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Proceedings of the 20th Workshop on Greenhouse Gas Inventories in Asia (WGIA20)

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Foreword

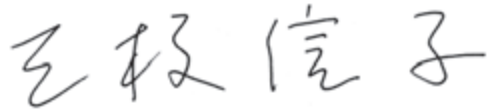
The international community now recognizes increases in anthropogenic emissions of greenhouse gases (GHGs) as the primary cause of climate change and its impacts. The Working Group I contribution to the Sixth Assessment Report (AR6) published by the Intergovernmental Panel on Climate Change (IPCC) in the year before last stated that "Observed increases in well-mixed greenhouse gas concentrations since around 1750 are unequivocally caused by human activities. Since 2011 (measurements reported in AR5), concentrations have continued to increase in the atmosphere, reaching annual averages of 410 ppm for carbon dioxide in 2019". In order to address mitigation and adaptation to climate change, all of us on the globe must be making more efforts than ever in each of our respective fields. To this end, the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) agreed to hold the increase in the global average temperature to well below 2°C above pre-industrial levels under the Paris Agreement at COP21 in 2015.

Transparency of mitigation actions is becoming increasingly important, and in this respect, national GHG inventories, which provide information on GHG emissions and their trends over time, play a critical role as a basis for decision-makers to design and implement strategies for their countries' mitigation actions to reduce GHG emissions. Against this background, all parties will soon be required to submit Biennial Transparency Reports (BTRs) under the Paris Agreement Enhanced Transparency Framework (ETF).

To enhance the capacities for national GHG inventories in Asian countries, the National Institute for Environmental Studies (NIES) has been organizing the "Workshop on GHG Inventories in Asia" (WGIA) annually since November 2003 with the support of the Ministry of the Environment of Japan (MOEJ). This workshop supports government officials, compilers, and researchers in Asian countries to develop and improve their GHG inventories through enhanced regional information exchange. The Greenhouse Gas Inventory Office of Japan (GIO) affiliated with the Center for Global Environmental Research (CGER), Earth System Division (ESD), NIES, has functioned as the Secretariat for this workshop since its first session.

This CGER report serves as the proceedings of the 20th WGIA (WGIA20), which was held in Tomakomai, Hokkaido, Japan, this year. We hope that this report will be useful for all those who work in the field of GHG inventories as well as climate change, and that it will contribute to the further progress of inventory development in Asia.

SAIGUSA Nobuko



Director
Earth System Division
National Institute for Environmental Studies

Preface

The Paris Agreement established an ETF to build mutual trust and confidence and to promote effective implementation. The purpose of the framework is to provide a clear understanding of climate change actions, including clarity and tracking of progress towards achieving Parties' individual nationally determined contributions (NDCs) to inform the global stocktake. Each Party shall provide the national GHG inventory and information necessary to track progress made in implementing and achieving its NDC in BTRs. Against this background, GHG inventories are being accepted more and more as being valuable because they support the transparency and accuracy of the implementation of national mitigation actions, and the importance of developing robust national systems for the steady preparation of inventories is now widely acknowledged.

WGIA has contributed significantly to the construction and consolidation of a network of officials and researchers involved in GHG inventory preparation in Asian countries and to the identification and provision of solutions for common issues relevant to the inventories.

This time, the WGIA20 was held in Tomakomai, Hokkaido, Japan from 26th to 29th June, 2023. The topics set out for this workshop were based on consideration of the current situation of the member countries.

The outcomes of the WGIA20 are summarized in this report as Proceedings. We hope that this report will be found useful and will contribute to the further improvement of the GHG inventories of the WGIA member countries.

We would like to thank all the attendees for their participation and active contribution to the workshop.

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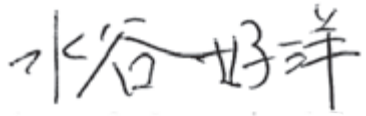


Director for International Cooperation for
Transition to Decarbonization and
Sustainable Infrastructure
Global Environment Bureau
Ministry of the Environment, Japan

List of Acronyms and Abbreviations

AB	WGIA Advisory Board
AD	Activity Data
AFOLU	Agriculture, Forestry and Other Land Use
AR	Assessment Report
ASEAN	Association of South-East Asian Nation
BTR	Biennial Transparency Report
BUR	Biennial Update Report
CBIT	Capacity-building Initiative for Transparency
CCS	Carbon Capture and Storage
CEF	Carbon Emission Factor
CGER	Center for Global Environmental Research
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
COP	Conference of the Parties
CRT	Common Reporting Tables
COVID-19	Coronavirus Disease 2019
CRF	Common Reporting Format
CS	Country Specific
EF	Emission Factor
EOR	Enhanced Oil Recovery
ESD	Earth System Division
ETF	Enhanced Transparency Framework
FOLU	Forestry and Other Land Use
FREL	Forest Reference Emission Level
FRL	Forest Reference Level
FY	Fiscal year
GHG	Greenhouse Gas
GIO	Greenhouse Gas Inventory Office of Japan
GPG	Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories
GPG-LULUCF	Good Practice Guidance for Land Use, Land-Use Change and Forestry
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
IPCC TFI	IPCC, Task Force on National Greenhouse Gas Inventories
IPPU	Industrial Process and Product Use
JCM	Joint Crediting Mechanism
LULUCF	Land Use, Land-Use Change and Forestry
ML	Mutual Learning
MOEJ	Ministry of the Environment, Japan
MPG	Modalities, Procedures, and Guidelines
MRV	Measurement, Reporting, and Verification Measurable, Reportable, and Verifiable
NAI	Non-Annex I

NC	National Communication
NDC	Nationally Determined Contribution
NIES	National Institute for Environmental Studies, Japan
NID	National Inventory Document
NIR	National Inventory Report
PA	Paris Agreement
QA	Quality Assurance
Q&A	Questions and Answers
QC	Quality Control
SBI	Subsidiary Body for Implementation
UNFCCC	United Nations Framework Convention on Climate Change
USEPA	United States Environmental Protection Agency
WGIA	Workshop on Greenhouse Gas Inventories in Asia
1996 IPCC Guidelines	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories
2006 IPCC Guidelines	2006 IPCC Guidelines for National Greenhouse Gas Inventories
2019 Refinement	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Chemical terms

CO_2	Carbon dioxide
CH_4	Methane
HFC	Hydrofluorocarbon
PFC	Perfluorocarbon
N_2O	Nitrous oxide
NF_3	Nitrogen trifluoride
Gg	Giga gram
kt	kilo tonnes
Mt	Million tonnes

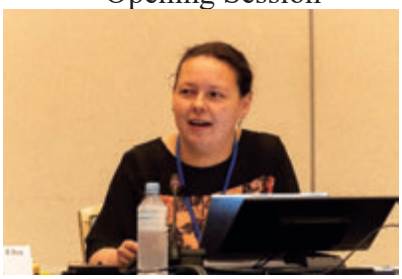
Photos of the Workshop

Welcome Address

Office of Director for International Cooperation for Transition to Decarbonization and Sustainable Infrastructure, Global Environment Bureau, Ministry of the Environment

The Plenary Sessions

Opening Session



Session I

Session II

Session IV

Session III Breakout Groups

The Mutual Learning Sessions

IPPU: Mongolia – Philippines

LULUCF: Indonesia – Laos

Waste: Viet Nam – Japan

Poster Session

Others

1. Executive Summary of WGIA20

1 Executive Summary of WGIA20

The Ministry of the Environment of Japan (MOEJ) and the National Institute for Environmental Studies (NIES) convened the "20th Workshop on Greenhouse Gas (GHG) Inventories in Asia (WGIA20)" from June 26th to June 29th, 2023, in Tomakomai, Hokkaido, Japan (partly online).

Annual workshops have been held since 2003 (excluding 2020 due to the COVID-19 pandemic) in order to support Asian countries to improve the accuracy of their GHG inventories and to facilitate the enhancement of cooperative relationships in the Asian region. This year, 86 participants (including those online) attended WGIA20 in total, including government and research representatives of 14 member countries (Bhutan, Brunei, Cambodia, India, Indonesia, Japan, the Republic of Korea, Laos, Malaysia, Mongolia, the Philippines, Singapore, Thailand, and Viet Nam), in addition to representatives of the Intergovernmental Panel on Climate Change (IPCC) Task Force on National Greenhouse Gas Inventories (TFI), the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environment Programme (UNEP), the United States of America, Bangladesh, and others.

Opening Session

The MOEJ delivered the welcome address, and the Greenhouse Gas Inventory Office of Japan (GIO) gave an introduction to the WGIA. Following this, MOEJ made a presentation on Japan's progress in climate change measures and international cooperation. Japan's total GHG emissions increased by 2.0% from FY2020 mainly due to increased energy consumption and the economic recovery from the COVID-19 pandemic. Japan aims to reduce GHG emissions by 46% by FY2030 from the FY2013 levels and promote decarbonization in the ASEAN and Indo-Pacific region through various initiatives, including the Paris Agreement (PA) Article 6 Implementation Partnership.

Updates on the GHG Inventory of the NCs and BURs from Non-Annex I Parties

Cambodia, Malaysia, Singapore, and Bangladesh gave presentations on their submitted National Communications (NCs) and/or Biennial Update Reports (BURs) and reported the most recent information on their emission estimates and relevant data.

Collecting time-series data, performing recalculations, adopting higher Tier methodologies, and conducting step-by-step Quality Assurance / Quality Control (QA/QC) procedures enhanced the countries' GHG inventories. Experience gained with BURs will directly benefit the first reporting of PA inventories. Countries are facing challenges in establishing systematic institutional systems, collecting more disaggregated data, developing Country-Specific (CS) Emission Factors (EFs), adopting the 2006 IPCC Guidelines methodologies, reducing uncertainty, and reporting the inventory in a transparent manner. Therefore, it is necessary to prioritize among the issues which need to be resolved for the timely submission of the first Biennial Transparency Reports (BTRs).

Changes in Reporting Under the Paris Agreement

The UNFCCC gave presentations on the GHG inventory reporting that will be required under the PA and the technical support/tools made available by the GHG Support Unit. After these presentations, the IPCC TFI introduced the newly released version of the IPCC Inventory Software that implements the functions for all methodological tiers and approaches in the 2006 IPCC Guidelines, as well as its Wetlands Supplement.

In order to submit BTRs by 2024 under the Enhanced Transparency Framework (ETF) of the PA, the WGIA countries should respectively enhance their national systems and compilation capacity to prepare national GHG inventories in the BTRs that meet the 2006 IPCC Guidelines and ETF reporting requirements. It is also necessary to think more specifically about how to report for each category/gas, using the GHG inventory reporting tool. It is important to effectively utilize the tools / capacity-building opportunities available to address the gaps identified in the preparation for the ETF reporting.

Planning for the First GHG Inventory Under the Paris Agreement

The WGIA Secretariat requested the participating countries to provide their planned schedules for submitting the first GHG inventory under the PA prior to the workshop. Three breakout group discussions were held on how to improve the planning based on these tables.

Many countries are willing to submit the first PA inventory on time. The participants recognized the importance of scheduling. They identified that some tasks needed to be undertaken before others and that each task would take more time than expected. Therefore, the deadline of December 2024 is not too far away. The participants confirmed that they would continue information exchange on issues and their solutions for submitting their first PA inventories under the WGIA.

Methodology for the Energy Sector

Brunei introduced the mandatory GHG emissions/removals reporting system and GHG estimates from the Energy Sector in Brunei. Following this presentation, the USEPA explained how Carbon Capture and Storage (CCS) was reflected in the US inventory. GIO also explained how CCS was reported in the Japanese inventory. The MOEJ explained Japan's policy for CCS.

Collection of accurate activity data and use of country- or facility-specific EFs are necessary for the Energy Sector under which many subcategories are key in the national GHG inventory. Mandatory reporting system of GHG emissions by facility may be useful as they enable the collection of such data (e.g., facility-specific EFs). Careful consideration is needed to reflect CCS in the GHG inventory. Capture and leakage of CO_2 should be reported under appropriate categories specified by the 2006 IPCC Guidelines. When captured CO_2 is imported/exported for CCS, coordination between countries is needed.

Mutual Learning

In this WGIA, Mutual Learning (ML) was held for the following three GHG inventory sectors: Industrial Processes and Product Use (IPPU) Sector (Mongolia and the Philippines), Land Use, Land-Use Change, and Forestry (LULUCF) Sector (Indonesia and Laos), and Waste Sector (Japan and Viet Nam). The participants exchanged materials and questions to learn about the inventory and institutional arrangements of the counterpart country. For each session, two countries engaged with each other by following up on the Questions and Answers (Q&A) which had taken place before the Workshop.

The participants shared with the partner countries their experiences in inventory preparation. Toward the 2024 submission in accordance with the Modalities, Procedures, and Guidelines (MPGs) under the PA, the participant countries are making efforts to enhance the completeness of their inventories by resolving not-estimated categories and by preparing time-series data, while they also continuously try to develop CS EFs and parameters to estimate GHG emissions more accurately. They are also improving their national inventory systems through developing and formalizing relationships with various

stakeholders under legal frameworks. Additionally, some countries have already strived/are striving to obtain data to reflect the effects of mitigation policies, such as the amount of clinker production or CH_4 recovery.

Poster Session

This was held to share information on various topics, such as institutional arrangements, the latest research results, and so on.

2. Workshop Report

2 Workshop Report

Please note that all presentation materials can be downloaded from the website of GIO: https://www.nies.go.jp/gio/en/wgia/20.html

2.1 Opening Session

The welcome address was delivered by Ms. Nishikawa Junko (MOEJ).

Mr. Senoo Kohei and Ms. Kuroda Kotoe (MOEJ) jointly made a presentation on Japan's progress on climate change measures and international cooperation. Mr. Senoo reported that Japan's total GHG emissions were estimated at 1,170 Mt CO_2 eq in FY2021 and had increased by 2.0% from FY2020 mainly due to increased energy consumption and the economic recovery from the COVID-19 pandemic. He also stated that Japan aims to reduce its GHG emissions by 46% by FY2030 from its FY2013 levels. Ms. Kuroda reported that Japan promotes decarbonization in the ASEAN and Indo-Pacific region through various initiatives, including the PA Article 6 Implementation Partnership. She emphasized that implementing Article 6 can reduce an additional 4-12 billion t CO_2 emissions per year by 2030, corresponding to 10-40% of global CO_2 emissions in 2018.

Mr. Ito Hiroshi (GIO) gave an introduction of WGIA20. He introduced the historical progress of WGIA as well as its participants, agenda, and expected outcomes. The expected outcomes of WGIA20 were:

- Building on experiences gained in NC/BUR reporting to enhance the quality of GHG inventories for the first BTR of PA
- Enhancing the understanding of the new Common Reporting Tables (CRT) format and the National Inventory Documents (NID) outlines
- Recognizing the importance of scheduling for the submission of the PA inventory in a timely manner and obtaining insights from others to improve scheduling
- Strengthening the participants' understanding of the methodology of the Energy Sector, including the reporting of CCS.

Mr. Ito emphasized that an accurate inventory in the NCs, BURs, and BTRs would contribute to the future planning and assessment of the progress towards emission reduction targets under the (PA).

2.2 Session I: Updates on the GHG Inventory of National Communications and Biennial Update Reports from Non-Annex I Parties

This session was chaired by Prof. Rizaldi Boer (AB member; Bogor Agricultural University) and the rapporteur was Ms. Hayashi Atsuko (GIO).

NAI Parties are required, as per COP 16 and COP 17 decisions, to submit national GHG inventories every two years as a part of their BURs or NCs. Under such circumstances, the WGIA member countries have submitted their BURs and/or NCs. In this session, Cambodia, Malaysia, Singapore, and Bangladesh gave presentations on their latest BURs and NCs.

The chair of this session, Prof. Rizaldi Boer, introduced the objective of this session as sharing information and experiences of preparing/updating the WGIA member countries' GHG inventories in their NCs and BURs and being an opportunity to learn from each other

how to address challenges in improving the quality of the inventory.

Ms. Heang Phallin (Cambodia) gave a presentation on Cambodia's national GHG inventory in its Third NC submitted in 2022. She explained the state of the GHG emissions in 2005 and 2010, which were estimated using the IPCC Inventory Software. She also explained that the country had been facing many constraints and gaps in its preparation of GHG inventories due to limited financial support, technology transfer, and institutional and human capacity. The lack of systematic coordination among respective agencies was also identified as a barrier.

Ms. Dayang Ratnasari Abu Bakar (Malaysia) gave a presentation on Malaysia's Fourth BUR submitted in 2022. She first presented the institutional arrangements for preparing the BUR and explained that together with the IPCC Inventory Software, external spreadsheets provided in the 2006 IPCC Guidelines were also used to check the calculations. The time-series data from 1990 to 2019 for each sector, the recalculation results, uncertainty analysis results, and a National GHG Inventory Improvement Plan for Activity Data (AD) and EFs were also described. At the end of the presentation, she continued her explanation that, in 2023, Malaysia was facing many challenges in its Nationally Determined Contribution (NDC) tracking and CRT preparation and expressed her expectation for WGIA to help with the improvement of the capacity for BTR reporting.

Ms. Winnie Chia (Singapore) gave a presentation on Singapore's Fifth BUR submitted in 2022. She showed the submission history of five NCs and five BURs and explained that the transition of methodological guidelines from the 1996 IPCC Guidelines to the 2006 IPCC Guidelines had been fully completed in 2020. After an explanation of Singapore's institutional arrangement for addressing climate change and BUR preparation, she explained the details of GHG inventory, such as time-series GHG emissions data from 2000 to 2018, key category analysis results, recalculation results, the data acquisition system, QC and QA processes together with the process of responding to International Consultation and Analysis, and so on.

Mr. Md. Rezaul Karim (Bangladesh) gave a presentation on Bangladesh's Third NC submitted in 2018, and on the national GHG inventory in its First BUR which is planned to be submitted in 2023. He compared the GHG emissions in 2012 and 2019 for each sector and the national total and mentioned that a 40% increase was observed in the national total. In the presentation slide, the per capita GHG emission in 2012 was shown as 0.98 tonnes CO_2-eq. He also showed time-series emissions data from 2013 to 2019 for each sector. For every year, the largest emission source was the Energy Sector, followed by the Agriculture, Forestry, and Other Land Use (AFOLU), Waste, and IPPU Sectors.

Regarding the presentations above, participants showed interest in the way of overcoming challenges, such as moving to higher Tier method use, improving QA/QC procedures, and reducing uncertainty through the change from the Revised 1996 IPCC Guidelines to the 2006 IPCC Guidelines. In response, the presenters explained the difficulties they faced, such as how they adopted higher Tier methods while also using the IPCC Inventory Software, how they conducted QA/QC, especially with regard to private company data providers, and how they considered and adjusted the uncertainty assessment to align with the new Guidelines.

For this session, the following conclusions were shared with the participants.

1) Countries enhanced their GHG inventories by collecting time-series data, performing recalculations, adopting higher Tier methods, and conducting step-by-step QA/QC procedures. The experience gained with BURs will directly benefit the first reporting of PA

inventories. 2) Countries are facing challenges in establishing systematic institutional systems, collecting more disaggregated data, particularly from private companies, developing CS EFs, adopting 2006 IPCC Guidelines methodologies, reducing uncertainty, and reporting the inventory in a transparent manner. Therefore, it is necessary to prioritize among the issues which need to be resolved for the timely submission of the first BTRs.

2.3 Session II: Changes in Reporting Under the Paris Agreement

This session was chaired by Ms. Sandee G. Recabar (Climate Change Commission).

Parties under the PA are required to submit their first BTR and national inventory report, if submitted as a stand-alone report, in accordance with MPGs for the transparency framework for action and support referred to in Article 13 of the PA at the latest by 31 December 2024. The WGIA member countries will need to enhance their national systems and compilation capacity to prepare national GHG inventories to meet the requirements, and therefore, this session was held to promote a clear understanding of the new reporting requirements together with their formats. Information was also provided on the tools that help inventory preparations and capacity-building opportunities.

Mr. Aizawa Tomoyuki (UNFCCC) gave a comprehensive overview of the GHG inventory reporting that will be required under the PA. In addition to the reporting requirements, information was provided on the flexibility provisions for developing countries that need them in the light of their capacities. He also explained how to prepare the CRTs using the GHG inventory reporting tool by showing the general steps needed for GHG inventory preparation towards the official submission to the UNFCCC. The structure of the CRTs together with the differences from data entry grids on the GHG inventory reporting tool was also explained. The GHG inventory reporting tool is currently under development, with the aim of finalizing it around June 2024.

Mr. Dominique Revet (UNFCCC) shared the information on the technical support/tools made available by the GHG Support Unit, such as the GHG support webpage, in-country QA workshops, e-learning, and the tool for data collection and management named SAGE (Sectoral Activity data for GHG Emissions). He mentioned that these support activities/tools will assist developing countries in all processes with their national GHG inventory preparations based on the new reporting requirements under the ETF.

Dr. Baasansuren Jamsranjav (AB; IPCC/TFI) explained that the newly released version 2.861 of the IPCC Inventory Software implements the functions for all methodological tiers and approaches in the 2006 IPCC Guidelines and its Wetlands Supplement. Information was also provided on the key functions of the IPCC Inventory Software: 1) data managers, 2) interoperability with the GHG inventory reporting tool, 3) inclusion of the IPCC Fifth Assessment Report (AR5) GWP values, and 4) emissions/removals estimation at the subnational level.

In response to the questions from a participant on how developing countries should enter their data into the CRTs, Mr. Aizawa clarified that there were three ways available for entering data: 1) entering data to the grids on the GHG inventory reporting tool manually, 2) importing JSON (JavaScript Object Notation) -formatted files, and 3) importing Excel-formatted files. Additionally, he mentioned that CRTs will be automatically generated by the GHG inventory reporting tool and also advised that considerations will be necessary to identify which way of entering data is the most appropriate for each country by using the test version of the GHG inventory reporting tool, which will be released in August 2023.

In response to questions from a participant relating to the transition to the 2006 IPCC Guidelines, Mr. Revet noted the importance of ensuring time-series consistency in an inventory and of conducting recalculations.

Regarding a question from a participant about the improvements in the IPCC Inventory Software, such as those in F-gases emission estimations, Dr. Jamsranjav clarified that the accuracy of estimations could be improved due to the implementation of higher tier methodologies and upgraded default emission factors. Mr. Revet emphasized the importance of transitioning to higher-tier methodologies, especially for key categories, to capture the effects of GHG emission mitigation.

For this session, the following conclusions were shared with the participants:

1) In order to submit BTRs by 2024 under the ETF of the PA, the WGIA countries should respectively enhance their national systems and compilation capacity to prepare national GHG inventories in the BTRs that meet the 2006 IPCC Guidelines and ETF reporting requirements. It is also necessary to think more specifically about how to report for each category/gas using the GHG inventory reporting tool. 2) It is important to effectively utilize the tools / capacity-building opportunities available to address the gaps identified in the preparation for ETF reporting.

2.4 Session III: Planning for the First GHG Inventory Under the Paris Agreement

Parties to the PA shall submit their first national GHG inventory under the PA by the end of 2024.[1] Now is a critical time to identify what tasks are needed for inventory compilation and when the tasks should be undertaken.

This Session aimed to have the participating countries share their planned schedules for their first inventory compilation and submission under the PA, and through break-out group discussions, also aimed to help improve the plans as well as to provide insights for other countries to improve their own planning.

The WGIA Secretariat requested the participating countries to provide their planned schedule before the workshop. It provided the template below and a sample of the schedule table.

[1] The least developed countries and small-island developing states may submit at their discretion.

Session 3 - Planning for the First GHG Inventory under the Paris Agreement - Worksheet

The 20th Workshop on Greenhouse Gas Inventories in Asia (WGIA20)

Country: XXXX

(Tasks shown below are just an example. Please feel free to add/edit/delete tasks and change the order to fit your national circumstances.)

	Task	Entity	2023 Done	Jul	Aug	Sep	Oct	Nov	Dec	2024 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2025	Difficulties/concerns	Good practices (to be filled during the session)
Preparation Stage																								
1	Reconsider institutional arrangement																							
2	Learn MPGs and IPCC Guidelines																							
3	Test trial version of the CRT reporting tool																							
4	Submit views on trial version of the CRT reporting tool																							
5	Get familiar with final version of the CRT reporting tool																							
6																								
Sectoral Inventory Compilation Stage																								
7	Identify methodological issues (including tier selection)																							
8	Consider methodological revision																							
9	Collect activity data																							
10	Collect emission factors																							
11	Calculate sectoral emissions & removals																							
12	Aggregate sectoral emissions to get national total																							
13	Draft NID																							
14	Input data to CRT																							
15																								
Cross-cutting Inventory Compilation Stage																								
16	Key category analysis																							
17	Uncertainty analysis																							
18																								
QA/QC and Final Approval Stage																								
19	QA/QC																							
20	Official consideration process																							
21	Submit inventory to UN																							
22																								

Remarks

Figure 2-1 Template of the schedule table

Some countries provided their schedule tables beforehand and some did so during the session.

Three breakout groups were launched during the session with the following countries.

Group	Countries
1	Singapore, Thailand, India, Cambodia, and Brunei Darussalam
2	Republic of Korea, Indonesia, Mongolia, the Philippines, and Bhutan
3	Malaysia, Viet Nam, Lao PDR, and Bangladesh

Following each country's explanation of its schedule, other participants raised questions or gave comments and the WGIA Secretariat facilitated further discussions.

The following guiding questions were referred to during the discussion:

- Are there any improvements in the tasks?
  - Are there any important tasks missing?
  - Are there any tasks whose order seems strange?
  - Are there any tasks for which the allocated time is too short or too long?
- Are there any critical tasks that will lead to a delay in submission?
- Does the schedule meet the first BTR deadline (December 2024)?

- What are the difficulties/concerns faced?
- What are the good practices?

The following findings were identified through the discussions.

Group 1

- Improvements needed in the tasks
  - One of the countries needs to change the timing of submission of comments on the test version of the ETF GHG Inventory Reporting Tool to an earlier time to meet the deadline (Dec. 2023).
  - Some countries need to change the timing of methodological consideration (including tier selection) to a time before data collection.
  - One of the countries needs to allocate more time for drafting the NID.
  - One of the countries needs to change the timing of the QA/QC process to after the data collection process.
- Difficulties or concerns
  - Some countries face difficulties in performing quantitative uncertainty assessments.
  - Some countries face difficulties in collecting time-series data from 1990.
- Good practices
  - One of the countries plans to submit views on the test version in a timely manner.
  - One of the countries allocates enough time for drafting NID.
  - Many countries established institutional arrangements to support a timely submission.
  - All countries in Group 1 are willing to submit on time by 2024.

Group 2

- Improvements needed in the tasks
  - Uncertainty analysis should ideally come before key category analysis, since approach 2 key category analysis needs results from the uncertainty analysis. Uncertainty analysis can even be started earlier, at a time when ADs and CS EFs are collected.
  - Data input to the CRT should be conducted after completing the QA/QC procedure.
  - Institutional arrangements should be strengthened to ensure timely and continuous submissions of the GHG inventory.
  - Implementing mapping is needed to address the shift from the Revised 1996 Guidelines to the 2006 IPCC Guidelines.
  - The data entry system must be adjusted to match the CRT format.
- Critical tasks for a timely submission
  - Formalization of strong institutional arrangements, including the establishment of strong coordination among agencies and data providers
  - Capacity building for each task to avoid cumulative delay.
- Difficulties or concerns
  - Change in personnel
  - Lack of training and capacity

- Capturing the impact of mitigation measures comprehensively in the GHG inventory
- Timing of the finalization of CRT, since the final version of CRT will be completed quite close to the deadline of the first BTR submission
- Technical concerns on the estimation tools, since the domestic data format does not always fit the data entry format of the existing estimation tools.

- Good practices
  - Provision of tools, templates, and guidelines at the start of the inventory cycle
  - Participation in international QA/QC workshops
  - Mapping between sub-categories of the Revised 1996 Guidelines and the 2006 IPCC Guidelines to separate between the Agriculture Sector and LULUCF Sector
  - QC done at each step from the beginning of the inventory cycle
  - Sharing information among participating countries (e.g., ML).

Group 3

- Improvements needed in the tasks
  - The ETF GHG Inventory Reporting Tool needs to be tested after the releases in August and November if countries wish to do so.
  - Countries should get familiar with the Tool during the testing period, but actual data entry would be done better at the final stage following the finalization of estimations.
  - QC should be done during AD/EF collection and estimations, whereas QA can be done at a later stage.
  - The scheduling of the tasks should take into account the timing of the outputs from improvement plans, such as those from the CBIT projects.
- Critical tasks for a timely submission
  - AD/EF collection and estimations need to be done sufficiently early in the process so that the later steps do not get overly postponed.
- Difficulties or concerns
  - Lack of primary data sources
  - Inconsistency in data collected from different sources
  - The predominant use of default EFs
  - Lack of GHG inventory experts
  - Lack of continuous time-series data.
- Good practices
  - Each country is making every effort to plan for its first national inventory under the ETF of the PA in accordance with its respective national circumstances.
- Other
  - Each country has country-specific steps to process the inventory.
  - Depending on the level at which a certain task is completed, the submission date could be moved up or moved back.

For this session, the following conclusions were made.

1) Many countries are willing to submit the first PA inventory on time. 2) The participants

recognized the importance of scheduling. 3) They identified that some tasks needed to be undertaken before others and that each task would take more time than expected. Therefore, the deadline of December 2024 is not too far away.

The participants confirmed that they would continue information exchange under the WGIA on issues and their solutions for submitting the first PA inventories.

2.5 Session IV: Methodology for the Energy Sector

This session was chaired by Mr. Tanabe Kiyoto (Co-Chair of IPCC TFI).

The Energy Sector is the largest emission source of the GHG inventory in most countries. This sector, especially CO_2 emissions from Fuel Combustion, is often identified as one of the key categories; hence countries having such key categories should make every effort to apply Tier 2 methods and develop CS EFs. Also, it is important to enhance AD collection in the Energy Sector.

Tomakomai, where WGIA was held this year, is a city where a large-scale demonstration experiment of CO_2 capture and storage (CCS) has taken place. The participants visited the Tomakomai CCS facility on 29th June on a study tour. CCS is one of the key mitigation measures of climate change, and it is important for inventory compilers to know how to report CCS under the GHG inventory.

Against the above backdrop, this session aimed at identifying good practices and issues relating to developing CS EFs and collecting AD for the Energy Sector. This session also aimed at enhancing the understanding of how to report CCS, which the 2006 IPCC Guidelines newly provided the methodology for.

Ms. Dk Nur Afifah Atikah PG HJ Ismail (Brunei Darussalam) gave a presentation on Brunei Darussalam's GHG Inventory Management System and GHG Estimates from the Energy Sector.

After the presentation, the following discussion was made. A participant asked why Tier 1 methods were chosen for some key categories and Tier 3 methods for some non-key categories. Ms. Ismail explained that the choice of Tiers depended on the data availability, e.g., the lack of CSEFs for public utilities. She also explained that there were currently no plans to move from Tier 1 to Tier 3. There were questions on why uncertainty for the whole inventory increased since 2020 and why the uncertainty increased even though higher Tier methods were applied. Ms. Ismail answered that there were no coal power plants in the past, but the introduction of a large coal power plant in late 2019 led to an increase in GHG emissions and uncertainty. She also explained that uncertainties in CS EF and AD were not available, and therefore the default values were used instead. The chair added that, in general, higher Tier methods required more data, including some that are highly uncertain, and this sometimes led to an increase in the uncertainty of emissions.

In response to a question that the Commercial/institutional category was not found in the presentation, Ms. Ismail clarified that the category was included in the Residential category because these categories were insignificant. The Chair pointed out that the Carbon Emission Factors (CEFs) were not dependent on the combustion technologies, and asked why Brunei was trying to collect facility-specific CEFs. Ms. Ismail answered that the preliminary analysis so far showed that the CEFs varied by facility, and collecting facility-specific CEFs was intended to reduce uncertainty. She added that the default CEFs were found to be quite larger than the facility-specific CEFs. She also explained that the facility-

specific CEFs were measured and that the mandatory reporting system covered all inventory sectors and was not limited to the Energy Sector.

In response to a question from a different participant, Ms. Ismail clarified that there was no threshold to exempt small facilities from reporting. She explained that there was no legal basis for facilities to report in the past, and therefore a mandatory reporting system was introduced to strengthen data collection. She also clarified that the mandatory reporting system covered the Commercial/institutional category and local airlines.

Mr. Vincent Camobreco (US EPA) gave a presentation on CO_2 Transport, Injection, and Geologic Storage in the Inventory of the U.S. Greenhouse Gas Emissions and Sinks.

After the presentation, a participant raised a question on the difference between the CO_2 amount captured for Enhanced Oil Recovery (EOR) (about 35 Mt in 2021) and the CO_2 amount sequestered (7 Mt) obtained from the Greenhouse Gas Reporting Program (GHGRP). Mr. Camobreco explained that some companies did not report the CO_2 amount sequestered as they recognized EOR was not subject to reporting of CO_2 sequestration. In response to an additional question, Mr. Camobreco clarified that the reported amount might include EOR at closed oil wells. The participant pointed out that the requirement of CO_2 purity was over 98% for Japan and over 90% for other countries, and that inventory compilers should be aware of CO_2 purity when reporting CCS in the GHG inventory.

Another participant asked how the GHG emissions from fuel combustion for CCS were addressed and whether there were any plans to monitor their long-term impact on CO_2 storage. Mr. Camobreco answered that the energy use from pipeline transport was reported under the GHG inventory and that the GHGRP required entities to submit a management verification plan, which included a long-term monitoring plan, under the Tier 3 method. There was a question on whether tax credits from CCS could be used as a means to disclose confidential information. Mr. Camobreco explained that to obtain federal tax credits, related data should be disclosed, and that the data may be a potential data source for the inventory. He also explained that the GHGRP required companies to report captured and sequestered amounts and meet the ISO standard under the management verification plan, which enabled tax credits to be granted.

Another participant raised a question on whether the leakage from sequestration should be reported under the capturing point or the storage point. Mr. Camobreco answered that the leakage should be reported under the corresponding category, e.g., leakage at the injection site should be reported under the injection site and the leakage at the capture site should be reported under the capture site. Another question was on how transboundary CO_2 transport was reported and governed. Mr. Camobreco answered that the emissions within the USA were to be reported under the USA and the emissions after export to Canada were to be reported under Canada. He added that the GHGRP required companies to establish MRV systems and that the information about these systems was publicly available.

An additional question was on the meaning of reporting CO_2 amounts under the information item in the Common Reporting Format (CRF) Table 1.C. Mr. Camobreco answered that the information item was for checking the balance and was not reflected in the national total. Regarding a question on when CO_2 was imported and stored and which country the CO_2 was subtracted from, Mr. Camobreco answered that CO_2 should be subtracted from source facilities. The Chair made a question whether there were any official agreements between the USA and Canada regarding transboundary CO_2 transport. Mr. Camobreco clarified that the USA was in close contact with Canada on how much CO_2 was imported/exported but no further agreements were made.

Mr. Kosaka Naofumi (GIO) made a presentation on Japan's reporting on CCS. Mr. Senoo Kohei and Ms. Uga Maiko (MOEJ) presented the policies for CCS in Japan and gave an overview of CCS under the Joint Crediting Mechanism (JCM).

After the presentations, a participant stated that zero-emission technologies other than CCS should be sought because energy consumption was unavoidable during CCS. Mr. Senoo explained that the government of Japan would seek various net-zero technologies including CCS and proceed with CCS projects. Mr. Camobreco also mentioned that CCS was one of the mitigation options. There was a question on whether Japan had any laws to determine CCS location. Mr. Senoo clarified that Japan was considering regulation. Another participant pointed out that Japan's 2050 goal of 0.12-0.24 billion tonnes of CO_2 capture per year established in the Long-term Road Map for CCS should be interpreted that Japan must reduce CO_2 emissions by 80-90% by energy saving and renewable energy and inject the remaining 10% of the current emissions to achieve net-zero emissions.

For this session, the following conclusions were made.

1) Collection of accurate AD and use of country- or facility-specific EFs are necessary for the Energy Sector under which many subcategories are key in the national GHG inventory. A mandatory reporting system of GHG emissions by facility may be useful as it enables the collection of such data (e.g., facility-specific EFs).
2) Careful consideration is needed to reflect CCS in the GHG inventory. Capture and leakage of CO_2 should be reported under appropriate categories specified by the 2006 IPCC Guidelines. When captured CO_2 is imported/exported for CCS, coordination between countries is needed. It is important to reduce GHG emissions to the extent possible and to use CCS as a supplementary measure to achieve net-zero emissions.

2.6 Poster Session

This was held to share information on various topics such as institutional arrangements, the latest research results, and so on. Six posters were displayed during the workshop and active discussions took place at the session. During the one-on-one informal conversations, detailed information on institutional arrangements, including adjusting them to BTR submissions, and the latest research results on the development of CSEFs and other specific issues on emission reductions were deeply discussed.

2.7 Wrap-up Session

Following the presentation of the summary of the ML sessions from Dr. Oda Takefumi (GIO), Ms. Hatanaka Elsa (GIO) called on countries that participated in ML to seek their comments. The participating countries were in agreement regarding the usefulness of the ML sessions for improving their inventories. They noted how helpful it was to share knowledge about their experiences and common challenges. Some also noted that they were made aware of new issues that they had not been aware of before and some suggested continuing communication to follow up on the issues identified. Ms. Hatanaka encouraged countries to make applications to take part in ML, even if it was in the same sectors as in the past, since there may have been personnel change, and taking part again may be beneficial.

Ms. Hayashi Atsuko (GIO) followed this by presenting a summary of the plenary

sessions. Ms. Hatanaka asked for oral comments on the proposals made by Ms. Hayashi for possible conclusions, however, no comments were received, including later in writing.

After the presentations of the session summaries, some general comments were received from the participants. Dr. Sirintornthp Towprayoon (AB; King Mongkut's University of Technology Thonburi) noted that this Workshop marked the 20th anniversary of WGIA, and congratulated countries on the progress they made in their inventories. She also highlighted that this was a historical period of entering into PA reporting and that the WGIA20's agenda, including the new Session III, was useful and informative. She encouraged countries to take home the findings and conclusions of the sessions and to think about further development.

Mr. Dominique Revet (UNFCCC) stressed the importance of more fully developing national systems to gather data in light of future PA reporting. He noted that there was no universal rule, and each country needed to translate what was internationally required and apply it to its domestic context.

Mr. Morimoto Takashi (Mitsubishi UFJ Research and Consulting) added that it was also important to develop national systems given the continuous submissions needed after 2024. He also highlighted the importance of capturing emission reductions in national inventories.

Dr. Rizaldi Boer (AB; Bogor Agricultural University), the chair of Session I, agreed with the previous speakers and added that good coordination was needed not only with the data providers but also with the agencies involved in implementing mitigation, and also highlighted the need for support for developing countries in this regard.

Ms. Sandee G. Recabar (Climate Change Commission, the Philippines), the chair of Session II, agreed with the need for strengthening national systems, but also highlighted the importance of documentation and archiving, time-series data, and recalculations. She expressed expectations for WGIA to be of help with timely submissions through sharing information from more experienced countries.

Mr. Tanabe Kiyoto (Co-Chair of IPCC TFI), the chair of Session IV, encouraged participants to exchange information and advice through the strong network established via WGIA and noted the importance of the timing of the next Workshop because preparation for PA reporting would be in full swing by then.

Following these and other comments, Ms. Hatanaka made some closing remarks. She explained that there were challenges faced in the planning of this WGIA20, with it being the first physical meeting after the spread of COVID-19, but noted that she was reminded of the efficiency of in-person communication and the joy of getting to know each other face-to-face. On the upcoming PA reporting, she stressed that this was a critical time to clarify one's understanding of the inventory requirements regarding methodological guidance and reporting. She pointed out that the goal was to aspire to achieve completeness in terms of categories, gases, and time series. She emphasized that more recent and complete inventories would more efficiently inform policy decisions. However, she also reminded participants of the importance of starting where one could and of the idea of learning by doing, since modifying inventories which would result in recalculations was already expected as part of the continuous improvement of the inventories. Lastly, she thanked all the participants for their active participation and closed WGIA20.

3. Abstracts

3 Abstracts

In this section, the abstracts of the presentations are compiled. The abstracts are attached in an unedited form, as they were received from the presenters.

3.1 Opening Session

Introduction to WGIA 20

ITO Hiroshi
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Abstract

Non-Annex I (NAI) Parties under the United Nations Framework Convention on Climate Change (UNFCCC) are required to prepare Greenhouse Gas (GHG) inventories as a part of National Communications (NCs) and Biennial Update Reports (BURs), and all countries will be required to prepare GHG inventories as part of or independent of their future Biennial Transparency Reports (BTRs) under the Paris Agreement. It is therefore increasingly important for countries to develop reliable GHG inventories.

To support developing and improving GHG Inventories of developing countries in Asia, the Workshop on GHG Inventories in Asia (WGIA) has been held annually since 2003. WGIA is organized by the Ministry of the Environment of Japan (MOEJ) and the National Institute for Environmental Studies (NIES). The member countries are 16 countries (Bhutan, Brunei, Cambodia, China, India, Indonesia, Japan, Republic of Korea, Laos, Malaysia, Mongolia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam). Throughout the years, WGIA has developed and strengthened a network of inventory experts, together with providing information to the public by making presentations and proceedings available on GIO's website.

The upcoming 20th Workshop on GHG Inventories in Asia (WGIA20) is to be held 26 - 29 June 2023. WGIA20 aims:
1) To build on experiences gained in NC/BUR reporting to enhance the quality of GHG inventory for first BTR of Paris Agreement (PA)
2) To enhance understanding of the new Common Reporting Tables (CRT) format, National Inventory Documents (NID) outlines
3) To Recognize the importance of scheduling for submitting the PA inventory in a timely manner and to obtain insights from others to improve their schedule, and
4) To strengthen the participants' understanding of the methodology of energy sector, including the reporting of carbon capture and storage (CCS).

Participants are government officials and researchers from 16 countries in Asia (Bhutan, Brunei, Cambodia, China, India, Indonesia, Japan, Republic of Korea, Laos, Malaysia, Mongolia, Philippines, Singapore, Thailand, Viet Nam, and Bangladesh) and experts from international organizations (the IPCC Task Force on National GHG Inventories (IPCC/TFI), the secretariat of UNFCCC, United States Environmental Protection Agency (USEPA)), and others.

Access to relevant information

https://www.nies.go.jp/gio/en/wgia/index.html

3. Abstract

Japan's Progress on Climate Change Measures and International Cooperation

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Decarbonized Society Promotion Office[※1], Office of Director for International Cooperation for Transition to Decarbonization and Sustainable Infrastructure[※2], Global Environmental Bureau, Ministry of the Environment, Japan

Abstract

Japan's greenhouse gas emissions had decreased seven years in a row from FY2014 to FY2020, mainly due to the decrease in energy consumption and decarbonization of electricity. In FY2021, Japan's total greenhouse gas emissions were estimated at 1,170 Mt CO_2 eq. (reflecting a 16.9% decrease compared to FY2013). Due to the Japanese economy recovering after COVID19, Japan's greenhouse gas emissions increased by 2.0% in FY2021. On the other hand, our GDP has been on the rise in recent years except in FY2020. Greenhouse gas emissions per unit of GDP have decreased nine years in a row. As a statutory plan recommending concrete policies and measures to be implemented by the whole government and outlining measures to be taken by both private and public sectors, the revision of the "Plan for Global Warming Countermeasures" was decided by the Cabinet in October 2021. The progress of the Plan is monitored every year, and the results are reported to and approved by the Global Warming Prevention Headquarters, which consists of all Cabinet members. Out of the 115 policies and measures listed in the Plan, in terms of reductions, 91% are evaluated as progressing at a pace that meets or exceeds the target levels.

In addition to domestic efforts, Japan promotes decarbonization globally through various initiatives, including the Paris Agreement Article 6 Implementation Partnership (A6IP) which promotes international collaboration for capacity building related to Article 6 of the Paris Agreement (A6). A6 allows countries to voluntarily cooperate with each other to achieve emission reduction targets set out in their NDCs, and it is estimated that implementing A6 can reduce an additional 4~12 billion tCO_2 emission per year by 2030, corresponding to 10% - 40% of global CO_2 emissions in 2018. Providing that the most recent national inventory report is one of the requirements to participate in A6, national inventories are critical to A6 implementation. Japan will continue to provide capacity building support through programs such as WGIA, A6IP, and the Joint Crediting Mechanism.

References/ Publications

1. National Greenhouse Gas Inventory Report of Japan (April 2023)
2. Submission of Japan's Nationally Determined Contribution (October 2021)
3. Overview of the Plan for Global Warming Countermeasures (October 2021)
4. Japan's Long-term Strategy under the Paris Agreement (October 2021)
5. Edmonds et al. 2021. How much could Article 6 enhance nationally determined contribution ambition toward Paris Agreement goals through economic efficiency?, Climate Change Economics; UNEP, UNEP-CCC 2021. Emissions Gap Report 2021; TSVCM. 2021. Taskforce on Scaling Voluntary Carbon Markets Final Report

Access to relevant information

1. https://unfccc.int/documents/627900
2. https://www4.unfccc.int/sites/NDCStaging/Pages/Home.aspx
3. https://www.env.go.jp/en/headline/2551.html
4. https://unfccc.int/sites/default/files/resource/Japan_LTS2021.pdf
5. A6IP Website https://a6partnership.org/

3.2 Session I

Cambodia's Third National Communication and GHG Emissions Target

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Abstract

The third National Communication (TCN) has been prepared to meet Cambodia's obligations as a Party to the United Nations Framework Convention on Climate Change (UNFCCC). It is a prepared based on the guidelines in Decision 17/CP.8, which contains the following chapters:
Chapter 1: National Circumstances
Chapter 2: National Greenhouse Gas Inventory
Chapter 3: Vulnerability and Adaptation Assessment
Chapter 4: Measures to Mitigate Climate Change
Chapter 5: Other Information and Relevant Activities
Chapter 6: Constraints and Gaps and Support Needs

The Royal Government of Cambodia (RGC) established her constitution in 1993 as a liberal democracy. The country is situated in mainland Southeast Asia, which comprises a total area of 181,035 km^2. The country's topography consists of the central plains surrounded by mountainous highland regions and a coastline to the south. Cambodia's climate is governed by monsoons and characterized by two major wet and dry seasons.

Cambodia's population was 14.68 million in 2013, which shows an increment of 1.28 million from 2008 to 2013. About 80% of Cambodians live in rural areas, while 20% live in urban areas, including the capital. The national population density in 2013 was 82 persons per km^2. Climate change impacts the poverty and health of the population of the country. The poverty of the country differs in urban areas and rural areas, in which the poverty in rural areas is higher than the poverty in urban areas. Cambodia was ranked 129th out of 177 countries based on the Human Development Index (HDI).

Cambodia's economy relies on four main sectors: agriculture, industry, tourism, and construction. The Agricultural sector is one of the main sectors that supports the rise of the Gross Domestic Product (GDP) of the country. This sector includes rice production, livestock, and rubber. Besides the above-mentioned sectors, Cambodia also focuses on other fields such as: (i) energy sector focused on the use of renewable energy sources such as hydropower, biomass, biogas, biofuel, etc. and energy efficiency practices, (ii) transport network of Cambodia consists of national roads, provincial roads, and rural roads, (iii) tourism sector, (iv) water resource and irrigation system provides the infrastructure to protect from natural disasters such as floods and droughts, (v) capacity to strengthen the quality of education in Cambodia is in progress by implementing the "Education for All" strategy, (vi) promote gender equality at all sectors and levels through Five-Year Strategic Plan for Strengthening Gender Mainstreaming and Women's Engagement (2009-2013), and (vii) Solid waste generation has increased over the past decades and has gradually changed from a considerable proportion of biodegradable and organic waste to non-degradable. Cambodia has made all of her utmost effort to develop the national economy to become one of the most rapid economic growth countries among the developing countries and is envisioned to reach the status of an upper-middle income country by 2030 and a high-income one by 2050.

Malaysia Fourth Biennial Update Report Under the United Nations Framework Convention on Climate Change

Dayang Ratnasari Abu Bakar, Elizabeth Philip
Ministry of Natural Resources, Environment and Climate Change, Malaysia

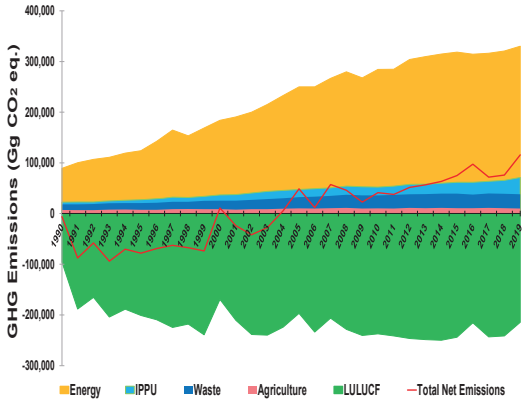
Abstract

Malaysia's Fourth Biennial Update Report (BUR4) was submitted to the United Nations Framework on Climate Change (UNFCCC) on 31 December 2022. The 2006 IPCC Guidelines for National Greenhouse Gas Inventories and 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands were used to estimate the GHG emissions and removals. In 2019, the energy sector remained as the largest contributor of emissions where it accounted for 78% of the total emissions. This is followed by the IPPU and the waste sectors, both contributed about 10% and 9% of the total emissions respectively. Meanwhile, the agriculture sector contributed the lowest emissions at 3%. The total GHG emissions recorded that year was 330,358.21 Gg CO_2 eq. Considering the LULUCF sector which shows a net sink of -214,714.54 Gg CO_2 eq., Malaysia's net GHG emissions was 115,643.68 Gg CO_2 eq. The summary of Malaysia's GHG inventory in 2019 is as Table 1. The GHG emission time series from 1990 to 2019 is shown in Figure 1. As part of the efforts to improve the GHG estimations to the extent possible, time series were recalculated to reflect the updated methodologies, activity data and emission factors in accordance with the guidelines. The recalculation includes among others but not limited to the following sectors: energy (road transport, fugitive emissions), IPPU (minor update on other process uses of carbonates), agriculture (updates in animal population) and LULUCF (forestland and cropland), and waste (minor update on solid waste disposal and updates on the recycling rate and domestic wastewater).

Table 1: Summary of Malaysia's GHG inventory in 2019

Sector	GHG Emission/ Removal (Gg CO_2 eq.)
Energy	259,326.11
IPPU	32,853.80
AFOLU-Agriculture	9,921.71
AFOLU-LULUCF	-214,714.54
Waste	28,256.59
Total (Excl. LULUCF)	330,358.21
Total (Incl. LULUCF)	115,643.68

Figure 1: GHG emission time series from 1990 to 2019



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Malaysia Fourth Biennial Update Report Under the United Nations Framework Convention on Climate Change, Ministry of Natural Resources, Environment and Climate Change, Malaysia, 2022. (https://unfccc.int/documents/624776)

Singapore's Fifth Biennial Update Report

Winnie Chia
National Environment Agency, Singapore

Abstract

As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), Singapore was committed to submitting the National Communications (NC) and the Biennial Update Report (BUR) to the UNFCCC. In November 2022, Singapore submitted its fifth NC and fifth BUR. Starting from the 4th Biennial Update Report, emissions were estimated using 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines and Global Warming Potential (GWP) from the IPCC Fifth Assessment Report (AR5).

The consistent submissions of the NC and BURs were made possible through the setup of institutional arrangements. The Inter-Ministerial Committee on Climate Change (IMCCC) chaired by Senior Minister and Coordinating Minister for National Security was established in 2007 while in 2010, National Climate Change Secretariat (NCCS) was established to ensure effective coordination of Singapore's domestic and international policies, plans, and actions on climate change. For the coordination of NC and BUR, an inter-agency working group (IAWG) led by National Environment Agency produced Singapore's NC and BUR.

Singapore's Greenhouse Gas (GHG) emissions for 2018 totaled 53,312.68 $GgCO_2$ eq. The most significant GHG emitted in Singapore was carbon dioxide (CO_2), primarily produced by the burning of fossil fuels to generate energy used by the industry, building, household, and transport sectors. Second to CO_2 emissions, perfluorocarbons (PFCs) emissions came from mainly the electronic and semiconductor industries under the Industrial Processes and Product Use (IPPU) sector.

In line with IPCC Good Practice Guidance to continually review the GHG inventory, for the fifth BUR, recalculations to emissions were conducted for the Land Use, Land-use Change and Forestry (LULUCF) and energy sector. In 2020, Singapore commissioned a study to develop a Tier 1 estimate of GHG emissions from the agriculture sector for the year 2018, using default parameter values such as emission and stock change factors from the 2006 IPCC Guidelines. The estimate was relatively small, 8.04 $GgCO_2$ eq, and included in the fifth BUR.

Singapore will continue to enhance its GHG inventory through the Quality Control and Quality Assurance plan developed based on the 2006 IPCC Guidelines, findings from the Technical Analysis Summary Report (TASR) provided by the Team of Technical Experts (TTE) through the International Consultation and Analysis (ICA) process and participating in technical workshops, and consulting subject experts at the UNFCCC Secretariat, think-tanks, academia and international organisations in preparation for the submission of the Biennial Transparency Report in December 2024.

References/ Publications

Singapore's Fifth National Communication/Fifth Biennial Update Report

Updates on the GHG Inventory of National Communications & BUR

MD Rezaul Karim
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Abstract

Bangladesh is considered one of the most climate-vulnerable countries in the world, while its contribution to global warming is negligible (contributes less than 0.48% of global emissions with per capita 0.98-ton CO_2-eq emission). Climate change has emerged as the biggest threat to sustainable development and is triggering widespread and unprecedented impacts that disproportionately burden the poorest and the most marginalized people in the country.

National Communications and Biennial Update Report:
According to the obligation of the UNFCCC, Bangladesh has submitted the following National Communications to the UNFCCC:

- Initial National Communication : Submitted in 2002
- Second National Communication : Submitted in 2012
- Third National Communication : Submitted in 2018

As per the Third National Communication, Bangladesh's GHG emission in 2012 was 152.27 million-ton CO_2-eq. Per capita, GHG emission was 0.98 tons CO_2-eq.

Bangladesh is being formulated its First Biennial Update Report (BUR1) by June 2023.

Nationally Determined Contribution (NDC):
As per the commitment to the Paris Agreement, Bangladesh revised and submitted its Updated Nationally Determined Contribution (NDC) on 26 August 2021. In its updated NDC, Bangladesh put forward quantified emission reduction commitments of 6.73%, i.e., 27.56-million-ton CO_2-equivalent reductions in the unconditional and an additional 15.12%, i.e., 61.91-million-ton CO_2-equivalent reductions in the conditional scenario by 2030.

Mitigation Actions:

- Bangladesh is involved in the Clean Development Mechanism (CDM) of the Kyoto Protocol under the UNFCCC. So far, Bangladesh has registered 21 CDM projects from CDM Executive Board.
- Bangladesh is involved in the Climate Technology Centre & Network (CTCN) under the UNFCCC Technology Mechanism. So far, 03 projects have been completed, and 06 more projects have been submitted this year for technology transfer.
- More than 6.0 million Solar Home Systems (SHS) in off-grid areas to ensure electricity access for 12% of its total population in remote areas (acclaimed as the world's largest off-grid renewable energy program).
- A major transformation is underway in the transport sector, shifting towards - Mass Rapid Transit (MRT), Bus Rapid Transit (BRT), and Express Way.

3.3 Session II

Overview on GHG inventory reporting under the Paris Agreement

Tomoyuki Aizawa
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Abstract

GHG Inventory Reporting under the Paris Agreement

For the changes in national GHG inventory reporting for developing countries, there are several differences between BUR and BTR, such as; i) use of the 2006 IPCC Guidelines, ii) cover year T-2 (T-3 with flexibility), iii) recalculations of previous data required, iv) reporting tables and outline of National Inventory Document (NID) finalized at CMA 3, v) key category analysis required (with flexibility), vi) reporting on institutional arrangements required (e.g. planning, preparation and management), vii) develop a QA/QC plan (with flexibility), vii) report basket of 7 gases (with flexibility), using AR5 GWP values (see the tables in the next page below), and viii) quantitatively estimate uncertainty (with flexibility) The structure of the Common Reporting Tables (CRT) is similar to the Common Reporting Format (CRF) with some modifications. The outline of the national inventory document (NID) is similar to the Annotated outline of the National Inventory Report (NIR). ETF reporting tools are under development aiming to finalize around June 2024.

ETF | GHG INVENTORY Reporting Tool

Following the mandate from decision 5/CMA.3, the secretariat is developing the ETF reporting tools for use by Parties for reporting the information as required by the modalities, procedures and guidelines for the enhanced transparency framework (decision 18/CMA.1). ETF | GHG INVENTORY Reporting Tool – Generates the common reporting tables (CRTs) for the electronic reporting of the information in the national inventory reports (NIRs) of anthropogenic emissions by sources and removals by sinks of GHG as contained in annex I to decision 5/CMA.3. The tool has three ways of data entry, manual filling with data entry grid, importing Excel file, and importing .json file, which can be prepared by the IPCC GHG Inventory Tool's interoperability functions with the ETF Reporting Tool. The data entry grid is similar to those for the CRF reporter, which is designed category by category for the whole reporting time series, while the CRT is annual basis.

The way forward

In August 2023, the 1st release of test versions of the ETF reporting tools will be provided to Parties. And In November, the 2nd release will be provided to Partis. Parties may provide submission of views and feedback on their experiences in using the tools, via the submission portal by December 2023. The final version of the ETF reporting tools will be provided to Parties on June 2024.

Access to relevant information

https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-paris-agreement
https://unfccc.int/enhanced-transparency-framework
https://unfccc.int/etf-reporting-tools
https://unfccc.int/event/demonstrating-the-progress-in-developing-the-etf-reporting-tools-0
https://unfccc.int/event/progress-update-on-the-development-of-the-reporting-tools-under-the-etf-0

Strengthen the capacity of developing countries to prepare and manage national GHG inventories as a basis for effective implementation of the Enhanced Transparency Framework under the Paris Agreement

Mr. Dominique Revet, *UNFCCC Secretariat*

Abstract

1. The project launched as pilot activities in 2016 to respond to the Paris Agreement was successfully implemented since. It was initially funded by the Swedish International Development Cooperation Agency (Sida), but this support has ended. The project has been sustained by the growth of requests received from developing countries, which demonstrate the recognition of the achievements and impacts of the capacity building activities developed and implemented.

2. The project has been implemented with key strategic partnership agreements developed, building on the comparative advantage of the institutions and synergy with the respective mandates. The partners include:

    a. IPCC, FAO, GRA, and Moja Global in regional training workshops in building sustainable GHG inventory management systems and the use of 2006 IPCC Guidelines;

    b. IEA and UNSD in the delivery of the energy sector quality assurance for the improvement of energy statistics and energy balances;

    c. GHG-MI in an online training of nominated national experts in the application of the 2006 IPCC Guidelines, and the development of Sectoral Activity Data for GHG Emissions (SAGE) tool to support collection and management of activity data for the energy, IPPU, waste, and agriculture sectors.

3. Of the 3600+ trained national experts since 2018:

    a. **310+ trained in in-person regional workshops** on MPGs, building sustainable national GHG-IMS, and the use of the 2006 IPCC Guidelines;

    b. **1200+ trained during 36 in-country QA of the national GHG inventory management system and latest GHG inventories**. The QA results are used by the countries to revise their national inventory reports before submission to UNFCCC and for the improvement of future submissions;

    c. **260+** have been trained in **10 in-country QA of national energy information systems and energy statistics and balance (Energy QA-NEIS-EB).** This new activity is assisting the countries to establish/strengthen energy sector MRV, energy activity data collection strategy for GHG inventories, and develop and maintain/improve national energy balances as a means of reinforcing transparency in reporting national GHG inventories on a regular basis;

    d. **1850+ nominated national experts supported financially to participate in online training and certification in 2006 IPCC Guidelines** in 4 with the GHG-Management Institute, since 2019. This is contributing to increasing in the enrollment and the pool of national experts on the UNFCCC roster of experts, critically needed for the BTR reviews.

Access to relevant information

GHG Support Unit website: https://unfccc.int/process-and-meetings/transparency-and-reporting/support-for-developing-countries/ghg-support

GHG Help Desk: https://unfccc.int/ghg-help-desk

Updates on the IPCC Inventory Software and Recent Activities

Baasansuren Jamsranjav

Senior Programme Officer, Technical Support Unit (TSU) of the IPCC Task Force on National Greenhouse Gas Inventories (TFI)

Abstract

A new upgraded version of the IPCC Inventory Software (version 2.861) is released on 6 June 2023. The software implements all tiers and approaches of the *2006 IPCC Guidelines,* and its *Wetlands Supplement*. It allows subnational disaggregation of emissions/removals (e.g., tracking specific activities or regions) and has interoperability functionality with the UNFCCC reporting tool for electronic reporting of common reporting tables (CRT).

IPCC Emission Factor Database (EFDB) which is an open library where users can find emission factors (EFs) and other parameters, with background documentation, that can be used for estimation of greenhouse gas (GHG) emissions and removals. The EFDB has been updated with new data and a new upgraded version with enhanced functionality will be released in 2023.

IPCC TFI has embarked on a new endeavor to develop a Methodology Report on Short-lived Climate Forcers (SLCFs) to be produced in IPCC's 7th assessment (AR7) cycle following the decision taken by the IPCC in May 2019.

References/ Publications

IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

IPCC 2014, 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands, Hiraishi, T., Krug, T., Tanabe, K., Srivastava, N., Baasansuren, J., Fukuda, M. and Troxler, T.G. (eds). Published: IPCC, Switzerland

Access to relevant information

https://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html
https://www.ipcc-nggip.iges.or.jp/public/wetlands/index.html
https://www.ipcc-nggip.iges.or.jp/software/index.html
https://www.ipcc-nggip.iges.or.jp/meeting/meeting.html

3.4 Session IV

Brunei Darussalam's GHG National Inventory System and GHG Estimates from the Energy Sector

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Abstract

Brunei Darussalam's energy sector, being a largely oil and gas country, has been the major source of GHG emissions. In 2021, the total gross emissions were about 13.8 million tonnes of CO_2 equivalent ($MtCO_2e$), of which 95% came from the energy sector. The energy industries attributed by combustion of coal, natural gas and oil for electricity and heat generation in power plants, accounted for 72%. This is followed by fugitive emissions (11%) and transport sector (9%). The remaining share were contributed by non-specified industry, industrial processes, agriculture, waste and residential sectors.[2]

For the energy sector, emission estimates were based on Tier 1 and Tier 3. Carbon dioxide (CO_2) is the most significant GHG contributor, resulted from the combustion of fossil fuels used to provide energy services. Methane (CH_4) also contributes significantly to total GHG emissions as fugitive emissions from the production, transportation, and processing of oil and gas, as well as emissions from the waste sector.

As the designated National Focal Point (NFP) to the UNFCCC for Brunei Darussalam, the Brunei Climate Change Secretariat (BCCS) coordinates and prepares the national GHG inventories and is responsible for submission of national GHG inventories to the UNFCCC.

Over the years, substantial progress was made as Brunei Darussalam strengthen its national GHG Inventory management system. With the introduction of a Mandatory Reporting Directive on Greenhouse Gases in April 2023, Brunei Darussalam adopted a Whole-of-Nation approach to national GHG inventory preparation that leverages sectoral pools of expertise. All facilities that emit and/or remove GHG, as well as relevant sectors in the value chain, are required to submit a report on a quarterly and annual basis. As a mean of ensuring consistency and transparency in reporting, a web-based centralised inventory system (CIS) will be in place by the end of 2023.

This presentation introduces the development of Brunei Darussalam's national GHG inventory management system and outlines the country's approach in estimating GHG emissions, particularly in the energy sector.

[2] GHG Inventory for 2021 will be reported in Brunei Darussalam's 3rd National Communications, planned to be submitted to the UNFCCC by the end of 2023.

Carbon Dioxide Transport, Injection, and Geologic Storage in the Inventory of U.S. Greenhouse Gas Emissions and Sinks

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Abstract

In the U.S. CO_2 is captured from a number of different types of industrial facilities, including fossil CO_2 sources at chemical and oil and gas facilities as well as biogenic CO_2 sources at breweries and renewable fuel producers. Naturally occurring CO_2 is also extracted from underground domes. The captured and extracted CO_2 is used in a variety of different end uses including geologic storage, enhanced oil recovery, food and beverage and other uses. Since 2010 the EPA has collected annual information on CO_2 capture as well as CO_2 injection and geologic storage through the Greenhouse Gas Reporting Program (GHGRP). However, the data linking capture and end use is not necessarily well understood. These complexities make it challenging to reporting CO_2 transport, injection, and geologic storage in the Inventory of U.S. Greenhouse Gas Emissions and Sinks currently. The EPA has identified potential options for incorporating CO_2 transport, injection, and sequestration into the Inventory and has put that out for expert review and comment. EPA continues to evaluate methods of incorporating geologic sequestration in the Inventory.

References/ Publications

Latest U.S. GHG Inventory report:
https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2021

Expert review memo on including CO_2 geologic sequestration in the Inventory:
https://www.epa.gov/system/files/documents/2022-10/us-ghg-inventory-1990-2020-expert-review-comment-log.pdf

Access to relevant information

GHGRP data: https://www.epa.gov/ghgreporting

Japan's Reporting on Carbon Capture and Storage

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Greenhouse Gas Inventory Office of Japan (GIO)

Abstract

5 carbon capture and storage (CCS) projects in Japan are reflected in the Japan's National GHG Inventory (JNGI): Kubiki (FY1990-1993), Sarukawa (FY1997-1999), Nagaoka (FY2003-2004), Yubari (FY2004-2007), and Tomakomai (FY2016-2019). The captured amount is subtracted from the CO_2 origin: Fuel Combustion (1.A.) and Chemical Industry (2.B.) categories. The fugitive emissions from CCS are reported using the notation keys (NO, NE, NA).

The following are some issues to note when reporting CCS in the GHG inventory.

CCS makes the comparison between the Reference Approach (RA) and the Sectoral Approach (SA) complicated. Both RA and SA are methodologies to estimate the CO_2 emissions from Fuel Combustion (1.A.) category, but RA uses a country's energy supply data and SA uses energy consumption data for each category. Captured amount is not subtracted under the RA calculation but is subtracted under the SA calculation. Intuitively, SA becomes lower than RA due to the introduction of CCS. However, according to the *2006 IPCC Guidelines* (Vol. 2, page 6.11), RA results should be compared with SA emissions before carbon captured amounts are subtracted out.

Some tables generated by the CRF Reporter do not reflect CO_2 captured in the Industrial Processes and Product Use (IPPU) sector. 'CO_2 captured' in table 10, summary 1.A and summary 2 are automatically filled from Table 1.A(a). It means the values in these tables cover CO_2 captured from the Energy sector only. Japan has some cases that captured CO_2 originated from the IPPU sector, therefore 'CO_2 captured' in the current CRF tables don't always represent all of the capture that occurred in Japan.

If the source of captured CO_2 is unknown, it is difficult to subtract the captured amount. According to the *2006 IPCC Guidelines* (Vol.2, Equation 2.7), the amount captured should be subtracted from the category where the capture takes place. However, if carbonated gas is purchased and stored underground, it may be difficult to identify the origin of the carbonated gas.

References/ Publications

National Greenhouse Gas Inventory Report of JAPAN 2023
2006 IPCC Guidelines for National Greenhouse Gas Inventories

Access to relevant information

None

Policies for Carbon Capture and Storage (CCS) in Japan and overview of CCS under the Joint Crediting Mechanism (JCM)

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Abstract

Carbon Capture and Storage (CCS) is essential for achieving carbon neutrality toward 2050. Japan implemented verification tests at five sites, and these results were reported in Japan's Greenhouse Gas Inventories. After completing verification tests, the Japanese government aims to create business plans for CCS. To realize this, the Ministry of the Environment and relevant ministries are accelerating discussions on the action plan for CCS, investigation of suitable land for CCS and monitoring methods.

The Joint Crediting Mechanism (JCM) is an international carbon market mechanism, implemented in consistence with the Article 6 of the Paris Agreement. This cooperative approach facilitates diffusion of leading decarbonizing technologies, infrastructure, etc., to contribute to the achievement of both the JCM Partner country and Japan's nationally determined contributions (NDCs). To realize CCS projects under the JCM, the Ministry of the Environment and the Ministry of Economy, Trade and Industry of Japan are developing rules for CCS.

References/ Publications

1. Summary of the study group on CCS projects in harmony with the environment (in Japanese)
2. Final explanation notes of the study group on CCS long term roadmap (in Japanese)
3. Model project to ensure environmental harmonization for early social implementation of CCUS and a decarbonized, sound material-cycle society (in Japanese)
4. Recent Developments of the Joint Crediting Mechanism (JCM) (April 2023, Government of Japan)

※Titles of the references in Japanese are draft translations.

Access to relevant information

1. https://www.env.go.jp/water/kaiyo/ccs2/chowa_001.html
2. https://www.meti.go.jp/shingikai/energy_environment/ccs_choki_roadmap/pdf/20230310_2.pdf
3. https://www.env.go.jp/content/000100925.pdf
4. https://www.jcm.go.jp/opt/all/about/20230421_JCM_goj_eng.pdf

3.5 Poster Session

Preparation of Japan's National Greenhouse Gas Inventory and Trends in GHG Emissions

Greenhouse Gas Inventory Office of Japan (GIO), Japan

Abstract

Under Article 4 and 12 of the United Nations Framework Convention on Climate Change (hereinafter, Convention) and relevant decisions adopted by the Conference of the Parties, the Annex I parties including Japan (i.e. developed countries) are required to prepare national greenhouse gas (GHG) inventories and submit them to the Secretariat of the Convention. Moreover, Article 7 of the Act on Promotion of Global Warming Countermeasures, which provides for domestic measures under the Convention, requires the Government of Japan to annually estimate and make public Japan's GHG emissions and removals.

In accordance with these Articles, the Greenhouse Gas Inventory Office of Japan (GIO) develops the national GHG inventory in cooperation with private consultant companies under a contract with the Ministry of the Environment. Before compiling the inventory, GIO collects data from relevant ministries, agencies, and organizations to estimate emissions and removals. Based on these data together with other data from statistical publications, GIO then compiles the GHG inventory.

Japan's GHG emissions and removals in FY2021 were 1,122 million tonnes of carbon dioxide equivalents (Mt CO_2 eq.). (Emissions: 1,170 Mt CO_2 eq., Removals: 47.6 Mt CO_2 eq.)

The emissions decreased by 16.9% (237.7 Mt CO_2 eq.) compared to the FY2013 emissions (1,408 Mt CO_2 eq.), mainly because of the reduced energy consumption (due to improved energy conservation, etc.) and the decrease in CO_2 emissions from electricity production due to the wider use of low-carbon electricity (wider adoption of renewable energy and resumption of nuclear power plant operations), despite the increase in hydrofluorocarbon (HFC) emissions.

Access to relevant information

https://www.nies.go.jp/gio/en/index.html

Towards the Enhanced Transparency Framework in the Republic of Korea: Improved Energy Inventory

Hyunhwa Lee, Jiyeon Kim, Hyung-Wook Choi
Greenhouse gas Inventory and Research Center (GIR), Republic of Korea

Abstract

As a main entity of preparing the national GHG inventory, the Greenhouse Gas Inventory & Research Center of Korea (GIR) has been tasked with comprehensive managing for the first GHG inventory under the Paris Agreement. For an effective implementation of the enhanced transparency framework, the GIR established the "2nd National GHG Inventory Management Plan 2020-2024" in cooperation with the relevant ministries and agencies in 2020. The plan includes the detailed goals and tasks of each sector to improve the inventory, whose progress is monitored and assessed annually.

In addition to facilitating the first GHG inventory, the GIR has been developing an independent electronic reporting system, which is 'Greenhouse gas Inventory Reporting System (GIRS). The GIRS's main function is to compile database, verify the inventory, and integrate the QA/QC procedures. The GIRS, designed in the linkage with the CRT reporting tool, is expected to support the submission of CRT.

The National MRV Guideline of Korea has been continuously revised in accordance with 2006 IPCC Guidelines. Especially, the methodologies and activity data in energy sector have been mainly improved to provide reliable and transparent inventory information. The scope of fuel consumption is expanded and the inventory is more specified. For example, coke ovens emission from fuel combustion occurring at iron and steel industry, which had been included in the manufacturing category is newly estimated as the energy streams clarify in the revised energy balance. The first inventory of the Republic of Korea is currently in the process of preparation and is expected to be submitted by Dec. 2024.

Research on Nonconventional Gases at CSIR-CIMFR, India

Prof. Debadutta Mohanty
Nonconventional Gases Research Group
CSIR-Central Institute of Mining and Fuel Research

Abstract

Reduction in anthropogenic methane emissions is critical to limit warming to 1.5˚C alongside the ambitious efforts to decarbonise the economies. Methane from human activity falls into three main sectors: agriculture (40%), fossil fuels (35%) and waste (20%). Fugitive emissions are the intentional or unintentional release of greenhouse gases that may occur during the extraction, processing and delivery of fossil fuels to the point of final use. India stands as distant 6th in fugitive emissions among the countries reported for 2016 inventory under the convention. India is a developing nation with a growing demand for energy to achieve the sustainable development goals while meeting the emission reduction targets. Hence, the country is focusing on the gas based economy and import substitution to meet the domestic demand while effecting smoother coal transition. It is in this context, the nonconventional resources should be fully tapped with added environmental benefits. Coalbed methane (CBM) is one such nonconventional hydrocarbon resource associated with coal deposits. On the other hand, underground coal gasification (UCG) provides the technology option to produce clean energy from the domestic coal resources, including those currently unmineable.

Pradhan Mantri Urja Ganga project, implemented by state-run gas utility GAIL, will provide a major boost to the CBM industry apart of connecting the eastern India to the gas grid with an aim to enhance the share of gas in the energy mix. Research on UCG is also imperative as it provides unmanned access to gasify coal to produce syngas for efficient power generation and feedstock for petrochemical industry. It also offers options for efficient CO_2 capture and accessible and affordable carbon sinks while eliminates the health and safety hazards of conventional mining. Carbon capture utilization and storage (CCUS) has an important role to play in decarbonizing the hard decarbonize sectors. According to an theoretical estimate by NITI Aayog, India has total CO_2 geologic storage capacity of 400-600 Gt with a share of 3.4 Gt, 3.5-3.7 Gt, 291 Gt, 97-315 Gt in depleted oil and gas reservoirs, unmineable coal seams, saline aquifers, and basalts, respectively. The paper discusses the challenges and opportunities in CBM/shale gas, UCG and geo-sequestration technologies for a seamless energy transition in Indian context and the need to refine the emission factors for fugitive methane emissions from fossil fuels.

References/ Publications

Sinha A., Mohanty D. (2022). Chapter-5: Coalbed methane (CBM) and underground coal gasification (UCG) in the evolving energy landscape of India. In Book: Sain K., Roy S., Gupta H. K. (eds.) Emerging Energy Resources in India (x+222), Geological Society of India, Bangalore, pp.105-133. ISBN No: 978-93-80998-48-0

Access to relevant information

https://di.unfccc.int/detailed_data_by_party

Disclaimer

The views/ideas expressed are solely of the author.

Greenhouse Gas Inventory and Climate Change Research at CSIR, India

Sunil Kumar Pathak*, Tuhin Suvra Khan, Shailesh Kumar Singh, Nanaji Islavath, Jasvinder Singh, Ojasvi Sharma, Ganesh Naik, Bhavya B Krishna
CSIR – Indian Institute of Petroleum

Abstract

In alignment with the climate change policies and commitments of the Government of India, Climate Change and Data Science (CCDS) has emerged as a significant focus area within CSIR. Given the criticality of climate change on a global scale, it is essential to harness the power of data science in understanding, monitoring and addressing its complexities to mitigate detrimental effects to environment and mankind. The primary mandate of the CCDS area is to independently validate the net greenhouse gas (GHG) impact and, where applicable, assess the overall environmental impact (excluding GHGs) of all CSIR-IIP technologies across divisions, both in existence and under development. CCDS is leveraging the Data Science tool for research in hydrogen storage, where Machine Learning (ML) is successfully employed to screen TiZrNbMoV and TiVZrHfNb as potential hydrogen storage material with capacity >2.5 weight percent. The developed HEA alloy can be connected to fuel cell ranging from 500 W to 10 kW to generate power. In another activity ML is used for the development of environment friendly, non-flammable solid-state battery for EV having high heat resistance, high energy capacity, high durability and fast charging. CCDS area using Life Cycle Assessment (LCA) of different in-house as well as emerging technologies for their net greenhouse gas (GHG) and associated environmental impact analysis.

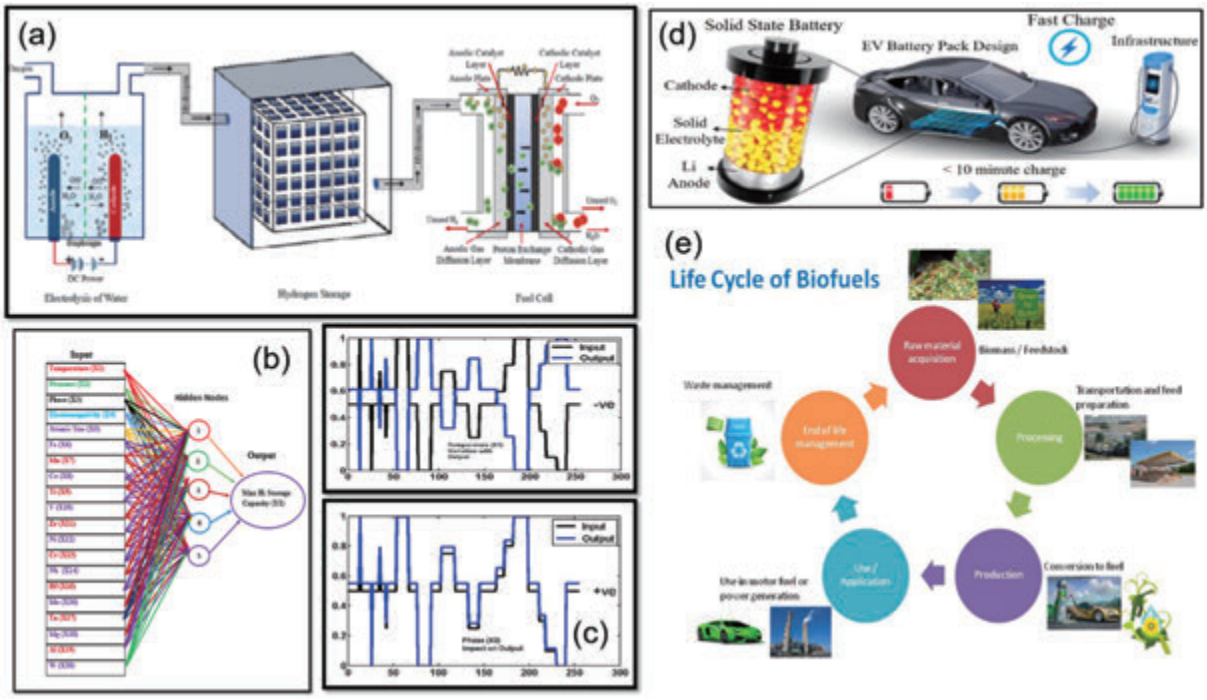

Figure 1: (a) Scheme showing the H_2 production, storage and utilization, (b) ML model input and output mapping for HEA as H_2 storage material, (c) Single Variable Response of Temperature and Phase on H_2 storage; (d) Scheme showing usage of solid state battery for EV; (e) Scheme for Life Cycle Assessment (LCA) of Biofuels

DATAMAN: A global database of methane, nitrous oxide, and ammonia emission factors for livestock housing and outdoor storage of manure

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Abstract

Livestock manure management systems can be significant sources of nitrous oxide (N_2O), methane (CH_4), and ammonia (NH_3) emissions. Many studies have been conducted to improve our understanding of the emission processes and to identify influential variables in order to develop mitigation techniques adapted to each manure management step (animal housing, outdoor storage, and manure spreading to land). The international project DATAMAN (http://www.dataman.co.nz) aims to develop a global database on greenhouse gases (N_2O, CH_4) and NH_3 emissions from the manure management chain to refine emission factors (EFs) for national greenhouse gas and NH_3 inventories. This paper describes the housing and outdoor storage components of this database. Relevant information for different animal categories, manure types, livestock buildings, outdoor storage, and climatic conditions was collated from published peer-reviewed research, conference papers, and existing databases published between 1995 and 2021. In the housing database, 2024 EFs were collated (63% for NH_3, 19.5% for CH_4, and 17.5% for N_2O). The storage database contains 654 NH_3 EFs from 16 countries, 243 CH_4 EFs from 13 countries, and 421 N_2O EFs from 17 countries. Across all gases, dairy cattle and swine production in temperate climate zones are the most represented animal and climate categories. As for the housing database, the number of EFs for the tropical climate zone is under-represented. The DATAMAN database can be used for the refinement of national inventories and better assessment of the cost-effectiveness of a range of mitigation strategies.

References/ Publications

J. Environ. Qual. 2023;52:207–223. doi.org/10.1002/jeq2.20430

Enteric methane emission models for diverse beef cattle feeding systems in South-east Asia: A meta-analysis

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Abstract

Prediction models for enteric methane (CH_4) emissions from beef cattle proposed by various groups may not perform with similar accuracy for the low- and middle-income countries in South-east Asia (SE-Asia) because beef cattle in these countries are raised under different climatic conditions with diverse feeding systems, and have different CH_4 emission characteristics. The objectives of this study were to: i) predict CH_4 emission (g d^{-1} $animal^{-1}$), yield [g kg^{-1} dry matter intake; DMI) $^{-1}$], intensity [g kg^{-1} average daily gain) $^{-1}$], and CH_4 conversion factor (Y*m*) using an intercountry database of individual animal records from SE-Asia; ii) evaluate the impact of different dietary forage contents (all-, high- and low-forage) representing the diverse feeding systems on CH_4 emission, yield, intensity and Y*m* in SE-Asia; and iii) cross-validate equations from this study with published data. A total of 398 individual animal observations of beef cattle from SE-Asia were used for this analysis. Linear models developed by incrementally adding covariates revealed that CH_4 emission model using only DMI fitted to all data had a root mean square prediction error (RMSPE) of 16.9%. Subsets containing data with 100% forage in the diet (all-forage), 50–85% (high-forage) and < 50% (low-forage) had an RMSPE of 16.5%, 14.7%, and 17.4%, respectively. Linear multiple equation based on DMI and dietary NDF concentration (DMI + NDF_C, RMSPE = 15.2%; all-data) improved prediction accuracy over that of DMI alone. The DMI + NDF_C models for all-forage (RMSPE = 14.6%) and high-forage subsets (RMSPE = 13.3%) except for low-forage (RMSPE = 16.4%), improved the precision and accuracy of CH_4 emission prediction. Methane yield and CH_4 emission intensity could not be reliably modelled with the current database. The present study provides improved CH_4 prediction models for beef cattle managed under diverse feeding systems in SE-Asia and affirmed that region-specific models are needed to reliably predict beef cattle CH_4 emission at national or regional levels, particularly for low- and middle-income countries.

References/ Publications

Anim. Feed Sci. Technol. 294:115474. doi: 10.1016/j.anifeedsci.2022.115474

4. Report on the Mutual Learning Session

4 Report on the Mutual Learning Sessions

4.1 Overview of the Mutual Learning

Mutual Learning (ML) is an activity to improve individual countries' inventories through the following series of processes: 1) exchanging inventories between two countries, 2) perusing a partner country's inventory, and 3) exchanging comments on each other's inventories. The primary purpose of ML is to improve GHG inventories by providing details of methods and data for GHG emission/removal estimation between two countries and by exchanging comments on the methods and data. ML is also expected to foster and strengthen a cooperative relationship among GHG inventory experts. Since the aim of ML is not criticism or audit, participants can conduct a two-way communication and follow-up through direct conversation.

The first ML was held on the Waste Sector between GIO and Korea Environment Corporation in the annual workshop in 2008. The Secretariat of WGIA introduced this activity in WGIA8 held in 2010. With the participants' agreement, ML has been held in the following WGIAs as a regular session since WGIA9 in 2011. Because of the global pandemic of the coronavirus disease 2019 (COVID-19), ML was held online between 2020 and 2022 and resumed in-person sessions this year at WGIA20.

Table 4.1.1 History of the ML

		General	Energy	IPPU	Agriculture	LULUCF	Waste
2008-2010		Trial implementation Japan–Korea					
2010	WGIA8	Introduction to ML (with hands-on training)					
2011	WGIA9	-	Indonesia–Mongolia	-	-	Japan–Laos	Indonesia–Cambodia–Korea
2012	WGIA10	-	Cambodia–Thailand	Indonesia–Japan	Indonesia–Viet Nam	-	China–Korea
2013	WGIA11	-	Laos–Thailand	-	China–Myanmar	-	Malaysia–Viet Nam
2014	WGIA12	-	Indonesia–Myanmar	-	China–Mongolia	Viet Nam*[1]	-
2015	WGIA13	Japan–Viet Nam	-	-	Indonesia–Laos	Cambodia–Mongolia	Korea–Myanmar
2016	WGIA14	-	Brunei–Korea	Myanmar–Malaysia	-	Indonesia–Laos	Mongolia–Thailand
2017	WGIA15	-	Mongolia–Viet Nam	-	-	Laos–Myanmar	China–Philippines
2018	WGIA16	-	India–Viet Nam	-	-	-	Japan–Laos
2019	WGIA17	China–Singapore	Thailand–Japan	-	Cambodia–Philippines	-	-
2020	ML2020*[2]	Indonesia–Japan	Cambodia–Myanmar	-	China–Japan	Mongolia–Singapore	-
2021	WGIA18	Thailand–Japan	Brunei–Mongolia	-	-	Bhutan–Indonesia	China–Indonesia
2022	WGIA19	-	China–Malaysia	-	-	Singapore–Viet Nam	-
2023	WGIA20	-	-	Mongolia–Philippines	-	Indonesia–Laos	Japan–Viet Nam

*[1]Reporting from Viet Nam with comments from experts
*[2]The physical meeting of WGIA was cancelled to prevent the risks of the COVID-19 but the Mutual Learning sessions were conducted online.

Participants

At the start of 2023, the WGIA Secretariat advertised ML to potential participants in WGIA20 and received applications. Considering the participants' potential interests and knowledge, an appropriate balance among sectors, and the feasibility of implementation, the WGIA Secretariat set up three pairs of countries (Mongolia and the Philippines on the IPPU Sector, Indonesia and Laos on the LULUCF Sector, and Japan and Viet Nam on the Waste Sector).

Preparation Process

A few months before WGIA20, the chosen participants for ML submitted the materials of their inventories to the WGIA Secretariat, including worksheets used for estimating emissions and reports describing details of methodologies, and exchanged the materials with their partner countries through the Secretariat. By perusing the materials provided by the partner country, the participants found good points, such as advanced methodologies and well-institutionalized inventory management systems, as well as unclear points and issues to be improved in the partner's inventory. Thus, participants provided such findings as comments and questions to their partner countries in "Q&A Sheets". After that, the "Q&A Sheets" were exchanged with the partner countries through the Secretariat. The

partner countries responded to these comments and questions before WGIA20 took place.

Table 4.1.2 Submitted Materials for the ML

Sector	Country	Inventory
IPPU	Mongolia	NC4 and NIR2023 (Draft)
	Philippines	"2010 Sectoral GHG Inventory Report" (Draft)
LULUCF	Indonesia	BUR3 (2021) and FRL2 (2021)
	Laos	BUR1 (2020)
Waste	Japan	NIR (2023)
	Viet Nam	BUR3 (2021)

Discussions

In the WGIA20, three ML sessions were held on June 26th to discuss sector-specific issues based on preliminary comment exchanges. To encourage a frank discussion and to ensure confidentiality, these sessions were held as closed-door discussions.

In these sessions, the participants shared with the partner countries their experiences in inventory preparation. Toward the 2024 submission in accordance with the MPGs under the PA, the participant countries are making efforts to enhance the completeness of their inventory by resolving not-estimated categories and by preparing time-series data, while they also continuously try to develop CS EFs and parameters to estimate GHG emissions more accurately. They are also improving the national inventory systems through developing and formalizing relationships with various stakeholders under legal frameworks. Additionally, some countries have already strived/are striving to obtain data to reflect the effects of mitigation policies, such as the amount of clinker production or CH_4 recovery.

The participants had discussions to further enhance and improve these efforts. Building on these discussions, the participants will improve and prepare their inventories for the 2024 submission.

The points of discussion and the outcomes of each ML session are summarized in the following sections (4.2–4.5).

4.2 Session on the IPPU Sector

Sector Overview

Mongolia and the Philippines participated in the ML session on the IPPU Sector. The general information for the two countries is shown in Table 4.2.1 below.

Table 4.2.1 Sector Overview of the ML on the IPPU Sector

	Mongolia	Philippines
National total GHG emissions (Gg CO_2 eq., with LULUCF)	12,909 (2020, NC4 draft)	107,345 (2010 Philippine Greenhouse Gas Inventory Report - Executive Summary draft)
GHG emissions of the IPPU Sector (Gg CO_2 eq.)	1,148 (2020, NC4 draft)	8,363 (2010 Philippine Greenhouse Gas Inventory Report - Executive Summary draft)
Responsible entity for the inventory	Ministry of Environment and Tourism	Climate Change Commission (overall) Department of Environment and Natural Resources (IPPU Sector)
Estimation methodology	The 2006 IPCC Guidelines, Tier 1	The 2006 IPCC Guidelines, Tier 1 and Tier 2
Source of emission factors	IPCC default values	Country-specific and IPCC default values
Source of AD	National statistics/surveys and data provided by industry	National statistics/surveys, data provided by industry, and international sources

Materials Used

To prepare for the ML session, the partner countries exchanged their materials relevant to the IPPU Sector through the Secretariat a few months before the workshop. The materials exchanged were as follows:

Mongolia
- NIR 2023 (Draft), Chapter 4 and Annex I
- NC4 (Draft), Chapter 2
- BUR1 (2017)
- NIR (2017)

Philippines
- 2010 Sectoral Greenhouse Gas Inventory Report - IPPU (Draft)
- 2010 Philippine Greenhouse Gas Inventory Report - Executive Summary (Draft)
- NC1 (2000)
- NC2 (2014)

Questions and Answers

After receiving the materials listed above, the countries studied them and sent questions and comments to the partner country before the session. The classification and the number

of questions are as follows.

Table 4.2.2 Classification of Questions and Comments in the ML on the IPPU Sector

Classification of questions	Number of questions/comments	
	from Mongolia to the Philippines	from the Philippines to Mongolia
Acquisition of AD	5	8
Adoption of EFs or parameters	3	4
Estimation methods	3	2
Institutional arrangement	0	0
Others	6	1

Outcomes of the Mutual Learning Session

Through the ML session, several issues and good practices in the participating countries' preparation of GHG inventory were identified.

- **Issues and Solutions / Outstanding issues**

The following were identified as issues, and the partner countries' experience was shared to seek options and solutions.

1. It is necessary to prepare to estimate using higher tier methods for key categories such as cement production and Refrigeration and air conditioning (RAC). This will require more disaggregated AD and the collection of confidential data in some cases (both countries).
2. It is necessary to ensure that the assumptions of the hybrid Tier 1a/b method for RAC provided by the 2006 IPCC Guidelines are appropriate for the national circumstances (both countries).
3. An assessment of completeness for IPPU emission sources based on the 2006 IPCC Guidelines is required. Surveys of industrial activity, communications with industry, and drafting of policy issuance to require industries to report are ongoing (Philippines).
4. Difficulties will be faced in terms of QC during recalculations and switching to reporting F-gas emissions using AR5 GWP values for the entire time series (both countries).
5. For categories with less complicated end-uses, such as electrical equipment (2.G.1), efforts may be taken to start estimation (both countries).
6. More description specific to a country is needed for the clarity of the reports, including e.g., what AD or EFs were actually applied (both countries).

- **Good Practices**

The following were identified as good practices:

Mongolia

1) Consistent time-series emissions from 1990 onward have been prepared.
2) For an accurate estimation of the mineral industry category, the largest source of IPPU, a quality check was conducted by comparing AD from the Ministry of Agriculture and Light Industry and the National Statistical Office.
3) An assessment of completeness for IPPU emission sources based on the 2006 IPCC

Guidelines was conducted, and categories that are not estimated have been discussed in the report.

Philippines

1) Executive Order No.174 provided the institutional arrangement for the GHG inventory management and reporting system. The Climate Change Commission as the overall lead agency issued guidance documents, templates, and tools to serve as reference for the agencies in the development of the latest inventory.
2) Clinker production data was used in the inventory estimation of cement production, which is a key category. It is also beneficial because clinker substitution is one of the mitigation measures in the NDC.
3) To fill the gaps in the clinker production data for Tier 2 cement production estimation, efforts were made to use alternative data from other sources.

Table 4.2.3 Participants in the ML on the IPPU Sector

Country	Name	Organization
Mongolia	Ms. Davaasambuu Ulzii-Orshikh	Climate Change Research and Cooperation Center
	Dr. Gerelmaa Shaariibuu	
	Dr. Bujidmaa Borkhuu	
Philippines	*Mr. Carl Louie Santiago	Climate Change Service, Department of Environment and Natural Resources
	*Mr. Rolando Abad Jr.	
	Mr. Bryan Bolivar Bongco	
	Mr. Ross Ian M. Avino	Environmental Management Bureau, Department of Environment and Natural Resources
	Ms. Sandee Gamulo Recabar	Climate Change Office, Climate Change Commission
	*Mr. Richard Victor Palma	Climate Change Commission
Facilitators, etc.	Ms. Hatanaka Elsa (Facilitator)	GHG Inventory Office of Japan, National Institute for Environmental Studies
	Ms. Hirata Eriko (Facilitator)	
	Mr. Kosaka Naofumi (Secretariat)	
	Mr. Terakawa Takuji (Resource person)	Mitsubishi UFJ Research and Consulting Co., Ltd.
	Ms. Kuroda Kotoe (Workshop organizer)	Ministry of the Environment, Japan

Note) *: Remote participants

4.3 Session on the LULUCF Sector

Sector Overview

Indonesia and Laos participated in the ML session on the LULUCF Sector. The general information for the two countries is shown in the table below.

Table 4.3.1 Sector Overview of the ML on the LULUCF Sector

	Indonesia	Laos
National total GHG emissions (kt-CO_2 eq., with LULUCF)	1,845,067 (2019, BUR3)	24,100 (2014, BUR1)
GHG emissions in the FOLU/ AFOLU category (kt-CO_2 eq.)	924,853 (FOLU in 2016, BUR3)	18,793 (AFOLU in 2014, BUR1)
Responsible agency for the inventory	Ministry of Environment and Forestry	- Department of Climate Change, Ministry of Natural Resources and Environment, - Department of Forestry, Ministry of Agriculture and Forestry
Estimation methodology	The 2006 IPCC Guidelines, Wetlands Supplement, Tier 1 and Tier 2	The 2006 IPCC Guidelines, Tier 1 and Tier 2
Source of EFs	IPCC default values and CS values	IPCC default values and CS values
Source of AD	National statistics and remote sensing data	National statistics and remote sensing data

Materials Used

To prepare for the ML session in WGIA20, both countries exchanged their documents relevant to the LULUCF Sector through the Secretariat starting a few months before the workshop. The documents exchanged were as follows:

Indonesia
- BUR3 (2021)
- Indonesia's Second Forest Reference Level (FRL) (2022)
- Summary of "Guidance to the Implementation and Reporting of National Greenhouse Gases Inventories", Director General of Climate Change Regulation No. 73/2017
- Summary of "Guidance of Quality Assurance and Quality Control (QA/QC) of Greenhouse Gas Inventories", Director General of Climate Change Regulation No. 10/2018

Laos
- BUR1 (2020)
- The technical annex of the BUR on REDD-PLUS activities (2020)
- Technical report on the CS forest fire data and EF development (2022)
- Worksheet of Laos' BUR1 for AFOLU

Questions and Answers

After receiving the materials described above, the countries studied them and sent questions and comments to the partner country before the workshop. The classification and the number of questions are as follows.

Table 4.3.2 Classification of Questions and Comments in the ML on the LULUCF Sector

Classification of questions	Number of questions/comments	
	from Indonesia to Laos	from Laos to Indonesia
Acquisition of AD	4	4
Adoption of EFs or parameters	1	2
Estimation methods	2	0
Institutional arrangement	6	3
Others	3	1

Outcomes of the Mutual Learning Session

Through the ML session, several issues and good practices in the participating countries' preparation of GHG inventory were identified.

➢ **Issues and Solutions / Outstanding issues**

The following were identified as issues, and experience was shared to seek options and solutions:

1. In order to meet the new requirements under the Paris Agreement (18/CMA.1, 5/CMA.3), the following challenges were identified:
   - ✓ Reporting consistent annual time-series data (Laos)
   - ✓ Estimating for not-estimated categories or using appropriate Notation Keys (both countries)
   - ✓ Disaggregating the emissions by sub-category and carbon pool in accordance with the CRT (both countries)
   - ✓ Separating the AFOLU into Agriculture and LULUCF/FOLU (both countries).
2. Difficulties have been faced in collecting appropriate AD (both countries).
3. Estimating all carbon pools, especially mineral soils, has been challenging (both countries).
4. Involving sub-national and local stakeholders in climate change communication to collect more data to reflect local circumstances on ADs/ EFs (both countries).

➢ **Good Practices**

The following were identified as good practices:

<u>Indonesia</u>

1) Submitting various reports, such as BURs and FRLs reports, has helped with the improvements for each submission.
2) The institutional arrangement for BUR3 was developed with better coordination and collaboration.
3) Remote sensing has contributed to improving the detection of land use and land-use changes, resulting in, e.g., the production of monthly maps of burnt scar areas and

annual land cover maps.

4) Indonesia has developed many aspects of its report for BUR3. The following are the practices improved from the previous BUR 2:
   - ✓ Reported a consistent annual time series starting from 2000 up to 2019, which is equivalent to two years prior to the submission.
   - ✓ Recalculations were conducted for all reporting years from the previous submission.
   - ✓ CH_4 and N_2O emissions from biomass burning were estimated in the FOLU Sector.
5) Improvement was made by prioritizing key categories.

Laos

1) 2006 IPCC Guidelines were applied.
2) A land-use change Matrix was developed.
3) To improve GHG estimations for forests, Laos has been making efforts to reflect its national circumstance, which includes developing CS parameters and applying the allometric equations from a neighboring country (Viet Nam) for some forest types.
4) CS EFs for estimating emissions from biomass burning are being studied and are planned to be used in the near future (such as in the FREL, GHG inventory).
5) A National GHG database management system is being developed through CBIT projects.
6) Standard Operational Procedures (SOP: a kind of agreement procedure for revising estimation methodologies) have been applied to every submission.

Table 4.3.3 Participants in the ML on the LULUCF Sector

Countries	Name	Organization
Indonesia	Mr. Heri Pumomo	Directorate of GHG Inventory and Measurement, Reporting, and Verification, Ministry of Environment and Forestry
	Ms. Endah Riana Oktavia	
	Ms. Fifi Nofitri	
Laos	Dr. BounEua Khamphilavanh	GHG Mitigation Division, Department of Climate Change, Ministry of Natural Resources and Environment
	Ms. Vathsouda Nilathsay	
	Mr. Somphavy Keoka	Forest Inventory and Planning Division, Department of Forestry, Ministry of Agriculture and Forestry
	Mr. Khamkhong Inthavong	
Facilitators, etc.	Ms. Hayashi Atsuko (Facilitator)	GHG Inventory Office of Japan, National Institute for Environmental Studies
	Mr. Ito Hiroshi (Facilitator)	
	Mr. Osako Akira (Secretariat)	
	Dr. Sato Atsushi (Resource person)	Mitsubishi UFJ Research and Consulting Co., Ltd.

4.4 Session on the Waste Sector

Sector Overview

Japan and Viet Nam participated in the ML session on the Waste Sector. The general information for the two countries is shown in the table below.

Table 4.4.1 Sector Overview of the ML on the Waste Sector

	Japan	Viet Nam
National total GHG emissions (kt-CO_2 eq., with LULUCF)	1,118,272 (2021, NIR2023)	316,735 (2016, BUR3)
GHG emissions in the Waste Sector (kt-CO_2 eq.)	17,712 (2016, NIR2023)	20,738 (2016, BUR3)
Responsible agency for the inventory	Ministry of the Environment	Department of Climate Change, Ministry of Natural Resources and Environment
Estimation methodology	The 2006 IPCC Guidelines, Default, Tier 2, Tier 3, and CS	The 2006 IPCC Guidelines, Tier 1 and Tier 2
Source of EFs	IPCC default values and CS values	IPCC default values
Source of AD	National statistics	National statistics

Materials Used

To prepare for the ML session in WGIA20, both countries exchanged their documents relevant to the Waste Sector through the Secretariat starting a few months before the workshop. The documents exchanged were as follows:

Japan
- NIR (2023)
- CRF (2023)

Viet Nam
- BUR3 (2021)
- NIR (2021)
- NDC (Updated in 2022)
- Excel files for emissions in 2016 drafted in 2020 (based on IPCC Waste Model and 2006 IPCC Guidelines Worksheets)

Questions and Answers

After receiving the materials described above, the countries studied them and sent questions and comments to the partner country before the workshop. The classification and the number of questions are as follows.

Table 4.4.2 Classification of Questions and Comments in the ML on the Waste Sector

Classification of questions	Number of questions/comments	
	from Japan to Viet Nam	from Viet Nam to Japan
Acquisition of AD	4	3
Adoption of EFs or parameters	1	1
Estimation methods	1	2
Institutional arrangement	2	1
Others	3	4

Outcomes of the Mutual Learning Session

Through the ML session, several issues and good practices in the participating countries' preparation of GHG inventory were identified.

➢ **Issues and Solutions / Outstanding issues**

The following were identified as issues, and experience was shared to seek options and solutions:

1. Applying appropriate extrapolation techniques can make up for the lack of historical data for the Solid Waste Disposal category, and this will eliminate the underestimation of CH_4 emissions (Viet Nam).
2. There is still room for improvement regarding differences between national statistics and aggregated data from municipalities (Viet Nam).
3. AD of CH_4 recovery and sludge needs to be collected through ongoing CDM projects and other upcoming relevant projects (Viet Nam).
4. Development of CS EFs and parameters can improve national emission estimations (both countries).

➢ **Good Practices**

The following were identified as good practices:

Japan

1) Transparent explanation and accurate estimation of GHG emissions were provided in NIR.
2) A national system, with the cooperation of the private sector, municipalities, and relevant agencies, has been established for collecting AD, developing EFs, and conducting QA/QC activities.
3) An effective legal framework for waste management has been established.

Viet Nam

1) A national inventory system has been established by domestic laws and has effective QC procedures.
2) Continuous efforts are made to improve the methodology for the next inventory submission.
3) Uncertainty analysis was conducted in detail.

Table 4.4.3 Participants in the ML on the Waste Sector

Parties	Name	Organization
Japan	Dr. Oda Takefumi (Facilitator)	GHG Inventory Office of Japan, National Institute for Environmental Studies
	Dr. Taki Wakana (Facilitator)	
	Ms. Hatanaka Elsa (Secretariat)	
	Mr. Oyama Seiya	Mitsubishi UFJ Research and Consulting Co., Ltd.
	* Mr. Ueda Hiroyuki	
	* Mr. Kawanishi Satoshi	
	Ms. Kuroda Kotoe (Workshop organizer)	Ministry of the Environment, Japan
Viet Nam	Mr. Tran Ha Ninh	Department of Climate Change, Ministry of Natural Resources and Environment
	Mr. Ly Viet Hung	
	Dr. Nguyen Hung Minh	

Note) *: Remote participants.

Annex I: Agenda

Annex I: Agenda

The 20th Workshop on GHG Inventories in Asia (WGIA20)
Period: 26th– 29th June 2023
Venue: Grand Hotel New Oji (Japan)

Day 1: Morning, 26th June 2023		
8:30-9:00	**Registration**	
9:00-12:30	**Mutual Learning (Closed sessions: only for countries participating in the session, facilitators, resource persons, rapporteurs and the WGIA Secretariat)**	
Sector	IPPU	
Combination of Participating Countries	**Mongolia – Philippines**	
Room	Yuri	
Facilitator	Ms. HIRATA Eriko (GIO) Ms. HATANAKA Elsa (GIO)	
Rapporteur		
12:30-14:00	*Lunch*	
Day 1: Afternoon, 26th June		
14:00-17:30	**Mutual Learning (Closed sessions: only for countries participating in the session, facilitators, resource persons, rapporteurs and the WGIA Secretariat)**	
Sector	LULUCF	Waste
Combination of Participating Countries	**Indonesia – Laos**	**Japan – Viet Nam**
Room	Yuri	Suzuran
Facilitator	Ms. HAYASHI Atsuko (GIO) Mr. ITO Hiroshi (GIO)	Dr. ODA Takefumi (GIO) Dr. TAKI Wakana (GIO)
Rapporteur		
Note: Mutual learning sessions are closed sessions in order to secure confidentiality of information so that countries participating in each mutual learning session can provide unpublished information. Therefore, only participating countries in each session, facilitators, resource persons and the WGIA Secretariat are allowed to.		

Annex I

Day 2: Morning, 27th June			
8:30 - 9:00	**Registration**		
9:00 – 10:00	**Opening Session**		
	Room: Grand Hall	**Chair: Ms. HATANAKA Elsa (GIO)**	**Rapporteur: Ms. HAYASHI Atsuko (GIO)**
9:00 – 9:10	Welcome Address		Ms. NISHIKAWA Junko (MOEJ)
9:10 – 9:25	Japan's Progress on Climate Change Measures and International Cooperation		Mr. SENOO Kohei/ Ms. KURODA Kotoe (MOEJ)
9:25 – 9:35	Introduction to WGIA20		Mr. ITO Hiroshi (GIO)
9:35 – 10:00	**Questions and Answers**		**All**
10:00 – 10:30	*Group Photo & Tea Break*		
10:30 – 12:00	**Session I: Updates on the GHG Inventory of National Communications (NCs) and Biennial Update Reports (BURs) from non-Annex I Parties**		
	Room: Grand Hall	**Chair: Prof. Rizaldi Boer (AB/ Bogor Agricultural University)**	**Rapporteur: Ms. HAYASHI Atsuko (GIO)**
10:30 – 10:45	Cambodia's Third National Communication and GHG Emissions Target		Ms. Heang Phallin (Cambodia)
10:45 – 11:00	Malaysia Fourth Biennial Update Report Under the United Nations Framework Convention on Climate Change		Ms. Dayang Ratnasari Abu Bakar/ Ms. Elizabeth Philip (Malaysia)
11:00 – 11:15	Singapore's Fifth Biennial Update Report		Ms. Winnie Chia (Singapore)
11:15 – 11:30	Updates on the GHG Inventory of National Communications & BUR		Mr. Md. Rezaul Karim (Bangladesh)
11:30 – 12:00	**Questions and Answers**		**All**
12:00 – 14:00	*Lunch*		

Day 2 Afternoon, 27th June			
14:00 – 15:30	**Session II: Changes in Reporting Under the Paris Agreement**		
	Room: Grand Hall	**Chair: Ms. Sandee G. Recabar (Philippines)**	**Rapporteur: Ms. HAYASHI Atsuko (GIO)**
14:00 – 14:30 (Online)	Overview on GHG Inventory Reporting Under the Paris Agreement		Mr. AIZAWA Tomoyuki (UNFCCC)
14:30 – 14:45	Strengthen the Capacity of Developing Countries to Prepare and Manage National Greenhouse Gas Inventories as a Basis for Effective Implementation of the Enhanced Transparency Framework Under the Paris Agreement		Mr. Dominique Revet (UNFCCC)
14:45 – 15:00	Updates on the IPCC Inventory Software and Recent Activities		Dr. Baasansuren Jamsranjav (AB; IPCC/TFI)
15:00 – 15:30	**Questions and Answers, Discussion**		**All**
15:30 – 15:35	Introduction to Session III		Mr. KOSAKA Naofumi (GIO)
15:35 – 16:00	*Tea Break*		
16:00– 17:40	**Session III: Planning for the First GHG Inventory Under the Paris Agreement**		
			Rapporteur: Ms. HAYASHI Atsuko (GIO)
	Session III-BOG1: Planning for the First GHG Inventory Under the Paris Agreement		
	Room: Grand Hall	**Discussion lead: Mr. KOSAKA Naofumi**	
16:00 – 17:40	Discussion		Breakout Group (BOG) 1
	Session III-BOG2: Planning for the First GHG Inventory Under the Paris Agreement		
	Room: Yuri	**Discussion lead: Ms. HAYASHI Atsuko**	
16:00 – 17:40	Discussion		Breakout Group (BOG) 2
	Session III-BOG3: Planning for the First GHG Inventory Under the Paris Agreement		
	Room: Suzuran	**Discussion lead: Ms. HATANAKA Elsa**	
16:00 – 17:40	Discussion		Breakout Group (BOG) 3
19:00 – 21:00	*Welcome Reception*		

Annex I

Day 3 Morning, 28th June			
9:00 – 12:00	**Session IV: Methodology for the Energy Sector**		
	Room: Grand Hall	**Chair: Mr. TANABE Kiyoto (IPCC/TFI)**	**Rapporteur: Ms. HAYASHI Atsuko (GIO)**
(Cancelled)	China's Country-Specific Emission Factors for the Energy Sector		Dr. Xu Danhui (China)
9:00 – 9:25	Brunei Darussalam's GHG National Inventory System and GHG Estimates from the Energy Sector		Ms. Dk Nur Afifah Atikah Pg Hj Ismail (Brunei)
9:25 –9:50	Carbon Dioxide Transport, Injection, and Geologic Storage in the Inventory of U.S. Greenhouse Gas Emissions and Sinks		Mr. Vincent Camobreco (US EPA)
9:50 – 10:20	**Questions and Answers, Discussion**		**All**
10:20– 10:50	*Tea Break*		
10:50 – 11:15	Japan's Reporting on Carbon Capture and Storage		Mr. KOSAKA Naofumi (GIO)
11:15 – 11:30	Policies for Carbon Capture and Storage (CCS) in Japan and Overview of CCS Under the Joint Crediting Mechanism (JCM)		Mr. SENOO Kohei/ Ms. UGA Maiko (MOEJ)
11:30 – 12:00	**Questions and Answers, Discussion**		**All**
12:00 – 13:30	*Lunch*		

Day 3 Afternoon, 28th June			
13:30 – 15:00	**Poster Session**		
	Room: Foyer		
13:30 – 15:00	**Discussion**		Poster Presenter
15:00 – 15:15	*Tea Break*		
15:15 – 16:20	**Wrap-up Session**		
	Room: Grand Hall	**Chair: Ms. HATANAKA Elsa (GIO)**	
15:15 – 15:30	Summary of the Mutual Learning Sessions		Dr. ODA Takefumi (GIO)
15:30 – 15:45	**Discussion**		**All**
15:45 – 16:00	Summary of the Plenary Sessions		Ms. HAYASHI Atsuko (GIO)
16:00 – 16:15	**Discussion**		**All**
16:15 – 16:20	Closing Remarks		Ms. HATANAKA Elsa (GIO)

Day 3 Evening, 28th June			
17:00 – 18:00	**Joint Meeting of the WGIA Organizing Committee and Advisory Board (members of the OC and AB are requested to attend)**		
	Room: Kikyo	**Chair: Mr. ITO Hiroshi (GIO)**	
17:00 – 17:30	Review of Activities in WGIA20		OC/AB members
17:30 – 18:00	Discussion on Topics for WGIA21		OC/AB members

Study Tour, 29th June		
8:15 – 11:30	Study Tour	Group 1
12:45 – 16:00	Study Tour	Group 2

Note:
Study Tour Groups will be assigned according to return flight schedules. The WGIA Secretariat will announce which group you will be included in.

Abbreviations:
AB: WGIA Advisory Board
BUR: Biennial Update Report
GHG: Greenhouse Gas
GIO: Greenhouse Gas Inventory Office of Japan, NIES
IPCC: Intergovernmental Panel on Climate Change
IPCC/TFI: IPCC, Task Force on National Greenhouse Gas Inventories
IPPU: Industrial Processes and Product Use
MOEJ: Ministry of the Environment, Japan
NC: National Communication
NIES: National Institute for Environmental Studies, Japan
OC: WGIA Organizing Committee
UNFCCC: United Nations Framework Convention on Climate Change

Annex I

Poster Session			
28th June, 13:30 – 15:00 Room: Foyer			
No.	**Topic**	**Title**	**Name, Organization**
P-1	7	Preparation of Japan's National Greenhouse Gas Inventory and Trends in GHG Emissions	GIO, NIES
P-2	7	Towards the Enhanced Transparency Framework in the Republic of Korea: Improved Energy Inventory	Ms. Hyunhwa Lee, Ms. Jiyeon Kim, Dr. hyung-Wook Choi Greenhouse Gas Inventory and Research Center of Korea (GIR), Republic of Korea
P-3	3	Research on Nonconventional Gases at CSIR-CIMFR, India	Prof. Debadutta Mohanty, Professor, AcSIR and Senior Principal Scientist and Head, Nonconventional Gases Research Group CSIR- Central Institute of Mining and Fuel Research
P-4	7	Greenhouse Gas Inventory and Climate Change Research at CSIR, India	Sunil Kumar Pathak*, Tuhin Suvra Khan, Shailesh Kumar Singh, Nanaji Islavath, Jasvinder Singh, Ojasvi Sharma, Ganesh Naik, Bhavya B Krishna CSIR – Indian Institute of Petroleum
P-5	1	DATAMAN: A Global Database of Methane, Nitrous Oxide, and Ammonia Emission Factors for Livestock Housing and Outdoor Storage of Manure	M Hassouna[1], TJ van der Weerden[2], I Beltran[3], B Amon[4,5], MA Alfaro[3], V Anestis[6], G Cinar[4,7], F Dragoni[4], NJ Hutchings[8], A Leytem[9], K Maeda[10], A Maragou[6], T Misselbrook[11], A Noble[2], A Rychła[5], F Salazar[3], P Simon[2] [1]INRAE, France, [2]AgResearch Ltd, New Zealand, [3]INIA, Chile, [4]Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Germany, [5]Univ. of Zielona Góra, Poland, [6]Agricultural Univ. of Athens, Greece, [7]Freie Univ. Berlin, Germany, [8]Aarhus Univ., Denmark, [9]USDA-ARS, USA, [10]JIRCAS, Japan, [11]Rothamsted Research, UK
P-6	1	Enteric Methane Emission Models for Diverse Beef Cattle Feeding Systems in South-East Asia: A Meta-Analysis	T.P. Tee[1], Y.M. Goh[1], M.H.M. Zainudin[1], S.C.L. Candyrine[1], K. Sommart[2], K. Kongphitee[2], W. Sumamal[3], I. Phaowphaisal[3], R. Namsilee[3], W. Angthong[3], S. Sunato[3], O. Keaokliang[3], K. Maeda[4], N.V. Thu[5], T.T. Trung[5], N.T.K. Dong[6], A. Purnomoadi[7], M. Kurihara[8], A. Jayanegara[9], K. Higuchi[8], Y. Kobayashi[8], F. Ohtani[8], H. Abe[8], F. Terada[10], H. Kumagai[11], H. Matsuyama[12], I. Nonaka[8], N. Takusari[8], N.

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Topics:
1. Emission factor development (Sector)
2. Remote-sensing and GIS
3. Data collection and statistics
4. International support programme
5. International framework
6. Low carbon society and mitigation measures
7. Other

Annex II: List of Participants

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