide consistent information on how emissions are allocated between the energy and industrial processes sectors.	51
		Explain and justify in the NIR all country-specific parameters developed by the Party as well as the reasons for the use of a default value for the fraction of carbon stored.	52
	Stationary combustion: solid fuels – CO_2	Investigate the possibility of calculating country-specific CO_2 EFs for lignite and sub-bituminous coal as a weighted average value based on information on specific coal production and a CO_2 EF for each basin.	53
		Investigate the reallocation of AD from the energy sector to the industrial processes sector, correct all misallocations and provide a carbon balance for the iron and steel industries and the non-ferrous industries in the NIR of the next inventory submission.	54
	Stationary combustion: liquid fuels – CO_2	Report CO_2 emissions from residual fuel oil, gasoline and diesel oil separately in the NIR of the next inventory submission.	55
	Coal mining and handling: solid fuels – CH_4	Include information on the CH_4 content and implied emission factors (IEFs) specified for underground mines in the NIR and explain the underlying reasons for the fluctuation in the trend in IEFs and CH_4 emissions in the next inventory submission.	56
		Include a summary of the justification documents on CH_4 content and IEFs specified for different mining fields in the next inventory submission.	57
		Clarify the reallocation of CH_4 emissions from reclaimed mines and provide a transparent explanation in the next inventory submission.	58
	Road transportation: liquid fuels – CH_4 and N_2O	Improve the accuracy of N_2O emission estimates for this category, taking into account the pollution control technologies introduced over time in the vehicle fleet, or provide a well-documented justification for the use of low constant values for the above-indicated period of time.	59
		Improve the accuracy of the CH_4 emission estimates for this category, taking into account the pollution control technologies introduced over time in the vehicle fleet.	60
	Solid fuel transformation – CO_2 and CH_4	Include, in the next inventory submission, explanations of the inconsistencies identified between the IEA and national data and, if possible, report emissions for this category. If this is not possible, include the rationale for the exclusion of these emissions from the estimates in the NIR of the next inventory submission.	62
		Ensure the correct use of notation keys and report information in the documentation boxes in the CRF tables of the next inventory submission.	
Industrial processes and solvent and	Sector overview	Provide a detailed description of the recalculations made, including the rationale and the changes in AD, EFs and methods, in the next inventory submission.	66

Sector	*Category*	*Recommendation*	*Paragraph reference*
other product use		Collect AD and estimate emissions for all categories for which there are the IPCC methodologies and EFs available, in order to improve the completeness of the inventory for the next inventory submission, in particular emissions for the missing subcategories under consumption of halocarbons and SF_6.	66
		Provide clear and consistent information as to where emissions for the categories reported as included elsewhere (IE) are included in the next inventory submission.	69
		Improve the overall transparency of the inventory by including clear and concise information on methods, EFs and AD used as well as other additional information, in order to fully adhere to the requirements of the UNFCCC reporting guidelines.	70
		Provide a clear description of the sector-specific QC checks and use the sector-specific QA procedures for key categories.	71
		Increase the transparency of the inventory, in general, by providing detailed descriptions of AD, EFs and methods used for all categories in this sector and of the recalculations (the rationale and changes in AD, EFs and methods) in the next inventory submission.	72
	Cement production – CO_2	Provide a detailed description of the technological process of cement production in the country, together with data, EFs and cement kiln dust correction factors used, in the next inventory submission, in order to improve the transparency of the inventory.	73
		Provide detailed information on recalculations, including the rationale for the recalculations and the changes in the AD, EFs or methods used, in the next inventory submission.	74
	Limestone and dolomite use – CO_2	Provide a detailed description of the AD, EFs and methods used in the next inventory submission, in order to improve the transparency of the inventory.	75
	Carbide production – CO_2	Revise the emission estimates and provide a detailed description of the method, AD and EFs used in the next inventory submission.	76
		Use a method that is in line with the Revised 1996 IPCC Guidelines and include the estimates in the next inventory submission.	77
	Iron and steel production – CO_2	Provide the explanation for the increase in the IEF for pig iron in the NIR of the next inventory submission.	78
		Develop a complete carbon balance for iron and steel production in order to avoid CO_2 emissions being not estimated or double counted under the energy and industrial processes sectors.	
		Provide precise information about the allocation of all emissions from coke production.	
	Ferroalloys production – CO_2	Provide a detailed description of the AD, EFs and methods used in the next inventory submission, in order to improve the transparency of the inventory.	79
	Aluminium	Provide a detailed description of the AD, EFs and methods used and provide explanations and the rationale for the recalculations	80

Sector	*Category*	*Recommendation*	*Paragraph reference*
	production – PFCs	in the next inventory submission.	
	Consumption of halocarbons and SF_6 – HFCs	Provide estimates of actual and potential emissions for all subcategories and species occurring in the country and a detailed description of the methods, AD and EFs used as well as of the occurrence of different activities under this category in the country in the NIR of the next inventory submission.	81
		Provide, in the NIR of the next inventory submission, a precise explanation, supporting documentation and a validation of the assumptions used for the estimates, especially for refrigeration equipment and mobile air-conditioning equipment, and correct the inconsistency in the reporting between the NIR and the CRF tables for 2010 as well as improve the QC procedures.	82
	Lime production – CO_2	Provide more detailed information about the methodology used to estimate these emissions.	83
		Use country-specific data to estimate emissions for this category and provide detailed descriptions of the method, AD and EFs used for the estimates in the next inventory submission, in order to improve the transparency of the inventory.	84
	Iron and steel production – CH_4	Specify the allocation of CH_4 emissions in the next inventory submission.	85
	Consumption of halocarbons and SF_6 – PFCs and SF_6	Provide estimates of actual and potential emissions for all subcategories and species occurring in the country and a detailed description of the methods, AD and EFs used, as well as a detailed description of the occurrence of different activities under this category in the country, in the NIR of the next inventory submission.	85
		Provide information about consumption of SF_6 from electrical equipment and include emission estimates in the next inventory submission.	87
Agriculture	Sector overview	Report prescribed burning of savannahs as not occurring in the next inventory submission.	90
		Include all missing animal species for the estimation of emissions in the next inventory submission using the IPCC methodologies and Food and Agriculture Organization of the United Nations data on livestock population, if such data are not available from the official statistical data of Kazakhstan.	91
		Improve the transparency of the reporting and include, in the next inventory submission, all detailed information on AD, methodologies, EFs and parameters in the NIR and the CRF tables as required by the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the UNFCCC reporting guidelines.	93
		Provide the sources and references for uncertainty values used in the analysis of the agriculture sector in the next inventory submission.	95
		Follow more closely the UNFCCC reporting guidelines and the IPCC good practice guidance and implement the QA/QC plan and provide information in the NIR of the next annual submission on source-specific QA/QC activities performed for	95

Sector	*Category*	*Recommendation*	*Paragraph reference*
		the agriculture sector.	
	Enteric fermentation – CH_4	Revise the feed intake estimates for cattle, providing accurate estimates for this category according to the IPCC good practice guidance, and provide all supporting data and parameters used for the calculations in the NIR and the CRF tables, in order to improve the transparency of the reporting in the next inventory submission.	100
		Provide separate estimates for goats and sheep in the next inventory submission.	101
	Manure management – CH_4 and N_2O	Provide CH_4 conversion factors in the next inventory submission, in order to improve the transparency of reporting.	103
		Verify and correct the data on allocation of manure per animal waste management system and revise the estimates of N_2O emissions from manure management and agricultural soils for the next inventory submission.	104
		Improve the consistency of the reporting between the NIR and the CRF tables.	104
	Agricultural soils – N_2O	Provide a justification for the use of the default EFs from the 2006 IPCC Guidelines in the NIR of the next inventory submission.	105
		Report correctly the fraction of manure excreted on pasture in CRF table 4.D in the next inventory submission.	106
		Follow the recommendations of the IPCC good practice guidance and revise the estimates of N_2O emissions from agricultural soils for the next inventory submission.	107
		Follow the IPCC good practice guidance and the Revised 1996 IPCC Guidelines to estimate indirect N_2O soil emissions from nitrogen leaching and run-off and report the emission estimates in the next inventory submission.	108
		Allocate N_2O emissions from mineralization of soil organic matter to the LULUCF sector in the relevant categories, as required by the IPCC good practice guidance for LULUCF.	109
		Verify the soil monitoring data, describe the reasons for the fluctuations in the emission trend of N_2O emissions from mineral soils in the NIR of the next inventory submission and report these emissions under the LULUCF sector.	110
LULUCF	Sector overview	Estimate net CO_2 emissions and removals and CH_4 and N_2O emissions from land converted to settlements for the next inventory submission.	112
		Improve the completeness of the inventory by collecting appropriate data and reporting all mandatory categories in the next inventory submission.	113
		Improve the consistency of the reporting for land representation according to the IPCC good practice guidance for LULUCF and report these data correctly in the next inventory submission.	114
		Make efforts to convert existing statistics into the IPCC land-use categories, and consider, among other issues, that: even if land	116

Sector	*Category*	*Recommendation*	*Paragraph reference*
		use results in no emissions, it is good practice to report its data and use appropriate notation keys for IEFs; where relevant, forest land, grassland, wetlands and other land should be divided into "managed" and "unmanaged", although emissions of unmanaged lands do not need to be reported, reporting the area would allow the consistency of data to be checked; the definitions of land categories in the IPCC good practice guidance for LULUCF are rather flexible, and this should facilitate the use of available statistics, with the help of proxy data, expert judgment and justified assumptions, which should be documented in the NIR; and, for the purposes of reporting, Kazakhstan may report aggregate estimates for all land conversions to a particular land use, when data are not available to report them separately, which should be clearly stated in documentation boxes and documented in the NIR.	
		Report all information required by the UNFCCC reporting guidelines to ensure the full transparency of the reported estimates in the next inventory submission.	118
		Provide a complete set of uncertainty estimates for carbon stock changes and other emissions covering all mandatory categories, using country-specific values, where possible, in the next inventory submission.	119
		Implement the QA/QC plan for the sector in accordance with the IPCC good practice guidance for LULUCF.	120
	Forest land remaining forest land – CO_2	Report carbon stock changes for all missing pools (net carbon stock change in dead organic matter, in both mineral and organic soils) of this category.	122
		Report both biomass gains and biomass losses separately in the next inventory submission.	124
	Grassland remaining grassland – CO_2	Check the reliability of the AD for the degree of grassland degradation for the entire time series for the next inventory submission.	125
		Implement the procedures included in the QA/QC plan for this key category in order to improve both the consistency and accuracy of the reporting in the next inventory submission.	126
	Land converted to forest land – CO_2	Provide complete estimates of carbon stock changes for each carbon pool and other emissions separately for land converted to forest land, with a full description of the methods and EFs used for the estimation.	127
	Cropland remaining cropland – CO_2	Apply the necessary procedures for the verification of emissions from soils, including any procedures in accordance with the QA/QC plan, and include these emissions in the next inventory submission.	128
		Exclude abandoned land from cropland and report this category under cropland converted to grassland, in order to improve the transparency of the NIR of the next inventory submission.	129
	Forest land converted to grassland – CO_2	Include AD in the CRF tables and estimate carbon stock changes in all pools for the next inventory submission.	130

Sector	*Category*	*Recommendation*	*Paragraph reference*
	Biomass burning – CO_2, CH_4 and N_2O	Collect AD and report emissions from wild fires on grassland in the next inventory submission.	132
		Collect AD and report emissions from wildfires on wetlands in the next inventory submission.	134
Waste	Sector overview	Improve the transparency and completeness of the reporting by including complete information on the methodologies, parameters and the rationale for their choice, including recalculations, in the next inventory submission.	137
		Enhance the QC activities to ensure the completeness of the CRF tables in the next inventory submission.	
	Solid waste disposal on land – CH_4	Describe correctly the methodologies used and ensure the consistency of the information on the method in the CRF tables and the NIR.	138
		Make further attempts to obtain the necessary AD and to apply the first order decay method for the next inventory submission.	
		Improve the completeness of the reporting and fill the gaps in the CRF tables in the next inventory submission.	139
		Ensure that the AD are reported correctly and provide a justification for any deviation from the default parameters in the next inventory submission.	140
		Collect more data on the changes in the amount and composition of disposed waste, especially from disposal sites near to large cities such as Almaty and Astana, and use these data for the estimations for the next inventory submission.	142
	Wastewater handling – CH_4 and N_2O	Increase the transparency of the reporting by providing more detailed information on the parameters used in the next inventory submission.	143

Annex I

Documents and information used during the review

A. Reference documents

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

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>.

Status report for Kazakhstan 2012. Available at <http://unfccc.int/resource/docs/2012/asr/kaz.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2012. Available at <http://unfccc.int/resource/webdocs/sai/2012.pdf>.

FCCC/ARR/2011/KAZ. Report of the individual review of the annual submission of Kazakhstan submitted in 2011. Available at <http://unfccc.int/resource/docs/2012/arr/kaz.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Gulmira Sergazina (Ministry of Environmental Protection), including additional material on the methodology and assumptions used. The following documents[1] were also provided by Kazakhstan:

The text of the order #193 from 23 July 2010 on the state greenhouse gas national inventory system.

A brief overview of the gas content of coal seams of the Ekibastuz coalbasin, 2003. Bogatyr Access Komir.

[1] Reproduced as received from the Party.

Annex II

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management system
CaC_2	calcium carbide
CaO	lime
CO	carbon monoxide
CH_4	methane
CKD	cement kiln dust
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
COD	chemical oxygen demand
CRF	common reporting format
DOC	degradable organic carbon
EF	emission factor
ERT	expert review team
FAO	Food and Agriculture Organization of the United Nations
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
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram (1 kg = 1,000 grams)
LULUCF	land use, land-use change and forestry
m^3	cubic metre
MCF	methane correction factor
MSW	municipal solid waste
N	nitrogen
NA	not applicable
NE	not estimated
NO	not occurring
NOx	nitrogen oxides
N_2O	nitrous oxide
NIR	national inventory report
NMVOC	non-methane volatile organic compound
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SF_6	sulphur hexafluoride
SO_2	sulphur dioxide
TJ	terajoule (1 TJ = 10^{12} joules)
UNFCCC	United Nations Framework Convention on Climate Change