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Report on the technical expert review of the first biennial transparency report of Canada

Addendum

Summary

This addendum to the report on the technical expert review of the first biennial transparency report of Canada, conducted by a technical expert review team in accordance with the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement, contains the results of the review of the consistency of the information submitted by the Party with those modalities, procedures and guidelines, and presents capacity-building needs identified by the Party and by the technical expert review team in consultation with the Party during the review. The review took place from 28 April to 2 May 2025 in Gatineau, Canada.

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
2019 Refinement to the 2006 IPCC Guidelines	*2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AD	activity data
BTR	biennial transparency report
CCS	carbon dioxide capture and storage
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
CRT	common reporting table
CTF	common tabular format
EF	emission factor
ETF	enhanced transparency framework under the Paris Agreement
GHG	greenhouse gas
GHGRP	Greenhouse Gas Reporting Program of Canada
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MPGs	modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NDC	nationally determined contribution
NE	not estimated
NID	national inventory document
NIR	national inventory report
NO	not occurring
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
SF_6	sulfur hexafluoride
TERT	technical expert review team
UNFCCC Annex I inventory reporting guidelines	“Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories”
VS	volatile solid(s)

Areas of improvement[1] identified during the technical expert review of the Party's first biennial transparency report

Tables 1–20 present the results of the review of the consistency with the MPGs[2] of the information submitted by Canada in its BTR1. All recommendations and encouragements contained in the tables are for the next BTR or NIR, unless otherwise specified.

A. General reporting provisions

Table 1
Areas of improvement relating to general reporting provisions

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
NA	NA	No areas of improvement identified

B. Greenhouse gas emissions and removals

Table 2
Areas of improvement relating to general findings on greenhouse gas emissions and removals

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
2.G.1	Specified in paragraph 51 of the MPGs Completeness	Canada did not provide information on precursor gases within the BTR1 or NID. In the NID (part 1, section ES.9, p.15, and part 2, annex 7, p.308), the Party provided a link to its air pollutant emissions inventory report. No data on precursor gas emissions were reported in the NID or the CRTs. During the review, the Party noted that it reports emissions of these gases via its air pollutant emission inventory reports, which are submitted to the United Nations Economic Commission for Europe. The TERT encourages Canada to report precursor gases in future BTRs or NIRs in, for example, the sector report CRTs (i.e. CRTs 1, 2(I), 3, 4 and 5) and CRT summary 1.
2.G.2	Specified in paragraph 52 of the MPGs Completeness	Canada reported in the NID (chap. 6) that emissions of CO from controlled biomass burning were reported as CO in CRF table 4, but are not included in the sectoral totals, and were instead reported as indirect CO_2 in CRF table 6. No other indirect CO_2 or N_2O emissions were reported in CRF table 6, and most cells were left blank with no notation keys included. In CRT 6, all cells were left blank. During the review, Canada noted that CRT 6 was left blank partly owing to technical issues with the reporting software and that it did not report indirect emissions for sectors other than LULUCF. The TERT noted that, because indirect CO_2 emissions from LULUCF were estimated, the Party should have presented totals with and without indirect CO_2. These totals were not reported in the relevant CRTs. The TERT recommends that Canada ensure totals with and without indirect CO_2 emissions are reported in future submissions. The TERT also encourages the Party to report indirect N_2O emissions or, if not estimated, to clearly indicate them using the appropriate notation keys in CRT 6.
2.G.3	Specified in paragraph 56 of the MPGs Methods	Canada used the simple decay approach to estimate emissions from HWP and did not report supplementary information related to the production approach in the CRTs or the NID, which is not in accordance with the requirements of the MPGs. During the review, Canada explained that the simple decay approach uses the same reporting boundaries as the production approach and that all products made from Canadian wood are included in the reporting. The Party also noted that it has updated its reporting of HWP in the 2025 NID to address this reporting requirement.

[1] As referred to in paras. 7, 8, 146(d) and 162(d) of the MPGs, contained in the annex to decision 18/CMA.1.

[2] Decision 18/CMA.1, annex.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		The TERT recommends that Canada provide supplementary information on emissions and removals from HWP estimated using the production approach.

Table 3
Areas of improvement of the reporting on greenhouse gas emissions and removals – energy sector

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
3.E.1	Specified in paragraphs 20, 22, 29, 35 and 39 of the MPGs 1.B.2 Oil, natural gas and other emissions from energy production – CH_4	Canada indicated in the NID (part 2, p.73) that it updated the inventory method for the upstream oil and gas sector by applying atmospheric measurements to estimate emissions for a number of sources where the methods previously used did not result in accurate estimates. According to NID section A3.2.2.1.5, the Energy and Emissions Research Laboratory at Carleton University has published detailed CH_4 emissions inventories for the upstream oil and gas sector for the provinces of Alberta for 2021 (Conrad et al., 2023), British Columbia for 2021 (Johnson et al., 2023) and Saskatchewan for 2020–2021 (Conrad, Tyner and Johnson, 2023). The laboratory's approach is based on atmospheric measurements made via gas mapping through light detection and ranging, using aircraft flying at low altitudes to identify CH_4 emissions sources within upstream oil and gas facilities. The NID notes (part 2, p.73) that the CH_4 estimates produced under this research are directly applicable to the years when the measurements were taken. NID table A3.2-21 (part 2) clarifies which individual sources were used for each province and year in the Canadian inventory: compressor buildings, tanks and unlit flares (British Columbia, 2021); compressor buildings, engine sheds, tanks and unlit flares/combustors (Alberta, 2021); and compressor buildings, engine sheds, tanks, unlit flares/combustors and wellheads (Saskatchewan, 2020–2021). No further information on the criteria according to which these sources were selected as priorities for improvement using the new atmospheric measurements method is provided. The TERT notes that using remote sensing measurements to derive source-specific EFs that were then applied as part of the upstream oil and gas method used in Canadian production facilities for all years is a novel use of new measurement techniques. The 2019 Refinement to the 2006 IPCC Guidelines outlines the use of remote sensing measurements for the verification of inventory estimates. Canada's country-specific method is a new application of remote sensing measurements within national inventories. The TERT notes that the 2006 IPCC Guidelines (vol. 1, chap. 2.2.2) do not recommend any specific measurement techniques but do note that the best measurement methods are those that have been developed by official standards organizations and field-tested to determine their operational characteristics and indicate that it is good practice for compilers to document the measurement or quality management standards that have been applied. The NID notes that measurement sites were chosen to provide representative samples of facility sizes, subtypes and locations to account for the heterogeneity of Canada's upstream oil and gas sector, but does not provide clear evidence that the measurements from flights made in 2020–2021 provide comprehensive coverage of Canadian production facilities and other (e.g. meteorological) conditions that may impact the measurements, nor that suitable proxy data with a strong correlation with the observed measurements were available for deriving country-specific EFs for each source, which could then be applied to the available AD for recent (and earlier) years. Moreover, the NID did not report information on the uncertainty associated with the emission estimates derived using this new method. Given the novel methodology and selection of specific sources for each production area, the measurement methods and overall approach applied to integrate the laboratory's research into emission estimates are not transparently presented in the NID. For example, the TERT notes that it would be helpful for the NID to contain a summary of the research findings, such as the variability of the observed emissions for each source, the number of observations for each source, year and production area, and an analysis of the measurement and observational evidence provided by the inventory agency to derive the EFs applied in the inventory methods and the associated uncertainty of the EFs per source, production area and gas. Providing such information would enable Canada to present a clear description and evaluation of the methodology, to justify the improvement to the

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		inventory method and to help identify priorities for future improvement by performing a sensitivity analysis of the reference data. While the research included multiple measurements per site during the survey periods in 2020 and 2021, to gather information on temporal variability the TERT notes that the measurements were taken during a limited time period per production area, and hence they may not fully capture variabilities in emission intensities over time owing to operational, regulatory or technological changes. Furthermore, the NID does not provide insight into the range of measurement conditions, such as prevailing meteorological conditions, that might affect the results of the surveys across different production areas and survey periods, and how these parameters are taken into consideration within the method to, for example, inform uncertainties. The TERT acknowledges that these same limitations exist in the traditional bottom-up methods typically used to estimate fugitive oil and gas emissions that rely on ground-level field measurements taken using, for example, handheld measurement equipment. The TERT also notes that the NID does not explain how or whether the method accounts for temporal shifts in emission patterns (e.g. owing to changes in regional production, maintenance practices or equipment configurations). Noting the limitations in the underpinning evidence base, the TERT considers that applying the EFs derived from measurement surveys conducted in 2020–2021 across the inventory time series may lead to over- or underestimation of emissions, especially in earlier years. The TERT also notes that the 2006 IPCC Guidelines (vol. 1, chap. 6, sections 6.7.1.2–6.7.1.3) set out good practices for QA/QC processes to be considered during the development of country-specific EFs and for EFs derived from direct measurements of emissions. These good practices include performing QC checks on the background data used to develop EFs, assessing the adequacy of the EFs and QA/QC performed during their development and determining whether any limitations in the secondary data (in this case, in reference publications from the Energy and Emissions Research Laboratory at Carleton University) have been identified and documented. Several of the good practice QC checks on models are also relevant, such as compiler checks on the appropriateness of model assumptions and extrapolations and plans to periodically evaluate and update or replace assumptions with appropriate new measurements, identifying key assumptions by performing sensitivity analysis. The TERT considers that, given the novel inventory method developed by Canada for this source, the NID does not provide sufficient information regarding the QA/QC performed during the development of EFs. During the review, the Party provided additional information, including scientific studies, to support the selection of sources integrated using atmospheric measurements, and examples of a comparative analysis of surrogate methods. The Party also indicated that further measurement surveys and research may be commissioned. The TERT notes that through access to more data, including additional measurement campaigns, a larger, more representative and robust data set for Canadian upstream oil and gas production facilities may be derived. The TERT acknowledges the significant efforts already made by the Party to develop a novel method for addressing the challenging issue of how to estimate fugitive CH_4 emissions in the oil and gas sector. The TERT noted that numerous scientific studies across many jurisdictions indicate that traditional bottom-up inventory methods may underestimate emissions of fugitive CH_4, as outlined in the NID (part 1, p.50). During the review, the Party noted that the close alignment between the inventory and atmospheric measurements, which indicates improved accuracy of the Canadian inventory, is presented in the NID (figure 2-A) and in recent academic literature (MacKay et al., 2024). The TERT recommends that Canada enhance the accuracy of its GHG inventory by collecting additional data to improve the evidence base applied within the country-specific method, across sources, production areas and years. The TERT also recommends that Canada clearly document the rationale for selecting sources integrated using atmospheric measurements, including supporting evidence from the underlying research as noted above.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		The TERT further recommends that Canada review, document and, where necessary, update the uncertainty estimates so that they fully reflect the methodology and observed measurements for each source and the applicability of the derived EFs across historical and recent years, noting the time-series consistency issue discussed under ID# 3.E.2 below. The TERT encourages Canada to present information in future submissions to illustrate the QA/QC activities and outcomes relevant to the development of the country-specific EFs and their use within this method, as per the requirements set out in the 2006 IPCC Guidelines (vol. 1, chap. 6, sections 6.7.1.2 and 6.7.1.3).
3.E.2	Specified in paragraphs 26, 27 and 39 of the MPGs 1.B.2 Oil, natural gas and other emissions from energy production – CH_4	According to the NID (part 2, section A3.2.2.1.5), Canada derived recalculations in comparison to its previous submission under the Convention of the historical time series of CH_4 emission estimates for specific sources within the oil and gas sector using a hybrid surrogate data method that involved extrapolating the EFs derived from atmospheric measurements taken in 2020–2021. Two different surrogate data methods were used to backcast emissions to 1990, namely using facility counts and volumetric AD. Final emission estimates were obtained by averaging the results obtained through the two methods, with no further information provided in the NID to demonstrate if the approach is consistent with the surrogate data method as presented in the 2006 IPCC Guidelines (vol. 1, chap. 5, section 5.3.3.2). No further information was reported in the NID to justify the selection of the specific sources or explain why the selected proxy methods used for backcasting estimates are considered adequate, given potential changes in technology, operational practices and production patterns within the Canadian upstream oil and gas sector, or in regulatory frameworks, over time. The 2006 IPCC Guidelines recommend that surrogate data sets be tested to identify which is most strongly correlated to reliable emission data and caution against using short-term data to extrapolate over long periods. In the NID, the Party did not describe how the two proxy methods were evaluated to assess their suitability for extrapolation purposes and applied evidence from measurement surveys covering only two years to backcast emission estimates to 1990. During the review, the Party shared information indicating that the revised oil and gas CH_4 inventory data compare well with top-down CH_4 emission estimates based on independent tower-based ambient measurements back to 2010, which provides a degree of validation for the method used to backcast the CH_4 emissions. During the review, the Party presented additional information suggesting that no significant variation would be expected in the most recent years of the time series, supporting the use of the selected proxy methods for recent periods. However, the results provided also indicate that the two surrogate methods produce notably different estimates for earlier years. The TERT encourages the Party to review and, where appropriate, update the proxy methods and assumptions used for backcasting, including by providing documentation that presents the correlation of each surrogate method, the rationale for averaging the results of the surrogate methods and the validation of the CH_4 inventory data across the time series to 2010, in accordance with the information provided during the review. The TERT recommends that the Party provide more detailed information in the NID to transparently document the gap-filling methods applied across the inventory time series, including the rationale for the choice of methods, assumptions and data sources at the appropriate level of detail, for example per source/component type (e.g. compressor buildings, tanks and wellheads), to demonstrate that the methods applied are consistent with the good practice guidance in the 2006 IPCC Guidelines (vol. 1, chap. 5).

Table 4
Areas of improvement of the reporting on greenhouse gas emissions and removals – industrial processes and product use sector

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
4.I.1	Specified in paragraphs 26–27 of the MPGs	The IEFs for CO_2 emissions from lime production are mostly in the range of 0.76–0.78 t CO_2/t lime produced, with two lower outliers for 2019 (0.68 t CO_2/t lime

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
	2.A.2 Lime production – CO_2	produced) and 2021 (0.72 t CO_2/t lime produced). Lime production AD for 2019 and 2021 have been recalculated since the 2023 submission under the Convention, resulting in values that are 19 and 13 per cent higher respectively in the most recent submission. During the review, Canada noted that the AD for lime production for 2019 and 2021 reported in CRT 2(I).A-H of the 2024 submission come from the annual mineral production survey carried out by Statistics Canada, the Party's national statistics agency, while emission estimates were sourced from the GHGRP. The AD for lime production were revised for the most recent submission owing to revisions made by Statistics Canada, which resulted in changes to the IEFs in the NID. Canada also noted that the above-mentioned IEF outliers have been addressed in the 2025 NID (chap. 4.3.2, p.112). In the 2025 submission, the Party has revised the methodology used to estimate emissions from lime production, replacing Statistics Canada AD with production data from the GHGRP to align with the emission estimates. Canada noted that this methodological update has resulted in a consistent range of IEFs across the time series for the 2025 submission, and that, owing to a higher proportion of dolomitic lime and the country-specific nature of the methodology (emissions from by-products and waste are included in the emission estimates), the range of IEFs is slightly higher (0.79–0.82 t CO_2/t lime produced) compared with the IPCC default EFs for hydraulic lime or high-calcium lime. The TERT notes that using this approach may address this issue. The TERT notes Canada's efforts to improve its submission, also noting that the estimates will be reviewed in the coming years and encourages the Party to use the same methods and a consistent approach for the underlying AD and EFs for each reported year, ensuring that the AD reported in CRT 2(I).A-H are consistent with the emissions reported.
4.I.2	Specified in paragraph 47 of the MPGs 2.C.1 Iron and steel production – CO_2	Emissions for subcategory 2.C.1.e pellet production were reported in the CRT as "NE"; the NID indicates that this was due to a lack of suitable AD for the entire time series and that work is ongoing to identify AD that would enable the inclusion of estimates for this subcategory in the inventory. During the review, Canada explained the challenges involved in gathering AD and estimating emissions. Historically, there were three iron ore pelletizing facilities in Canada. Two are still in operation, and Canada has recently sourced historical production data from 1995 and from 2000 to 2024. One facility closed in 2013, but Canada has sourced production data from 1995 and is continuing to search for other data from this facility to complete the time series. A tier 1 estimate is being completed and Canada plans to include these emission estimates in its 2026 submission, noting that emissions for this category range from 500 to 700 kt CO_2/year. The TERT notes Canada's efforts to improve its submission, also noting that the estimates will be reported in the coming years, and recommends that Canada report emissions for subcategory 2.C.1.e in its next submission.
4.I.3	Specified in paragraphs 26 and 39 of the MPGs 2.C.3 Aluminium production – PFCs	The NID (part 1, section 4.12) outlines the various methodologies (tier 2 or tier 3) used for each plant over time, as well as highlighting plant closures. NID table 4-15 indicates that, for the early years of the time series, PFC emissions were estimated for each plant using a country-specific EF (i.e. a tier 2 method) and then, at various points in the time series, plant-specific EFs (i.e. a tier 3 method) were introduced and used to produce facility-level emission estimates. However, there are several notable step changes in the PFC IEFs across the time series, including for (1) 2006 and 2007 (0.117 and 0.098 kg CF_4/t aluminium respectively); (2) 2009 and 2010 (0.099 and 0.074 kg CF_4/t aluminium respectively); (3) 2013 and 2014 (0.064 and 0.044 kg CF_4/t aluminium respectively); and (4) 2021 and 2022 (0.027 and 0.030 kg CF_4/t aluminium respectively). It is not clear from the description provided in the NID of the changes in methods and closures over time whether the observed downward trend in IEFs until the latest year, where the IEF increases, is due to methodological changes (i.e. tier 2 to tier 3) or shifts in production across Canadian aluminium plants.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		During the review, Canada provided information from the Aluminium Association of Canada to explain the observed step changes in IEFs across the time series, noting that most of the reductions in IEFs were due to closures of higher-emitting plants that used older technology, including the plants in Bauhamois and Shawinigan, which were closed in 2009 and 2013 respectively, and shifts in production methods, where new technology production lines were introduced. Canada also explained that the increase in the IEF for 2022 was primarily due to an increase in emissions from the Kitimat facility, where the smelter was restarted after a labour dispute in July 2021, which resulted in production falling by 75 per cent and several facilities being closed. The Party also noted that it has not tested the time-series consistency of the method by, for example, backcasting tier 3 data from later years to validate or recalibrate the country-specific EFs applied for earlier years owing to a lack of detailed data for years prior to 2017. The TERT recommends that Canada include in future submissions the explanations provided during the review for the step changes in IEFs for the sector across the time series, which reflect the closure of plants using older technology. The TERT also recommends that Canada improve the documentation of the method used, in particular by providing more details of how the country-specific EFs for the tier 2 method were derived, the subsequent use of tier 3 EFs per facility in more recent years and how the time-series consistency of the method is ensured.
4.I.4	Specified in paragraphs 40 and 47 of the MPGs 2.C.5 Lead production – CO_2	Emissions from lead and zinc production were reported as "IE" for category 2.D.3 other (other and undifferentiated) non-energy fuel use. The NID notes that, across the time series, there are two primary and nine secondary lead production facilities and four zinc production facilities, with one primary and five secondary lead production facilities and two zinc production facilities still in operation in the latest year reported. The NID (part 1, section 4.14.1) notes that work is ongoing to disaggregate reductant use in these industries throughout the time series to enable emissions to be reported for categories 2.C.5 lead production and 2.C.6 zinc production. During the review, Canada noted that research has been conducted on how facilities report their fuel use to Statistics Canada. However, with existing data it is not yet feasible to produce a sufficiently robust methodology for disaggregating estimates and reconciling the fuel use with the Report on Energy Supply and Demand in Canada. The TERT recommends that Canada disaggregate emissions from the use of reductant in lead and zinc production by continuing to investigate AD and report these emissions under the appropriate categories.
4.I.5	Specified in paragraphs 31 and 47 of the MPGs 2.D.1 Lubricant use – CO_2	The Party reported CO_2 emissions for category 2.D.1 lubricant use as "NE" in CRT 9, noting that country-specific information is currently unavailable. The NID does not contain any further documentation regarding emissions from lubricant use, either within two-stroke engines in the transport sector or within the IPPU sector. During the review, Canada explained that it reported the incorrect notation key in CRT 9 for this category, which should have been reported as "IE" (as part of category 2.D.3 other), noting that, since the AD for lubricant use from its national statistics were regarded as confidential, emissions could not be disaggregated and reported in category 2.D.1. However, Canada also noted that, in the 2025 NID, estimates for lubricating oils and greases have been disaggregated from category 2.D.3 and reported under category 2.D.1 as the data confidentiality issue has been resolved. The TERT recommends that Canada estimate and report emissions from lubricant use under category 2.D.1 or report the appropriate notation key for this category in the relevant CRT and explain why it was used.
4.I.6	Specified in paragraphs 20 and 23 of the MPGs 2.D.3 Other (non-energy products from fuels and solvent use) – CO_2	The TERT notes that this is a key category in the Canadian inventory, and a tier 1 method was applied per fuel reported in the Report on Energy Supply and Demand in Canada as non-fuel, which includes some aggregated fuel types such as other products. It is also, for 2022, the single largest key category for CO_2 emissions in the IPPU sector, accounting for some 31 per cent of total CO_2 emissions in the sector. There is a risk that the use of tier 1 methodology for some fuels has led to

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		inaccurate emission estimates; this constitutes an accuracy issue as well as a transparency issue. During the review, Canada explained that the model used for category 2.D.3 other is a complex database that reconciles fuel used in other IPPU categories with all fuels reported by facilities to Statistics Canada as non-fuel use. For context, total emissions for this category are the sum of emissions for all non-fuel uses (e.g. natural gas, solid fuels such as petroleum coke, liquid fuels such as butane, and other products) reported to Statistics Canada. The Party also clarified that recent improvement efforts have focused on studying the composition of other products, which represents the largest amount (35 per cent in 2022) of emissions for this category and is defined as the total quantities of waxes, paraffin and unfinished products (i.e. items that cannot be identified in end-product terms). The Party plans to discuss with Statistics Canada ways to potentially disaggregate the fuel reported as other products, which includes paraffin wax, and to determine if there is a portion of the fuel that is not emissive, and then to update the oxidized during use factor for the fuel in question. Canada indicated that there is no clear time frame for completing the research and reflecting the findings in the NID. The TERT recommends that Canada advance research to gain a better understanding of the AD that are published as a combined entity, including to what extent they are emissive, and move to a higher-tier methodology for this key category by applying the decision tree in the 2006 IPCC Guidelines, or clearly document why the methodological choice does not follow the decision tree and justify how the selected method is consistent with the 2006 IPCC Guidelines.
4.I.7	Specified in paragraph 47 of the MPGs 2.D.3 Other (non-energy products from fuels and solvent use) – CO_2	According to the NID (part 1, section 4.15), the Party's method for estimating CO_2 emissions from the use of urea in vehicles with selective catalytic reduction applies assumptions regarding the dosing rate, the default purity for diesel exhaust fluid and country-specific information relating to the road transport vehicle fleet only. However, other machinery, including non-road mobile machinery, may also use urea-based selective catalytic reduction technology, and the 2006 IPCC Guidelines (vol. 2, chap. 3, equation 3.3.4) contain a methodology for estimating associated emissions. It is unclear from the NID whether the inventory agency has considered or researched the scope of the use of urea-based selective catalytic reduction technology and sought to access urea-based additive sales and/or production and import/export data to improve or validate the inventory method used by Canada. During the review, Canada explained that the method used for category 2.D.3 only considers the use of urea in the on-road vehicle fleet. The Party acknowledged that there may be a wider scope for the use of urea-based selective catalytic reduction technology in the country, and the Party has been working with its regulatory division to obtain regulatory data on the use of urea-based selective catalytic reduction technology in such equipment. Any urea used in other mobile equipment is currently allocated to subcategory 2.B.10.b other (other uses of urea – CO_2 emissions), which is a country-specific urea balance category that accounts for production, imports and exports and reconciles the use of urea in on-road vehicles with selective catalytic reduction and use of urea in agriculture. The TERT recommends that Canada continue to research AD and estimate emissions from the use of urea in selective catalytic reduction in non-road mobile machinery and report the emission estimates under the appropriate source category.
4.I.8	Specified in paragraphs 20, 24 and 39 of the MPGs 2.F Product uses as substitutes for ozone-depleting substances – HFCs	The NID (part 1, section 4.17.2, p.146) states that the country-specific EFs used across the time series for HFC use and disposal in the refrigeration and air-conditioning sectors are based on surveys carried out in 2012, with the results published in 2013. For aerosols, foam blowing, fire extinguishers, solvents and other applications, default EFs from the 2006 IPCC Guidelines were applied. Industry practices are likely to have changed since 2012 with regard to maintenance and HFC recovery and disposal; therefore, the use of country-specific EFs derived from 2012 data may not be representative of current practices, leading to potential underestimates or overestimates. During the review, Canada explained that several improvement activities are under way, including (1) a review of end-of-life EFs and recovery rates for refrigeration,

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		air conditioning and foam-blowing agents as these source categories represent the largest contributors to emissions; (2) a consultation with the Heating, Refrigeration and Air Conditioning Institute of Canada to explain the Party's needs in terms of national inventory data and seek access to any information that may verify or inform the revision of any of the Party's EFs, with a particular focus on end-of-life EFs. The TERT recommends that Canada provide in the NID justification for retaining the use of the historic HFC country-specific EFs as representative across the time series or conduct research with a view to updating or verifying the country-specific EFs used for refrigeration, air conditioning and foam-blowing agents across the time series, with a focus on end-of-life EFs, in accordance with the 2006 IPCC Guidelines.
4.I.9	Specified in paragraphs 20, 26, 27 and 39 of the MPGs 2.F Product uses as substitutes for ozone-depleting substances – HFCs	The AD for HFCs are based on regular surveys of bulk importers and exporters. However, as noted in the NID (part 2, section A3.3.3.2, p.95), there has not been a survey to obtain data on imported and exported manufactured items that contain HFCs since 2010, with the relevant AD extrapolated for 2011–2022 using proxy variables. The lack of recent AD and the long period for which extrapolated data were used for manufactured items containing HFCs may have led to significant inaccuracies in the results and an overestimation or underestimation of emissions. During the review, Canada explained that there are ongoing and planned efforts to address this issue, for example, (1) in order to improve the transparency of the Party's method, NID table A3.3-4 (part 2) was redesigned to show the proxy variables used for extrapolating data on manufactured items for each application and subapplication, and the collection of updated data on manufactured items is included in the category-specific planned improvements (NID part 1, section 4.17.6, p.147); (2) progress has been made in the Party's consultations with the United States Environmental Protection Agency aimed at seeking import/export data related to the United States of America and Canada from records provided by the United States, although at this time the organization is unable to share AD on fluorinated gas regarded as commercially confidential; (3) Canada is exploring the feasibility of obtaining data on traded manufactured items from industry trade organizations or through Statistics Canada's Canadian International Merchandise Trade Web Application; (4) Canada aims to explore the use of surveys for industry trade organizations to obtain supplemental information needed for data integration, such as the percentage of pre-charged equipment for each type of traded item, the charge sizes and the refrigerants used, as well as information on changes over time; and (5) Canada plans to consult with the Heating, Refrigeration and Air Conditioning Institute of Canada to seek access to AD. The TERT recommends that Canada collect data on imported and exported manufactured items that contain HFCs for more recent years in order to derive more complete and accurate estimates of the total HFC bank and emissions in Canada by, for example, implementing new surveys on the import/export of these items and/or by consulting with importing/exporting countries, and that Canada explain, if applicable, any recalculations of the emission estimates in future submissions. In addition, while research is ongoing, the TERT encourages Canada to include further information in the NID on how the current extrapolation method is performed.
4.I.10	Specified in paragraph 47 of the MPGs 2.G.2 SF_6 and PFCs from other product use – SF_6, PFCs	Canada reported emissions as "NE" for this category, noting in CRT 9 that data on emissions of SF_6 and PFCs in other product uses and recovery are not available, and work is in progress to gather data and assess significance. During the review, Canada explained that work is under way to address this issue, for example (1) the inventory agency has consulted with the United States Environmental Protection Agency to seek access to trade data for the United States and Canada, but the organization has been unable to share data on the import/export of bulk SF_6 and PFCs and manufactured items containing them because such data are confidential; furthermore, the trade data do not have the level of detail required by Canada; (2) Canada has reviewed past surveys of bulk suppliers of SF_6 and PFCs and compiled data to use in preparing a top-down estimate; and (3) Canada has compiled bottom-up estimates for some end uses (e.g. particle accelerators).

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		To address remaining data gaps, the Party plans to request major gas and product suppliers, industry associations (e.g. window soundproofing, tyres and shoes) and government agencies that regulate products (e.g. cosmetics) to provide information in 2025. Subject to new information becoming available, Canada plans to analyse the data received and process them in 2025–2026. The tentative timeline for resolving this issue by demonstrating insignificance or including a tier 1 estimate in the inventory is by the 2027 submission. The TERT recommends that Canada continue the research efforts described during the review and estimate emissions for this category in future submissions.
4.I.11	Specified in paragraphs 20–24 and 47 of the MPGs 2.G.4 Other (other product manufacture and use) – PFCs	Canada reported aggregated PFC emissions in a country-specific category (category 2.G.4). During the review, Canada explained that this item is part of its inventory improvement plan. During the 2024 reporting cycle, Canada conducted a detailed internal review of source data (surveys and sales data) related to this category to identify possible reallocations for PFC emissions from category 2.G.4. Work is scheduled to continue during the 2026 reporting cycle. However, because the source data for the analysis are for 1995–2009, additional relevant information may not be available. Depending on how the work progresses in the 2026 reporting cycle, the Party aims to reallocate the emissions or explain why they were not reallocated in the 2026 or 2027 NID. The TERT recommends that Canada continue its work to revise the allocation of PFC emissions from the current country-specific aggregate category (category 2.G.4) to improve the comparability of the inventory.

Table 5
Areas of improvement of the reporting on greenhouse gas emissions and removals – agriculture sector

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
5.A.1	Specified in paragraph 39 of the MPGs 3.A.1 Cattle, 3.B.1 Cattle – NA	The NID (e.g. part 1, sections 5.1 and 5.2.1, and part 2, annex 3.4, pp.111–112) describes the heterogeneity of the agriculture sector across Canada's regions, highlighting factors such as variability in production systems, livestock types and climatic zones. For example, dairy production practices vary across provinces owing to differences in land prices, climate and forage availability (NID part 2, p.106), which led to the use of province-specific practices in a 2004 country-specific study (Boadi et al., 2004). It is also noted that management practices and cattle diets have changed since 1990 (both in terms of quantity and quality), and province-specific parameters were consequently applied in the tier 2 methodologies for categories 3.A.1 and 3.B.1 (cattle emissions). The complexity of Canada's bottom-up methodologies is partially reflected in several NID tables, which present key parameters and show regional variations in data availability and assumptions (e.g. the annex tables on cattle production stages and average milk production by province). The TERT acknowledges that providing a fully transparent description of inventory methods for these key categories is challenging and appreciates Canada's progress in developing the NID, annexes and supporting tables, which illustrate province-specific IEFs at a high level. The NID does not include a clear explanation of how the national weighted average data are derived from disaggregated methodological parameters at the regional level for estimating emissions from non-dairy cattle under categories 3.A.1.b and 3.B.1.b. For example, information on how national weighted average parameters, such as MCF, VS, manure biodegradability, animal waste management systems, N excretion rates, body weight, daily weight gain, mature weight, mean winter temperature, milk production, milk fat content, calving rates, number of offspring and feed digestibility, were derived from underlying (provincial) data is not included. The Party reported the use of provincial-level data to reflect geographical differences in the estimation parameters (NID part 2, p.105), but the NID does not describe the differences in those parameters under categories 3.A.1 and 3.B.1. During the review, Canada clarified that work is under way to address this gap. To improve transparency, Canada has launched the STEAM project, a multi-year project aimed at migrating all agriculture inventory calculations to the R

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		programming language with a view to enhancing transparency by separating data storage from processing logic, enabling all equations and processing steps to be accessible on demand, with a manageable file size and an open-source environment familiar to the scientific community. Documentation of processing steps will be embedded using R Markdown, allowing for integrated, up-to-date documentation that can be automatically generated in Microsoft Word or a PDF. The first phase is expected to be tested for the 2026 NIR. The TERT commends Canada for its ongoing efforts to improve transparency through the use of accessible programming tools and recommends that the Party further enhance transparency, for example by providing more detailed, disaggregated information on methodological parameters at the regional level in the NID and worked examples to illustrate how the national weighted average parameters are derived; to do this, the TERT notes that the Party is considering the publication of reference data tables and methodological documentation within accessible data repository platforms (e.g. GitHub).
5.A.2	Specified in paragraphs 20, 24 and 39 of the MPGs 3.A.1 Cattle, 3.B.1 Cattle – NA	The NID (part 2, section A3.4.2.2) references several studies supporting its parameter selection for enteric fermentation, including MacDonald and Liang (2011) and Ellis et al. (2007, 2009, 2010). The NID also notes that the dairy cattle methodology was updated for the 2018 submission on the basis of recent CH_4 measurements, while updates for non-dairy cattle were still pending owing to ongoing data compilation and the absence of comprehensive studies linking regional livestock statistics with productivity. However, the main supporting studies are over a decade old, and emissions from non-dairy cattle, which is a more significant category than dairy cattle, still rely on tier 2 parameters based on expert opinion (Boadi et al., 2004). While dairy cattle parameters were updated using Lactanet data and partially validated with Statistics Canada's Livestock Farm Practices Survey, work on implementing similar improvements for the beef sector is still in progress. The reliance on data from research carried out in the 2000s and 2010s may have led to overestimates or underestimates in the inventory for recent years. During the review, Canada clarified that it is reviewing the animal nutrition time series and the CH_4 model parameters for beef cattle using multiple data sources (see NID table 8-6, p.243), though progress is limited owing to challenges related to aligning survey data across the time series. The TERT recommends that Canada provide in the NID justification for retaining the use of the historic country-specific parameters and CH_4 EFs for non-dairy cattle as representative across the time series, or continue its research efforts in order to review and, where necessary, update the tier 2 EFs and parameters used for enteric fermentation and manure management, considering differences in key parameters such as nutrition, production and waste management systems over time and across regions, to the extent possible, noting the limitations of available survey data, to ensure that the method delivers emission estimates that are representative of Canadian circumstances across the time series.
5.A.3	Specified in paragraphs 20, 24 and 39 of the MPGs 3.B Manure management – CH_4	The NID (part 2, section 3.4.3) sets out the methodology and underlying data used to generate the CH_4 estimates for manure management. Many of the parameters were derived from expert consultations summarized in studies from 2004 and 2005, often based on underlying data from the 1980s and 1990s, including VS for swine, and animal categories other than cattle and swine (part 2, p.123), and digestible energy expressed as a percentage of gross energy and dry matter intake for many livestock subcategories (NID part 2, tables A3.4-15, p.124, and A3.4-16, p.125), based on Marinier et al. (2004); and animal waste management system distribution factors for the dairy sector (Sheppard et al., 2011), the swine sector (Sheppard et al., 2010) and other animal subcategories (Marinier et al., 2004). However, given the dates of these studies and the Party's statement that limited reliable information is published on the distribution of manure management systems in Canada (NID part 2, section A3.4.3.3), the parameters applied may not be representative of current practices, particularly in the light of the intensification of livestock production

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		in the intervening years; therefore, the method may have led to overestimates or underestimates. During the review, Canada noted that the distribution of manure management systems is based on early estimates from 2004, which were used for the later years of the time series for most animals. The Party continues to explore opportunities to develop a better understanding of manure storage and trends over time but comparing studies over time remains a significant challenge. It is not believed, however, that there have been changes in practice for solid manure storage resulting in major changes in emissions and emission trends. The dominant trend in manure management emissions is driven by increases in the use of liquid manure systems. The AD time series was developed by analysing the relationship between farm size (number of animals) and proportion of animals under liquid system for dairy and swine production systems on the basis of surveys carried out between 1995 and 2011. Solid systems were then adjusted to the liquid proportion. Canada is exploring new data analysis techniques to identify and derive trends from various survey sources, including more recent surveys, that are representative of the sector. Canada is also exploring recent farm management surveys and multiple other sources of survey data to improve the accuracy of its methodology. The Party clarified that the main drivers for the increase in the CH_4 EF for manure management are increases in (1) the use of liquid manure management systems over time, (2) milk productivity in dairy cattle and (3) VS over time owing to dietary changes. Acknowledging the challenge involved in accessing and analysing survey data from across Canada over time, the TERT recommends that the Party provide in the NID justification for retaining the use of the historic country-specific CH_4 EFs as representative of manure management across the time series, or continue its research to analyse recent survey data in order to review and, where appropriate, update the model input parameters to improve the accuracy of the method and ensure that it is representative of national circumstances.
5.A.4	Specified in paragraphs 20, 24 and 39 of the MPGs 3.B Manure management – CH_4	The NID (part 2, section A3.4.3.4) states that the MCFs applied were taken from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.17) for all animals, applying the values for cool climate and average annual temperature of 12 °C. Given the variability of average monthly and annual temperatures across Canadian provinces, selecting an MCF based on a single annual average temperature may lead to an overestimation or underestimation of emissions. During the review, Canada clarified that it plans to adopt the approach outlined in the 2019 Refinement to the 2006 IPCC Guidelines, whereby CH_4 losses are estimated on the basis of monthly temperatures and manure retention time, rather than relying on an annual average temperature. This methodological change is included in the inventory improvement plan in the NID (part 1, table 8-6, p.243). The methodology has already been tested in a recent publication (Hung et al., 2022), and work is ongoing to integrate these estimates into the inventory production system. The TERT recommends that the Party develop a time series of average temperatures and apply MCFs for all animal categories based on regional annual average temperatures in line with the 2006 IPCC Guidelines. If the Party wishes to derive MCFs for manure management by implementing the method outlined in the 2019 Refinement to the 2006 IPCC Guidelines, the Party should explain in the NID why the method is more appropriate than the method contained in the 2006 IPCC Guidelines.
5.A.5	Specified in paragraph 47 of the MPGs 3.B Manure management – indirect N_2O	According to the NID (part 1, section 5.3.3.2, p.164), leaching losses were not estimated for animal categories other than dairy cattle and swine because no country-specific leaching loss factors were available. During the review, Canada clarified that it is still working towards reporting indirect N_2O emissions from leaching and run-off for additional livestock categories, but these emissions are not anticipated to have a significant impact on the overall inventory. Although the Party is exploring methodologies contained in the 2019 Refinement to the 2006 IPCC Guidelines, addressing these data gaps is challenging owing to the lack of default EFs in the 2006

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		IPCC Guidelines and the difficulties involved with assigning minor livestock categories to the existing manure management categories. The TERT recommends that the Party estimate indirect N_2O emissions from leaching losses for all animal categories.
5.A.6	Specified in paragraph 47 of the MPGs 3.D.1.b.iii Other organic fertilizers applied to soils – N_2O	In CRT 3.D, emissions from N inputs through the application of other organic fertilizers to soils (subcategory 3.D.1.b.iii) were reported as "NE". During the review, Canada clarified that it reported emissions from manure and human biosolids in subcategories 3.D.1.b.i and 3.D.1.b.ii; however, since other organic materials, such as municipal compost, are not yet included in the inventory, "NE" was reported for subcategory 3.D.1.b.iii. Canada is currently assessing organic fertilizer application practices, the availability of AD and the possibility of developing a methodology for estimating direct N_2O emissions from the application of organic fertilizers, such as compost derived from municipal waste. This improvement project is included in the Party's inventory improvement plan (NID, table 8-6, p.240). The TERT recommends that Canada estimate and report both direct and indirect N_2O emissions from all organic fertilizers applied to soils, including N inputs through the application of other organic fertilizers.
5.A.7	Specified in paragraph 35 of the MPGs 3. General (agriculture)	The TERT notes that the calculation models used to deliver the tier 2 method emission estimates for categories 3.A enteric fermentation and 3.B manure management implement a complex series of calculations, combining numerous data inputs and assumptions and generating estimates that reflect the range and variability of, inter alia, livestock types, production systems and climatic conditions evident across Canada's provinces. IPCC good practices for reporting on the use of inventory models are set out in the 2019 Refinement to the 2006 IPCC Guidelines (vol. 1, chaps. 6.12.6–6.12.7), including to document basis and type of model (statistical, deterministic, process-based, empirical, etc.); main equations/processes; material assumptions (important assumptions made in developing and applying the model); domain of application (description of the range of conditions for which the model has been developed to apply); how the model parameters were estimated; description of key inputs and outputs; details of calibration; description of the approach taken for the uncertainty analysis and the sensitivity analysis, and the results of these analyses; QA/QC procedures adopted; and comparison of model results with lower tier approaches. Much of the information required by the 2019 Refinement to the 2006 IPCC Guidelines (vol. 1, chaps. 6.12.6–6.12.7) for reporting on the use of inventory models is evident in the NID, including with regard to input data, assumptions and periodic verification studies comparing model outputs with other measurements and research findings. However, the NID contains limited information on overall model design, model structure and data flow; verification (of individual modelling steps and the overall model function against a technical specification); calibration of model calculations; sensitivity of the models; and the QA/QC procedures implemented by the inventory agency when running the model to prepare inventory estimates. During the review, Canada noted the significant challenges involved in fully documenting all elements of its complex models, which involves multiple large, linked databases, and outlined the process of updating the model for the agriculture inventory using the R programming language. Canada also noted that the data models or empirical/statistical equations used to estimate parameters that are subsequently used in the tier 2 methods do not, in its view, constitute a process model, as per the guidance from the 2019 Refinement to the 2006 IPCC Guidelines. Noting the ongoing STEAM project aimed at overhauling the agriculture model and the Party's documentation approach, the TERT encourages Canada to produce a summary, including descriptions of the methodologies and data flow and QA/QC activities and outputs, such as tables of IEFs for each province/territory for key categories, which may help future users and

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		reviewers to understand and evaluate the Party's complex system of tier 1 and tier 2 calculations, and include the summary in future submissions.

Table 6
Areas of improvement of the reporting on greenhouse gas emissions and removals – land use, land-use change and forestry sector

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
6.L.1	Specified in paragraph 32 of the MPGs 4. General (LULUCF) – CO_2	In the NID (part 1, table 6-4) and CRTs (4.A–4.F and 4.1), Canada applied notation keys inconsistently. For example, "NO" was reported for forest land and grassland converted to cropland, grassland converted to peat extraction, land converted to peat extraction, land converted to flooded land, and forest land and grassland converted to settlements, even though these land-use transitions occur in Canada and methodologies are available in the 2006 IPCC Guidelines. In CRT 4.1, several land conversions (e.g. wetlands or settlements converted to cropland or wetlands, and wetlands converted to settlements) were reported as "IE", while in NID table 6-4 these same transitions were reported as "NE". Further, the Party reported "IE" in CRTs in cases where the emissions were not estimated (see ID# 6.L.3 below for further information). During the review, Canada explained that "NO" was reported for forest land converted to settlements because the inventory prioritizes major emission drivers, and for other land-use transitions, such as land converted to peat extraction, because these are not significant or frequent activities. Canada clarified that "IE" was reported when one component of emissions was captured under a broader category while another component was expected but not separately estimated, often due to data limitations or mapping challenges. The Party also noted that a multiphase improvement project is under way to address these issues and that it is reviewing its use of "IE", "NE" and "NO" to ensure greater accuracy and transparency. The TERT recommends that Canada review and correct its use of notation keys in the NID (e.g. table 6-4 in part 1) and CRTs (e.g. 4.A–4.F and 4.1), ensuring that "IE", "NE" and "NO" are applied consistently and in accordance with the good practice guidance in the 2006 IPCC Guidelines, and update future submissions accordingly.
6.L.2	Specified in paragraph 55 of the MPGs 4. General (LULUCF)	Part 2 of the NID (p.168) describes Canada's approach to natural disturbances, whereby only events causing over 20 per cent mortality are included. During the review, Canada clarified that the 20 per cent threshold is not based on statistical analysis, but reflects observed insect mortality patterns, where high-mortality events are less common owing to ecological and climatic constraints. The threshold marks a shift from endemic to extreme outbreaks. Canada noted that work is ongoing to improve and justify this threshold. The TERT recommends justifying the 20 per cent mortality threshold used by either providing further, detailed references for peer-reviewed papers or technical reports or providing statistical analysis justifying the selection of the threshold, which may cause anthropogenic removals to be underestimated by excluding them until forests' biomass or maturity recover to pre-disturbance levels, or revising the parameter, as applicable.
6.L.3	Specified in paragraph 47 of the MPGs Land representation – NA	Not all mandatory carbon pools and land-use transitions have been estimated in the LULUCF sector. In CRTs 4.A–4.F, "NE" was reported for mineral and organic soils in cropland converted to settlements, organic soils in settlements remaining settlements, mineral soils in grassland remaining grassland, biomass gains and losses in cropland converted to settlements, and organic soils in grassland converted to settlements. Furthermore, the Party reported "NO" for various land-use transitions that occur in Canada, for which methodologies are available in the 2006 IPCC Guidelines, and reported "IE" in cases where emissions were not estimated. During the review, Canada provided clarifications on the completeness issues associated with the use of "IE", "NE" and "NO". For the cases where "NO" was reported, although the activities occur in Canada and methodologies exist,

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		the Party explained that emissions from forest land and grassland converted to cropland have already been estimated for the 2025 NID. "NO" was reported for forest land converted to settlements because the inventory prioritizes major emission drivers, and for forest land and grassland converted to settlements and land converted to peat extraction because these are not significant or frequent activities. However, as these land-use transitions do occur in Canada and estimation methods are available in the 2006 IPCC Guidelines, "NO" should not be used. For the cases reported as "NE", Canada explained that conversions of grassland to settlements primarily occur in northern regions, where interactions between infrastructure development and permafrost complicate the estimation of emissions, particularly from organic soils. "NE" was also reported for mineral and organic soils in cropland converted to settlements, organic soils in settlements remaining settlements, and biomass gains and losses in cropland converted to settlements. These cases are part of ongoing methodological improvements, as briefly described in the NID (part 1, sections 6.8.1–6.8.2, pp.213–214, and table 8-5, p.243). For the cases where "IE" was used but emissions were not estimated, Canada clarified that "IE" was applied when one component of emissions was captured under a broader category while another component was expected but not separately estimated, often owing to data limitations or mapping challenges. The TERT recommends that Canada improve the completeness of its reporting for the LULUCF sector by estimating all mandatory pools currently reported as "NE" (as in CRTs 4.A–4.F) and by providing estimates for land-use transitions that occur in Canada but were reported as "NO", in line with the 2006 IPCC Guidelines.
6.L.4	Specified in paragraph 40 of the MPGs Land representation – NA	Canada reported in CRT 4.1 the areas for the previous and latest inventory years, and changes in areas between those years. The initial land areas for each year do not match the final land areas of the previous year. During the review, Canada explained that land-use AD were derived from the census of agriculture and adjusted on the basis of Earth observation data. While areas of cropland and forest land were reconciled within reconciliation units, other land-use types have not yet been fully reconciled. Canada is transitioning towards more comprehensive monitoring based on Earth observations and is gradually reducing its reliance on tabular and sampling-based approaches, and work to address these inconsistencies is ongoing. The TERT recommends that the Party ensure that, for all years and land-use categories in the land-use matrix, the final areas reported for year X–1 in CRF table 4.1 match the initial areas reported for year X with a view to improving the consistency of its reporting on land use and land-use change.
6.L.5	Specified in paragraph 47 of the MPGs 4.E Settlements – NA	The NID (part 1, p.184) states that diversity of settlements has thus far precluded a complete assessment of the extent of settlements in the Canadian landscape, indicating that the full extent of this land-use category is not reflected in the Party's estimates. During the review, Canada clarified that efforts to implement improvements aimed at addressing this completeness issue are ongoing, as outlined in NID part 1, sections 6.8.1–6.8.2 and table 8-5. The main challenge faced by the Party is aligning methodologies and reconciling land-use estimates for less prominent categories such as settlements owing to the diversity of drivers for land-use change. Canada follows a sequential approach, which involves initially focusing on the most significant emissions sources, such as deforestation. The TERT noted that not all settlement areas are currently considered in the inventory, which affects land representation in the inventory. The TERT recommends that Canada revise the land areas of settlements, estimating all carbon stock changes to and from settlements, and recalculate the entire time series accordingly.
6.L.6	Specified in paragraph 47 of the MPGs Land representation – NA	Canada reported the area of total unmanaged land excluding unmanaged forest land in CRT 4.1, and not by category. During the review, Canada clarified that, given the country's extensive areas of land, diverse landscape and environmental conditions, determining a single,

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		accurate value to represent the total national areas disaggregated by all land uses and land-use changes represents a significant challenge. The TERT recommends that the Party report in CRT 4.1 unmanaged land in the relevant category and not under total unmanaged land.
6.L.7	Specified in paragraphs 26 and 39 of the MPGs – NA	CRT 4.1 shows an increase in the total area of unmanaged land from 574,215.64 kha in 1990 to 580,218.59 kha in 2022. The increase in total unmanaged land implies the conversion of managed land to unmanaged land, which is not in line with the 2006 IPCC Guidelines. During the review, the Party clarified that the reduction in managed land is associated with inconsistencies in Canada's land monitoring system, particularly between statistical survey data and Earth observation methods used to estimate land-use change. While deforestation is well captured through satellite-based sampling, and afforestation is monitored via dedicated programmes, the main issue lies in the reported decline of managed agricultural land in census data. This decline is due to abandonment, land speculation or conversion to recreational use – changes that are difficult to detect via remote sensing and have unclear carbon implications. Canada is addressing this through a phased plan focused on three areas: peri-urban zones, forest fringe regions and core agricultural areas showing unexplained land loss. For each of these areas, new land categories (e.g. peri-urban idled land, natural reforestation and rural idled land) will be created using satellite data. Carbon stock changes are yet to be estimated, and while this approach will improve accounting, further work is needed to fully resolve the inconsistencies. The TERT recommends that the Party revise the land areas reported under total unmanaged land in the most recent submission, as well as identify the conversions from and to all land areas and revise the time series accordingly. The TERT also recommends that Canada include information in the NIR to justify the increases in total unmanaged land over the time series, as applicable.
6.L.8	Specified in paragraph 47 of the MPGs 4.A.2.1 Cropland converted to forest land – CO_2	Canada reported emissions associated with carbon stock changes in cropland converted to forest land in CRT 4.A. However, it is unclear whether these estimates include all types of cropland, such as abandoned cropland. During the review, the Party clarified that the values reported for cropland converted to forest land originate solely from tree-planting programmes (i.e. afforestation). None of the areas reported as afforestation involve abandoned farmland undergoing natural regeneration into forest land. The Party also noted that improving understanding of cropland abandonment and the transition of such cropland to other land covers, such as forest land, is the focus of ongoing improvement projects. The TERT recommends that Canada identify and estimate carbon stock changes associated with the conversion of all cropland types to forest land, including abandoned cropland, and recalculate the time series of CO_2 emissions accordingly.
6.L.9	Specified in paragraph 47 of the MPGs 4(III) Direct and indirect N_2O emissions from N mineralization/ immobilization – N_2O	In its NID (part 1, p.190), Canada stated that soil N_2O emissions from soil organic carbon losses in managed forest stands can be considered insignificant under paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, and "NE" was reported in CRT 4(III). However, the insignificance threshold defined in paragraph 32 of the MPGs applies at the category level, meaning that the UNFCCC Annex I inventory reporting guidelines are not applicable in this case. During the review, Canada clarified that its forests are N-limited ecosystems, with large carbon to nitrogen ratios and slow N cycling, making N_2O emissions unlikely except in specific conditions, which cannot yet be identified authoritatively. Canada indicated that estimated upper-bound emissions are negligible and noted that estimates of aggregated emissions range from 55 kt in 1990 to 0 kt in recent years (NID part 1, section 6.3.1.2). The TERT reiterates that the insignificance threshold is only applicable at the category level, meaning that it does not apply in this case. The TERT recommends that the Party estimate all direct N_2O emissions, as well as the associated indirect N_2O emissions, from N mineralization or

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		immobilization associated with loss or gain of soil organic matter in forests, using the parameters and guidance contained in the 2006 IPCC Guidelines (vol. 4, chap. 11).

Table 7
Areas of improvement of the reporting on greenhouse gas emissions and removals – waste sector

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
7.W.1	Specified in paragraph 40 of the MPGs 5.A Solid waste disposal on land – CH_4	In CRT 5.A, Canada reported CH_4 emissions and recovery for category 5.A.2 unmanaged waste disposal sites as "NO" for all years. However, according to the NID (part 2, p.211), emissions from industrial pulp and paper landfills were included under category 5.A.1 managed waste disposal, while emissions from landfills in solid wood industry were reported under category 5.A.2. During the review, the Party confirmed that emissions from industrial solid wood waste landfills were erroneously reported under category 5.A.1 managed waste disposal sites. The Party also confirmed that emissions from industrial solid wood waste landfills were estimated separately from emissions resulting from waste disposed of at municipal solid waste landfills, using default IPCC parameters for unmanaged landfills (i.e. a methane correction factor of 0.8 and an oxidation factor of 0). The TERT recommends that the Party allocate CH_4 emissions from industrial solid wood waste landfills to the appropriate category for unmanaged landfills (5.A.2). The TERT also recommends that the Party explain the profile of industrial solid waste landfills and the parameters applied for estimating CH_4 emissions in the NID.
7.W.2	Specified in paragraphs 20 and 39 of the MPGs 5.A Solid waste disposal on land – CH_4	In the NID (part 2, section A3.6.1.2.2, p.221), the Party explained that it collects data on landfill gas capture via biennial voluntary surveys for site operators and outlined the approaches applied for filling data gaps. However, the NID does not include any additional technical information regarding the data collected, such as information on the methods used by operators to estimate the CH_4 recovery data, the coverage of the surveys or data quality control. During the review, the Party explained that the amount of landfill gas captured is measured by site operators, and associated information, including gas content, recovery systems and equipment and volume of gas flared and used, is also reported through the survey. The TERT recommends that the Party include in the NIR technical background information, including on the methods used to estimate CH_4 recovered and the volume of CH_4 recovered, recovery systems and equipment, and the roles of landfill operators, provinces, territories and Environment and Climate Change Canada in data collection and QA/QC with regard to reporting CH_4 recovery.
7.W.3	Specified in paragraphs 20 and 39 of the MPGs 5.A Solid waste disposal on land – CH_4	In the NID (part 2, section A3.6.1.2.2, p.221), the Party explained that it collects data on landfill gas capture via biennial voluntary surveys of site operators. However, no information was provided in the NID regarding the coverage of the surveys or the completeness of operator responses to Environment and Climate Change Canada. During the review, the Party explained that CH_4 recovery is reported by 96 per cent of landfills in the country with landfill gas collection systems, noting that 110 of the 115 facilities with landfill gas capture systems responded to the survey prior to 2024. Of the five facilities that did not report values for the latest year, three provided data on CH_4 capture for 2022 and earlier. All of the CH_4 captured at these sites is flared and not used for energy recovery. This indicates that 1.33 kt CH_4, or 37.22 kt CO_2 eq, are not reflected in the NIR. The TERT recommends that the Party continue its efforts to collect data from all facilities if it continues to use voluntary surveys to collect data for the GHG inventory.
7.W.4	Specified in paragraph 47 of the MPGs	In CRT 5.B, Canada reported all emissions from composting under subcategory 5.B.1.a municipal solid waste, with activity and emissions for subcategory 5.B.1.b other reported as "IE". However, in the NID (part 2, section A.3.6.2.1.2, p.226), Canada noted that GHG emissions from home composting are not yet

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
	5.B.1 Composting – CH_4	estimated, and that estimated emissions from this source are below the significance threshold specified in paragraph 32 of the MPGs. No further details were provided in the NID to support this conclusion. During the review, Canada explained that, to derive preliminary estimates, it used the AD of 3 kg waste disposed of in-home composts/week/single-family household. EFs of 4.2 kg CH_4/Mg waste and 0.55 kg N_2O/Mg waste were taken from a study of Danish households (Anderson et al., 2011). The number of households in Canada was taken from Statistics Canada's 2021 census survey. These data result in a GHG estimate of 166 kt CO_2 eq, when combining CH_4 and N_2O emissions, which is 0.01 per cent of total national emissions. Reiterating that the significance threshold is not applicable in this case as home composting is a source under subcategory 5.B.1.a, the TERT recommends that the Party include emissions from home composting in its estimates of CH_4 and N_2O emissions from the composting of municipal solid waste (subcategory 5.B.1.a), using the best available information, to improve the completeness of its reporting.
7.W.5	Specified in paragraph 22 of the MPGs 5.B.2 Anaerobic digestion at biogas facilities – CH_4	In the NID (part 2, section A3.6.2.2.2, p.227), the Party described the country-specific method used to estimate emissions from anaerobic digestion at biogas facilities (category 5.B.2), which involved using information on the amount of biogas produced collected from the facilities through in-house and industry surveys. The Party also explained that, where facility-level information on biogas production was unavailable, it applied conversion factors for each feedstock type and data on feedstock inputs to estimate biogas production. However, the conversion factor approach was not clearly described in the NID. In addition, no AD information was provided regarding the assumptions for each feedstock type or the completeness of operator reporting, and therefore the number of installations where the conversion factor approach was applied. Moreover, with regard to AD for anaerobic digestion at biogas facilities, the amount of waste treated was reported as "IE" in CRT 5.B, and no quantitative information was provided in the NIR owing to the confidentiality of this information. During the review, Canada noted that the detailed underlying data from operator surveys are considered confidential and were therefore not presented in the NID. Canada also confirmed that the method involved applying facility-reported data on biogas produced from a survey of operators carried out through an industrial association. The biogas production data were used to produce totals at the provincial level, and CH_4 content and density were determined by averaging available data. Fugitive losses of CH_4 in biogas (2.1 per cent) were used as the EF to estimate emissions for this category. Therefore, the conversion factor specified in the NIR was not used. The TERT recommends that the Party correct the documentation of the country-specific method for collecting biogas production data from facilities in future submissions.
7.W.6	Specified in paragraph 40 of the MPGs 5.B.2 Anaerobic digestion at biogas facilities – CH_4	Under NID section A3.6.2.2 (part 2, p.227) on anaerobic digestion at biogas facilities (category 5.B.2), the Party explained that emissions from on-farm anaerobic digesters are not yet included in the Canadian inventory. During the review, Canada explained the difficulties involved in avoiding double counting with the agriculture sector. The Party also explained that this source is considered insignificant as preliminary estimates indicate that some 33 Gg manure (dry mass) was digested on farms in 2021, resulting in emissions of some 24 Mg N_2O–N (10 kt CO_2 eq). Noting the difficulties involved in accessing complete, accurate data for on-farm anaerobic digesters and the risk of double counting with the activity manure management under the agriculture sector, the TERT recommends that Canada continue to seek access to complete AD and estimate CH_4 emissions from on-farm digesters under the waste sector. If this is not practical, the TERT recommends that the Party include a justification by explaining that the emissions are reported under the agriculture sector.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
7.W.7	Specified in paragraph 21 of the MPGs 5.D Wastewater treatment and discharge – N_2O	In the NID (part 2, table A1-6), N_2O from wastewater treatment and discharge was reported as a key category by trend (with LULUCF). According to the explanation provided in the NID (part 2, section A3.6.4.2), for most treatment facilities the estimation method used for this key category was a modified tier 1 method involving the application of the default EFs set out in NID table A3.6-17 (part 2) and the use of equations from the 2019 Refinement to the 2006 IPCC Guidelines (with a modified equation for the domestic wastewater treatment plants; see equation A3.6-31 in NID part 2, p.247). During the review, the Party clarified its use of facility-level AD with default EFs, which is tier 2 in accordance with the 2019 Refinement to the 2006 IPCC Guidelines. The Party used the default EFs and N removal fractions provided in tables 6.8 and 6.10(c) of the 2019 Refinement to the 2006 IPCC Guidelines. Facility-level data were used to determine the amount of N entering wastewater treatment facilities, loss of N, removal of N as sludge through the treatment processes, and N content in wastewater discharged. The TERT agrees that the approach used by the Party is considered tier 2 under the 2019 Refinement to the 2006 IPCC Guidelines. The TERT recommends that the Party enhance transparency by improving the description of the tier 2 method used by including in the NID the information provided during the review on the use of facility-level data.
7.W.8	Specified in paragraph 39 of the MPGs 5.D Wastewater treatment and discharge – N_2O	In table A3.6-17 (NID part 2) on N_2O EFs and N removal for different treatment types, the N removal fraction for constructed wetlands is given as 1. However, the Party did not explain the origin of this value or justify why it is appropriate for Canada's national circumstances. During the review, the Party explained that the N removal fraction for wetlands is based on expert judgment, with the assumption that the long residence time and vegetative uptake in a wetland setting will effectively remove all N from wastewater. Canada also indicated that it does not have detailed information on the types of constructed wetlands used for municipal (domestic) wastewater treatment. The TERT recommends that the Party provide information on its country-specific value of 1 for the N removal fraction for constructed wetlands, including technical background information and the assumptions used in its expert judgment for the estimation of N_2O emissions from constructed wetlands, as required by the 2006 IPCC Guidelines.
7.W.9	Specified in paragraphs 39–40 of the MPGs 5.E Other (waste) – CO_2	The Party reported under category 5.E other in CRT 5 CO_2 emissions from non-biogenic organic inputs from facilities with on-site treatment of wastewater. In NID part 2 (p.249), the Party explained that chemical manufacturing facilities, such as oil refineries and methanol production facilities, can produce non-biogenic CO_2 emissions from their wastewater treatment. However, the Party did not report information on the methodologies, approaches or AD used to estimate these CO_2 emissions in the NID. Although the 2006 IPCC Guidelines do not provide methodologies for estimating non-biogenic CO_2 emissions from wastewater treatment and discharge, appendix 6A.1 to the 2019 Refinement to the 2006 IPCC Guidelines provides information on potential sources of non-biogenic CO_2 from wastewater treatment and technical references, and countries, particularly those with higher levels of fossil carbon in wastewater, are encouraged to evaluate whether such emissions should be reported. During the review, the Party explained that these CO_2 emissions were estimated by industries where fossil-based organics in wastewater are expected and reported via the GHGRP. The methods applied for estimating emissions vary by facility. The largest share of reporting facilities used EFs (41 per cent), followed by measurement and monitoring data (19 per cent) and mass balance (6 per cent), with 33 per cent of facilities reporting "unknown". The TERT recommends that the Party provide in future submissions technical information, including the AD, methodologies and approaches applied, related to the estimation of emissions from non-biogenic CO_2 from industrial wastewater treatment, as well as the evidence provided during the review

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		justifying that the methodology, based on the 2019 Refinement to the 2006 IPCC Guidelines, is representative of Canada's national circumstances.

C. Information necessary to track progress in implementing and achieving the nationally determined contribution under Article 4 of the Paris Agreement

Table 8
Areas of improvement of the reporting on national circumstances and institutional arrangements

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
NA	NA	No areas of improvement identified

Table 9
Areas of improvement of the description of the nationally determined contribution under Article 4 of the Paris Agreement, including updates

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
NA	NA	No areas of improvement identified

Table 10
Areas of improvement of the reporting of the information necessary to track progress in implementing and achieving the nationally determined contribution under Article 4 of the Paris Agreement

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
NA	NA	No areas of improvement identified

Table 11
Areas of improvement of the reporting on mitigation policies and measures, actions and plans, including those with mitigation co-benefits resulting from adaptation actions and economic diversification plans, related to implementing and achieving the nationally determined contribution under Article 4 of the Paris Agreement

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
11.1	Specified in paragraph 83 of the MPGs	Canada did not report information on the costs for each action, policy and measure reported in the BTR1. During the review, the Party acknowledged that the BTR1 does not include information on costs for each policy and measure reported. The TERT encourages Canada to provide information on costs for each action, policy and measure, or to indicate in the BTR that it has elected not to report information on the costs for each action, policy and measure reported and explain why this information is not provided.
11.2	Specified in paragraph 88 of the MPGs	Canada did not identify its actions, policies or measures that influence GHG emissions from international transport. During the review, Canada acknowledged that the BTR1 does not include information on this matter. There are, however, some references in the BTR1 (e.g. section 2.4.3, p.70) to transport initiatives, including on aviation, maritime and freight, all of which have international implications. The TERT encourages the Party to identify and provide information on actions, policies or measures that influence GHG emissions from international transport.
11.3	Specified in paragraph 90 of the MPGs	Canada did not provide detailed information on the assessment of economic and social impacts of response measures. During the review, Canada explained that it opted to focus on all mandatory provisions of the MPGs for its BTR1 to gain confidence in its abilities to meet all relevant reporting requirements, with plans to expand its reporting to include non-mandatory provisions under the MPGs for future BTRs.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		The TERT encourages the Party to provide, to the extent possible, detailed information on the assessment of economic and social impacts of response measures.

Table 12
Areas of improvement of the summary of greenhouse gas emissions and removals

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
NA	NA	No areas of improvement identified

Table 13
Areas of improvement of the projections of greenhouse gas emissions and removals

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
13.1	Specified in paragraph 96 of the MPGs	Canada described in detail the methodology for developing projections, reporting emissions by economic sector and by IPCC sector. However, there were discrepancies in the descriptions of sectors and subcategories between the Canadian and IPCC classifications. For instance, the NIR states that off-road transportation emissions accounted for some 28.6 per cent of total transport sector emissions, whereas the BTR lacks such data. During the review, Canada provided a table of emissions that maps its economic sectors with the IPCC sectors, which shows that off-road emissions were allocated to the sectors agriculture, waste and other. The TERT encourages Canada to include more detailed information on the IPCC sector and subsector emissions, aligned with its projections by economic sector, in future submissions.
13.2	Specified in paragraph 96 of the MPGs	Canada based its projections on specific economic sectors, including ‘waste and others’, which encompasses waste management, light manufacturing, coal production, construction and forest resources. The waste management sector covers GHG emissions from the treatment and disposal of liquid and solid waste. However, there is limited information on wastewater treatment and discharge, and on biological treatment of solid waste. During the review, Canada presented a slide showing that emissions from the waste and others sector totalled 23.4 Mt, which aligns with the IPCC waste sector figures (see table ES-1 in NIR part 1, and BTR table 2-4). There is confusion regarding the emissions for other categories, such as light manufacturing and coal production. The TERT encourages Canada to provide more detailed descriptions of waste sector subcategories and clearly outline the emissions associated with the ‘others’ sector in future BTRs.
13.3	Specified in paragraph 96 of the MPGs	BTR table 27 details CCS emission reductions by sector for the ‘with measures’ and ‘with additional measures’ scenarios, reporting a historical total of –2.8 Mt CO_2 eq for 2022, while table 2-4 of the same document on CO_2 transport and storage reports 0.00 Mt CO_2 eq for 2022. During the review, Canada clarified that the CCS emission reduction was reported in the relevant chapter of the NIR. In NIR section ES.4 on GHG emissions and trends by IPCC sector, CCS emissions were reported as 0.64 kt CO_2 eq for 2022. However, NIR tables ES-1 and 2-3 list CO_2 transport and storage emissions as 0.00 Mt CO_2 eq for 2022. NIR table 3-1 on the GHG emissions from energy reports CO_2 transport and storage emissions as 0.64 kt CO_2 eq for 2022. In NIR table 3-2, under GHG emission changes due to recalculations, emissions for categories 1.B fugitive emissions from fuels and 1.C CO_2 transport and storage were reported separately as 15.5 Mt CO_2 eq for method, data and change in EFs and as 6.4 Mt CO_2 eq for change in global warming potential. The TERT encourages Canada to provide further clarification on CCS emissions to resolve inconsistencies in reporting between the NIR and BTR.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
13.4	Specified in paragraph 96 of the MPGs	Canada's BTR1 indicates that the agriculture sector includes three subsectors: crop production, animal production and on-farm fuel use. According to NIR table 2-12 on trends in GHG emissions by Canadian economic sector, emissions from these subsectors were 14 Mt CO_2 eq for on-farm fuel use, 19 Mt CO_2 eq for crop production and 37 Mt CO_2 eq for animal production in 2022. However, in NIR table 2-3 on Canada's GHG emissions by IPCC sector, emissions from the enteric fermentation and manure management subsectors were reported as 27 and 7.8 Mt respectively, totalling 34.8 Mt, which is lower than the 37 Mt reported under the corresponding Canadian economic subsector. Additionally, no data were provided on emissions from field burning of agricultural residues and liming, urea application and other carbon-containing fertilizers. During the review, Canada presented a slide explaining crop production emissions in terms of IPCC subsectors. The TERT encourages Canada to provide further details on subsector emissions within the agriculture sector to ensure consistency with the IPCC classifications.

Table 14
Areas of improvement of other information relevant to tracking progress in implementing and achieving the nationally determined contribution under Article 4 of the Paris Agreement

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
NA	NA	No areas of improvement identified

D. Financial, technology development and transfer, and capacity-building support provided under Articles 9–11 of the Paris Agreement

Table 15
Areas of improvement of the reporting on national circumstances and institutional arrangements

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
15.1	Specified in paragraph 119(c) of the MPGs	Canada did not present information on experience and good practices in relation to public policy and regulatory frameworks to incentivize further private climate financing and investment in BTR section 4.2.1 covering national circumstances and institutional arrangements. During the review, Canada explained that, to avoid information being duplicated across different sections of the BTR, information on experience and good practices in relation to public policy and regulatory frameworks to incentivize further private climate financing and investment was provided in BTR section 4.4.4, which presents information on finance mobilized through public interventions. The TERT recommends that the Party provide information on experience and good practices in relation to public policy and regulatory frameworks to incentivize further private climate financing and investment in the chapter covering national circumstances and institutional arrangements or provide an appropriate reference to other sections in the BTR where this type of information can be found.

Table 16
Areas of improvement of the reporting on underlying assumptions, definitions and methodologies relating to financial, technology development and transfer, and capacity-building support provided under Articles 9–11 of the Paris Agreement

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
16.1	Specified in paragraph 121(j) and (m)(iii) of the MPGs	From the information that Canada reported in BTR section 4.3.1, it was not clear whether subsectors were determined using, inter alia, the definitions of the Development Assistance Committee of the Organisation for Economic Co-operation and Development. In addition, information was not provided on how the Party avoided double counting between the resources reported as provided or mobilized, and the resources used under Article 6 of the Paris Agreement by the acquiring Party for use towards the achievement of its NDC.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		During the review, the Party explained that it used, among other things, the sector classifications of the Development Assistance Committee of the Organisation for Economic Co-operation and Development to identify relevant subsectors for all international assistance projects. The Party also explained that it has not yet decided to engage in the acquisition or transfer of internationally transferred mitigation outcomes under Article 6 of the Paris Agreement, and therefore, as at the date of submission for the BTR1, there could be no double counting with support provided under Article 9. The TERT recommends that the Party include information on: (a) How relevant subsectors were identified, as applicable; (b) How double counting was avoided between the resources reported as provided and the resources used under Article 6 of the Paris Agreement, or, if resources under Article 6 were not used, clearly state that there can be no double counting with support provided under Article 9 as a result.

Table 17

Areas of improvement of the information on financial support provided under Article 9 of the Paris Agreement – bilateral, regional and other channels

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
17.1	Specified in paragraph 123(k–l) of the MPGs	In CTF table III.1, the cells for additional information were left blank, along with cells for information on whether the support provided contributes to capacity-building and/or technology development and transfer objectives, and the Party did not report notation keys in the BTR for either of these reporting provisions. During the review, the Party explained that, according to Canada's Official Languages Act, public communications from the Government of Canada must be in both official languages (English and French). At the time of the submission, it was not possible to use special characters (i.e. punctuation and accented letters) in the tool for reporting under the ETF that enables bulk entry of data, which prevented the inclusion of additional information on support in both official languages. Therefore, project descriptions were omitted to avoid creating differences between the CTF tables and the annexes included in the BTR. Canada also explained that, in 2023, the Government of Canada undertook an exercise to improve its tracking of technology transfer and capacity-building support through the Total Official Support for Sustainable Development survey, and enhanced approaches to data collection were therefore not in place when climate finance data for 2021 and 2022 were collected for the BTR1. Canada aims to include information on how bilateral and regional financial support provided contributes to capacity-building and/or technology development and transfer objectives in future BTRs. The TERT recommends that the Party: (a) Report additional information, as available, on financial support provided under Article 9 of the Paris Agreement (bilateral, regional and other channels), or, if such information is not available, instead report an appropriate notation key in the CTF tables, accompanied by an explanation in the BTR; (b) Include the results of the Total Official Support for Sustainable Development survey in future BTRs when reporting whether the bilateral and regional financial support provided contributes to capacity-building and/or technology development and transfer objectives, as available, and, if such information is not available, report instead an appropriate notation key in the CTF tables, accompanied by an explanation in the BTR.
17.2	Specified in decision 5/CMA.3, annex III, table III.1	Canada reported information for CTF III.1 using the tool for reporting under the ETF that enables bulk entry of data, where the two reporting years (2021 and 2022) are presented in one table. During the review, the Party explained that, owing to technical issues with the tool for reporting under the ETF that enables bulk entry of data, Canada was not able to submit data using the relevant tool for reporting under the ETF, and instead used

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		the tool for reporting under the ETF that enables bulk entry of data for the submission of CTF III.1. The TERT recommends that the Party report information on financial support provided under Article 9 of the Paris Agreement (bilateral, regional and other channels) in a separate table for each reporting year, namely 20XX–3 and 20XX–2, where 20XX is the reporting year.

Table 18
Areas of improvement of the information on financial support provided under Article 9 of the Paris Agreement – multilateral channels

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
NA	NA	No areas of improvement identified

Table 19
Areas of improvement of the information on technology development and transfer provided under Article 10 of the Paris Agreement

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
19.1	Specified in paragraph 126(a) and (d) of the MPGs	Canada did not provide information on whether strategies are employed to support technology development and transfer, including the examples of technology development and transfer highlighted in the BTR. In addition, Canada did not provide information on whether there have been efforts to encourage private sector activities related to technology development and transfer and how such efforts supported developing country Parties. During the review, the Party explained that its international assistance priorities provide a broad strategic framework for technology transfer, including in the area of environment and climate action. The Party also explained that there is no official policy in place to encourage technology transfer from the private sector. Since departments and agencies providing technology development and transfer support have their own approaches to and mandates for working with the private sector, the extent of their engagement varies. However, Canada recognizes the important role of the private sector in addressing climate change and the importance of increasing efforts to work with the private sector in international assistance programming. The TERT recommends that the Party include information, to the extent possible, on: (a) Strategies employed to support technology development and transfer; (b) Efforts to encourage private sector activities related to technology development and transfer and how such efforts support developing country Parties.
19.2	Specified in paragraph 127(d) of the MPGs	In CTF table III.4, Canada reported the type of support for a project related to the carbon budget model of the Canadian Forest Service as mitigation and adaptation, rather than reporting the default type of support (cross-cutting) and, as a result, the project is not comparable with other reported support. During the review, the Party explained that this was a reporting error, and the error will be addressed for future submissions. The TERT recommends that the Party use the default type of support when reporting on measures or activities related to technology development and transfer support provided to enable the information to be comparable.

Table 20
Areas of improvement of the information on capacity-building support provided under Article 11 of the Paris Agreement

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
20.1	Specified in paragraph 128(a–c) of the MPGs	Canada presented a number of case studies on capacity-building support provided to developing country Parties but did not report supporting information regarding strategies employed to provide capacity-building support and policies that promote capacity-building support. In addition, Canada did not provide overall information

on how the capacity-building support provided responds to the existing and emerging capacity-building needs, priorities and gaps identified by developing country Parties.

During the review, the Party explained that the provision of support under the climate finance commitment is the Government of Canada's primary mechanism for enhancing the capacities of developing countries with regard to facing climate change and that all activities supported under the commitment must align with the climate finance results framework. The Party also explained that, for capacity-building support provided in addition to the support provided under the climate finance commitment, the different departments and agencies that provide this support operate according to their own mandates and policy or programme priorities.

With regard to how the capacity-building support provided responds to the existing and emerging capacity-building needs, priorities and gaps identified by developing country Parties, Canada explained that some 80 per cent of the support provided under the climate finance commitment is delivered through multilateral development banks, international financial institutions and multilateral partners (e.g. the Global Environment Facility and the Green Climate Fund), and therefore Canada relies on the expertise of these partners to develop appropriate activities that are grounded in the priorities and gaps identified by developing country Parties. With regard to bilateral climate programming, an approach involving measurement, reporting and verification and climate governance is used to support countries in identifying NDC implementation gaps, with stakeholder workshops aimed at producing road maps to guide action plans, and monthly follow-ups that build trust and strengthen stakeholder relationships.

The TERT recommends that the Party include information, to the extent possible, on:

(a) Strategies employed to provide capacity-building support, and policies that promote capacity-building support, including the role of the climate finance results framework, to enable a better understanding of the drivers behind the case studies and examples presented in the BTR;

(b) How the capacity-building support provided responds to the existing and emerging capacity-building needs, priorities and gaps identified by developing country Parties in the areas of mitigation, adaptation and technology development and transfer.

Annex

Documents and information used during the review

A. Reference documents

BTR1 of Canada. Available at https://unfccc.int/first-biennial-transparency-reports.

BTR1 CTF tables of Canada. Available at https://unfccc.int/first-biennial-transparency-reports.

CRTs of Canada. Available at https://unfccc.int/first-biennial-transparency-reports.

"Guidance for operationalizing the modalities, procedures and guidelines for the enhanced transparency framework referred to in Article 13 of the Paris Agreement". Decision 5/CMA.3. FCCC/PA/CMA/2021/10/Add.2. Available at https://unfccc.int/documents/460951.

IPCC. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. S Eggleston, L Buendia, K Miwa, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl.

IPCC. 2014. *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Geneva: IPCC. Available at https://www.ipcc.ch/publication/2013-supplement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories-wetlands/.

IPCC. 2019. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.* E Buendia, K Tanabe, et al. (eds.). Geneva: IPCC. Available at https://www.ipcc-nggip.iges.or.jp/public/2019rf/.

"Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement". Annex to decision 18/CMA.1. FCCC/PA/CMA/2018/3/Add.2. Available at https://unfccc.int/documents/193408.
NID of Canada. Available at https://unfccc.int/first-biennial-transparency-reports.

B. Additional information provided by the Party

Responses to questions during the review were received from Rebecca Hellam and Raphaëlle Pelland St-Pierre (Environment and Climate Change Canada), including additional material. The following references were provided by Canada and may not conform to UNFCCC editorial style as some have been reproduced as received:

Andersen J.K., Boldrin A., Christensen T.H., Scheutz C. 2010. "*Greenhouse gas emissions from home composting of organic household waste"*. Waste Management 30, Issue 12, pp.2475-2483 Science Direct, Elsevier Ltd. Available at .

Andersen J.K., Boldrin A., Christensen T.H., Scheutz C. 2011. *"Greenhouse gas emissions from home composting of organic household waste". Waste Management 30, Issue 12, pp.2475-2483. Science Direct, Elsevier Ltd.* Available at https://www.sciencedirect.com/science/article/abs/pii/S0956053X10003442?via%3Dihub.

Boadi DA, Ominski KH, Fulawka DL, Wittenberg KM. 2004a. Improving estimates of methane emissions associated with enteric fermentation of cattle in Canada by adopting an IPCC tier-2 methodology. Final report. Prepared by the Department of Animal Science, University of Manitoba, for the Greenhouse Gas Divisio n, Environment Canada. Winnipeg (MB): University of Manitoba.

Boadi DA, Wittenberg KM, Scott SL, Burton D, Buckley K, Small J A, Ominski KH. 2004b. Effect of low and high forage diet on enteric and manure pack greenhouse gas emissions from a feedlot. Canadian Journal of Animal Science, 84: 445–453.

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