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Report on the technical expert review of the first biennial transparency report of Thailand*

Addendum

Summary

This addendum to the report on the technical expert review of the first biennial transparency report of Thailand, 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 15 to 19 September 2025 in Bangkok.

* In the symbol for this document, 2024 refers to the year in which the biennial transparency report was submitted, not to the year of publication.

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AD	activity data
AR	Assessment Report of the Intergovernmental Panel on Climate Change
BOD	biochemical oxygen demand
BTR	biennial transparency report
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRT	common reporting table
CSC	carbon stock change
CTF	common tabular format
EF	emission factor
F-gas	fluorinated gas
GHG	greenhouse gas
GWP	global warming potential
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
LT-LEDS	long-term low-emission development strategy(ies)
LULUCF	land use, land-use change and forestry
MBT	mechanical-biological treatment
MCF	methane correction 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
NCV	net calorific value
NDC	nationally determined contribution
NE	not estimated
NF_3	nitrogen trifluoride
NID	national inventory document
NIR	national inventory report
NO	not occurring
PaMs	policies and measures
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
SF_6	sulfur hexafluoride
SOC	soil organic carbon
SWDS	solid waste disposal site(s)
TERT	technical expert review team
TGEIS	Thailand Greenhouse Gas Emission Inventory System
WAM	‘with additional measures’
WM	‘with measures’

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

1. Tables 1–14 present the results of the review of the consistency with the MPGs[2] of the information submitted by Thailand 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*
1.1	Specified in paragraph 3 of decision 18/CMA.1 and paragraph 38 of the MPGs	Thailand submitted its BTR1 on 26 December 2024, before the deadline of 31 December 2024 mandated in paragraph 3 of decision 18/CMA.1. However, it submitted its CRTs and CTF tables on 12 June 2025, after the deadline of 31 December 2024. During the review, the Party clarified that resource constraints and lack of capacity prevented it from finalizing the CRTs and CTF tables by the deadline. The TERT noted the delay in the Party's submission of its CRTs and CTF tables and acknowledged the clarification provided by the Party during the review. The TERT recalled the submission timeline established in paragraph 90 of decision 1/CP.21 that all Parties except for the least developed country Parties and small island developing States shall submit the information referred to in Article 13, paragraphs 7–10, of the Paris Agreement, as appropriate, no less frequently than on a biennial basis.
1.2	Specified in paragraph 6 of the MPGs	In its BTR1 (table 2-2), Thailand reported on the application of the flexibility provided for reporting a consistent annual time series of GHG inventory results starting from 1990 (as per para. 57 of the MPGs) and using the tier 2 approach for key categories. Regarding the latter, the TERT noted that the use of the tier 2 approach is not subject to flexibility as defined in the MPGs. Regarding the former, the Party also stated in the foreword to its BTR1 that it needed to make use of the flexibility provided for in paragraphs 57–58 of the MPGs to present a consistent annual time series starting from 2000 (rather than 1990); however, the Party provided no information on its application of flexibility in the dedicated CRT (Flex_Summary), nor did it clarify its capacity constraints or provide self-determined time frames for making improvements in relation to those capacity constraints. During the review, Thailand explained that it faces constraints in understanding how to apply the flexibility provided for in the MPGs. The Party identified this as a high-priority area for capacity-building and proposed timelines for such capacity-building starting from January 2026. The TERT recommends that Thailand provide complete and transparent information on its application of flexibility provided for in the MPGs, including its respective capacity constraints and self-determined time frames for making relevant improvements. The TERT notes that the Party has the option to report on its use of flexibility provisions in the dedicated CRT.
1.3	Specified in paragraph 2 of decision 5/CMA.3 in conjunction with paragraph 106 of the MPGs	In its BTR1, Thailand presented information related to climate change impacts and adaptation across multiple sections of the report, which limited the ability of the TERT to assess the information in a coherent manner.

[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*
		During the review, the Party acknowledged its relevant capacity constraints and expressed interest in enhancing the clarity and structure of future BTR submissions in this regard. The TERT encourages the Party to follow the outline in annex IV to decision 5/CMA.3 more closely in preparing its BTR, specifically by structuring the content according to the recommended chapter format, which would help to strengthen coherence, reduce fragmentation and improve transparency within the reported information.

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 19(b) of the MPGs Institutional arrangements	Thailand reported in the executive summary of its BTR1 that its GHG emissions were estimated using the TGEIS, but the BTR1 does not include further details on the TGEIS. During the review, Thailand explained that the TGEIS is a comprehensive platform that was developed to support its efforts in monitoring, reporting and verifying GHG emissions. The TGEIS was designed to align with international reporting obligations under the Paris Agreement and facilitates the compilation and management of GHG data across multiple sectors, including energy, IPPU, agriculture, forestry and waste. The TGEIS helps to enhance data transparency, consistency and accuracy by combining advanced methodologies and user-friendly interfaces for data entry and analysis. The TERT recommends that Thailand explain in its BTR the role of the TGEIS in the GHG inventory preparation, in particular by providing information on the legal and institutional basis for the establishment and operation of the TGEIS, covering laws, regulations and mandates that govern the use of the TGEIS; how the TGEIS functions within the broader national GHG inventory system, including its role in data collection, processing, QA/QC and reporting; and which and how key stakeholders, such as government agencies, data providers and technical experts, are involved in the operation and maintenance of the TGEIS, including details of their responsibilities and coordination mechanisms.
2.G.2	Specified in paragraphs 21 and 23 of the MPGs Methods	Thailand applied tier 1 methods for estimating emissions for most of the key categories in the energy, IPPU and agriculture sectors (see ID#s 3.E.1, 4.I.4 and 5.A.4 respectively) and did not provide reasons for not applying higher-tier methods. During the review, Thailand explained that lack of AD, country-specific EFs and capacity makes it challenging for it to apply higher-tier methods for estimating emissions for those key categories. The TERT recommends that the Party clearly explain the reasons for not applying higher-tier methods for estimating emissions for key categories. The TERT encourages the Party to make every effort to use higher-tier methods for estimating emissions for key categories in line with the IPCC good practice guidance and to report on how it is addressing or intends to address this issue.
2.G.3	Specified in paragraph 25 of the MPGs Key category analysis	Thailand did not report a level assessment for the key category analysis for the starting year (2000) of the time series, or the results of the key category analysis for the trend assessment excluding LULUCF. During the review, Thailand confirmed that it had not identified key categories for the starting year of the time series or for GHG emissions excluding LULUCF.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		The TERT recommends that Thailand identify and report key categories for the starting year and the latest reporting year of the time series, including and excluding LULUCF, using approach 1, for both level and trend assessment, as specified in the MPGs.
2.G.4	Specified in paragraph 29 of the MPGs Uncertainty analysis	Thailand did not quantitively estimate the uncertainties of its GHG emission estimates for the starting year of the time series for the IPPU sector (see ID# 4.I.11) or provide estimates of the uncertainty of its emission and removal estimates for all categories in the LULUCF sector (see ID# 6.L.2).
		During the review, Thailand explained that it will address these reporting issues in the future.
		The TERT recommends that Thailand quantitatively estimate and qualitatively discuss the uncertainty of the emission and removal estimates for all source and sink categories, including for the IPPU and LULUCF sectors, for at least the starting year and the latest reporting year of the inventory time series.
2.G.5	Specified in paragraph 31 of the MPGs Notation keys	In its CRTs, Thailand either did not use notation keys where numerical data were not available or used them incorrectly in many cases for reporting categories in the energy, IPPU, LULUCF and waste sectors (see ID#s 3.E.5, 4.I.5, 6.L.4 and 7.W.6 respectively).
		During the review, Thailand explained that it will address these reporting issues in the future.
		The TERT recommends that Thailand use notation keys where numerical data are not available when completing the CRTs and indicate why emissions from sources and removals by sinks and associated data for specific sectors, categories and subcategories or gases could not be reported.
2.G.6	Specified in paragraphs 34–35 of the MPGs QA/QC and verification	Thailand did not provide a description of its inventory QA/QC plan in accordance with the MPGs and the 2006 IPCC Guidelines (vol. 1, chap. 6).
		During the review, Thailand explained that it has internal sectoral QA/QC guidance and protocols in place. Furthermore, the GHG inventory data are subject to QA/QC at stakeholder meetings during the BTR preparation.
		The TERT recommends that Thailand elaborate an inventory QA/QC plan in accordance with the MPGs and the 2006 IPCC Guidelines (vol. 1, chap. 6). The TERT also recommends that the Party implement and provide information on general inventory QC procedures in accordance with that inventory QA/QC plan.
2.G.7	Specified in paragraph 35 of the MPGs CRTs	The estimates of total national GHG emissions (both excluding and including LULUCF) reported by Thailand in its BTR1 (table 2-4) are not consistent with the data reported in CRT 10s1 for 2020–2022. The estimates of total sectoral GHG emissions reported for 2020–2022 in the BTR1 for all sectors except agriculture also deviate from the data in the CRTs (see also ID#s 4.I.9 and 7.W.1).
		During the review, Thailand clarified that the data on total national and sectoral GHG emissions reported in its BTR1 are correct. It attributed the discrepancies with the data in the CRTs to technical challenges encountered when transferring data from the TGEIS to the format used in the CRTs. Thailand indicated its intention to revise the data in the CRTs in future to ensure accuracy.
		The TERT recommends that Thailand enhance the consistency of its GHG emission reporting by ensuring that accurate and harmonized GHG emission data are presented across the BTR and the CRTs.
2.G.8	Specified in paragraph 35 of the MPGs QA/QC and verification	Thailand indicated in the sector-specific sections of chapter 2 of its BTR1 that it has developed category-specific QA/QC procedures for all sectors.
		During the review, Thailand explained that it has prepared category-specific guidance documents that include QA/QC procedures that should be applied during the estimation of AD and emissions. It was unclear to the TERT whether these procedures were implemented as documented, including for

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		the IPPU, LULUCF and waste sectors (see ID#s 4.I.3, 6.L.3 and 7.W.15 respectively). The Party expressed interest in strengthening its QA/QC procedures, particularly in relation to QC by data owners, but noted that it faces challenges in this regard due to a lack of capacity-building support. The TERT encourages Thailand to implement and report category-specific QA/QC procedures, particularly for the IPPU, agriculture, waste and LULUCF sectors, and to document the outcomes of the QA/QC processes it implements.
2.G.9	Specified in paragraph 38 of the MPGs CRTs	Thailand's BTR1 covers the national GHG inventory for 2000–2022 (see BTR1 table 2-4). As mentioned in the BTR1 (table 2-2), the Party applied the flexibility provided for in paragraph 57 of the MPGs and therefore did not estimate or report GHG emissions for 1990–1999. However, the CRTs submitted by Thailand cover 2020–2022 only. The TERT noted that, in accordance with the MPGs, each Party shall provide an NIR of anthropogenic emissions by sources and removals by sinks of GHGs, which comprises the NID and the CRTs. During the review, Thailand explained that the CRTs for 2000–2019 are being prepared and will be submitted in the future. The TERT recommends that Thailand submit CRTs covering the same reporting years as those included in the BTR.
2.G.10	Specified in paragraph 39 of the MPGs NID	The reporting of the methods used to compile the national GHG inventory, as well as the descriptions, assumptions, references and sources of information used for the EFs and AD applied, is lacking transparency in Thailand's BTR1 across all sectors (see ID#s 3.E.4 and 3.E.11 for the energy sector, ID# 4.I.7 for the IPPU sector, ID# 5.A.1 for the agriculture sector, ID#s 6.L.7 and 6.L.13 for the LULUCF sector and ID#s 7.W.2, 7.W.4, 7.W.5, 7.W.7, 7.W.8, 7.W.10, 7.W.11, 7.W.12, 7.W.14, 7.W.15 and 7.W.17 for the waste sector). During the review, Thailand explained that it will address these reporting issues in the future. The TERT recommends that Thailand improve the general transparency of its reporting by describing the methods used, including the rationale for the choice of methods, in accordance with the 2006 IPCC Guidelines, and the descriptions, assumptions, references and sources of information used for the EFs and AD applied, to compile the national GHG inventory.
2.G.11	Specified in paragraphs 45 and 47 of the MPGs Completeness	Thailand did not estimate emissions and/or removals for a number of source and sink categories for which IPCC default methodologies are available in the energy (see ID# 3.E.5), IPPU (see ID# 4.I.1), agriculture (see ID# 5.A.2), LULUCF (see ID#s 6.L.4, 6.L.5, 6.L.6, 6.L.8, 6.L.9, 6.L.10, 6.L.11 and 6.L.12) and waste (see ID# 7.W.13) sectors, and did not provide any rationale for not estimating these emissions and/or removals. During the review, Thailand explained that it is lacking AD and capacity for estimating emissions and/or removals for those sources and sinks. The TERT recommends that Thailand collect AD for the sources and sinks that were not considered and estimate and report the relevant GHG emissions and/or removals. If this is not possible, the TERT recommends that the Party explain the reasons for the lack of completeness of its inventory, including by providing information on any methodological or data gaps, in accordance with paragraphs 30–33 of the MPGs.

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 21 and 23 of the MPGs	The TERT noted that the methodology used to estimate emissions for key categories in the energy sector is not in accordance with the decision trees in the 2006 IPCC Guidelines (vol. 2, chaps. 2–4). BTR1 table 2-11 indicates that Thailand applied tier 1 methods and default EFs to estimate

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
	1. General (energy sector) – CO_2, CH_4 and N_2O	emissions for all categories and gases in the energy sector; however, BTR1 tables 2-6–2-7, which present the results of the key category analysis by level and trend respectively, both include key categories in the energy sector. During the review, the Party pointed to its lack of resources and need for capacity-building for adopting a higher-tier method for estimating emissions for key categories in the energy sector, particularly for improving its data-collection system to allow it to gather AD at a disaggregated level and elaborate country-specific EFs. The TERT encourages the Party to make every effort to use higher-tier methods for estimating emissions for key categories in the energy sector, in accordance with the 2006 IPCC Guidelines.
3.E.2	Specified in paragraph 31 of the MPGs 1. General (energy sector) – liquid, gaseous and solid fuels – all gases	In CRT 9, the Party used "NE" to report emissions for subcategories 1.A.3.b.ii light-duty trucks, 1.A.3.b.iii heavy-duty trucks and buses, 1.A.3.b.iv motorcycles, 1.A.4.c.ii off-road vehicles and other machinery, 1.A.4.c.iii fishing, 1.A.5.a stationary, 1.D.2 multilateral operations and 1.D.4 CO_2 captured. However, no explanatory information on constraints preventing the Party from estimating emissions for these subcategories is included in the BTR1 or CRT 9. During the review, the Party clarified that "IE" should be used for reporting the emissions for subcategories 1.A.3.b.ii light-duty trucks, 1.A.3.b.iii heavy-duty trucks and buses and 1.A.3.b.iv motorcycles, since the Party used a tier 1 method with default EFs for estimating emissions for subcategory 1.A.3.b road transportation. The Party further clarified that "IE" should also be used for reporting the emissions for subcategories 1.A.4.c.ii off-road vehicles and other machinery, 1.A.4.c.iii fishing, 1.A.5.a stationary and 1.D.2 multilateral operations. To improve transparency, the TERT recommends that the Party correct the use of notation keys in line with the MPGs by changing "NE" to "NO" for subcategories 1.A.3.b.ii light-duty trucks, 1.A.3.b.iii heavy-duty trucks and buses, 1.A.3.b.iv motorcycles, 1.A.4.c.ii off-road vehicles and other machinery, 1.A.4.c.iii fishing and 1.D.4 CO_2 captured and "NE" to "IE" for subcategories 1.A.5.a stationary and 1.D.2 multilateral operations. The TERT also recommends that the Party explain in detail its reasons for using specific notation keys in the BTR and CRT 9.
3.E.3	Specified in paragraphs 45 and 47 of the MPGs 1. General (energy sector) – peat and other fossil fuels – all gases	Thailand provided incomplete estimates of emissions for subcategories 1.A.1.a public electricity and heat production, 1.A.2 manufacturing industries and construction and 1.A.4 other sectors by reporting "NE" in CRT 1.A(a) for emission estimates for all gases from the combustion of peat and other fossil fuels. It did not provide any explanatory information in the BTR1 or CRT 9 on constraints preventing it from estimating emissions from combustion of peat and other fossil fuels. During the review, the Party clarified that a technical error occurred with the GHG inventory reporting tool for reporting under the enhanced transparency framework and incorrect information was reported in CRT 1.A(a). The Party indicated that the notation key used for reporting emissions from combustion of other fossil fuels will be changed to "IE" in the next inventory submission. To improve the transparency and completeness of the reporting, the TERT recommends that the Party make every effort to collect data on the combustion of peat and other fossil fuels, if these are not included elsewhere; apply the methodology from the 2006 IPCC Guidelines (vol. 2, chap. 2) to provide relevant emission estimates; or provide detailed information in the BTR and CRT 9 on the use of "NE" and "IE", indicating clearly why emissions from sources and associated data were not reported.
3.E.4	Specified in paragraph 39 of the MPGs	Thailand provided incomplete estimates of emissions for subcategory 1.A.1.b petroleum refining, indicating in its BTR1 (table 2-16) that only 6 per cent of its total amount of refined crude oil was used for energy purposes for oil refining in 2020–2022. The amount of oil refined in 2022

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	1.A.1.b Petroleum refining – liquid fuels – CO_2, CH_4 and N_2O	reported in the BTR1 (59,926 ML) differs significantly from the amount reported in CRT 1.B.2 (57,248 10^3 m^3). Moreover, according to the energy balance of Thailand, 4,624 ML crude oil was produced domestically, 52,998 ML was imported and 780 ML was exported, resulting in a total of 56,842 ML crude oil being supplied to the Thai economy in 2022. The BTR1 (table 2-16) states that the NCV of crude oil is 36.33 TJ/ML without indicating the source of this information. It should also be noted that in the BTR1 this NCV is not compared with the default value of 42.3 TJ/Gg provided in the 2006 IPCC Guidelines (vol. 2, chap. 1, p.1.8). The BTR1 also does not provide any information on the EFs used to estimate emissions from the combustion of crude oil for energy purposes. Further, the TERT noted that, owing to the complexity of the oil refining process, other types of fuel may also be combusted during this process. During the review, the Party explained that, owing to the absence of detailed information on types of fuel combusted during oil refining, it followed the tier 1 approach from the 2006 IPCC Guidelines (vol. 2, chap. 2), which indicates that the fuel combusted within petroleum refineries typically amounts to 6–10 per cent of the total fuel input to the refinery, depending on the complexity and vintage of the technology. Thailand further explained that the NCV of crude oil of 36.33 TJ/ML is reflected in its energy balance. The Party clarified that discrepancies in the AD used for oil input to refineries are due to the information being from different sources. Specifically, the amount of oil refined reported in the BTR1 (table 2-16) was obtained from the Department of Mineral Fuels, while the AD in CRT 1.B.2 were obtained from the energy balance table reported by the Department of Alternative Energy Development and Efficiency. The Party provided information on its ongoing discussions with relevant institutions relating to how it will improve and update the AD for the next inventory submission. To improve the transparency of the reporting, the TERT recommends that the Party report detailed information on the methods used, including the rationale for the choice of methods, and the descriptions, assumptions, references and sources of information used for the EFs, NCVs and AD used, to estimate emissions for subcategory 1.A.1.b petroleum refining, while ensuring internal consistency of the data used within the sector.
3.E.5	Specified in paragraph 47 of the MPGs 1.A.1.c Manufacture of solid fuels and other energy industries – CO_2, CH_4 and N_2O	The Party left blank cells in CRT 1.A(a)s1 for all fuels and emission estimates for subcategory 1.A.1.c manufacture of solid fuels and other energy industries. According to the energy balance of Thailand 13,641 and 21,534 kt coal were produced and imported in 2022 respectively, which may lead to emissions from fuel use during the manufacture of secondary and tertiary products from solid fuels, including the production of charcoal. In addition, the TERT noted that oil and gas production activities in Thailand may lead to emissions from on-site fuel use for oil and gas extraction and the processing and upgrading of natural gas, as indicated in the 2006 IPCC Guidelines (vol. 2, chap. 2, table 2.1). During the review, the Party clarified that consultations with relevant institutions are under way with a view to developing the necessary data-collection framework for this subcategory. To improve the completeness of the reporting, the TERT recommends that the Party collect AD for subcategory 1.A.1.c manufacture of solid fuels and other energy industries, use methods from the 2006 IPCC Guidelines to estimate the associated emissions and explain in detail the NCVs and EFs used for the estimation.
3.E.6	Specified in paragraph 54 of the MPGs Feedstocks, reductants and other non-energy use of fuels – CO_2	The TERT noted that the information reported by the Party on feedstocks, reductants and other non-energy use of fuels is not completely in line with the 2006 IPCC Guidelines (vol. 2, chap. 6.6). In CRT 1.A(d), the Party reported "NO" for quantities of all fuels, except waste (non-biomass fraction) and biomass, which it reported as "NE". No information on the use of notation keys was provided in the BTR1. Nevertheless, CRT 2(I).A-H provides information on the consumption of lubricants, as well as the production of ethylene and the production of petrochemicals and carbon

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		black. According to the energy balance of Thailand, 3,679 and 2,114 ML condensate were produced domestically and imported in 2022 respectively, with no stock changes reported in the same year, but the BTR1 does not include any information on condensate consumption. Nevertheless, according to publicly available information, Thailand uses condensates as refinery feedstocks for the manufacture of products such as petrol (gasoline), jet fuel, diesel and heating fuels, as well as for the manufacture of ethylene. During the review, the Party provided information on constraints related to the collection of AD on feedstocks, reductants and other non-energy use of fuels. No additional rationale was provided for not estimating fuel quantities for the non-energy use of waste (non-biomass fraction) and biomass. To improve the accuracy and transparency of the reporting, the TERT encourages the Party to make every effort to collect AD for reporting in CRT 1.A(d), to use methods from the 2006 IPCC Guidelines to estimate the carbon content of the fuels and petrochemicals produced domestically, to exclude carbon stored from the estimation of fuel combustion using the reference approach in CRT 1.A(b) and to clearly document in the BTR and CRT 1.A(d) where the emissions from non-energy use of fuels are reported in the inventory.
3.E.7	Specified in paragraphs 26 and 28 of the MPGs 1.B.2 Oil, natural gas and other emissions from energy production – CO_2 and CH_4	The TERT observed a sudden increase in fugitive CO_2 and CH_4 emissions for subcategory 1.B.2 oil and natural gas and other emissions from energy production for 2011–2014. The BTR1 (p.2-53) provides information on trends in fugitive CO_2 and CH_4 emissions for 2000–2022. According to BTR1 figure 2-28, fugitive CH_4 emissions for subcategory 1.B.2 reached their highest level of 12,500.02 kt CO_2 eq in 2013, before decreasing to 7,929.46 kt CO_2 eq in 2022. Fugitive CO_2 emissions reached almost 12 kt CO_2 eq in 2013, before decreasing sixfold in 2022. The BTR1 does not explain why such fluctuations in fugitive CO_2 and CH_4 emissions took place in 2011–2014. During the review, the Party indicated that it will check and update the estimation of fugitive CO_2 emissions from oil and gas operations as well as the amount of oil and gas produced for the BTR2. To ensure the consistency of the information reported for the entire time series, the TERT encourages the Party to make every effort to explain the trend in fugitive CO_2 and CH_4 emissions from oil and gas operations and, if a lack of time-series consistency is identified, perform recalculations in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 6), ensuring that changes in emission trends are not introduced as a result of changes in methods or assumptions used across the time series.
3.E.8	Specified in paragraph 36 of the MPGs Fuel combustion – reference approach – CO_2	CRT 1.A(b) for 2022 does not include AD for primary fuel production by fuel type or AD for fuel exports, imports, stock change or non-energy use for most fuels. The Party reported waste (non-biomass fraction) and peat as "NE". Consequently, in CRT 1.A(c), "NA", "NE" and "NO" are reported for apparent energy consumption and CO_2 emissions for all fuel types (liquid, solid and gaseous fuels), which in turn results in a –100 per cent difference between the estimates of CO_2 emissions from fuel combustion calculated using the reference approach and the sectoral approach. Nevertheless, AD for the production of solid fuels during surface coal mining and AD for oil and natural gas production are provided in CRTs 1.B.1 and 1.B.2 respectively. Detailed information on production, import, export and stock change for all fuel types is provided in the energy balance of Thailand. Moreover, the BTR1 (p.2-25) states that there is a 21.6 per cent difference between the estimates of CO_2 emissions from fuel combustion calculated using the reference approach and the sectoral approach. During the review, the Party explained that a technical error occurred during the transfer of information from the TGEIS to the CRTs. To improve the transparency and completeness of the reporting, the TERT encourages the Party to make every effort to compare the national estimates

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		of CO_2 emissions from fuel combustion with those obtained using the reference approach and report the results of this comparison in the BTR.
3.E.9	Specified in paragraph 31 of the MPGs 1.A.3.a Domestic aviation – all gases	In CRT 1.A(a)s3, the Party reported emissions of all gases from combustion of biomass and aviation gasoline for subcategory 1.A.3.a domestic aviation as "NE". However, the BTR1 does not explain the use of "NE". During the review, the Party clarified that combustion of biomass and aviation gasoline did not occur for domestic aviation and stated that "NO" will be reported in the next inventory submission. To improve the transparency of the reporting, the TERT recommends that the Party provide in its BTR detailed information on the use of notation keys in both the NID and CRT 9, indicating clearly why emissions from biomass and aviation gasoline under subcategory 1.A.3.a domestic aviation are not reported.
3.E.10	Specified in paragraph 31 of the MPGs 1.A.3.d Domestic navigation – all gases	In CRT 1.A(a)s3, the Party reported emissions of all gases from combustion of residual fuel oil, gaseous fuels and gasoline for subcategory 1.A.3.d domestic navigation as "NE". However, the BTR1 does not explain the use of "NE". During the review, the Party clarified that combustion of residual fuel oil, gaseous fuels and gasoline did not occur for domestic navigation and stated that "NO" will be reported in the next submission. To improve the transparency of the reporting, the TERT recommends that the Party provide in its BTR detailed information on the use of notation keys in both the NID and CRT 9, indicating clearly why emissions from combustion of residual fuel oil, gaseous fuels and gasoline under subcategory 1.A.3.d domestic navigation are not reported.
3.E.11	Specified in paragraphs 39–40 of the MPGs 1. General (energy sector) – use of biofuels – all gases	For subcategories 1.A.3.b road transportation and 1.A.2 manufacturing industries and construction, the Party provided information on the use of biofuels in its BTR1 (tables 2-20 and 2-27), but did not provide information on the types of biofuel, NCVs and EFs used to estimate emissions for these subcategories. During the review, the Party clarified the types of biofuel and NCVs used for road transportation. According to the Party, bioethanol (produced from molasses and cassava) is blended with gasoline to make three types of gasohol (E10, E20 and E85). Bio-oil (produced from palm oil) is blended with diesel to make three types of biodiesel (B7, B10 and B20). All of these gasohol and biodiesel fuels are used in road transportation. NCVs are applied in accordance with the energy statistics published by the Department of Alternative Energy Development and Efficiency (2023). The Party explained that CH_4 and N_2O EFs for subcategory 1.A.2 manufacturing industries and construction were applied according to the tier 1 approach from the 2006 IPCC Guidelines (vol. 2, chap. 2) as default for bioethanol and bio-oil and corrections to the share of biofuels in the fuel mix were made. To improve the accuracy and transparency of the reporting, the TERT recommends that the Party report detailed information on the methods used, including the rationale for the choice of methods and the descriptions used for the types of biofuel, as well as detailed information on the NCVs and EFs used and the assumptions made for AD when estimating and reporting emissions from biofuels for the energy sector.
3.E.12	Specified in paragraph 45 of the MPGs 1. General (energy sector) – gaseous fuels – all gases	The Party reported emissions for subcategory 1.B.2.c venting and flaring as "NE", but did not explain the constraints preventing it from estimating emissions for this subcategory in the BTR1 or CRT 9. During the review, the Party clarified that it is in the process of collecting information from relevant institutions to assist it in estimating emissions for subcategory 1.B.2.c venting and flaring, but that it still needs capacity-building support to provide estimates for this subcategory. To improve the transparency of the reporting, the TERT recommends that the Party provide detailed information in its BTR and CRT 9 on the use of "NE"

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		for reporting emissions for subcategory 1.B.2.c, indicating clearly why emissions from sources and associated data for the subcategory are not reported.

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 30, 31, 45, 47 and 48 of the MPGs 2. General (IPPU) – PFCs and NF_3	The Party did not report PFC or NF_3 emissions for the IPPU sector, which is mandatory according to the MPGs (in the case of NF_3, the Party did not state that it was applying flexibility in relation to the reporting of this gas). Furthermore, no explanations or notation keys to indicate whether the emissions were "NE", "IE" or "NO" were provided in accordance with the MPGs. During the review, the Party clarified that it imports PFCs, but that no estimates of emissions have been made owing to a lack of information on the types of equipment for which the PFCs have been used. In the case of NF_3, the Party indicated that this gas was likely being used in electronics manufacturing but that no AD were available. The TERT recommends that the Party investigate the use of PFCs and NF_3 in the country, and collect the necessary information to estimate and report the relevant emissions in the inventory. The TERT also recommends that the Party report the reasons for the lack of completeness of this reporting in its NID or BTR and report an appropriate notation key for the omitted emission estimate as well as an explanation in CRT 9.
4.I.2	Specified in paragraphs 26, 28 and 47 of the MPGs 2. General (IPPU) – CO_2, CH_4, N_2O and SF_6	The Party reported limited information on emission trends in the IPPU sector in its BTR1 and did not provide reasons for significant fluctuations in emissions. For example, BTR1 figure 2-55 shows a 770 per cent increase in SF_6 emissions from electrical equipment between 2019 and 2022. The Party noted the dramatic increase in emissions but did not provide any information on the key drivers of this increase. The BTR1 includes other such instances where fluctuations in emissions displayed in figures are not explained, such as CO_2 emissions for subcategories 2.A.3 glass production (figure 2-37), 2.A.4.b other uses of soda ash (figure 2-38), 2.B.8.c ethylene dichloride and vinyl chloride monomer (figure 2-44), 2.C.1 iron and steel production (figure 2-49) and 2.D.1 lubricant use (figure 2-51), as well as N_2O emissions for subcategory 2.B.2 nitric acid production (figure 2-41) and CO_2 and CH_4 emissions for subcategory 2.B.8.f carbon black (figure 2-46). During the review, the Party explained that AD on emission trends were supplied by the Department of Industrial Works and no further explanation for the fluctuations in AD levels was available. The TERT recommends that the Party clearly explain fluctuations in emission levels in the IPPU sector between inventory years, including by providing information on key drivers for AD trends such as operational circumstances like temporary or permanent plant closures, changes in domestic or international demand for industrial products and other temporary or permanent impacts. If a lack of time-series consistency is identified, the TERT also recommends that the Party perform recalculations of emission estimates in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 6), ensuring that changes in emission trends are not introduced as a result of changes in methods or assumptions used across the time series.
4.I.3	Specified in paragraph 35 of the MPGs 2. General (IPPU)	The Party provided limited information on category-specific QA/QC procedures applied for categories in the IPPU sector. During the review, the Party provided more information on category-specific QC procedures supposed to be undertaken by data owners and the sectoral working group, including a detailed workflow chart. However, the Party indicated that these procedures were not strictly followed and reasons

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		for unusual fluctuations in AD and associated emission estimates were not documented. The TERT encourages the Party to enhance and fully describe its category-specific QA/QC procedures for categories in the IPPU sector, for example by ensuring that the data owners and sectoral working group provide clear reasons for fluctuations in AD in writing so that this can be included in the NID or BTR.
4.I.4	Specified in paragraphs 21 and 23 of the MPGs 2. General (IPPU) – CO_2, CH_4 and HFCs	The TERT noted a lack of explanation in the BTR1 for applying tier 1 estimation methods for key categories within the IPPU sector (subcategory 2.B.8 petrochemical and carbon black production and category 2.F product uses as substitutes for ozone-depleting substances). During the review, the Party explained that a lack of suitable AD prevented it from complying with the MPGs. The TERT recommends that the Party clearly explain why it applied tier 1 methods for estimating emissions from key categories. The TERT encourages the Party to make every effort to use higher-tier methods for estimating emissions for key categories in line with the 2006 IPCC Guidelines (vol. 1, chap. 6) and to report how it is addressing or intends to address this issue.
4.I.5	Specified in paragraph 31 of the MPGs 2. General (IPPU)	The TERT noted a large number of blank cells in the CRTs for the IPPU sector (CRTs 2(I)–2(II).B-Hs2) that were not populated with notation keys where numerical values were not available. During the review, the Party indicated that technical problems prevented it from populating the cells with notation keys in the CRTs. The TERT recommends that the Party ensure that all cells of the CRTs for the IPPU sector for which numerical data are not available are populated with appropriate notation keys.
4.I.6	Specified in paragraph 20 of the MPGs 2. General (IPPU)	In the introductory text on the methodology used for estimating emissions from the IPPU sector in the BTR1 (p.2-57), the Party indicated that it used the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* in addition to the 2006 IPCC Guidelines. During the review, the Party indicated that the above-mentioned guidance was used for certain input parameters for the IPPU uncertainty analysis. The TERT recommends that the Party update the relevant text and its uncertainty analysis on the basis of the 2006 IPCC Guidelines.
4.I.7	Specified in paragraphs 39–40 of the MPGs 2.F Product uses as substitutes for ozone-depleting substances – HFCs	The Party reported AD and emissions from stocks only and only one HFC species per subcategory under category 2.F product uses as substitutes for ozone-depleting substances in the CRTs. The Party did not report detailed information in its NID on the AD used to estimate emissions for this category, such as the fact that all F-gases consumed in Thailand are imported and trade data are collected under customs regulations and as part of the process of allocating the F-gases consumed to equipment types. During the review, the Party clarified that no F-gases are produced in the country and that the consumption of F-gases is based on the net imports and exports of gas reported under trade regulations. The TERT recommends that the Party provide a more detailed description of the AD for estimating F-gases, such as the fact that all F-gases consumed in Thailand are imported and information on how trade data collected under customs regulations and as part of the process of allocating the F-gases consumed to equipment types are used to estimate emissions for category 2.F product uses as substitutes for ozone-depleting substances, consistent with the information provided during the review.
4.I.8	Specified in paragraph 27 of the MPGs 2.A.2 Lime production – CO_2	The Party provided estimates of emissions for subcategory 2.A.2 lime production for 2011–2022 based on the quantity of limestone used in lime production.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		During the review, the Party explained that this was due to a lack of disaggregated limestone AD to support the estimation of production and emissions. The TERT understands that data for prior to 2011 are available on industrial rock, which includes limestone. To ensure time-series consistency, the TERT encourages the Party to examine whether data on industrial rock can be used to derive data on lime production and associated emission estimates for prior to 2011 or whether it can use other methods consistent with the splicing techniques provided in the 2006 IPCC Guidelines to estimate the emission values missing as a result of the lack of AD.
4.I.9	Specified in paragraph 35 of the MPGs 2.G.1 Electrical equipment – SF_6	The TERT noted an inconsistency in the SF_6 AD reported for subcategory 2.G.1 electrical equipment between BTR1 table 2-92 and CRT 2(II).B-Hs2 for 2020, 2021 and 2022. The AD differ by a factor of 1,000 for all three years. During the review, the Party acknowledged the discrepancy and agreed to investigate and resolve the issue. The TERT recommends that the Party enhance its QA/QC measures and resolve this inconsistency.
4.I.10	Specified in paragraphs 20 and 47 of the MPGs 2.G.1 Electrical equipment – SF_6	The Party estimated emissions from the manufacture only of insulated switch gear using the IPCC tier 1 EF of 0.29. No emissions from stocks or disposal were estimated. The 2006 IPCC Guidelines provide for the concept of a composite EF under category 2.F product uses as substitutes for ozone-depleting substances but not 2.G other product manufacture and use, for which they instead provide default EFs for manufacture, use and disposal. The TERT noted that emissions and AD were misallocated to emissions from stocks rather than emissions from manufacturing in CRT 2(II).B-Hs2. During the review, the Party indicated that it will examine and resolve this issue for the next submission. The TERT recommends that the Party account for emissions from all phases of the insulated switch gear life cycle in line with the 2006 IPCC Guidelines (vol. 3, chap. 8, table 8.4) and ensure that emissions are reported in the appropriate cells in CRT 2(II).B-Hs2.
4.I.11	Specified in paragraph 29 of the MPGs 2. General (IPPU)	The Party did not provide an uncertainty estimate for the starting year of the IPPU inventory (2000) in accordance with the MPGs. The Party provided uncertainty estimates for 2020–2022 only in BTR1 table 2-54. It is unclear if the overall inventory uncertainty reported in BTR1 table 2-5 for 2000–2022 includes the uncertainty for the IPPU sector. During the review, the Party clarified that the uncertainty for the IPPU sector was not included in the BTR1 owing to capacity constraints and stated that it plans to include this information in its BTR2. The TERT recommends that the Party provide uncertainty estimates for the starting year of the time series for the IPPU sector.

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. General (agriculture) – CO_2, CH_4 and N_2O	In the BTR1 (e.g. p.2-111), the AD and EFs used for assessing GHG emissions in the agriculture sector and the livestock population characteristics were obtained from annual reports and literature reviews (more than 15 articles in national journals and manuals), expert opinions mainly from the Department of Livestock Development and IPCC default EFs. No references to those sources were identified in the BTR1, meaning that it is not possible to assess whether the metrics used are robust. During the review, the Party submitted numerous reports, assessments and other data used for the estimates to justify the use of the AD and EFs for the sectoral estimations. However, all the information was provided in Thai, which made it difficult for the TERT to validate its use.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		The TERT recommends that the Party transparently explain the data and/or parameters selected and provide descriptions, assumptions, references and sources of information used for the EFs and AD applied to compile the GHG emission estimates for the agriculture sector and any verification performed (e.g. by comparing them with default EFs or values from similar countries in the region).
5.A.2	Specified in paragraphs 45 and 47 of the MPGs 3.D Direct and indirect N_2O emissions from agricultural soils – N_2O 3.E Prescribed burning of savannahs – CO_2, CH_4 and N_2O	In its BTR1 and CRTs, the Party did not report emissions from sewage sludge applied to soils (subcategory 3.D.1.b.ii other organic fertilizers applied to soils, see ID# 7.W.2), nor did it report emissions for subcategories 3.D.1.e mineralization/immobilization associated with loss/gain of soil organic matter or 3.D.1.f cultivation of organic soils (i.e. histosols) or category 3.E prescribed burning of savannahs, despite estimation methods being provided in the 2006 IPCC Guidelines. No explanation was provided for their exclusion from the BTR1. During the review, the Party reported that no estimations of GHG emissions were provided for those (sub)categories owing to the lack of AD or the scarcity of organic soils and savannah areas in Thailand. The TERT recommends that the Party provide estimations of GHG emissions from these (sub)categories and report those estimates in its BTR and CRTs. If this is not possible, the TERT recommends that the Party provide the reasons for the lack of completeness of this reporting, including information on any gaps in emission sources, or demonstrate the insignificance of the (sub)categories in terms of their emission level in accordance with paragraph 32 of the MPGs.
5.A.3	Specified in paragraph 27 of the MPGs 3.G Liming – CO_2	In its BTR1 (figure 2-62), the Party reported CO_2 emissions from the application of lime on farmland for 2011–2021 without clarifying the reasons for this reduced time series. During the review, the Party indicated that there are no national data on the amount of lime applied prior to 2011; however, it indicated that this practice has been decreasing year after year since 2011. To ensure a consistent time series, the TERT encourages the Party to use methods consistent with the splicing techniques provided in the 2006 IPCC Guidelines to estimate the emission values missing as a result of the lack of AD for liming.
5.A.4	Specified in paragraph 23 of the MPGs 3. General (agriculture)	In the sections of the BTR1 on category-specific planned improvements across all categories in the agriculture sector, the Party mentioned various requirements for improving its application of tier 2 methods for estimating GHG emissions. However, it did not indicate how these improvements are progressing and whether these requirements have already been included in a sector improvement plan, which contains, at a minimum, a schedule and budget. During the review, no document could be identified that contains a list of such improvements. The TERT encourages the Party to develop a detailed improvement plan for the agriculture sector inventory, indicating at a minimum the time and resources required to implement the improvements.

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 paragraphs 20 and 47 of the MPGs Land representation	Thailand used approach 1 for land representation but did not report areas for any land-use or land-use change categories under forest land, cropland, grassland, wetlands, settlements and other land in CRTs 4.1 and 4.A–4.E, although CSCs were reported for some categories. In its BTR1 (table 1-2), Thailand presented areas of agricultural land, wetlands, forest land and other land, referencing a 2023 report on the national state of the environment by the Office of Natural Resources and Environmental Policy and Planning. The Party also referred to several

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		sources of AD for the LULUCF sector in BTR1 table 2-181. The TERT noted that, according to the 2006 IPCC Guidelines (vol. 4, chap. 3, p.3.6), all land definitions and classifications should be specified at the national level, described in a transparent manner and applied consistently over time. During the review, Thailand explained that area data per land-use category and soil surveys, providing relevant data for reporting and monitoring land-use changes with national coverage, are available from the Land Development Department and the Geo-Informatics and Space Technology Development Agency. Further, the Party indicated that capacity-building is needed to use these data for approach 3 for land representation and to construct a system for tracking and reporting land-use changes, both historically and going forward. The TERT recommends that Thailand estimate and report areas of all land uses and land-use changes in CRT 4.1 with complete national coverage and disaggregate these areas into areas of mineral and organic soils by classifying them into the appropriate land-use categories in CRTs 4.A–4.F. The TERT also recommends that the Party provide detailed information on land-use definitions, data sources, approaches and methods used for land representation and the construction of land matrices. The TERT further recommends that Thailand construct a complete time series for reporting historical and future land use and land-use changes for all six land-use categories to enable it to estimate and report emissions and removals from all carbon pools.
6.L.2	Specified in paragraphs 29 and 44 of the MPGs 4. General (LULUCF)	In its BTR1 (figure 2-101), Thailand quantified the total uncertainty for the LULUCF sector inventory for 2000–2022 and reported that subcategory 4.B.1 cropland remaining cropland contributes significantly to this overall uncertainty. However, Thailand did not provide uncertainty estimates by source or sink category, nor include methodological information on how uncertainties were estimated or information on the sources of the data. During the review, Thailand explained that uncertainty was estimated for all reported sinks and sources in the LULUCF sector in accordance with the 2006 IPCC Guidelines (vol. 4, chaps. 3–5) and specified the AD and EFs used. The TERT recommends that Thailand report uncertainty estimates for all sinks and sources in the LULUCF sector for the starting year and latest reporting year of the time series and describe the methods and underlying assumptions used for the analysis.
6.L.3	Specified in paragraph 35 of the MPGs 4. General (LULUCF)	In its BTR1 (pp.2-231–2-232), Thailand provided a workflow description for LULUCF estimates, including aspects related to QA/QC. However, it provided insufficient information on category-specific QA/QC procedures for LULUCF. The TERT noted that the 2006 IPCC Guidelines (vol. 1, chap. 6) provide information on how category-specific QA/QC procedures for LULUCF should be implemented. During the review, the Party explained that a LULUCF working group of stakeholders and data providers has been established to undertake category-specific QA/QC procedures, particularly related to the review of AD and EFs. However, systematic QC procedures specific to the LULUCF sector have not been set up or documented. The TERT encourages the Party to enhance its LULUCF-specific QA/QC procedures in accordance with the 2006 IPCC Guidelines by establishing systematic quality checks of the CRTs and NID or BTR and clarifying in the NID or BTR the role of the LULUCF working group in terms of QA/QC.
6.L.4	Specified in paragraphs 31 and 47 of the MPGs 4.A Forest land 4.B Cropland 4.C Grassland – CSC/CO_2 – dead organic matter (deadwood and litter)	The Party did not report CSCs in deadwood or litter for category 4.A forest land in CRT 4.A or dead organic matter for categories 4.B cropland and 4.C grassland in CRTs 4.B and 4.C. However, in its BTR1 (p.2-229), Thailand mentioned that deadwood and litter were not estimated for areas in a "remaining" land-use subcategory. According to the methodology in the 2006 IPCC Guidelines (vol. 4, chap. 4, p.4.20, and chap. 5, p.5.13), CSCs in the dead organic matter carbon pool are assumed to be in a steady state under tier 1. During the review, Thailand explained that a tier 1 method was used for deadwood and litter in category 4.A forest land and for dead organic matter in

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		category 4.B cropland and it is thereby assumed that CSCs in litter and deadwood can be approximated to zero. The TERT recommends that Thailand report the CSCs in deadwood and litter in CRT 4.A and in dead organic matter in CRTs 4.B and 4.C as "NA" if the steady-state condition is applicable and provide information in the NID or BTR to justify how emissions and removals do not occur from deadwood, litter and dead organic matter. The TERT also recommends that the Party consider areas "remaining" and under conversion separately so that it can report data in the CRTs under the "remaining" and "converted to" land-use subcategories.
6.L.5	Specified in paragraphs 20 and 47 of the MPGs 4.A Forest land 4.B Cropland 4.C Grassland – CSC/CO_2 – organic soils 4(II) Emissions/removals from drainage and rewetting and other management of organic/mineral soils – N_2O and CH_4	The Party did not report net CSCs in organic soils for categories 4.A forest land, 4.B cropland or 4.C grassland in CRTs 4.A–4.C, or N_2O and CH_4 emissions from drained organic soils in CRT 4(II). Further, no information was provided to explain the exclusion of this information. The 2006 IPCC Guidelines (vol. 4, chap. 2, p.2.35) provide a general methodology for estimating emissions from drained organic soils and EFs are provided in the *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands* (chap. 2, tables 2.1–2.3). During the review, Thailand informed the TERT that soil survey data enabling area estimates of organic soils under forest land, grassland and cropland are available from the Land Development Department. The Party explained that areas of peatland in Thailand are being drained and converted to oil palm plantations. The TERT recommends that Thailand estimate areas of drained organic soils for categories 4.A forest land, 4.B cropland and 4.C grassland and report CSCs in the organic soils pool in CRTs 4.A–4.C and N_2O and CH_4 emissions in CRT 4(II). The TERT encourages Thailand to consider using relevant EFs from the *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands* (chap. 2).
6.L.6	Specified in paragraphs 21 and 47 of the MPGs 4.A Forest land 4.B Cropland 4.C Grassland – CSC/CO_2 – mineral soils	Thailand did not report CSCs in mineral soils for categories 4.A forest land, 4.B cropland or 4.C grassland in CRTs 4.A–4.C, or provide information in accordance with the MPGs on why these sources and sinks were omitted. The TERT noted that the 2006 IPCC Guidelines provide a default method for estimating CSCs in mineral soils, relevant for cropland and grassland (vol. 4, chap. 2, pp.2.29–2.31), and that the mineral soils carbon pool on forest land can be assumed to be in a steady state according to the 2006 IPCC Guidelines (vol. 4, chap. 2, pp.4.23–4.24). During the review, Thailand explained that data are available for determining areas of different soil types under forest land, grassland and cropland and that this is also the case for agricultural management practices (e.g. tillage and inputs of organic amendments). Furthermore, scientific studies provide estimates of country-specific SOC stocks for typical agricultural and forestry systems. However, the Party indicated a need for capacity-building support for estimating CSCs using higher-tier methods. The TERT recommends that Thailand estimate CSCs in mineral soils, report associated emissions and removals in CRTs 4.A–4.C and provide transparent information on methodology, AD and SOC stocks used. The TERT encourages Thailand to evaluate if a higher-tier method can be implemented for estimating CSCs for cropland given the availability of country-specific data.
6.L.7	Specified in paragraphs 20, 39 and 40 of the MPGs 4.B.1 Cropland remaining cropland – CSC/CO_2 – living biomass	Thailand reported CSCs in living biomass for subcategory 4.B.1 cropland remaining cropland for 2020–2022 in CRT 4.B and additionally for 2000–2022 in its BTR1 (p.2-247). The Party reported in the BTR1 (table 2-180) that tier 1 and 2 methods were used to estimate gains and losses in living biomass and that cropland remaining cropland is a key category (p.2-8). Further, emissions and removals from cropland remaining cropland were only reported for rubber plantations (see BTR1 p.2-243), with the justification that insufficient AD have been collected for oil palm and fruit trees. Thailand did not transparently present sufficient methodological details on the estimation of emissions and removals for this key category.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		During the review, the Party provided information on the calculation method used, including country-specific annual increment and loss factors for rubber plantations and national AD, and informed the TERT that preparations are ongoing to provide equivalent information on other cropping systems. The TERT recommends that Thailand provide details on the AD and country-specific factors used for all cropping systems, including by referencing scientific articles or reports that support the emission and/or carbon stock factors used. The TERT also recommends that Thailand expand the reporting to include information on CSCs in the living biomass pool for all major woody cropping systems.
6.L.8	Specified in paragraphs 32 and 47 of the MPGs 4.C Grassland – CSC/CO_2 – living biomass	The Party did not report areas of grassland or CSCs in living biomass for category 4.C grassland in CRT 4.C but explained in its BTR1 that grassland accounts for less than 0.4 per cent of its total forest land and that the majority of this grassland is made up of small fragments located within forest land. The TERT noted that the 2006 IPCC Guidelines (vol. 4, chap. 6) provide a methodology for estimating CSCs in living biomass on grassland and that Thailand has a substantial amount of livestock grazing pasture as reported for the agriculture sector (more than 10 million cattle in 2022 according to CRTs 3.B(a)–3.B(b)). During the review, the Party explained that current data do not differentiate between areas of forest land and grassland but that grassland is unlikely to be a significant emission source. The TERT recommends that Thailand estimate the area of grassland and report grassland areas and CSCs in living biomass in CRT 4.C. If this category is considered insignificant, it recommends that the Party provide substantiated information in line with the MPGs to demonstrate why grassland is not a significant source of emissions or removals considering the country's cattle population.
6.L.9	Specified in paragraph 47 of the MPGs 4.E Settlements – CSC/CO_2	Thailand did not report areas of settlements or CSCs for category 4.E settlements in CRT 4.E, but stated that it is preparing AD, EFs and methodologies for estimating GHG emissions and removals for this category. The TERT noted that the 2006 IPCC Guidelines (vol. 4, chap. 8) provide a methodology for estimating emissions from settlements. During the review, Thailand confirmed that it is preparing its reporting process for settlements and that this will include estimating the area of land converted to settlements using remote sensing data and soil mapping. The TERT recommends that Thailand apply the 2006 IPCC Guidelines and estimate emissions and removals for subcategories 4.E.1 settlements remaining settlements and 4.E.2 land converted to settlements and report these data in CRT 4.E, while providing information on methodology, AD and EFs used in the NID or BTR.
6.L.10	Specified in paragraph 47 of the MPGs 4.G HWP – CO_2	Thailand did not report emissions and removals for category 4.G HWP in CRTs 4.Gs1–4.Gs2 but stated in its BTR1 (p.2-229) that CSCs in HWP were not reported. The TERT noted that the 2006 IPCC Guidelines (vol. 4, chap. 12, table 12.1, and chap. 12, annex 12.A.1) provide a methodology for estimating emissions and removals from HWP. During the review, the Party clarified that there is a flow of HWP in Thailand, but that national capacity is lacking for implementing the methodology provided in the 2006 IPCC Guidelines for estimating emissions and removals from HWP. The TERT recommends that Thailand estimate emissions and removals from HWP in accordance with the 2006 IPCC Guidelines, report the estimates in CRT 4.Gs1–4.Gs2 and provide documentation in the NID or BTR on the approach taken.
6.L.11	Specified in paragraphs 31 and 47 of the MPGs 4(I) Direct and indirect N_2O emissions from N	The Party did not report direct or indirect N_2O emissions from N inputs to managed soils in CRT 4(I), nor did it provide information in its BTR1 on why this source of emissions was not reported. The TERT noted that the 2006 IPCC Guidelines (vol. 4, chap. 11, p.6.25) include a methodology for estimating direct

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
	input to managed soils – N_2O	and indirect N_2O emissions from N inputs to managed soils and provide default EFs in tables 11.1 and 11.3. During the review, Thailand explained that there are no national data available for separating N inputs for the fertilization of forest land and cropland and stated that the total amount of imported N fertilizer is reported under the agriculture sector. The TERT recommends that Thailand report direct and indirect N_2O emissions at the most disaggregated level in CRT 4(I). If this is not possible, the TERT recommends that the Party report the emissions as "IE" and include accompanying explanatory information in the NID or BTR and CRT 9.
6.L.12	Specified in paragraph 47 of the MPGs 4(III) Direct and indirect N_2O emissions from N mineralization/ immobilization – N_2O	The Party did not report direct or indirect N_2O emissions from N mineralization/immobilization in CRT 4(III), nor provide information in its BTR1 on why this source of emissions was not reported. The TERT noted that the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.5, equation 11.8) provide a methodology for estimating N_2O emissions from N mineralization/ immobilization. During the review, the Party explained that it needs capacity-building for estimating the soil organic CSCs on cropland and grassland that provide the AD for CRT 4(III). The TERT recommends that Thailand estimate and report N_2O emissions in CRT 4(III) in accordance with the 2006 IPCC Guidelines.
6.L.13	Specified in paragraphs 39–40 of the MPGs 4(IV) Biomass burning – N_2O and CH_4	Thailand reported CH_4 and N_2O emissions from biomass burning on forest land and land converted to cropland in CRT 4(IV) but did not provide the related AD in its BTR1 or CRTs. The Party also did not indicate whether the emissions reported were from wildfires or controlled burning. The TERT noted that the MPGs require Parties to provide information on the methodology, AD and EFs applied at the most disaggregated level. During the review, Thailand provided background information and explained that the emissions reported were from both wildfires and controlled burning. The TERT recommends that Thailand report emissions from biomass burning in CRT 4(IV) under the appropriate subcategories of controlled burning and wildfires and provide details on the national circumstances surrounding biomass burning as well as the AD and EFs used for the time series (from 2000).

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 35 of the MPGs 5. General (waste) – CO_2, CH_4 and N_2O	The information on the waste sector reported by Thailand in its CRTs for 2020–2022 deviates from the corresponding data reported in the BTR1 in terms of total GHG emissions from the waste sector in kt CO_2 eq (BTR1 table 2-4 and CRT 5) and the amount of solid waste disposal at SWDS in kt (BTR1 table 2-148 and CRT 5.A). During the review, Thailand clarified that the data on GHG emissions from the waste sector and the amount of solid waste disposal reflected in its BTR1 are correct. The discrepancies with the data in the CRTs were attributed to technical challenges encountered during the process of transferring data from the TGEIS to the format used in the CRTs. Thailand indicated its intention to revise the data for the waste sector for future submissions of the CRTs to ensure accuracy. The TERT recommends that Thailand enhance the consistency of information in its reporting for the waste sector by ensuring that accurate and harmonized data are presented across the BTR and the CRTs.
7.W.2	Specified in paragraph 39 of the MPGs 5. General (waste) – CO_2, CH_4 and N_2O	Thailand did not report in its BTR1 information on industrial waste and sludge treatment practices occurring in the country. During the review, Thailand explained that all industrial waste in the country is treated through incinerators and is not disposed of at SWDS. A portion of the sludge from wastewater treatment systems is incinerated, while another portion is added to soils as a soil amendment in the agriculture sector (see ID# 5.A.2).

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		GHG emissions from industrial waste and sludge without energy recovery are accounted for and reported under subcategory 5.C.1 waste incineration, while GHG emissions from incineration with energy recovery are reported under the energy sector. The TERT recommends that Thailand include in its BTR a description of the industrial waste and sludge treatment practices occurring in the country.
7.W.3	Specified in paragraph 22 of the MPGs 5.A Solid waste disposal on land – CH_4	In its BTR1 (table 2-152), Thailand reported that it applied a value of 0.55 for the fraction of CH_4 in generated landfill gas in the estimation of CH_4 emissions from solid waste disposal. It cited this figure in reference to the default value provided in the 2006 IPCC Guidelines. The TERT noted that the default value for the CH_4 fraction specified in the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.15) is actually 0.5. During the review, Thailand explained that the applied value of 0.55 was based on research published on the CH_4 fraction in biogas from waste disposal sites in Japan and South-East Asia. Field measurements conducted at five waste disposal sites in Japan, Thailand and Indonesia indicated that the CH_4 fraction in biogas is typically distributed in the range of 53–65 per cent (of [CH_4 + CO_2]) in the most active emission zones, irrespective of seasonal or geographical differences. Thailand therefore adopted the value of 0.55 for its national GHG inventory on the basis of this research. The TERT recommends that Thailand justify in its BTR its use of the country-specific value of 0.55 for the fraction of CH_4 in generated landfill gas.
7.W.4	Specified in paragraph 39 of the MPGs 5.A Solid waste disposal on land – CH_4	In its BTR1, Thailand did not report AD for solid waste disposal prior to 2020, nor provide information on the starting historical year used to estimate CH_4 emissions from solid waste disposal. The TERT noted that, according to the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.6), it is good practice to use disposal data covering at least 50 years prior to the base year when estimating CH_4 emissions. This time frame provides an acceptably accurate result for most typical disposal practices and conditions. During the review, Thailand shared with the TERT its calculation file for CH_4 emissions from solid waste disposal and presented all the background information used to perform the calculations, including the data on solid waste disposal covering 1954–2022 used to estimate CH_4 emissions from solid waste disposal for 2000–2022. The TERT recommends that Thailand include in its BTR AD for solid waste disposal and the descriptions, assumptions, references and sources of information used to derive the time series of solid waste disposal AD.
7.W.5	Specified in paragraphs 20–21 of the MPGs 5.A Solid waste disposal on land – CH_4	Thailand did not report any information in its BTR1 on the delay time used to estimate CH_4 emissions from solid waste disposal. During the review, Thailand specified that it uses a 12-month delay time but did not provide any further explanations to support this. The TERT noted that the default delay time provided in the 2006 IPCC Guidelines (vol. 5, chap. 3, p.3.19) is between zero and six months. The TERT recommends that Thailand give evidence to support its use of a 12-month delay time by providing a relevant description in the BTR or otherwise apply the default delay time provided in the 2006 IPCC Guidelines, which varies between zero and six months when estimating CH_4 emissions from solid waste disposal.
7.W.6	Specified in paragraph 31 of the MPGs 5.A Solid waste disposal on land – CH_4	Thailand reported "NE" for CH_4 flaring at SWDS in CRT 5.A for 2020–2022, but no explanatory information was provided in the BTR1 or the CRTs. During the review, Thailand explained that, according to the Pollution Control Department, flaring is not performed at SWDS in Thailand, so flaring at SWDS does not occur in the country. The TERT recommends that Thailand report "NO" for the amount of CH_4 flaring at SWDS in CRT 5.A and explicitly report in its BTR that flaring at SWDS does not occur in the country.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
7.W.7	Specified in paragraph 39 of the MPGs 5.A Solid waste disposal on land – CH_4	In its BTR1 (table 2-148), Thailand reported separately on the amount of solid waste disposed at managed anaerobic and semi-aerobic SWDS and unmanaged deep and shallow SWDS. However, it provided no information on how the solid waste disposal data were distributed among the different categories of SWDS, including the methodology, data sources or assumptions used to classify and allocate waste to each category of SWDS. During the review, Thailand explained that the allocation of solid waste disposal among the above-mentioned categories of SWDS is based on site-specific data on waste inflow collected at each disposal site for which data on operational conditions are available. It clarified that this is what allowed it to classify each SWDS in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 3, table 3.1) for the entire time series of the AD. The TERT recommends that Thailand include in its BTR a description of how the solid waste disposal data are distributed among the categories of SWDS.
7.W.8	Specified in paragraph 39 of the MPGs 5.A.1 Managed waste disposal sites – CH_4	Thailand reported in its BTR1 (p.2-179) that CH_4 recovery data for electricity and/or heat generation from waste for 2020–2022 were provided by the Department of Alternative Energy Development and Efficiency. However, it provided no further information on how the primary data on CH_4 recovery at SWDS were collected and processed to assess the amount of CH_4 recovered. During the review, Thailand explained that the Department of Alternative Energy Development and Efficiency collects information on electricity generated and supplied to the grid from the use of biogas at SWDS. For the national GHG inventory, the reported electricity data were converted to CH_4 quantities using key parameters, including the specific fuel consumption of power generators, generation efficiency, the CH_4 fraction in biogas and gas density. QC procedures are implemented through the Department of Alternative Energy Development and Efficiency's monitoring and verification system to ensure that CH_4 recovery data are reliable, consistent and suitable for inclusion in the national GHG inventory. The TERT recommends that Thailand describe in its BTR how CH_4 recovery data are derived for electricity and/or heat generation from waste.
7.W.9	Specified in paragraph 22 of the MPGs 5.B Biological treatment of solid waste – N_2O	Thailand reported in its BTR1 (table 2-156) that the default IPCC EFs of 0.6 g CH_4/kg waste treated and 0.24 g N_2O/kg waste treated were used to estimate emissions from the MBT of solid waste. No further information was provided in the BTR1 on how these EFs were derived. The TERT noted that the 2006 IPCC Guidelines do not provide explicit EFs for MBT. During the review, Thailand explained that the EFs for MBT were derived on the basis of the assumption that 15 per cent of the solid waste treated at MBT facilities is composted, while the remaining portion is mechanically separated and either recycled or treated as refuse-derived fuel. Accordingly, the EFs were calculated by multiplying the default EFs for composting by the share of waste composted at MBT facilities. The TERT noted that, following this approach, the N_2O EF for MBT should be 0.036 g N_2O/kg waste treated (i.e. 0.24 g N_2O/kg × 0.15). Thailand confirmed that the value of 0.24 g N_2O/kg waste treated was used erroneously instead of the correct value of 0.036 g N_2O/kg waste treated. The TERT encourages Thailand to revise its estimate of N_2O emissions from MBT by applying the correct EF of 0.036 g N_2O/kg waste treated and to include a clear explanation on how the EFs were derived for MBT.
7.W.10	Specified in paragraph 39 of the MPGs 5.B Biological treatment of solid waste – CH_4 and N_2O	In its CRT 5, Thailand reported separate AD for composting and MBT under category 5.B biological treatment of solid waste. The TERT noted that, according to the 2006 IPCC Guidelines (vol. 5, chap. 4.1, p.4.4), mechanical operations typically separate waste into fractions that undergo further treatment, such as composting, anaerobic digestion, combustion or recycling. During the review, Thailand explained that AD for biological waste treatment was reported by the focal point for the waste sector and classified by the waste management method into composting, MBT and anaerobic digestion, thereby avoiding any double counting of AD and associated GHG emissions.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		The TERT recommends that Thailand confirm in its BTR that none of the AD or GHG emissions for composting and MBT practices reported in CRT 5 under category 5.B biological treatment of solid waste are double counted.
7.W.11	Specified in paragraph 39 of the MPGs 5.B.1 Composting – CH_4 and N_2O	Thailand reported in its BTR1 (table 2-155) that 596 kt solid waste was composted in 2020, 769 kt in 2021 and 677 kt in 2022. However, no further explanation was provided on whether these figures refer to the wet mass or dry mass of the composted material. During the review, Thailand confirmed that the reported quantities of biologically treated solid waste refer to the wet mass of the waste. The TERT recommends that Thailand clarify in its BTR that the reported quantities of biologically treated solid waste refer to the wet mass of the waste.
7.W.12	Specified in paragraph 39 of the MPGs 5.C.1 Waste incineration – CO_2, CH_4 and N_2O	In its BTR1 (pp.2-190–2-196), Thailand reported the AD used to estimate and report GHG emissions for subcategory 5.C.1 waste incineration for 2020–2022, along with the EFs used and the sources of the data. However, the BTR1 does not describe the waste incineration technologies and practices used in Thailand. In addition, no information was provided on how the Party distinguished between AD for waste incineration with energy recovery and AD for waste incineration without energy recovery. During the review, Thailand explained that waste incineration with energy recovery relates to incineration at waste incineration facilities where the recovered CH_4 is utilized as biogas or energy and is reported under the energy sector. Incineration without energy recovery includes general waste burning practices such as the incineration of municipal solid waste, industrial waste, infectious waste and sludge. Emissions from these activities are reported under the waste sector. Accordingly, the amounts of waste reported in CRT 5.C for subcategory 5.C.1 waste incineration only represent incineration without energy recovery. This approach is consistent with the sector allocation guidance provided in the 2006 IPCC Guidelines. The TERT recommends that Thailand include in its BTR a description of waste incineration practices in the country, along with a clear explanation of how it distinguishes between waste incineration with and without energy recovery in its reporting.
7.W.13	Specified in paragraphs 32 and 47 of the MPGs 5.C.2 Open burning of waste – CO_2, CH_4 and N_2O	Thailand did not estimate GHG emissions for subcategory 5.C.2 open burning of waste and did not explain in its BTR1 its rationale for not estimating these emissions. During the review, Thailand explained that open burning of municipal solid waste has occurred in the country in the past, particularly in rural areas or in locations not served by waste collection systems. Thailand has enacted laws and policies addressing the open burning of waste, such as the Public Health Act B.E. 2535 (1992), which empowers local authorities to prohibit activities deemed as 'public nuisances', including waste burning that causes smoke, soot or other health hazards. Despite this, the open burning of waste may still occur in the country. The TERT recommends that Thailand collect data on open burning of waste and estimate and report GHG emissions for subcategory 5.C.2 open burning of waste or provide information demonstrating the insignificance of these emissions in terms of their level in accordance with the MPGs.
7.W.14	Specified in paragraph 39 of the MPGs 5.D.1 Domestic wastewater – N_2O	Thailand did not report in its BTR1 data on protein consumption per capita prior to 2020. During the review, Thailand explained that data on protein consumption per capita for particular historical years were obtained from national food consumption surveys (the Thai National Health Examination Survey and surveys conducted by the Health Systems Research Institute and Ministry of Public Health). Historical values (for 2000–2015) were extrapolated, while a national value of 21.06 kg/capita was applied for 2016 onward. The TERT recommends that Thailand report in its BTR data on protein consumption per capita covering the entire time series, along with an explanation of how these data were derived.

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
7.W.15	Specified in paragraph 35 of the MPGs 5.D.1 Domestic wastewater – CH_4	Thailand reported in its BTR1 (table 2-168) that an MCF of 1.0 was used for untreated domestic wastewater discharged into seas, rivers and lakes to estimate CH_4 emissions from domestic wastewater treatment and discharge. The TERT noted that this value deviates from the default MCF of 0.1 specified in the 2006 IPCC Guidelines (vol. 5, chap. 6, p.6.13). During the review, Thailand explained that the value of 1.0 reported for the MCF was a reporting error. Upon verification, the internal data were confirmed to be consistent with the default MCF of 0.1 specified in the 2006 IPCC Guidelines. The Party checked the data entry template files used in the TGEIS and confirmed that the calculations had been carried out correctly using the IPCC default value of 0.1. The TERT recommends that Thailand report a correct MCF for estimating CH_4 emissions from untreated domestic wastewater discharged into seas, rivers and lakes, namely the default value of 0.1 specified in the 2006 IPCC Guidelines.
7.W.16	Specified in paragraph 26 of the MPGs 5.D.1 Domestic wastewater – CH_4	Thailand reported that CH_4 emissions from domestic wastewater treatment and discharge significantly decreased from 3.34 Mt CO_2 eq in 2013 to 2.12 Mt CO_2 eq in 2014, representing a 36.5 per cent reduction (see BTR1 table 2-170). However, no explanation for this fluctuation was provided in the BTR1. During the review, Thailand explained that the decrease in CH_4 emissions from domestic wastewater treatment and discharge in 2014 is mainly due to a revision of the wastewater characteristics used in the inventory. From 2014, the Pollution Control Department, as the sectoral focal point for the waste sector and the responsible authority for municipal wastewater management in Thailand, conducted a nationwide survey on the quantity and characteristics of domestic wastewater. On the basis of the survey results, the Pollution Control Department established a BOD concentration of 150 mg/l for domestic wastewater, which is lower than the BOD values previously applied for 2000–2013 (approximately 250–300 mg/l). This downward revision of the BOD parameter directly led to the reduction in estimated CH_4 emissions for 2014 onward. The TERT encourages Thailand to check the consistency of the BOD values used to estimate CH_4 emissions from domestic wastewater treatment and to revise the BOD values for particular years if doing so is necessary to improve the consistency of the estimates throughout the time series.
7.W.17	Specified in paragraph 39 of the MPGs 5.D.2 Industrial wastewater – CH_4	Thailand reported the amount of CH_4 recovery from industrial wastewater treatment for the entire time series in BTR1 table 2-175, along with a detailed breakdown of the annual amount of CH_4 recovery by industry for 2020–2022 in the BTR1 (p. 2-214). However, no explanatory information was provided in the BTR1 on the source of the CH_4 recovery data or on how the primary data on CH_4 recovery were derived, collected and processed for the purpose of the national GHG inventory. During the review, Thailand explained that the primary data on CH_4 recovery were obtained from the Department of Alternative Energy Development and Efficiency and the Energy Regulatory Commission. The former collects and compiles information on electricity generation from biogas utilization in industrial wastewater treatment systems and on the associated amount of electricity supplied to the grid. For the national GHG inventory, the reported electricity data were converted back to CH_4 quantities using parameters such as the specific fuel consumption of power generators, generation efficiency, the CH_4 fraction in biogas and gas density. QC procedures were implemented through the Department of Alternative Energy Development and Efficiency's monitoring and verification system. These steps ensure that CH_4 recovery data are reliable, consistent and suitable for inclusion in the national GHG inventory. The TERT recommends that Thailand include in its BTR a description of how CH_4 recovery data from industrial wastewater treatment were derived.

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*
8.1	Specified in paragraph 59(a) of the MPGs	Thailand provided extensive information on its national circumstances relevant to progress in implementing and achieving its NDC in its BTR1. However, it did not provide information on government structure relevant to progress in implementing and achieving its NDC. During the review, Thailand explained that the process of developing the NDC has a similar structure to that presented in chapter 1 and figure 1.1 of its LT-LEDS, which was submitted in 2022. The TERT recommends that the Party provide information on government structure relevant to progress in implementing and achieving its NDC, including the process for preparing and approving its BTR.
8.2	Specified in paragraph 60 of the MPGs	Thailand did not report explicitly in its BTR1 information on how its national circumstances, such as demographic developments and changes in the structure of its primary energy supply and exports and imports, as well as changes in transport patterns and structural changes in the agriculture sector, affect GHG emissions and removals over time. During the review, Thailand noted that some drivers are presented in its BTR1 under "National Emission Trends by Greenhouse Gases: CO_2, CH_4, N_2O & F-gases" (pp.2-10–2-14). However, the Party recognized the need to provide more detailed information on how its national circumstances affect GHG emissions and removals over time. The TERT recommends that the Party include more detailed information on national circumstances that affect GHG emissions and removals over time.
8.3	Specified in paragraph 62 of the MPGs	Thailand included information on its National Committee on Climate Change Policy and the roles of the main responsible agencies and their organizational structure in the BTR1 (figure 1-35). However, it did not provide information on legal and procedural arrangements for domestic implementation, monitoring, reporting, archiving of information and stakeholder engagement related to the implementation and achievement of its NDC. During the review, Thailand explained how its climate change mitigation efforts and the implementation of its NDC were conducted on a voluntary basis in accordance with the roles of the main responsible agencies and their organizational structure as described in its BTR1 (figure 1-35). Furthermore, Thailand provided the documents *NDC Action Plan on Mitigation 2021–2030* and *Subcommittee on Climate Change Knowledge and Database*, as well as 2024 regulations of the Prime Minister's Office concerning climate change. These documents provide information on legal and procedural arrangements for domestic implementation, monitoring, reporting, archiving of information and stakeholder engagement related to the implementation and achievement of its NDC. The *NDC Action Plan on Mitigation 2021–2030* outlines the mandate for various entities, including the identification of activities, GHG emission reduction targets, budget allocations, implementation timelines and the relevant agencies in each sector. The plan is aimed at achieving a 30 per cent emission reduction through domestic efforts and an additional 10 per cent reduction with international support under the conditional NDC target. The TERT recommends that the Party provide information on its legal and procedural arrangements for domestic implementation, monitoring, reporting, archiving of information and stakeholder engagement related to the implementation and achievement of its NDC.

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 65 of the MPGs	In its BTR1 (section 3.2.1), Thailand identified two indicators for tracking progress in implementing and achieving its NDC: CO_2 eq reduction in absolute terms and in percentage relative to the 'business as usual' scenario. However, the TERT noted that in CTF tables 1 and 4 only one indicator, namely the GHG emission reduction in kt CO_2 eq, was reported. As two indicators were identified, a separate CTF table 4 would have been expected for each indicator. Additionally, in CTF table 4.1, the GHG emission levels, rather than the GHG emission reductions, have been reported. During the review, Thailand explained that the indicators selected to track its NDC progress are the emission reduction and percentage emission reduction. Furthermore, the Party explained that preparing the CTF tables for tracking progress in the implementation and achievement of the NDC was challenging owing to a lack of comprehensive training for using the tool for reporting progress under the enhanced transparency framework. The TERT recommends that the Party provide in the BTR and CTF tables consistent and transparent information on, including description(s) of, the indicator(s) that it has selected to track progress towards the implementation and achievement of its NDC.
10.2	Specified in paragraph 74(b) of the MPGs	Thailand provided a general description in its BTR1 of the methodology used to construct its baselines for tracking progress towards the NDC. However, detailed information on the construction of the 'business as usual' scenario, including the underlying data, was not provided or referenced. During the review, the Party explained that its pathway to carbon neutrality and net zero GHG emissions was developed using the methodology of the Asia-Pacific Integrated Model/Enduse model to quantify climate change assessments and relevant policies for mitigating GHG emissions. Relevant driving factors are presented in chapter 3 and figure 3.1 of Thailand's LT-LEDS, which was submitted in 2022. The TERT recommends that the Party provide detailed information on the construction of its 'business as usual' scenario for tracking progress towards the NDC, including the methodology (i.e. the IPCC approach/tier), EFs and other underlying data used.
10.3	Specified in paragraph 76(b) of the MPGs	Thailand did not provide information in its BTR1 or CTF table 3 on how using the GWP values from the AR5 has affected its 2030 emission estimates for the 'business as usual' scenario, as the NDC is based on the 100-year GWP values in accordance with the AR4. During the review, Thailand confirmed that the 2030 'business as usual' GHG emission estimates will increase slightly owing to the GWP of CH_4 being taken from the AR5. Furthermore, Thailand explained that for its latest NDC it is using the GWP values from the AR5, while keeping the same 'business as usual' baseline of 555 Mt CO_2 eq in 2030. The TERT recommends that Thailand provide information in its BTR and CTF table 3 on the impact of using the GWP values from the AR5 on the 2030 'business as usual' estimates, as well as the impact of recalculations of and updates to the GHG inventory.

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	Thailand's BTR1 contains information on PaMs that support the implementation and achievement of its NDC. However, Thailand did not provide any information on how it determined which PaMs to include in its BTR1. Furthermore, it was not clear how those PaMs relate to the key categories referred to in the national GHG inventory, such as subcategories 1.A.3.b road transportation and 2.B.8 petrochemical and carbon black production. During the review, Thailand explained that guidelines for the mitigation tracking process for each policy or measure have been developed; however, these guidelines are only available in Thai. The Party recognized the need to provide more detailed information in its BTR on the determination of the PaMs relevant to the implementation and achievement of its NDC and further recognized the need to focus on those PaMs that have the most significant impact on GHG emissions or removals and on those affecting key categories in the national GHG inventory. The TERT recommends that Thailand provide information on how the reported PaMs support the implementation and achievement of its NDC, focusing on those that have the most significant impact on GHG emissions or removals and those affecting key categories in the national GHG inventory.
11.2	Specified in paragraph 81 of the MPGs	In its BTR1 Thailand provided details on mitigation PaMs, actions and plans for the energy (table 3-7), transport (table 3-8), IPPU (table 3-9), agriculture (table 3-10) and waste (table 3-11) sectors. The TERT noted that mitigation PaMs are not provided for the LULUCF sector. Thailand also provided details on mitigation PaMs, actions and plans in CTF table 5, but did not use the sectors listed in footnote (i) to CTF table 5 and paragraph 81 of the MPGs. During the review, Thailand explained that LULUCF is excluded from its NDC, and it has not analysed the interaction between mitigation PaMs, particularly those related to LULUCF. Furthermore, the Party noted that it needs support to investigate and identify the avoidance of negative impacts on LULUCF from the implementation of PaMs, such as biomass and new clean energy. The TERT recommends that Thailand organize the reporting of PaMs, actions and plans by sector, to the extent possible, using consistent information on sectors in the BTR and CTF tables in line with the MPGs, and include in its BTR PaMs for the LULUCF sector that might interact with PaMs in other sectors or clearly explain why information thereon is not included.
11.3	Specified in paragraph 82(g) of the MPGs	Thailand provided in CTF table 5 information on mitigation PaMs, including on the gases affected. The TERT noted that no PaMs targeting N_2O are reported for any sector. Furthermore, the TERT noted that all the PaMs provided for the energy sector, for example, are reported to only target CO_2, even if these PaMs also have an impact on N_2O and CH_4. Additionally, some PaMs are reported to be targeting GHG emissions that do not arise from the respective sector, such as CO_2 emissions from waste management in the livestock sector. During the review, Thailand explained that only quantifiable PaMs were reported. However, the Party recognized the need to report estimates of GHG emission reductions on the basis of all GHGs. The TERT recommends that Thailand report complete information on the gases affected by each quantifiable and qualitative policy or measure or, if this is not yet assessable, explain the reasons for not including certain gases in the information on quantifiable and qualitative mitigation PaMs, actions and plans.
11.4	Specified in paragraph 83 of the MPGs	Thailand did not report information on the costs on non-GHG mitigation benefits of each mitigation policy and measure, or on how mitigation actions interact with each other. During the review, Thailand explained that relevant information was not reported owing to a lack of data and capacity. A capacity-building need for institutional and technical capacity has been identified for estimating the costs of each

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
		mitigation policy and measure and for providing information on their non-GHG mitigation benefits and on how the mitigation actions interact with each other. The TERT encourages Thailand to provide information on the costs and non-GHG mitigation benefits of each mitigation policy and measure reported in CTF table 5, and how the mitigation actions interact with each other. If this is not possible, it encourages the Party to explain why it did not report this information.
11.5	Specified in paragraph 86 of the MPGs	Thailand estimated the expected and achieved GHG emission reductions for its PaMs in its BTR1 (section 3.2.3) and CTF table 5. However, Thailand did not report on the methodologies and assumptions used to estimate the GHG emission reductions or removals due to each action, policy or measure. During the review, Thailand recognized the need to report relevant information. The TERT recommends that Thailand provide, to the extent possible, a description of the methodologies and assumptions used to estimate the GHG emission reductions or removals due to each action, policy or measure.
11.6	Specified in paragraph 88 of the MPGs	Thailand did not identify and report its PaMs that influence GHG emissions from international transport in terms of both international aviation and maritime transport (also known as international bunker fuel emissions). During the review, Thailand explained that PaMs related to international bunker fuel emissions fall under the jurisdiction of the Civil Aviation Authority of Thailand and the Marine Department, and that these PaMs are reported to the International Civil Aviation Organization and the International Maritime Organization in accordance with their respective reporting obligations. The TERT encourages Thailand to provide information on PaMs that influence GHG emissions from international transport in terms of both international aviation and maritime transport, for example, through various international reporting frameworks, or to explain why it did not report this information.
11.7	Specified in paragraph 90 of the MPGs	Thailand did not provide information on the assessment of economic and social impacts of response measures. During the review, the Party explained that it needs capacity-building to report on this topic. The TERT encourages Thailand to provide detailed information, to the extent possible, in the BTR 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*
12.1	Specified in paragraph 91 in conjunction with paragraphs 77(b) and 99 of the MPGs	Thailand's summary of its GHG inventory (for 2020–2022), provided in CTF table 6, does not cover the same time series as its most recent national GHG inventory (i.e. 1990 and 2000–2022, provided in CRT 10s6). Furthermore, the TERT noted discrepancies between the information (values) provided in the BTR1 (e.g. table 2-4), CRT 10s6 and CTF tables 4.1, 6 and 7, as the total GHG emissions and removals without LULUCF for 2022 in kt CO_2 eq are reported as 384,276.88 in CRT 10s6, 384,278.07 in CTF table 6 and 385,941.14 in CTF tables 4.1 and 7 and the BTR1. During the review, Thailand confirmed the discrepancies and stated that they are due to the CTF tables, CRTs and BTR1 being finalized on different dates and to a lack of consistency checks. The correct total national GHG emissions and removals are reported in the BTR1 (e.g. table 2-4) as 278,039.71 kt CO_2 eq with LULUCF and 385,941.14 kt CO_2 eq without LULUCF. The TERT recommends that the Party report consistent information on GHG emissions and removals in its CTF tables, CRTs and BTR, ensuring consistency with the Party's most recent NIR.

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 95 of the MPGs	Thailand reported projections up to 2030 only and did not indicate projections for 2025 in its CRTs. During the review, the Party noted that, owing to capacity constraints, it was not possible for it to develop projections extending at least 15 years after the most recent year in its inventory. Noting that Thailand did not request to apply flexibility in the light of its capacities in this regard, the TERT recommends that Thailand report projections beginning from the most recent year in its NIR and extended to at least 15 years beyond the next year ending in zero or five after the most recent year in its inventory.
13.2	Specified in paragraph 96(a), (c) and (d) of the MPGs	Thailand provided in its BTR1 (table 3-2) information on projections of GHG emissions and removals under the 'without measures', WM and WAM scenarios. However, Thailand did not indicate whether specific PaMs are included in the WM scenario. Thailand also did not provide information in its BTR1 on the models and approaches used for its projections. Furthermore, Thailand did not provide a sensitivity analysis for any of its projections, together with a brief explanation of the methodologies and parameters used. During the review, Thailand explained that the WM scenario is based on PaMs aligned with the unconditional NDC target for 2030 and that the WAM scenario is based on PaMs aligned with the conditional NDC target for 2030. No specific PaMs were identified, but it was assumed that an additional 10 per cent reduction in GHG emissions compared with the unconditional NDC target for 2030 could be achieved with international support. With regard to the lack of information on models and approaches applied for its projections, the Party stated that it used the Asia-Pacific Integrated Model/Enduse model, developed by the National Institute for Environmental Studies of Japan to develop its mitigation targets. However, for projections, Thailand explained that, in the absence of a model, it relied on fixed emission values rather than model-based scenarios to project emissions up to 2030. The TERT identified that the description provided for developing projections applies to the Party's second NDC, but that the estimates in the BTR1 are presented on the basis of the first NDC, for which the base year is 2015. The Party explained that it lacks capacity to carry out the sensitivity analysis and requested support to develop this capacity. The TERT encourages Thailand to indicate whether specific PaMs are included in the WM or the WAM scenarios or to clearly explain why this information is not provided, and to enhance its reporting of projections by providing transparent information on the models and/or approaches, key underlying assumptions and parameters used for the projections, as well as providing a sensitivity analysis for its projections.
13.3	Specified in paragraph 98 of the MPGs	Thailand provided information on projections on a sectoral basis, but not by gas. Furthermore, the projections are based on the GWP values from the AR4. This is not consistent with the NIR, which uses the GWP values from the AR5. During the review, Thailand explained that its emission reduction targets were not disaggregated by gas owing to a failure by the stakeholders to provide disaggregated data on time. However, the Party clarified that, in the analytical work undertaken for the preparation of the second NDC and LT-LEDS, it disaggregated emission reduction targets by gas and by sector. The TERT recommends that Thailand provide fully disaggregated information on its projections, including on a sectoral basis and by gas, using a common metric that is consistent with that used for its NIR.

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*	*Description of area of improvement with recommendation or encouragement*
General reporting		
1_CBN.1	Specified in paragraph 3 of the MPGs	Strengthening capacity to ensure timely reporting of the BTR and associated documents
1_CBN.2	Specified in paragraph 6 of the MPGs	Strengthening technical and institutional capacity to understand the MPGs related to the application of flexibility provisions
NIR – general		
2.G_CBN.1	Specified in paragraphs 31 and 38 of the MPGs	Reporting accurate, complete and consistent GHG inventories using the CRTs for the entire time series, including the use of notation keys where numerical data are not available and the provision of supporting information in CRT 9
2.G_CBN.2	Specified in paragraphs 34–35 of the MPGs	Elaborating, implementing and reporting on overarching QA/QC activities and category-specific inventory QA/QC plans
2.G_CBN.3	Specified in paragraph 39 of the MPGs	Improving the transparency of the GHG inventory and reporting on progress towards NDC targets
2.G_CBN.4	Specified in paragraph 21 of the MPGs	Establishing institutional arrangements to support the systematic collection of AD and the development of EFs and other parameters at a disaggregated level in line with tier 1 requirements for key categories under the 2006 IPCC Guidelines, while enabling the application of higher-tier methodologies where feasible
NIR – energy		
3.E_CBN.1	Specified in paragraphs 26, 31, 39 and 47 of the MPGs	Establishing institutional arrangements to ensure that AD are collected at a disaggregated level for key categories and categories for which "NE" is reported, including the development of country-specific EFs and other parameters to comply with the requirements for key categories under the 2006 IPCC Guidelines
3.E_CBN.2	Specified in paragraph 36 of the MPGs	Filling in CRT 1.A(b) to allow a comparison to be made between the national estimates of CO_2 emissions from fuel combustion (sectoral approach) and those obtained using the reference approach and to allow the results of this comparison to be reported in the NIR
3.E_CBN.3	Specified in paragraph 54 of the MPGs	Filling in CRT 1.A(d) and consistently reflecting in CRT 1.A(d) the information on carbon stored provided in CRT 1.A(b) and improving institutional arrangements to allow for the collection of AD on feedstocks and non-energy use of fuels to establish QA/QC procedures for ensuring that complete information is reported for the energy or IPPU sector in accordance with the 2006 IPCC Guidelines

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

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
3.E_CBN.4	Specified in paragraphs 39–40 of the MPGs	Aligning methods used to estimate the impact of mitigation measures in the transport sector, such as the introduction of biofuels, with methods used to estimate GHG emissions for relevant categories in the national GHG inventory, while considering the possibility of switching to higher-tier methods
NIR – IPPU		
4.I_CBN.1	Specified in paragraph 47 of the MPGs	Improving the estimates of F-gases, including by gaining a better understanding of the applications where imported gases are being consumed and using disaggregated EFs by life cycle stage
NIR – agriculture		
5.A_CBN.1	Specified in paragraphs 22 and 39 of the MPGs	Reporting the relevant information needed to understand the assumptions and methodologies applied when compiling the GHG emission estimates for the agriculture sector, including references to the national methods, studies and assessments used by the Party
5.A_CBN.2	Specified in paragraphs 30 and 47 of the MPGs	Providing estimates of GHG emissions from subcategories 3.D.1.b.ii sewage sludge applied to soils, 3.D.1.e mineralization/immobilization associated with loss/gain of soil organic matter and 3.D.1.f cultivation of organic soils (i.e. histosols) and category 3.E prescribed burning of savannahs
5.A_CBN.3	Specified in paragraph 23 of the MPGs	Developing a detailed improvement plan for the agriculture sector, indicating at a minimum the time and resources required to implement the improvements
5.A_CBN.4	Specified in paragraph 27 of the MPGs	Using extrapolation to complete the time series of data for liming
NIR – LULUCF		
6.L_CBN.1	Specified in paragraphs 20 and 47 of the MPGs	Developing a spatially explicit (approach 3) land representation for estimating areas of land use and land-use change to enable areas in remaining and conversion categories to be reported for the appropriate time series by establishing a monitoring system that uses remote sensing to continuously update data on land-use changes and to construct a historical land-use change matrix
6.L_CBN.2	Specified in paragraphs 20, 30 and 47 of the MPGs	Collecting and combining data to develop a geospatial national soil map for estimating areas with mineral and organic soils and for identifying natural peatlands and drained areas for forestry or agricultural production with the aim of reporting all land uses and land-use changes; and providing AD for subcategory 3.D.1.f cultivation of organic soils (i.e. histosols)
6.L_CBN.3	Specified in paragraphs 20, 30 and 47 of the MPGs	Developing a higher-tier method for estimating changes in SOC stocks in mineral soils on cropland using a model-based approach by collecting AD from historical and present agricultural management practices and by collecting data on pedoclimatic conditions to model and define appropriate stratification for the inventory; and providing AD for subcategory 3.D.1.e mineralization/immobilization associated with loss/gain of soil organic matter
6.L_CBN.4	Specified in paragraphs 20, 30 and 47 of the MPGs	Establishing a system for collecting data on and estimating emissions from HWP by collecting historical and current data on the production, import and export of semi-finished HWP, including sawnwood, wood-based panels and paper and paperboard, to support the estimation of emissions and removals associated with CSCs in HWP using the tier 1 method from the 2006 IPCC Guidelines
NIR – waste		
7.W_CBN.1	Specified in paragraphs 32 and 47 of the MPGs	Estimating GHG emissions from the open burning of waste in Thailand for the entire time series
Information necessary to track progress in implementing and achieving the NDC under Article 4 of the Paris Agreement		
8_CBN.1	Specified in paragraphs 59–91 of the MPGs	Strengthening institutional and technical capacity to understand the provisions of the MPGs, especially those related to tracking progress towards the NDC

ID#	*Reporting requirement*	*Description of area of improvement with recommendation or encouragement*
8_CBN.2	Specified in paragraphs 59–91 of the MPGs	Strengthening institutional and technical capacity to elaborate, implement and report on overarching QA/QC activities and category-specific inventory QA/QC plans for the entire preparation process to ensure consistency between the BTR, NID (as a chapter of the BTR or a stand-alone document), CRTs and CTF tables
8_CBN.3	Specified in paragraphs 59–91 of the MPGs	Strengthening institutional and technical capacity to understand and develop knowledge on the functionality of the enhanced transparency framework progress reporting tool
11_CBN.1	Specified in paragraph 60 of the MPGs	Strengthening institutional and technical capacity to identify and assess national circumstances that affect GHG emissions and removals over time
11_CBN.2	Specified in paragraph 80 of the MPGs	Strengthening institutional and technical capacity to identify and assess mitigation PaMs, actions and plans, as well as their relation to and impact on the key categories referred to in the national GHG inventory
11_CBN.3	Specified in paragraph 81 of the MPGs	Strengthening institutional and technical capacity to identify and assess interactions between mitigation PaMs, including those in the LULUCF sector
11_CBN.4	Specified in paragraph 83 of the MPGs	Strengthening institutional and technical capacity to identify and assess costs and non-GHG mitigation benefits of PaMs, specifically by collecting data and using a relevant methodology for calculating and reporting on the costs of mitigation PaMs by building expertise and capacity in relation to identifying non-GHG mitigation benefits
13_CBN.1	Specified in paragraph 95 of the MPGs	Preparing and reporting projections in line with the MPGs and specifically reporting projections for a minimum of 15 years beyond the next year ending in zero or five after the latest inventory (in this case, up to 2040)
13_CBN.2	Specified in paragraph 96(a) and (d) of the MPGs	Using models to develop projections and carry out a sensitivity analysis of the modelled projections
13_CBN.3	Specified in paragraph 98 of the MPGs	Disaggregating projections by gas

Annex

Documents and information used during the review

A. Reference documents

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

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B. Additional information provided by the Party

Responses to questions during the review were received from Oranuch Ketsungnoen (Ministry of Natural Resources and Environment of Thailand), including additional material. The following references were provided by Thailand and may not conform to UNFCCC editorial style as some have been reproduced as received:

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