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

Addendum

Summary

This addendum to the report on the technical expert review of the first biennial transparency report of Panama, 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 2 to 6 December 2024 in Panama City.

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
C	carbon
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRT	common reporting table
CTF	common tabular format
DE%	digestible energy expressed as a percentage of gross energy
DOM	dead organic matter
EF	emission factor
F-gas	fluorinated gas
FX	flexibility
GHG	greenhouse gas
HWP	harvested wood products
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
LULUCF	land use, land-use change and forestry
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
NH_3	ammonia
NID	national inventory document
NMVOC	non-methane volatile organic compound
NO	not occurring
NO_X	nitrogen oxides
PaMs	policies and measures
QA/QC	quality assurance/quality control
REDD+	reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70)
SOC	soil organic carbon
TERT	technical expert review team

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

1. Tables 1–13 present the results of the review of the consistency with the MPGs[2] of the information submitted by Panama in its BTR1. All recommendations and encouragements contained in the tables are for the next BTR or national inventory report, 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*
1.1	Specified in paragraph 38 of the MPGs	Panama provided in its BTR1 (annex A2) the CTF tables for reporting the information necessary to track progress in the implementation of and compliance with NDCs, in accordance with Article 4 of the Paris Agreement. However, Panama did not submit CRTs together with its NID as part of its national inventory report. The TERT noted that the CRTs were submitted on 10 January 2025, after the deadline for the submission of the BTR1 mandated in decision 18/CMA.1. As a result, the TERT did not consider the CRTs during the review. During the review, Panama explained that it experienced significant technical challenges related to use of the CRT reporting tool, which hindered the timely submission of the CRTs, including challenges related to institutional email addresses, reporting worksheets, the function for automatically entering selected data in the tool, performance of the tool, and uploading the JavaScript Object Notation file downloaded directly from the IPCC inventory software to the reporting tool, despite the interoperability of the software. Owing to these recurring barriers, despite the tool's availability since June, the CRTs could not be submitted earlier. Panama reported that while capacity-building would enhance its ability to effectively use the tool, it is equally critical to recognize the significant and unexpected technical challenges encountered. Additionally, Panama's inventory team faces resource constraints. The TERT recommends that Panama report the CRTs in accordance with the formats included in annex I to decision 5/CMA.3 by the deadline for the submission of BTRs mandated in decision 18/CMA.1.
1.2	Specified in paragraphs 35 and 47 of the MPGs	There were significant inconsistencies between the tabular and textual information included in both the BTR and the NID, which were communicated to the Party during the review. For example, there were significant discrepancies between the textual and tabular information reported on the LULUCF sector and two different baseline projection values were included in the BTR (section 2.6) and the CTF tables (table A2.9). During the review, Panama acknowledged that errors occurred during the editing of the final published versions of the BTR and NID. For example, for the LULUCF sector some tables of EFs were deleted and some EF values were modified but then not included. Panama explained that, while it made efforts to ensure the quality of its reporting, time constraints and its small team available for QA of the final document hindered its ability to address these errors before the document was published. The TERT recommends that Panama report accurate and consistent information in its BTR and NID. The TERT also recommends that Panama make efforts to strengthen its QA/QC process with a view to ensuring the quality of its BTR and NID.

[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.

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 21 of the MPGs Methods – CO_2, CH_4, N_2O	The TERT noted that the Party mostly used tier 1 methods from the 2006 IPCC Guidelines to estimate emissions and removals from various source and sink categories in its GHG inventory, including key categories for which the 2006 IPCC Guidelines recommend using higher-tier methods (see ID#s 3.E.3 in table 3, 4.I.1 in table 4 and 7.W.2 in table 7). The NID states that, while the Party made significant efforts to maximize efficiency and precision in data collection and analysis following the 2006 IPCC Guidelines, in specific cases where the adoption of a higher-level method was not feasible owing to resource limitations, tier 1 methods were used. During the review, the Party noted the need for enhanced technical skills to improve the efficiency and precision of its data collection consistently with the 2006 IPCC Guidelines and thus increase the accuracy of its GHG inventory. The TERT encourages the Party to make efforts to use the method (tier level) for estimating emissions and removals for key categories that is recommended in the relevant IPCC guidelines.
2.G.2	Specified in paragraphs 32 and 47 of the MPGs Completeness – CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride	Panama did not report emissions for many categories for which methods are provided in the 2006 IPCC Guidelines (see ID#s 3.E.4 in table 3, 5.A.7 in table 5, 6.L.11 in table 6, and 7.W.1 and 7.W.3 in table 7). The TERT noted that the MPGs allow Parties to report "NE" for emissions that would be insignificant in terms of level. However, the Party explained in the NID that it did not report "NE" for any insignificant categories. During the review, the Party acknowledged the need to strengthen its capacity to estimate GHG emissions, particularly for categories for which emissions are currently reported as "NE" in its GHG inventory. The Party explained that, although the 2006 IPCC Guidelines provide methods for many of these categories, it faces several challenges in estimating the relevant emissions, including poor data availability, lack of technical capacity for data collection and difficulties in interpreting the 2006 IPCC Guidelines. The TERT recommends that the Party estimate GHG emissions currently not reported for categories for which methods are provided in the 2006 IPCC Guidelines or provide information demonstrating that the emissions would be insignificant in terms of level as defined in paragraph 32 of the MPGs.
2.G.3	Specified in paragraph 51 of the MPGs Completeness – precursor gases	The Party did not report information on precursor gases, namely CO, NMVOCs and sulfur oxides. The Party explained in the NID that emissions of precursor gases were not estimated owing to lack of technical capability to estimate them. During the review, the Party explained that, owing to the prioritization of direct GHGs during the development of its GHG inventory, it has not yet focused on these estimates, as resources have been directed towards establishing foundational capabilities to estimate direct GHGs for key sectors. The TERT encourages the Party to report information on precursor gases.
2.G.4	Specified in paragraph 52 of the MPGs Completeness – indirect CO_2, indirect N_2O	The Party did not report indirect CO_2 emissions from the atmospheric oxidation of CH_4, CO and NMVOCs. Further, the Party did not report indirect N_2O emissions from sources other than those in the agriculture and LULUCF sectors as a memo item. It explained in the NID that such emissions were not estimated because of a lack of technical capability to develop estimates thereof in line with the relevant 2006 IPCC Guidelines methodology. During the review, the Party explained that, owing to the prioritization of direct GHGs during the development of its GHG inventory, it has not yet focused on these estimates, as resources have been directed towards establishing foundational capabilities to estimate direct GHGs for key sectors. The TERT encourages the Party to report indirect CO_2 emissions from the atmospheric oxidation of CH_4, CO and NMVOCs and indirect N_2O emissions

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		from sources other than those in the agriculture and LULUCF sectors as a memo item.

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 35–36 of the MPGs 1.A Fuel combustion – reference approach – all fuels – CO_2	The TERT noted large differences (more than 10 per cent) between national values of CO_2 emissions from fuel combustion estimated using the sectoral and reference approaches for some years, including a difference of 48.2 per cent for 2021. The TERT noted that the 2006 IPCC Guidelines (vol. 2, chap. 2.6) state that differences between national values of CO_2 emissions from fuel combustion estimated using the sectoral and reference approaches of more than 5 per cent should be explained and accounted for. The TERT noted that the Party explained in the NID (section 3.2.4.2) that the large differences between the estimates made using the two approaches for some years are mainly attributable to the transformation of fuels until 2002 and inconsistencies in the data on total supply of some fuels in the national energy balance for those years, which highlights the need for a thorough review of the underlying energy supply data in the national energy balance. The TERT also noted that addressing the causes of inconsistencies between the sectoral and reference approaches is included in the NID (section 3.2.7) in the category-specific improvement plan for category 1.A fuel combustion. During the review, the Party acknowledged those large differences and noted the need for capacity-building in this area, not only to enable it to enhance the accuracy of data collected for its national energy balance but also to allow it to address similar potential errors in current and past inventory submissions. The TERT encourages the Party to (1) prioritize a thorough review and improvement of the national energy balance to identify and resolve the underlying causes of discrepancies with the sectoral approach; (2) improve data-collection processes for the national energy balance, if needed; and (3) continue monitoring the differences between the sectoral and reference approaches as part of ongoing improvements. The TERT also encourages the Party to provide more detailed explanations in the NID regarding any differences between national values of CO_2 emissions from fuel combustion estimated using the sectoral and reference approaches of more than 5 per cent.
3.E.2	Specified in paragraphs 21 and 23 of the MPGs 1.A Fuel combustion – sectoral approach – all fuels – CO_2	The Party used conversion factors provided by the Latin American Energy Organization and default CO_2 EFs from the 2006 IPCC Guidelines (vol. 2, chap. 2.3.2) to estimate emissions from the combustion of fuels related to key categories. The TERT noted that, since fuel combustion (1.A) categories are key categories, the Party should use higher-tier methods to estimate related emissions. The TERT noted that the Party explained in the NID (section 3.2.12.2) that information on the carbon contents of domestic fuels is not available for applying a higher-tier method for fuel combustion in the current inventory cycle. The Party also included making progress in obtaining information on carbon content and net calorific value of domestic fuels in the planned improvements for the fuel combustion categories in the NID (sections 3.2.11.8 and 3.2.12.8). During the review, the Party explained that the Energy Secretariat (which is in charge of the comprehensive use of natural resources and all energy sources in the country), supported by the Technological University of Panama, is actively working on collecting information on the characteristics of fuels related to key categories (e.g. net calorific value, density and carbon content), which will enable the Party to use higher-tier methods. However, the Party identified a need for capacity-building in this area. The TERT encourages the Party to make efforts to use higher-tier methods for estimating emissions for fuel combustion categories in accordance with the 2006 IPCC Guidelines, including by collecting information on the characteristics of fuels related to key categories.
3.E.3	Specified in paragraph 21 of the MPGs	The Party estimated emissions from maritime and river navigation using the tier 1 CO_2 EF from the 2006 IPCC Guidelines for commercial/institutional activities

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
	1.A.3.d Domestic navigation – diesel and fuel oil – CO_2	under the subcategory other sectors (1.A.4). The TERT noted that considering that this is a key category, developing country-specific EFs for domestic navigation and improving identification of the specific types and quantities of fuel used for domestic navigation activities would enable the Party to enhance the accuracy of domestic navigation emission estimates. The TERT noted that the Party included obtaining information on carbon content and net calorific value for domestic fuels with a view to deriving country-specific EFs in the improvement plan for the subcategory in the NID (section 3.2.13.8). During the review, the Party explained that it used the CO_2 EF for commercial/institutional activities under the subcategory other sectors because it faced difficulties in distinguishing between national and international emissions from maritime and river navigation using data on sales of fuel at ports. The TERT encourages the Party to make efforts to use a higher-tier method for estimating emissions from domestic navigation in accordance with the 2006 IPCC Guidelines by developing country-specific EFs and clearly identifying fuel used for domestic navigation, considering that it is a key category.
3.E.4	Specified in paragraph 47 of the MPGs 1.B.2 Oil, natural gas and other emissions from energy production – oil and natural gas – CO_2, CH_4, N_2O	The Party did not estimate or report fugitive emissions from the transport of oil and transmission and storage of natural gas. The Party noted in the NID (section 3.3) that it did not estimate fugitive emissions from fuels owing to a lack of technical capacity to collect AD for the category and estimate emissions. During the review, the Party indicated that capacity-building support is needed for identifying relevant emissions sources, applying methods for data collection and establishing systematic processes for gathering AD. The Party also indicated that, given that it does not produce fuels in the country, fugitive emissions are related to transport and distribution. The TERT recommends that the Party collect the data needed for estimating fugitive emissions from the transport of oil and transmission and storage of natural gas or provide information demonstrating that the emissions would be insignificant in terms of level as defined in paragraph 32 of the MPGs.

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 21 and 23 of the MPGs 2.F Product uses as substitutes for ozone-depleting substances – F-gases	The Party estimated emissions of F-gases from product uses as substitutes for ozone-depleting substances (category 2.F) using the tier 1a method provided in the 2006 IPCC Guidelines (vol. 3, chap. 7.1.2.2). The Party noted that, given that category 2.F is a key category, as per the 2006 IPCC Guidelines, a higher-tier method should be used. However, as explained in the NID (section 4.7.3), this was not possible due to lack of country-specific information needed for applying a higher-tier method. The TERT noted that the Party included applying higher-tier methods for this category in the planned improvements for the category in the NID (section 4.7.8) During the review, the Party mentioned that it requires technical capacity-building support to identify and assess the relevance of the data needed for estimating emissions for this category and develop the corresponding calculation worksheets. The TERT encourages the Party to make efforts to use a recommended method (tier level) for estimating emissions of F-gases from product uses as substitutes for ozone-depleting substances in accordance with the relevant IPCC guidelines.
4.I.2	Specified in paragraph 47 of the MPGs 2.F.4 Aerosols, 2.F.5 Solvents – F-gases	The Party did not report emissions from aerosols or solvents owing to lack of AD on the import of F-gases for these applications. During the review, the Party explained that the National Ozone Unit is responsible for ensuring compliance with the Montreal Protocol on Substances that Deplete the Ozone Layer, including for F-gases, and for reporting relevant information to the Ozone Secretariat. Given that the Unit is already tasked with collecting AD on the import of F-gases for aerosols or solvents, there is a potential risk of duplicated efforts in gathering and reporting the AD. Therefore, Panama considers it essential to develop national capacities to facilitate the

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		collection of relevant data by the technical team responsible for estimating emissions from the IPPU sector and the National Ozone Unit while avoiding duplication of efforts. The TERT recommends that the Party report emissions from aerosols and solvents (e.g. by working with the National Ozone Unit to collect the relevant AD) or provide information demonstrating that such emissions would be insignificant in terms of level as defined in paragraph 32 of the MPGs.

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 paragraphs 21 and 39 of the MPGs 3.A.1 Cattle – CH_4	The Party reported in its NID (table 5.13) country-specific values for the DE% used for the estimation of gross energy for different cattle groups. However, the Party did not include transparent information on how the national values of DE% were estimated. For example, the Party did not report how the data on cattle feed used to calculate these values were derived, including the number of data samples used for the different cattle groups, whether those samples were representative of the entire population or in which years the samples were collected. The TERT noted that the information about the DE% values should reflect the shares of the feed for high- and low-producing dairy cattle that are expected to come from feed concentrates across the whole time series. During the review, the Party provided additional information clarifying that the DE% values were estimated on the basis of expert knowledge and the predominant types of pasture in the country. It noted that, while the estimates fairly closely reflect the actual situation, further data collection is needed to improve accuracy, including by designing a sampling strategy that represents the different regions of the country and variability of cattle in the country. This would require strengthening its capacity and securing funding for collecting those data. A file specifying feed information from the Institute of Agricultural Innovation of Panama was provided during the review. The TERT recommends that the Party include the information provided during the review about the estimation of national values of DE% used to calculate gross energy, including the underlying assumptions, and the sources of information used for different cattle groups. The TERT also recommends that the Party reflect any potential changes in the diet composition for cattle across the time series in the methodology used to estimate CH_4 emissions for the category.
5.A.2	Specified in paragraphs 21 and 39 of the MPGs 3.A.1 Cattle – CH_4	The Party reported in its NID (table 5.13) country-specific values for the weight, including adult weight, and average rate of weight gain for different cattle groups and the rate of milk production and fat content (%) for dairy cattle. However, it did not report the inventory year to which these data related. The TERT noted that it is reasonable to expect some changes in these values across the time series, for example, due to changes in cattle breeds or feed ration content. The TERT also noted that, in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 10.3.5), changes in management practice and/or implementation of mitigation measures for significant livestock categories over time that influence emissions should be reflected in the GHG inventory estimates of a key category. During the review, the Party explained that, while there may be changes in the milk yield or fat percentages for dairy cattle across the GHG inventory time series, these were not reflected in the estimates of enteric CH_4 emissions from dairy cows in the inventory, and that the values pertaining to adult weight and weight gain for different cattle groups were assumed to be constant across the time series. The Party acknowledged the need for further refinement of the estimation methodology, for which it requires training or information exchanges with countries using more advanced methods to estimate livestock GHG emissions and close collaboration with experts in the agriculture sector who have a better understanding of changes in values across the time series. The Party plans to incorporate relevant changes into the estimation methodology in future GHG inventories.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		The TERT recommends the Party explain in the NID that it used constant values for the weight, including adult weight, and average rate of weight gain for the different subcategories of cattle, as well as constant values of milk yield and milk fat percentages for dairy cattle, to estimate gross energy consumption. The TERT also recommends that the Party investigate potential changes in those values across the time series and reflect them in its GHG inventory estimates for the category.
5.A.3	Specified in paragraphs 21 and 39 of the MPGs 3.B Manure management – N_2O	The Party reported in its NID (table 5.28) the typical animal mass values used to estimate annual N excretion for various livestock categories. However, there was no information clarifying whether changes in typical animal mass for different livestock categories across the time series are reflected in the N excretion values used in the GHG inventory estimates. The TERT noted that this reporting is not in line with the 2006 IPCC Guidelines (vol. 4, chap. 10.5.6) because changes in management practice and/or implementation of mitigation measures for significant livestock categories over time that influence emissions should be accounted for in the GHG inventory estimates of key categories. During the review, the Party explained that the same typical animal mass values were used for all years in the time series. It noted that it currently lacks sufficient capacity and personnel to implement more refined methods for estimating agriculture sector GHG emissions and efforts are ongoing to build expertise in this area. The TERT recommends that the Party explain in the NID that constant typical animal mass values are used to estimate N excretion for various livestock categories. The TERT also recommends that the Party investigate changes in those values across the time series for significant livestock categories (e.g. dairy cattle) and reflect them in its GHG inventory estimates for the category.
5.A.4	Specified in paragraphs 21 and 39 of the MPGs 3.B.5 Indirect N_2O emissions – N_2O	The Party reported in its NID (table 5.33) the EF used to estimate indirect N_2O emissions from volatilization from manure management for different livestock categories. The EF used was 0.01 kg N_2O–N (kg NH_3–N + NO_X–N volatilized)$^{-1}$, which is the tier 1 EF value from the 2006 IPCC Guidelines (vol. 4, chap. 11.2.2.2). However, the TERT noted that, as shown in the NID (table 5.58), the Party used an EF of 0.014 kg N_2O–N (kg NH_3–N + NO_X–N volatilized)$^{-1}$ from the 2019 Refinement to the 2006 IPCC Guidelines (vol. 4, chap. 11.2.2.2) to estimate indirect N_2O emissions from volatilization from agricultural soils. However, the NID does not explain why two different EFs were used to estimate indirect N_2O emissions from volatilization for categories 3.B and 3.D. During the review, the Party acknowledged that the EF from the 2019 Refinement to the 2006 IPCC Guidelines (0.014 kg) should have been used for both categories and explained that it plans to correct the EF for estimating indirect N_2O emissions from volatilization from manure management for the next GHG inventory. The TERT recommends that the Party use the appropriate EF to estimate indirect N_2O emissions from volatilization from manure management in accordance with the good practice elaborated in the relevant IPCC guidelines, ensuring consistent use across categories 3.B and 3.D and correctly documenting the EF used.
5.A.5	Specified in paragraphs 21 and 35 of the MPGs 3.D.1 Direct N_2O emissions from managed soils – N_2O	The Party reported in its NID (table 5.53) direct N_2O emissions from agricultural soils and provided the AD (table 5.56) and EFs (table 5.57) underlying its estimates. However, there were some discrepancies between the values of N_2O emissions presented in the NID and those calculated by the TERT using the AD and EF values provided. For example, for inorganic N fertilizers applied to managed soils and flooded rice, the emission estimate for 2021 calculated by the TERT using the AD and EFs reported was 175.9 kt CO_2 eq, and not 111.9 kt CO_2 eq as presented in NID (table 5.53). The TERT noted the same issue with the estimates of direct N_2O emissions for other inputs to managed soils. During the review, the Party explained that the values presented in the NID were not converted from N_2O–N to N_2O and that this issue will be addressed for the next GHG inventory. The TERT recommends that the Party correct the errors in the values of direct N_2O emissions from agricultural soils reported in the NID by converting N_2O–N

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		to N_2O. The TERT encourages the Party to enhance its category-specific QC procedures in accordance with the relevant IPCC guidelines to avoid errors in the reporting of its emission estimates.
5.A.6	Specified in paragraphs 21 and 39 of the MPGs 3.D.1.d Crop residues – N_2O	The Party reported in its NID (table 1.6, chap. 5.5.3.1 and annexes 5.3–5.6) information on the AD and methodology used to estimate direct N_2O emissions from crop residues. However, the Party did not provide transparent information in the NID on (1) whether default factors from the 2006 IPCC Guidelines or country-specific values were used for the N content of above- and below-ground residues for different crops and for the ratio of above- and below-ground residues for the different crop types; (2) the values and data sources for the fractions of crop residues burned and removed used for the emission estimates; and (3) whether there is any production of perennial forage crops like grasses and grass-clover mixtures that only have periodic pasture renewal in the country (perennial forage crops are not included in the crop list in NID table A.5.3). During the review, the Party explained that default values from the 2019 Refinement to the 2006 IPCC Guidelines were used because no national data were available. The estimation of N from crop residues followed the step-by-step methodology outlined in the 2006 IPCC Guidelines (vol. 4, chap. 11.2.1.3). Given that emissions for subcategory 3.D.1.d were being estimated for the first time, expert judgment by a technician from the livestock directorate of Panama's Ministry of Agricultural Development was used to obtain crop data. The Party noted that further research is needed to determine the crop data needed for estimating the relevant emissions. Regarding pastures, the Party noted that it is common for producers to renew them every six to eight years, depending on grazing intensity. However, there are no statistical records on this practice and, as such, the information in the NID is based on expert knowledge. It explained that data on the fraction of residues burned (e.g. sugarcane, rice and maize) were erroneously omitted from the subcategory estimates. As a result, the total N value for the subcategory was overestimated. This issue is planned to be corrected for the next reporting cycle. The Party also provided to the TERT two files containing the values of parameters used in the estimation of the annual amount of N in crop residues (above and below ground) for the different crop types. The TERT recommends that the Party enhance the transparency of its NID by including information on the methods used to estimate N_2O emissions from crop residues, including the assumptions, references and sources of information used to derive the underlying EFs and AD. The TERT also recommends that the Party correct the estimated amount of N in crop residues burned and ensure that all the crops are included in the emission estimates. The TERT further recommends that the Party make efforts to obtain AD for perennial forage crops, considering the fraction of pastures renewed every year, and include these AD in its emission estimates.
5.A.7	Specified in paragraphs 31 and 47 of the MPGs 3.D.1.e Mineralization/immobilization associated with loss/gain of soil organic matter – N_2O	The Party reported direct N_2O emissions from mineralization in agricultural soils in the NID (section 5.5). However, it was not clear from the NID whether the reported emissions include those associated with carbon stock losses under both cropland remaining cropland and land converted to cropland, as well as those under both grassland remaining grassland and land converted to grassland. The TERT also noted that according to CRT 3.D (footnote 4), N_2O emissions from mineralization from land converted to cropland and land converted to grassland should be reported under the LULUCF sector instead of under the agriculture sector, while those from cropland remaining cropland and grassland remaining grassland should be reported in the agriculture sector. During the review, the Party explained that the N_2O emissions reported under the agriculture sector (CRT 3.D) were associated with the mineralization of soil in land converted to cropland and in land converted to grassland. However, N_2O emissions from N mineralization in cropland remaining cropland and grassland remaining grassland were not estimated owing to lack of transparent, consistent and accurate information regarding changes in crop management practices. The TERT recommends that the Party collect the necessary information regarding changes in crop management practices and estimate and report N_2O emissions from N mineralization in cropland remaining cropland and grassland remaining grassland. The TERT also recommends that the Party reallocate the reported N_2O

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		emissions associated with the mineralization of soil in land converted to cropland and land converted to grassland from category 3.D.1.e to category 4(III) or use the relevant notations keys.

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 39 of the MPGs 4. General (LULUCF) – CO_2	The Party used the tier 1 method from the 2006 IPCC Guidelines to estimate carbon stock changes in mineral soils associated with land-use change (vol. 4, chap. 2, equation 2.25) and provided in the NID (annex, pp.472–473) a list of default parameters used, including the reference SOC stocks from the 2019 Refinement to the 2006 IPCC Guidelines (vol. 4, chap. 2, table 2.3) and the carbon stock change factors for land use, management and input relevant to forest land and cropland from the 2006 IPCC Guidelines (vol. 4, chap. 5, table 5.5). However, the Party did not clearly explain in the NID which carbon stock change factors for land use, management and input were actually applied to land converted to cropland. The Party also did not specify the carbon stock change factors applied to land converted to grassland, land converted to settlements and land converted to other land. During the review, the Party provided additional information on the carbon stock change factors used for each land-use change in different land categories, including the rationale for the parameters selected, and explained that this information was inadvertently omitted from the NID annex during the GHG inventory compilation process. The TERT recommends that the Party report comprehensive information in the NID on the calculation of carbon stock changes in mineral soils associated with land-use change in different land categories, including the initial SOC and the carbon stock change factors for land use, management and input applied to each land-use change, as well as the justification for the choice of parameters.
6.L.2	Specified in paragraph 21 of the MPGs 4. General (LULUCF) – CO_2	Panama used the default reference SOC stocks provided in the 2019 Refinement to the 2006 IPCC Guidelines (vol. 4, chap. 2, table 2.3) as the initial SOC of perennial and annual cropland before land-use conversion when calculating carbon stock changes in mineral soils for cropland converted to another land use. The TERT noted that Panama estimated the values of SOC of perennial and annual cropland in three ecosystems (tropical mountain, humid tropical and very humid tropical) on the basis of the tier 1 method provided in the 2006 IPCC Guidelines using the associated default reference SOC stocks and the default carbon stock change factors for land use, management and input for mineral soils for land converted to cropland (see ID# 6.L.1 above). The TERT noted that the SOC values calculated for mineral soils in perennial and annual cropland at the end of land-use conversion to cropland represent the average SOC values for perennial and annual cropland, which are used as the initial SOC values of perennial and annual cropland before its conversion to another land use under the tier 1 method from the 2006 IPCC Guidelines (vol. 4, chap. 2.3.3). Therefore, the Party used the incorrect values for the initial SOC of perennial and annual cropland before land-use conversion when calculating carbon stock changes in mineral soils for cropland converted to another land use. During the review, the Party explained that this mistake was due to lack of understanding of the methods in the 2006 IPCC Guidelines. The TERT recommends that the Party use the estimated SOC values of annual and perennial cropland as the initial SOC values of annual and perennial cropland before land-use conversion to calculate carbon stock changes in mineral soils in cropland converted to another land use.
6.L.3	Specified in paragraph 31 of the MPGs 4. General (LULUCF) – CO_2, CH_4, N_2O	The Party reported carbon stock changes for wetlands converted to another land use as “NE” for all years, including years when no land-use conversion from wetlands to another land use occurred. The TERT noted that, in cases where an activity does not take place (i.e. no land-use conversion occurs), the correct notation key to be used is “NO”.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		During the review, the Party clarified that it did not estimate carbon stock changes for wetlands converted to another land use owing to lack of availability of biomass data on floodable low vegetation. The TERT recommends that the Party estimate and report carbon stock changes for wetlands converted to another land use for years in which such land-use conversions occurred or provide information demonstrating that the carbon stock changes would be insignificant in terms of level as defined in paragraph 32 of the MPGs, and report "NO" for years in which such land-use conversions did not occur.
6.L.4	Specified in paragraphs 40 and 47 of the MPGs 4. General (LULUCF) – CO_2	The Party did not report in the NID information on the methods applied for estimating carbon stock changes for each carbon pool at the subcategory level, including for forest land remaining forest land (land conversions among forest subcategories), forest land converted to other land and grassland converted to other land. During the review, the Party provided additional information on the methods used for estimating carbon stock changes in forest land remaining forest land (biomass and DOM pools) and forest land and grassland converted to other land (biomass, DOM and SOC pools) and the assumptions made for estimating biomass carbon stock changes in annual cropland converted to forest land, grassland, wetlands and settlements. The TERT recommends that the Party include in the NID information on the methods for estimating carbon stock changes for each carbon pool at the subcategory level, to the extent possible, namely for forest land remaining forest land, annual cropland converted to forest land, annual cropland converted to grassland, annual cropland converted to wetlands, annual cropland converted to settlements and land converted to other land.
6.L.5	Specified in paragraph 21 of the MPGs Land representation – CO_2, N_2O	The Party collected annual land use and land-use change information for 2000 onward and calculated areas of land-use conversion for 2000–2018 as the total area converted to another land-use category since 2000 and not as the total area converted during the past 20 years (the default length of the land transition period in the 2006 IPCC Guidelines). The TERT noted that, as a result, the carbon accumulation of DOM associated with the conversion of land to forest land and the carbon stock changes in mineral soils associated with land-use change were underestimated for 2000–2018 because the AD did not include the total area converted from one land-use category to another in the land-use transition period. In addition, some biomass carbon stock changes that should have been reported under land converted to forest land were reported under forest land remaining forest land for 2000–2018. The TERT noted that this is not in line with the relevant methodology provided in the 2006 IPCC Guidelines (vol. 4, chap. 2.3.2.2). During the review, the Party explained that it used this approach because the land-use data available before 2000 in Panama are not as accurate as those available since 2000. The TERT recommends that the Party recalculate the carbon stock changes in DOM and SOC in land converted to another land use using the total area of land-use conversion during the past 20 years, including by using the data splicing techniques (e.g. surrogate data, extrapolation and interpolation) provided in the 2006 IPCC Guidelines (vol. 1, chap. 5.3.3) to estimate the area prior to 2000.
6.L.6	Specified in paragraph 21 of the MPGs 4.A Forest land – CO_2	Panama estimated the carbon stock changes in biomass for "rastrojos" (mixed vegetated land including shrubs, pioneer trees and herbaceous species with an average height of less than 5 m) using the country-specific above-ground growth ratio, which was based on the estimated growth ratio for young secondary forests up to five years old taken from a national forest survey (5.74 t dm/ha/year).The TERT noted that, based on the land matrices provided in the Party's NID, only a small portion (around 2 per cent) of the "rastrojos" was converted to secondary forests annually and most of the area under "rastrojos" remained unconverted. As such, its carbon stocks did not reach the level of that of a five-year-old secondary forest.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		During the review, the Party acknowledged that not all "rastrojos" will be converted to secondary forests and thus the current above-ground growth ratio used for "rastrojos" may be too high. The Party also explained that it will consider reclassifying "rastrojos" from forest land to grassland for its next GHG inventory. The TERT recommends that the Party use a growth ratio for "rastrojos" that accurately reflects its growth characteristics to estimate carbon stock changes in biomass.
6.L.7	Specified in paragraphs 21 and 39 of the MPGs 4.A Forest land – CO_2	Panama used the default values for biomass conversion and expansion factor applicable to wood removals provided in the 2006 IPCC Guidelines to estimate biomass losses in forest land remaining forest land. The Party provided in the annex to its NID a list of the default values for the expansion factor applicable to wood removals from the 2006 IPCC Guidelines (vol. 4, chap. 4, table 4.5) that it used to estimate biomass carbon losses for each forest subcategory, but did not include information on how those values were selected. During the review, the Party explained that the default values for the expansion factor applicable to wood removals were selected taking into account the appropriate ranges of growing stock based on the estimated average commercial volume for each forest type. The Party also explained that the default value used for mature forest was wrongly selected and the default values used for secondary forests in tropical mountain regions were incorrectly transcribed in its NID, and provided the correct values. The TERT recommends that the Party estimate and report carbon stock changes in biomass in mature forests for the entire time series using the correct values for the expansion factor applicable to wood removals. The TERT also recommends that the Party report in the NID the default values for the expansion factor applicable to wood removals used to estimate biomass losses in forest land remaining forest land and the rationale for selecting them.
6.L.8	Specified in paragraphs 21 and 39 of the MPGs 4.B Cropland – CO_2	Panama estimated carbon stock changes in perennial crop biomass using the tier 1 method provided in the 2019 Refinement to the 2006 IPCC Guidelines (vol. 4, chap. 5.2.1). However, the Party did not provide transparent information in the NID on how it estimated carbon losses in biomass for perennial cropland, including on the AD and parameters used. During the review, the Party explained that carbon gains were calculated using the total perennial crop area, while carbon losses in biomass for perennial cropland were reported as part of the carbon losses in forest land. This was done because the Party used as a basis for the calculation national data on permits for tree harvesting, which apply to both forest trees and perennial woody trees such as fruit trees, and the Party was unable to disaggregate those data by tree type owing to time constraints. The TERT recommends that the Party estimate and report carbon stock changes in biomass for perennial cropland by collecting disaggregated information on carbon losses in biomass, including transparent information on the estimation methods and AD used.
6.L.9	Specified in paragraph 21 of the MPGs 4.F.2 Land converted to other land – CO_2	Panama did not include in the NID information on the carbon stock change factors used to estimate carbon stock changes in mineral soils in land converted to other land (see ID# 6.L.1 above). During the review, the Party explained that SOC for mineral soils in other land was calculated using the carbon stock change factors 0.8, 1.0 and 1.0 for land use, management and input respectively. The TERT noted that, as also acknowledged by the Party during the review, the SOC of mineral soils in land converted to other land should be zero based on the tier 1 method from the 2006 IPCC Guidelines (vol. 4, chap. 9.3.3.1) and, as such, it is incorrect to use carbon stock change factors to calculate the SOC stocks of mineral soils in other land. The TERT recommends that the Party use zero for the SOC of mineral soils in other land to estimate carbon stock changes in mineral soils in land converted to other land when using the tier 1 method from the 2006 IPCC Guidelines.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
6.L.10	Specified in paragraph 47 of the MPGs 4.G HWP – CO_2	The Party did not report carbon stock changes in HWP. The Party explained in its NID that those changes were not estimated owing to lack of AD and lack of capacity to apply the methods for calculating the changes. The Party noted that it is in the process of building its capacity to estimate carbon stock changes in HWP. The TERT noted that it is mandatory to report carbon stock changes in HWP given that default methods are provided in the 2006 IPCC Guidelines. During the review, the Party explained that it may use the production approach to estimate carbon stock changes in HWP in the future. The TERT recommends that the Party estimate and report emissions and removals from HWP in accordance with the relevant IPCC guidelines or provide information demonstrating the insignificance of the HWP pool, if applicable.
6.L.11	Specified in paragraphs 21, 45 and 47 of the MPGs 4(III) Direct and indirect N_2O emissions from N mineralization/ immobilization – N_2O	The Party reported N_2O emissions for land-use conversion categories as "NO" in the sector summary table in the NID and thus did not report N_2O emissions from N mineralization under the LULUCF sector. The TERT noted that the 2006 IPCC Guidelines (vol. 4, chap.11.2) provide default methods for estimating them. The Party did not provide information on the lack of reporting or a justification that the emissions do not exist or are insignificant in terms of level as defined in paragraph 32 of the MPGs. During the review, the Party clarified that N_2O emissions from N mineralization associated with land converted to cropland were reported under the agriculture sector (see ID# 5.A.7 in table 5) and that emissions from other N mineralization associated with carbon stock losses from a land-use conversion were not estimated because it was not clear which C:N ratio from the 2006 IPCC Guidelines should be used to estimate them. The TERT recommends that the Party estimate and report under the LULUCF sector all N_2O emissions from N mineralization associated with mineral soil carbon losses due to a land-use or land management change, (except those occurring in cropland remaining cropland and grassland remaining grassland), or provide information demonstrating that the emissions would be insignificant in terms of level as defined in paragraph 32 of the MPGs.

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 paragraphs 32 and 47 of the MPGs 5. General (waste) – CO_2, CH_4, N_2O	The Party reported emissions of all gases for categories 5.B biological treatment of solid waste, 5.C.1 waste incineration and 5.D.2 industrial wastewater as "NE", but did not explain why these emissions were not estimated or provide any evidence of their insignificance by deriving a likely level of emissions as per paragraph 32 of the MPGs. During the review, the Party explained that, as noted in the NID, emissions for the above-mentioned categories were not estimated and their insignificance was not verified owing to lack of data and technical and human capacity. The TERT recommends that the Party estimate and report emissions for categories 5.B biological treatment of solid waste, 5.C.1 waste incineration and 5.D.2 industrial wastewater or provide information demonstrating their insignificance in terms of level of emissions in line with paragraph 32 of the MPGs.
7.W.2	Specified in paragraph 21 of the MPGs 5.A Solid waste disposal on land – CH_4	Panama estimated CH_4 emissions from solid waste disposal on land (category 5.A) using the tier 1 method from the 2006 IPCC Guidelines (vol. 5, chap. 3.2.1). The TERT noted that, given that category 5.A is a key category, as per the 2006 IPCC Guidelines the Party should use higher-tier methods to estimate related emissions. The Party explained in its NID (section 7.2.3) that those emissions were not estimated using a higher-tier method owing to lack of capacity to collect the time series of data required on the different waste management models used in the country. The Party detailed all the activities it plans to carry out in order to enable the use of higher-tier methods for this category in the category-specific improvement plan (NID section 7.21).

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		During the review, the Party acknowledged that the available sources of data, as provided in the NID (table 7.4), were sufficient for deriving the missing estimates in the time series using the methods provided in the 2006 IPCC Guidelines (vol. 5, chap. 3.2.2). The TERT encourages the Party to make efforts to use a recommended higher-tier method for estimating CH_4 emissions for key category 5.A solid waste disposal on land in accordance with the relevant IPCC guidelines.
7.W.3	Specified in paragraph 47 of the MPGs 5.E Other (waste) CH_4, CO_2, N_2O	The Party did not report GHG emissions from clinical and hazardous waste. The Party stated in its NID that such emissions were not estimated owing to lack of time, although it did identify the data providers. However, the TERT noted that estimating these emissions is not included in the planned improvements in the NID. During the review, the Party explained that estimating these emissions was not included in the planned improvements in the NID owing to an oversight but noted that it plans to include it in its planned improvements in future GHG inventory submissions. The TERT recommends that Panama estimate and report emissions from clinical and hazardous waste or provide information demonstrating their insignificance in terms of level of emissions in line with paragraph 32 of the MPGs.

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*
10.1	Specified in paragraph 74(b–c) of the MPGs	Panama provided in the structured summary table included in the BTR information related to the methodology and/or accounting approach for developing the indicators for its quantitative targets, namely its indicators pertaining to the share of non-conventional renewable energy sources in the total installed electricity generation capacity, hectares of forest restored and hectares of degraded land restored under agroforestry and silvopastoral systems. However, Panama did not provide a transparent description of the methodology or accounting approach used to construct the baseline or the indicator used for its NDC target relating to reducing total GHG emissions from the energy sector below a baseline scenario (percentage of GHG emissions (CO_2 eq) reduced compared with the baseline scenario). For example, it did not include transparent information on key parameters, assumptions (e.g. modelling assumptions related to population trends, economic development, energy prices and technical and sector-specific factors, including efficiency improvements in industrial processes and emission intensity), definitions, data sources, models or the IPCC guidelines used. The Party provided a hyperlink in the BTR (p.75) to a document that

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		provides details on all the projection scenarios, but did not include a summary of that information in the BTR. During the review, Panama reported that information on the methodology and accounting approach used to construct the baselines can be found in the BTR (tables A2.1, A2.3 and A2.4). It also reported that BTR tables 2.11 and 2.2 and section 2.2 specify the strategy for achieving each emission reduction target. More specifically, BTR section 2.3.1 contains details of each target, its indicator and a description of the methodology used. Panama further reported that it did not report more details owing to the extensive length of the information available on the strategies. The TERT noted that the Party could present the information more clearly by including a summary of the information in the BTR. The TERT recommends that Panama enhance the description of each methodology and/or accounting approach used for the indicator selected to track progress towards the NDC target relating to reducing total GHG emissions from the energy sector below a baseline scenario and, to the extent possible, for constructing the 'business as usual' scenario for that indicator.
10.2	Specified in paragraph 76(b) of the MPGs	Panama provided limited information in the BTR explaining how the methodologies used to develop some of its indicators for quantitative targets (share of non-conventional renewable energy sources (MW) in the total installed electricity generation capacity, hectares of forest restored and hectares of degraded land restored under agroforestry and silvopastoral systems) are consistent with the methodologies used when communicating the NDC. Further, Panama did not explain how the methodologies for estimating the percentage reduction in total energy sector emissions compared with a baseline scenario in each reporting year are consistent with those used when communicating the NDC. During the review, Panama reported that its methodologies for estimating emissions and removals are based on the 2006 IPCC Guidelines and the accounting for the indicators has been done and associated information reported for the first time. Panama also explained that it had concerns about the key assumptions and parameters used for the baseline scenario reported in the BTR and, as such, it applied flexibility with respect to the reporting of projections. Panama further explained that the methodologies used for the indicators were developed for the BTR and there were no such methodologies for the NDC. However, this explanation was not included in the BTR. Given its concerns regarding the baseline scenario prepared for the BTR, Panama only reported the percentage change in GHG emissions relative to the baseline scenario for 2025, 2030 and 2050. Panama further explained that it does not have to report on inconsistencies in the methodology as this is Panama's first BTR. The TERT recommends that Panama provide detailed and transparent information explaining how the methodology for estimating the quantitative indicators in each reporting year is consistent with the methodology or methodologies used when communicating the NDC, including with regard to key parameters, assumptions, definitions, data sources and models used.

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 80 of the MPGs	Panama reported its main climate change policies and overarching frameworks in narrative format in its BTR. However, it was not clear how those PaMs support the achievement of Panama's NDC objectives or relate to the key categories referred to in the national GHG inventory. Further, the TERT noted discrepancies in the PaMs reported in narrative and tabular format, and the Party did not describe the relationship between the PaMs reported in the two formats. In addition, certain PaMs affecting key GHG inventory categories, such as the national forest restoration plan, were not reported in tabular format.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		During the review, Panama explained that most of its PaMs also pertain to its NDC targets, and as such each policy or measure directly supports the implementation and achievement of the NDC targets. It also clarified that PaMs described in the BTR (section 2.4) are policy frameworks that support the implementation of NDC targets and, as such, are described more generally. It further explained that the PaMs included in CTF table 5 (table A2.5) are considered to have the most significant impact in terms of GHG emissions or removals and to have an impact on the key categories referred to in the national GHG inventory. The TERT recommends that Panama provide information on how each of its PaMs support the achievement of its NDC targets. The TERT also recommends that Panama report consistent information on its PaMs in the BTR and CTF tables, focusing on those PaMs that have the most significant impact on GHG emissions and removals and have an impact on the key categories referred to in the national GHG inventory.
11.2	Specified in paragraph 81 of the MPGs	In its BTR, Panama did not organize the reporting of narrative information on PaMs by sector (energy, transport, IPPU, agriculture, LULUCF, waste management and other). The TERT noted that some PaMs reported by the Party were sector-specific (e.g. the national forest restoration plan and the national REDD+ strategy). During the review, Panama explained that the BTR (section 2.4) focuses on cross-cutting PaMs, which are not organized by sector, while CTF table 5 (table A.2.5) specifies the sector for the most significant PaMs, which are NDC targets. The TERT recommends that Panama, to the extent possible, organize the reporting of PaMs by sector (energy, transport, IPPU, agriculture, LULUCF, waste management and other).
11.3	Specified in paragraph 83 of the MPGs	In its BTR, Panama did not report information on the costs of each action, policy and measure; non-GHG mitigation benefits; or how mitigation actions interact with each other. During the review, Panama explained that it currently lacks the capacity to fully evaluate these aspects. The TERT encourages Panama to report for each action, policy and measure information on costs, non-GHG mitigation benefits and how actions and PaMs interact with each other or clearly explain why this information is not provided.
11.4	Specified in paragraphs 6, 85 and 86 of the MPGs	Panama reported in tabular format estimates of expected and achieved GHG emission reductions for its actions and PaMs using notation keys, “0” and blank cells. Hence, the Party did not describe the methodologies and assumptions used to estimate the GHG emission reductions or removals resulting from each action, policy or measure. The TERT noted that Panama applied the flexibility available to those developing countries that need it in the light of their capacities with respect to this provision in reporting the expected and achieved GHG emission reductions for its actions and PaMs, citing capacity constraints as the reason and providing a broad time frame for improving its reporting thereon (2025–2030). The TERT noted that the capacity constraints cited were the same as those relating to the flexibility applied for reporting on projections (paras. 92 and 102 of the MPGs), to which they were more specifically related. As such, it was not clear to the TERT which specific capacity constraints were related to estimating expected and achieved GHG emission reductions and removals. During the review, Panama explained that it reported “0” where actions and PaMs were not associated with GHG emission reductions, such as the development of guidelines or plans, and “NE” for actions and PaMs where GHG emission reductions were expected but could not be estimated. It clarified that constraints in estimating expected and achieved GHG emission reductions include challenges related to developing robust baselines, projecting GHG emission impacts by comparing scenarios with and without measures, and evaluating interactions between overlapping PaMs. The TERT noted that, given that the Party applied the flexibility with respect to this provision, it may use the notation key “FX” to report expected and achieved GHG emission reductions of PaMs in tabular format.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		The TERT encourages the Party to report, to the extent possible and within the estimated time frame for improvement specified by the Party, expected and achieved GHG emission reductions for its actions and PaMs, as relevant, providing a relevant explanation in cases where there are no expected GHG emission reductions or justifying why any expected GHG emission reductions have not been estimated and describing the methodologies and assumptions used to estimate GHG emission reductions or removals. The TERT recommends that Panama clearly identify the specific capacity constraints faced related to estimating expected and achieved GHG emission reductions resulting from actions and PaMs.
11.5	Specified in paragraph 88 of the MPGs	Panama did not identify its actions and PaMs that influence GHG emissions from international transport in its BTR. During the review, Panama explained that it addresses these emissions through active participation in international organizations, such as the International Maritime Organization and the International Civil Aviation Organization. However, this information was not included in the BTR owing to time constraints. The TERT encourages Panama to include information on its actions and PaMs that influence GHG emissions from international transport.
11.6	Specified in paragraph 89 of the MPGs	Panama did not report in its BTR how its actions and PaMs are modifying longer-term trends in GHG emissions and removals. During the review, Panama explained that, while it developed emissions scenarios, it did not carry out a specific evaluation of PaMs linked to the NDC or their impact on long-term trends in GHG emissions and removals. The Party also explained that the scenarios reported in the BTR (section 2.6) do not include the PaMs listed in CTF table 5. The TERT encourages Panama to include, to the extent possible, information on how its actions and PaMs are modifying longer-term trends in GHG emissions and removals.
11.7	Specified in paragraph 90 of the MPGs	Panama did not provide detailed information on the assessment of the economic and social impacts of its response measures in its BTR. During the review, Panama explained that the broad scope of some PaMs and the Party's lack of prior experience with similar PaMs make it challenging to accurately estimate their economic and social impacts. The TERT encourages Panama to include, to the extent possible, detailed information on the assessment of economic and social impacts of its PaMs in the BTR.

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 6 in conjunction with paragraphs 92 and 102 of the MPGs	Panama reported in its BTR that it applied the flexibility available to those developing country Parties that need it in the light of their capacities for reporting projections provided for in paragraphs 92 and 102 of the MPGs, and provided information on its capacity constraints in this area, reporting an estimated time frame for improving its reporting on projections. The Party noted that the information on projections contained in the BTR was only provided for illustrative purposes. During the review, Panama explained that the information in the BTR regarding projections describes its progress in this area to date, as well as its constraints in

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		this regard, but emphasized that it applied the flexibility provided for in paragraphs 92 and 102 of the MPGs. The TERT encourages Panama to estimate and report projections in line with paragraphs 93–101 of the MPGs within the estimated time frame for improvement provided by the Party.

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

II. Capacity-building needs[3] identified by the Party and by the technical expert review team in consultation with the Party during the technical expert review of its first biennial transparency report

2. Table 15 presents capacity-building needs identified by the Party and by the TERT in consultation with the Party during the technical expert review of its BTR1.

Table 15
Capacity-building needs identified in consultation with the Party

ID#	*Reporting requirement*	*Area in which capacity-building is needed*
General reporting		
1_CBN.1[a]	Specified in paragraph 38 of the MPGs	Efficiently using the common reporting format tool (high priority)
1_CBN.2[a]	Specified in paragraphs 35 and 47 of the MPGs	Reporting accurate and consistent information in the BTR and national inventory report by strengthening the QA/QC process (high priority)
National inventory report – general		
2.G_CBN.1	Specified in paragraph 21 of the MPGs	Improving data collection and derivation to facilitate use of the method (tier level) for assessing key categories recommended in the relevant IPCC guidelines (e.g. categories 1.A fuel combustion, 1.B fugitive emissions from fuels, 2.F product uses as substitutes for ozone-depleting substances, 3.A enteric fermentation, 4.G HWP, 5.A solid waste disposal and 5.C incineration and open burning of waste) (high priority)
2.G_CBN.2[a]	Specified in paragraphs 29 and 44 of the MPGs	Performing an uncertainty analysis using the tier 2 method from the 2006 IPCC Guidelines, including enhancing data collection (medium priority)
2.G_CBN.3	Specified in paragraph 47 of the MPGs	Collecting data and understanding the methods in the relevant IPCC guidelines needed for estimating GHG emissions currently reported as "NE" or demonstrating that such estimates would be insignificant in terms of level as defined in paragraph 32 of the MPGs (e.g. 1.B.2.b fugitive emissions from the production of natural gas, 2.F.4 product uses as substitutes for ozone-depleting substances (aerosols), 2.F.5 product uses as substitutes for ozone-depleting substances (solvents), 4(III) direct N_2O emissions from N mineralization/immobilization, 5.B biological treatment of solid waste, 5.C.1 waste incineration and 5.D.2 industrial wastewater) (high priority)
2.G_CBN.4	Specified in paragraph 51 of the MPGs	Enhancing technical capacity to collect data needed for estimating emissions of precursor gases (low priority)

[3] As referred to in paras. 7, 8 and 162(d) of the MPGs.

ID#	*Reporting requirement*	*Area in which capacity-building is needed*
2.G_CBN.5	Specified in paragraph 52 of the MPGs	Enhancing technical capacity to collect data needed for estimating indirect CO_2 emissions (low priority)
National inventory report – energy		
3.E_CBN.1	Specified in paragraphs 35–36 of the MPGs	Analysing the time-series consistency of fuels in the energy balance to improve the accuracy of energy sector data collection and ensuring the availability of reliable data to support the estimation of emissions from the energy sector using both the reference and the sectoral approach (high priority)
3.E_CBN.2	Specified in paragraphs 21 and 53 of the MPGs	Identifying sources of AD that will enable better differentiation between national and international navigation emissions and developing country-specific EFs to enhance the accuracy of emission estimates (high priority)
3.E_CBN.3[a]	Specified in paragraph 47 of the MPGs	Collecting data on emissions sources and related AD needed for estimating fugitive emissions from natural gas or demonstrating that those emissions would be insignificant in terms of level as defined in paragraph 32 of the MPGs (low priority)
National inventory report – IPPU		
4.I_CBN.1	Specified in paragraphs 21 and 23 of the MPGs	Collecting detailed AD needed for estimating F-gas emissions in key categories using a higher-tier level (high priority)
4.I_CBN.2	Specified in paragraph 47 of the MPGs	Collecting AD needed for estimating emissions of aerosols and solvents or demonstrating that such estimates would be insignificant in terms of level as defined in paragraph 32 of the MPGs (high priority)
National inventory report – agriculture		
5.A_CBN.1[a]	Specified in paragraphs 21 and 39 of the MPGs	Enhancing data on livestock used for the agriculture sector by collecting feed data, including by designing a sampling strategy that represents the different national regions and variability of cattle in the country; developing a system for collecting and updating data and trends pertaining to livestock productivity across the country (e.g. weight, weight gain, milk productivity) to apply the enhanced characterization for the estimation of gross energy and the CH_4 conversion rate for different cattle groups across the time series; and estimating the N excretion rate for different cattle groups; and incorporating changes in the average cattle body weight across the time series (high priority)
5.A_CBN.2[a]	Specified in paragraphs 21 and 39 of the MPGs	Enhancing the accuracy and completeness of AD for crop residues and improving understanding of the estimation methodology provided in the 2006 IPCC Guidelines (medium priority)
National inventory report – LULUCF		
6.L_CBN.1[a]	Specified in paragraph 47 of the MPGs	Collecting historical and current data on the production, import and export of semi-finished HWP, including sawnwood, wood-based panels and paper and paperboard, in order to support the estimation of emissions and removals associated with carbon stock changes in HWP using the tier 1 method from the 2006 IPCC Guidelines, or justifying the insignificance of HWP, if applicable (high priority)
6.L_CBN.2	Specified in paragraph 21 of the MPGs	Developing methods for estimating areas subject to land-use conversion before 2000 to generate AD on total land area under conversion to correctly calculate carbon stock changes in mineral soils across the time series (high priority)
6.L_CBN.3	Specified in paragraph 21 of the MPGs	Improving the calculation of country-specific growth ratio(s) for "rastrojos", for both pioneer trees that transition to secondary forest and other ecosystems that remain "rastrojos" for more than five years (high priority)
6.L_CBN.4	Specified in paragraph 21 of the MPGs	Understanding the methodologies provided in the 2006 IPCC Guidelines for calculating carbon stock changes in mineral soils associated with land-use change (low priority)

ID#	*Reporting requirement*	*Area in which capacity-building is needed*
Information necessary to track progress in implementing and achieving the NDC under Article 4 of the Paris Agreement		
10_CBN.1	Specified in paragraphs 65–90 of the MPGs	Understanding the provisions of the MPGs, especially those related to tracking progress towards the NDC (high priority)
10_CBN.2	Specified in paragraph 74(b) of the MPGs	Identifying and selecting appropriate models for the construction of the baseline for the country's circumstances, understanding the data requirements for those models and learning how to operate the models (high priority)
10_CBN.3[a]	Specified in paragraph 76(b) of the MPGs	Enhancing the definition and description of indicators for tracking progress towards the NDC, developing them using better quality data and more detailed methodologies and accounting approaches, and enhancing their tracking and reporting (high priority)
11_CBN.1	Specified in paragraph 81 of the MPGs	Describing PaMs by sector in both narrative and tabular format (medium priority)
11_CBN.2	Specified in paragraph 82(d) of the MPGs	Understanding the types of instrument defined in the MPGs and how they relate to the national definitions of types of instrument (low priority)
11_CBN.3	Specified in paragraph 82(f) of the MPGs	Identifying and reporting on the sectors listed in the MPGs affected by each policy or measure (low priority)
11_CBN.4	Specified in paragraphs 83–84 of the MPGs	Identifying and assessing interactions between PaMs, as well as costs and non-GHG mitigation benefits (high priority)
11_CBN.5	Specified in paragraphs 80, 84 and 85 of the MPGs	Designing more detailed and specific PaMs, collecting data relevant to assessment of their progress, including their GHG emission impact, aggregating PaMs as appropriate, and assessing how each policy or measure contributes to achieving each NDC target (high priority)
11_CBN.6	Specified in paragraph 88 of the MPGs	Assessing and reporting on the PaMs related to international transport (low priority)
11_CBN.7	Specified in paragraph 89 of the MPGs	Assessing the long-term impact of PaMs on emissions and integrating PaMs into long-term emission scenarios (high priority)
11_CBN.8	Specified in paragraph 90 of the MPGs	Assessing the economic and social impacts of PaMs (high priority)
13_CBN.1	Specified in paragraph 93 of the MPGs	Defining projection scenarios and describing projections in the BTR and their contribution to the achievement of NDC targets (high priority)
13_CBN.2[a]	Specified in paragraph 96(a) of the MPGs	Selecting and applying appropriate models by sector for developing projections, gathering sufficient and reliable data and determining appropriate assumptions and parameters to run the models and reporting information related to those elements in the BTR (high priority)
13_CBN.3[a]	Specified in paragraphs 93–94 of the MPGs	Including the impact of PaMs in emissions scenarios and defining relevant assumptions in line with national circumstances and context (high priority)
13_CBN.4	Specified in paragraph 96(d) of the MPGs	Undertaking sensitivity analyses for projections (high priority)
13_CBN.5	Specified in paragraph 97 of the MPGs	Using projections to develop indicators for NDC progress tracking (high priority)
13_CBN.6	Specified in paragraph 95 of the MPGs	Using the latest national GHG inventory as a basis for developing projections consistently under all scenarios for at least 15 years beyond the next year ending in zero or five (high priority)
13_CBN.7	Specified in paragraphs 98–100 of the MPGs	Reporting projections on a sectoral and gas-by-gas basis, with and without LULUCF, and presenting projections relative to actual inventory data for the preceding years (high priority)

[a] Capacity-building need identified by the Party in its BTR1.

Annex

Documents and information used during the review

A. Reference documents

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

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

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

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. 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.

B. Additional information provided by the Party

Responses to questions during the review were received from Melani Paulette Acosta Chin (Ministry of Environment of Panama), including additional material. The following references were provided by Panama and may not conform to UNFCCC editorial style as some have been reproduced as received:

Ministry of Environment, Panama. 2022. *Guía de Buenas Prácticas Para la Sostenibilidad Empresarial*. Available at https://www.gacetaoficial.gob.pa/pdfTemp/29642_A/GacetaNo_29642a_20221012.pdf.

Ministry of Environment, Panama. 2022. *Guia Técnica de Cambio Climatico para Planificacion Prefactibilidad Factibilidad de Proyectos de Inversion Publica.* Available at https://www.gacetaoficial.gob.pa/pdfTemp/29565_A/92314.pdf.