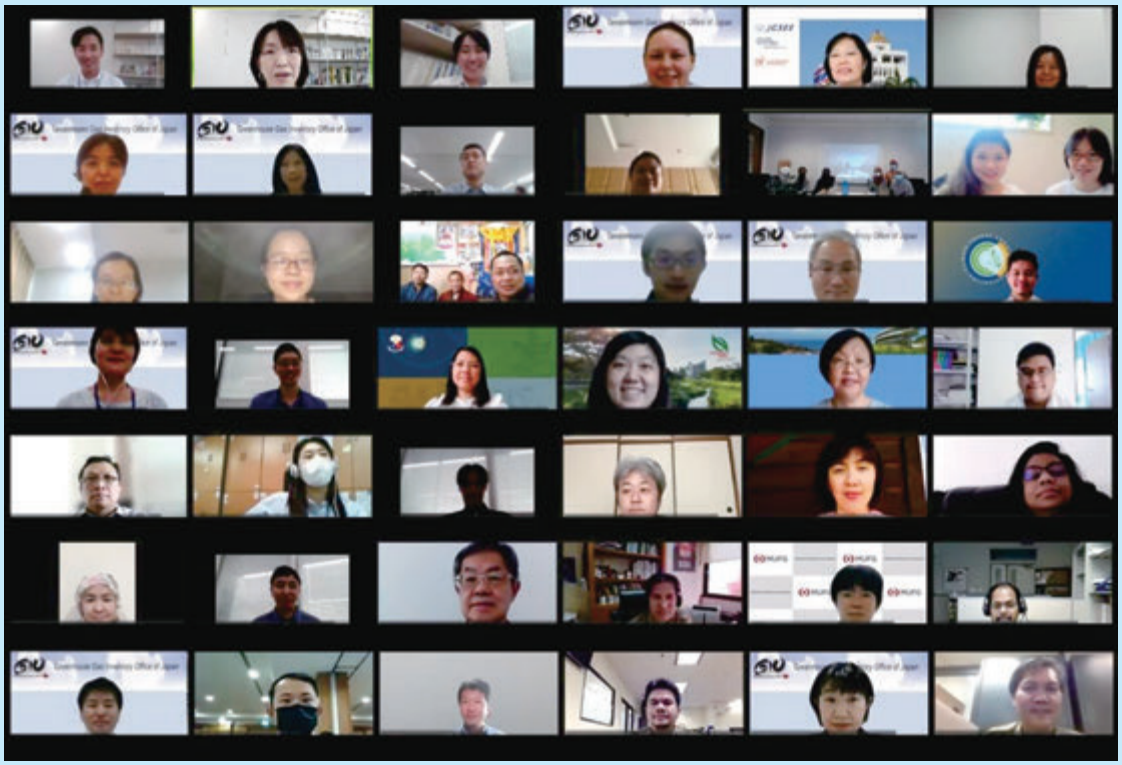
CGER-REPORT

ISSN 1341-4356
CGER-I162-2022

Proceedings of the 19th Workshop on Greenhouse Gas Inventories in Asia (WGIA19)

7th July – 13th July 2022



Greenhouse Gas Inventory Office of Japan (GIO)

Center for Global Environmental Research

National Institute for Environmental Studies, Japan

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Contents

Foreword

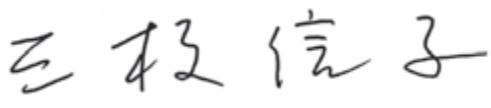
The international community now recognizes increases in anthropogenic emissions of greenhouse gases (GHGs) as the primary cause of climate change and its impacts. The Working Group I contribution to the Sixth Assessment Report (AR6) published by the Intergovernmental Panel on Climate Change (IPCC) last year 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 19th WGIA (WGIA19), which was held online from 7th to 13th July, 2022. 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
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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.

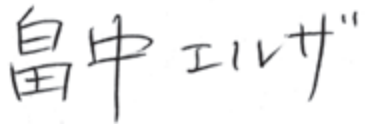
WGIA has contributed significantly to the construction and consolidation of a network of officials and researchers involved in GHG inventory preparation in Asian countries and to the identification and provision of solutions for common issues relevant to the inventories.

This time, the WGIA19 was held online from 7th to 13th July, 2022. The topics set out for this workshop were based on consideration of the current situation of the member countries.

The outcomes of the WGIA19 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.

HATANAKA Elsa



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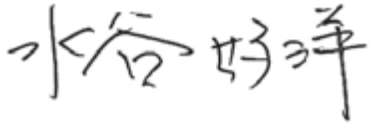
MIZUTANI Yoshihiro



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List of Acronyms and Abbreviations

AB	WGIA Advisory Board
AFOLU	Agriculture, Forestry and Other Land Use
AR	Assessment Report
ASEAN	Association of South East Asian Nations
BTR	Biennial Transparency Report
BUR	Biennial Update Report
C	Confidential
CGE	Consultative Group of Experts
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
CRTs	Common Reporting Tables
CSC	Carbon Stock Change
COVID-19	Coronavirus Disease 2019
CRF	Common Reporting Format
ESD	Earth System Division
ETF	Enhanced Transparency Framework
FAO	Food and Agriculture Organization of the United Nations
FY	Fiscal year
GHG	Greenhouse Gas
GDP	Gross Domestic Product
GHG-DM	Greenhouse Gas-Data Management
GIO	Greenhouse Gas Inventory Office of Japan
GOSAT	Greenhouse Gases Observing Satellite
GPG 2000	IPCC, Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000
GWP	Global Warming Potential
IE	Included elsewhere
IPCC	Intergovernmental Panel on Climate Change
IPCC TFI	IPCC, Task Force on National Greenhouse Gas Inventories
IPPU	Industrial Process and Product Use
LULUCF	Land Use, Land-Use Change and Forestry
M&E	Monitoring and Evaluation
MOEJ	Ministry of the Environment, Japan
MPGs	Modalities, procedures and guidelines
MRV	Measurement, Reporting, and Verification Measurable, Reportable, and Verifiable
NAI	Non-Annex I
NC	National Communication
NE	Not estimated
NDC	Nationally Determined Contribution
NIES	National Institute for Environmental Studies, Japan
NID	National Inventory Document

NIR	National Inventory Report
QA	Quality Assurance
Q&A	Questions and Answers
REDD+	Reducing emissions from deforestation and forest degradation in developing countries
QC	Quality Control
TGEIS	Thailand GHG Emission Inventory System
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

Chemical terms

CO_2	Carbon dioxide
CH_4	Methane
HFCs	Hydrofluorocarbons
N_2O	Nitrous oxide
NF_3	Nitrogen trifluoride
NMVOC	Non-methane volatile organic compounds
PFCs	Perfluorocarbons
SF_6	Sulfur hexafluoride
Gg	Giga gram (10^9 g)
GW	Giga Watt (10^9 W)
kt	Kilo tonnes (10^3 t)
Mt	Million tonnes (10^6 t)

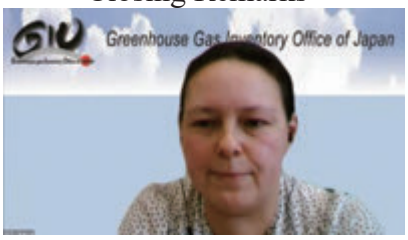
Photos of the Workshop

The Plenary Sessions

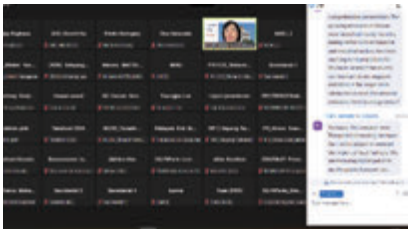
Welcome Address

Opening Session

Closing Remarks

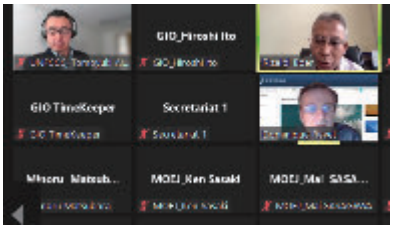


Session I



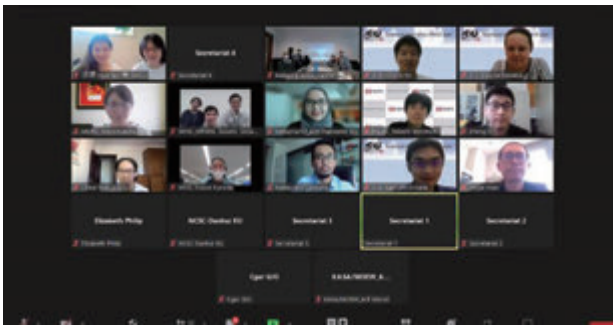
Session II

Session III



The Mutual Learning Sessions

Energy: China – Malaysia



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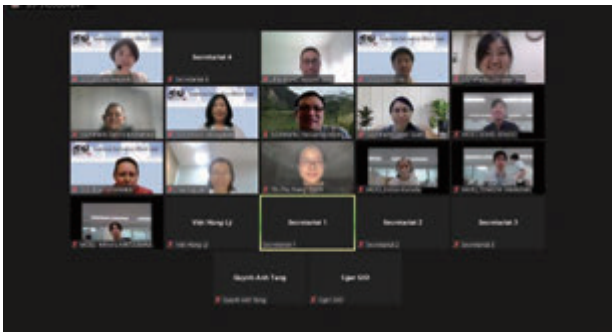
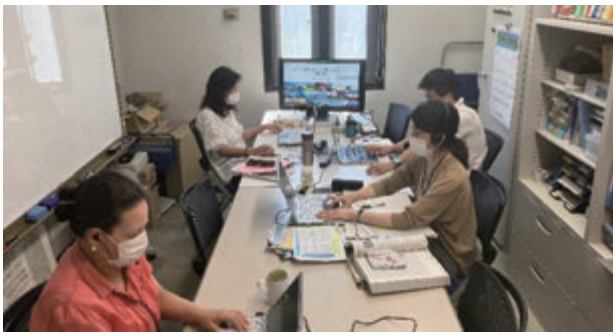


LULUCF: Singapore – Viet Nam



LULUCF: Singapore – Viet Nam

1. Executive Summary of WGIA19

1 Executive Summary of WGIA19

The Ministry of the Environment of Japan (MOEJ) and the National Institute for Environmental Studies (NIES) convened the "19th Workshop on Greenhouse Gas (GHG) Inventories in Asia (WGIA19)" from July 7 (Thursday) to July 13 (Wednesday), 2022 online.

Annual workshops have been held since 2003 in order to support non-Annex I (NAI) Parties in Asia to improve the accuracy of their GHG inventories and to facilitate the enhancement of cooperative relationships in the Asian region. This year, approximately 100 participants attended WGIA19 in total, including government and research representatives of 16 member countries (Bhutan, Brunei, Cambodia, China, India, Indonesia, Japan, Republic of Korea, Laos, Malaysia, Mongolia, Myanmar, 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), Food and Agriculture Organization of the United Nations (FAO), the United States Environmental Protection Agency (USEPA), and others.

Opening Session

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 current progress in global warming countermeasures. Japan's GHG emissions have decreased seven years in a row since fiscal year (FY) 2014 mainly due to the decrease in energy consumption and the decarbonization of electricity. Japan aims to reduce GHG emissions by 46% in FY2030 from the FY2013 levels and will continue to support the transition towards decarbonization in Asian countries.

Updates on the GHG Inventories in the NCs and BURs from Non-Annex I Parties

Bhutan, India, Indonesia, Korea, and Thailand 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, as well as mitigation activities.

This is a crucial time before countries fully step into the preparation of Biennial Transparency Reports (BTRs) under the Enhanced Transparency Framework (ETF) of the Paris Agreement. Asian countries need to strengthen their understanding and knowledge of developing/preparing BTRs. Although various systems that support inventory preparation are starting to be put into place, it is important to enhance the capacity of inventory compilers by utilizing various training opportunities that suit their different circumstances/challenges.

New Reporting Formats and Tools Under the Paris Agreement

UNFCCC gave presentations on the new GHG inventory reporting formats such as the Common Reporting Tables (CRTs) and the National Inventory Document (NID) under the Paris Agreement and the support activities by the GHG Support Unit. After these presentations, IPCC TFI introduced their software currently undergoing testing that will implement the functions for all methodological tiers and approaches for the Energy and Agriculture, Forestry, and Other Land Use (AFOLU) sectors. Chuo University (Japan) gave an overview of estimating CO_2 emissions using satellite data to qualitatively evaluate the effects of the introduction of briquettes in Ulaanbaatar, and FAO shared the information on their products and tools for enhanced transparency.

In order to prepare for the ETF, WGIA countries should respectively enhance their

understanding of reporting formats and outlines and advance their thinking about the details of how to report using these formats and outlines. The transition to ETF reporting is a large change, with new reporting formats and outlines, and therefore it is important to utilize the tools and capacity-building opportunities available.

Cross-cutting Guidance for Reporting Under the Paris Agreement

USEPA explained the function of notation keys, and the Philippines gave an overview of the Philippine institutional arrangement for the GHG inventory and their experience in Quality Assurance (QA) / Quality Control (QC). After these presentations, Mongolia gave a presentation on fugitive emissions from solid fuels and oil production and the results of a comparison between the reference and sectoral approaches. Following this, GIO explained that performing recalculations was one of the key elements in ensuring time-series consistency.

Using notation keys will add transparency and completeness, and reviewing Not Estimated (NE) categories will also help improve the inventory. It is important to prepare a QA/QC plan and implement QA/QC activities, and good institutional arrangements need to be in place to do so. Areas of improvement could be identified through a comparison between the sectoral approach and the reference approach. Performing recalculations helps to better understand the real trend. Reporting and confirming recalculations may sometimes serve as QC.

The Mutual Learning

In this WGIA, the Mutual Learning was held for the following two GHG inventory sectors: Energy sector (China and Malaysia), and Land Use, Land-Use Change, and Forestry (LULUCF) sector (Singapore 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.

These countries recognized that there were some challenges to overcome in preparing for future BTRs. Such challenges are in the estimation of GHG emissions/removals from categories currently not estimated, in the preparation of elements which should be newly reported, and in the need for earlier reporting of GHG emissions/removals - two years prior to the year of submission.

Poster Session

This was held to share information on the latest research results and deepen the discussion on specific issues. This year's WGIA19 was held online, therefore, posters were displayed on a designated website and presenters and participants held discussions in each breakout group.

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/19.html

2.1 Opening Session

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

Mr. Ito Hiroshi (GIO) gave an introduction of WGIA19. He introduced the historical progress of WGIA, as well as its participants, agenda, and expected outcomes. The expected outcomes of WGIA19 were:

- Enhancement of the quality of GHG inventories for NCs, BURs, and future BTRs.
- Enhancement of the understanding of the new CRT format, NID outlines, and tools to support the development of national inventories.
- Strengthening of the participants' understanding of the cross-cutting guidance for reporting under the Paris Agreement.

Mr. Ito Hiroshi 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 Paris Agreement.

Mr. Senoo Kohei (MOEJ) made a presentation on Japan's current progress in global warming countermeasures. He reported that Japan's GHG emissions have decreased seven years in a row since FY2014 mainly due to the decrease in energy consumption and the decarbonization of electricity. Japan's total GHG emissions in FY2020 were estimated at 1,150 Mt CO_2 eq. Japan aims to reduce its GHG emissions by 46% in FY2030 from its FY2013 levels.

In October 2021, Prime Minister Kishida put forward the "ASEAN-Japan Climate Change Action Agenda 2.0" at the ASEAN-Japan Summit Meeting. Taking into account the three pillars of transparency, mitigation, and adaptation, the Government of Japan has significantly expanded and strengthened its efforts to co-create a decarbonized society in the region. Mr. Senoo Kohei emphasized that Japan would continue to support the transition towards decarbonization in Asian countries.

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

This session was chaired by Dr. Sirintornthep Towprayoon (WGIA Advisory Board (AB) member; King Mongkut's University of Technology Thonburi).

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, Bhutan, India, Indonesia, Korea, and Thailand gave presentations on their latest BURs and NCs.

The chair of this session, Dr. Sirintornthep Towprayoon, introduced the objective of this session as sharing information and experiences of preparing/updating WGIA member countries' GHG inventories in their NCs and BURs and being an opportunity to enhance knowledge before fully starting preparation for BTRs.

Mr. Rinzin Namgay (Bhutan) made a presentation on Bhutan's national GHG inventory in its

Third NC. He showed an overview of the national GHG inventory and explained that the national net total including LULUCF was -5,572.50 Gg CO_2 eq. in 2015. He also described the emissions/removals in detail by sector and by gas. Regarding the emission trend from 1994 to 2015, he showed that regardless of the forest fires that caused the largest emissions and fluctuations, the net total for each year has been negative owing to the most significant key category "Forest land remaining forest land" (e.g. showed 8,181.187 Gg CO_2 eq. removals in 2015).

Mr. Ajay Raghava (India) gave a presentation on India's Third BUR. He summarized the history of India's GHG inventory submissions under the UNFCCC and the institutional arrangements for BUR preparation and inventory compilation. He also explained in detail the contents of the BUR, including the national GHG inventory (for 2014 and 2016). As for the details of the national net total (2,531.07 Mt CO_2 eq. including LULUCF for 2016), he explained that the energy sector accounted for over 70% of the total emissions (excluding LULUCF) and that the emissions of the second largest sector, Agriculture, turned from increasing to decreasing recently thanks to mitigation measures. He also explained the mitigation measures conducted for the Energy sector and the Industrial Process and Product Use (IPPU) sector.

Dr. Syaiful Anwar (Indonesia) gave a presentation on Indonesia's Third BUR, including the latest GHG inventory for 2019. He gave an overview of BUR3 together with the institutional arrangements for the coordination of climate change governance and implementation of the Climate Change Convention, including the preparation of the GHG inventory. He explained that Indonesia's primary GHG emission sources were in the AFOLU sector including peat fires, and that the total national GHG emissions including LULUCF increased more rapidly than that without LULUCF from 2000 to 2019. He also gave details of the workflow for the national registry system which includes the verification process of the results of climate change actions and is also utilized for preparing NCs/BURs.

Ms. Sohyang Lee (Korea) gave a presentation on Korea's National GHG Inventory in the Fourth BUR. She explained the history of Korea's GHG inventory submissions, the institutional arrangements, and an overview of the BUR preparation. She also explained the breakdown of the national total GHG emissions (727.6 Mt CO_2 eq. excluding LULUCF) by sector and by gas for 2018, followed by the GHG emission trends from 1990 to 2018 per capita and per GDP which were influenced by economic events. She provided information on challenges and plans for the improvement of their inventory, such as reporting X-2 data in the inventory and establishing an IT system for measurement, reporting, and verification (MRV) to apply the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines) and for reporting in CRT format.

Mr. Sivach Kaewcharoen (Thailand) gave a presentation on Thailand's national GHG inventory in its Third BUR. He showed the submission status of NCs and BURs and the plans for future submissions of Thailand's GHG inventory until the first BTR under the Paris Agreement. He also showed the breakdown by each sector; the Energy sector was the main emission source at 253,895.61 Gg CO_2 eq. followed by the Agriculture sector at 52,158.70 Gg CO_2 eq. He then shared ongoing domestic/international work to facilitate the transition of the national system for reporting BTRs under the ETF.

Regarding the presentations above, participants showed great interest in gaining knowledge about technical issues such as the application of Global Warming Potentials (GWPs) or the respective national systems for preparing GHG inventories, which also have strong links with mitigation measures. Presenters described the basic challenges they faced in preparing data for the inventory, the efforts taken especially by the network of scientific institutions for mitigation measures, and their initiatives aiming at maintaining low emissions by utilizing long-term

projections based on models. Furthermore, since some countries had started the preparation of their first BTR, they shared their progress and challenges faced at present.

For this session, the following conclusions were made.

1) This is a crucial time before countries fully step into the preparation of BTRs under the ETF of the Paris Agreement.

2) Asian countries need to strengthen their understanding and knowledge of developing/preparing BTRs.

3) Although various systems that support inventory preparation are beginning to be put into place, it is important to enhance the capacity of inventory compilers by utilizing various training opportunities that suit the different circumstances/challenges that they face.

2.3 Session II: New Reporting Formats and Tools Under the Paris Agreement

This session was chaired by Prof. Rizaldi Boer (AB member; Bogor Agricultural University).

Parties under the Paris Agreement are required to submit their first BTR (BTR1) and national inventory report (NIR), if submitted as a stand-alone report, in accordance with the modalities, procedures, and guidelines (MPGs) for the transparency framework for action and support referred to in Article 13 of the Paris Agreement, at the latest by 31 December 2024. WGIA member countries will need to enhance their national systems and compilation capacity to prepare national GHG inventories to meet the requirements, based on a clear understanding of the new reporting requirements together with their formats and outlines. This session was held to share information on the new reporting formats and outlines as well as the tools that help inventory preparations, and capacity-building opportunities.

Mr. Aizawa Tomoyuki (UNFCCC) gave a comprehensive overview of GHG inventory reporting that will be required under the Paris Agreement. In addition to the changes in the reporting requirements for developing countries, information on the structure of CRTs and NID outlines was provided. In the explanation about CRTs, he commented that implied emission factors which were automatically calculated in CRTs could be helpful for checking potential errors such as unit conversion errors and could, therefore, be utilized for QC. He also explained that the reporting tools for the ETF were currently under development with the aim of finalizing them around June 2024.

Mr. Dominique Revet (UNFCCC) shared information about the activities implemented by the GHG Support Unit such as in-country QA activities, regional training workshops, and the provision of e-learning and certification opportunities regarding the 2006 IPCC Guidelines. These activities aim to assist developing countries in establishing/maintaining sustainable national GHG inventory management systems and building the technical capacities of their national experts in GHG inventories and other related issues.

In response to the questions from Prof. Rizaldi Boer and Mr. Hassan Ibrahim (Singapore) about capacity-building activities provided by the UNFCCC, Mr. Dominique Revet emphasized that in-country QA workshops were very important since many recommendations for improvement were provided (almost 200-pages, in the QA template) and that there was in-depth interaction during the 5-day workshop. He also mentioned that workshops on uncertainty assessment were available and already held, including those upon request from developing counties.

Regarding the presentation of Mr. Aizawa Tomoyuki, Ms. Hatanaka Elsa (GIO) commented that she interpreted that the HFC and PFC gas species shown in CRT Table 2(II) (sectoral summary table) were mandatory gases under the MPGs. During the Q&A session, Mr. Wan Lek Kong (Singapore) raised a question about the NID, to which Mr. Aizawa Tomoyuki answered that parties could select whether to submit NID together with the BTR or as a stand-alone report.

In response to a question from Ms. Winnie Chia (Singapore) whether the use of the IPCC Inventory Software was necessary prior to the data input to the CRTs, Mr. Tanabe Kiyoto (Co-Chair of IPCC TFI; Consultative Group of Experts (CGE) member) clarified that Parties to the Paris Agreement were not obliged to use the IPCC Inventory Software. It is expected that countries using the IPCC Inventory Software could import their data to the CRT reporting tool by using an importable format file(s) generated by the upcoming version of the IPCC Inventory Software, while countries not using the IPCC Inventory Software would need to directly/manually enter data into the CRTs. Additionally, Mr. Kosaka Naofumi shared that Japan imported data to the CRFs from the calculation Excel files for estimation by establishing links with the importable format Excel files generated by the CRF Reporter.

Dr. Baasansuren Jamsranjav (AB member; IPCC/TFI) explained that the upgraded version 2.80 of the IPCC Inventory Software that was currently under testing implemented the functions for all methodological tiers and approaches for the Energy and AFOLU sectors in the 2006 IPCC Guidelines and the 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands (Wetlands Supplement). She also described future update plans for the software.

Prof. Watanabe Masataka (Chuo University) made a presentation on CO_2 emission estimations by using Greenhouse Gases Observing Satellite (GOSAT) data to qualitatively evaluate the effects of the introduction of briquettes instead of raw coal in Ulaanbaatar. The satellite observation data of CO_2 in Ulaanbaatar showed a decrease in the winter of 2019 compared to the winter of 2018. He mentioned the need for inverse analysis for quantitative estimations of emissions, removals, and reductions.

Dr. Mirella Salvatore (FAO) shared information on the products and tools for enhanced transparency. Institutional arrangements-related products (e.g., the Greenhouse Gas Data Management (GHG-DM) tool), MRV and monitoring and evaluation (M&E)-related products (e.g., E-learning courses for the national GHG inventory), and NDCs-related products are already available on their website, and the land representation tool to develop land-use matrices is under development. She also introduced the roster of transparency practitioners and examples of supporting activities for developing countries in Asia and the Pacific.

In response to a question from Dr. Elizabeth Mp. Philip (Malaysia) about the IPCC Inventory Software, Dr. Baasansuren Jamsranjav clarified that the upgraded IPCC Inventory Software under testing could be used for estimations related to the five carbon pools and welcomed Dr. Philip to test this function.

In relation to a question raised by Ms. Tegshjargal Bumtsend (Mongolia) about data availability for CO_2 reduction estimations, Prof. Watanabe Masataka clarified that GOSAT data enabled the estimations of reductions without information on the actual situation of the use of raw coal/coal briquette in Ulaanbaatar.

In response to a question from Mr. Hassan Ibrahim (Singapore) about the GHG-DM tool, Dr. Mirella Salvatore explained that this tool was an Excel-based package that helped manage metadata, such as data sources, and publishing frequency, etc. of required data for estimation of all sectors/categories in the 2006 IPCC Guidelines. She also emphasized that this tool would help

developing countries keep track of the data lacking for estimation.

For this session, the following conclusions were made.

1) In order to prepare for the ETF, WGIA countries should respectively enhance their understanding of reporting formats/outlines and advance their thinking about the details of how to report using these formats/outlines.

2) The transition to ETF reporting is a large change, with new reporting formats/outlines, and therefore, it is important to utilize the tools / capacity-building opportunities available.

2.4 Session III: Cross-cutting Guidance for Reporting Under the Paris Agreement

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

The elements which need to be reported in GHG inventories will be more detailed under the ETF of the Paris Agreement. As for cross-cutting issues, the following elements will need to be strengthened: use of notation keys, preparation of a QA/QC plan, ensuring transparency of recalculations, comparison between the reference approach and the sectoral approach, and so on. This session was held to share information on the experiences of countries that currently reported such cross-cutting elements.

Ms. Amanda Chiu (US-EPA) explained the function of notation keys as shorthand documentation to explain inventory completeness and illustrated how to use them by drawing on examples from the U.S. national GHG inventory. She emphasized that their use added transparency to country reporting and would continue to be required under the Paris Agreement MPGs. She also stressed the importance of documenting the rationales for the choices of notation keys.

Ms. Sandee Recabar (Philippines) gave an overview of the Philippine institutional arrangement for the GHG inventory and their experience in QA/QC. She also noted the importance of Executive Order No. 174 series of 2014 that enabled the country to generate data and track its emissions, and Climate Change Commission Resolution No. 2018-003 that provided the implementing rules and regulations for the above-mentioned Executive Order, including those for QA/QC of the national inventory.

Ms. Tegshjargal Bumtsend (Mongolia) first provided information on how Mongolia estimated fugitive emissions from solid fuels and oil production, which is a new source in the 2006 IPCC Guidelines. She then introduced the results of Mongolia's comparison between the reference and sectoral approaches and the analysis of discrepancies, which is also a new element that needs to be strengthened in the Paris Agreement ETF reporting. The discrepancies were found to be mainly due to the complexity of energy transformation processes and the application of category-specific emission factors.

Ms. Hirata Eriko (GIO) explained that performing recalculations was one of the key elements in ensuring time-series consistency of national GHG inventories and that recalculations were a mandatory requirement under the MPGs. She shared Japan’s examples of recalculations and experiences of quality checks by confirming recalculations. She noted that typically, recalculations in Japan were made when the statistics/surveys were updated or when existing data used in previous submissions were revised/corrected in addition to methodological change, and that the reasons for the recalculations and their effects on the time-series, etc. should be explained.

Regarding the question from Ms. Tegshjargal Bumtsend (Mongolia) about when to use the notation key Included Elsewhere (IE), Ms. Amanda Chiu clarified that it could be used when data could not be disaggregated and activity data or emissions/removals had to be combined in another category/sub-category, but that countries needed to aim to disaggregate when it was a potential key category. Ms. Chiu also explained the difference between the notation keys Confidential (C) and IE and how to choose which to use, in response to a question from Ms. Hatanaka Elsa (GIO). She acknowledged that there was a certain amount of knowledge and judgement necessary to determine what notation key to use and noted that it was important to be as transparent as possible, to exercise each country's best judgement, and to explain the rationale of the choice. However, she also noted that it was still possible to make changes in future reporting.

In response to the request for elaboration on the Philippine Interagency Meetings for the NIR Improvement from Mr. Miyata Kazuaki (MOEJ), Ms. Sandee Recabar clarified that it was held before the next inventory cycle started to identify what needed to be updated (Emission Factors, methodology, etc.) in the next inventory, and that the meetings consisted of an overall interagency meeting and separate meetings with agencies that were tasked to prepare sectoral inventories. Mr. Tanabe Kiyoto also commented that the Mutual Learning (ML) exercise during WGIA could possibly serve as part of the QA process as well since countries could receive questions and advice from external inventory experts.

Regarding Mongolia’s presentation, Mr. Tanabe Kiyoto noted Mongolia’s great efforts to improve its inventory estimates and commented that interactions with other inventory experts through opportunities such as WGIA, including Mutual Learning, would surely help further improve inventory quality. In response to a clarification question from Mr. Ito Hiroshi (GIO), Ms. Tegshjargal Bumtsend confirmed that one of the improvements made in BUR2 following BUR1 was the addition of estimates for fugitive emissions from oil flaring, however, fugitive emissions from the distribution of oil products could not be estimated due to lack of data.

For this session, the following conclusions were made.

1) Using notation keys will add transparency and completeness and reviewing NE categories will also help improve the inventory.
2) It is important to prepare a QA/QC plan and implement QA/QC activities, and good institutional arrangements need to be in place to do so.
3) Areas of improvement could be identified through a comparison between the sectoral approach and the reference approach.
4) Performing recalculations helps to better understand the real trend. Reporting and confirming recalculation may sometimes serve as QC.

2.5 Closing Session

Ms. Hatanaka Elsa (GIO) commenced this session by presenting an oral summary of the ML sessions and the preceding plenary sessions. Regarding the ML sessions, she highlighted some of the outstanding issues and good practices identified in the participating countries’ inventories that were discussed in each session. She first noted an issue discussed during the ML for the Energy sector, which was about the common challenge of obtaining X-2-year data. She also noted that one of the participating countries had provided detailed tables as an attachment to the Technical Annex of BUR, and this was identified as a good practice from the perspective of transparency. Regarding ML for the LULUCF sector, she noted that an issue was identified as outstanding in

relation to the obtained data being incomplete for estimating Carbon Stock Change (CSC) in mineral soils. However, the fact that some country-specific parameters for estimating living biomass pools had been developed was noted in the ML session as a good practice. Regarding the plenary sessions, she made proposals for possible conclusions and asked the chairs for their comments.

There were no comments on possible conclusions, but Dr. Sirintornthp Towprayoon (AB; King Mongkut's University of Technology Thonburi), the chair of Session I, commended the secretariat's work on conclusions and mentioned that the session was useful for all the participating countries for preparing for the upcoming BTR by way of exchanging experiences.

Mr. Tanabe Kiyoto (Co-Chair of IPCC TFI; CGE member) acknowledged that Session III that he chaired was enjoyable with informative presentations followed by fruitful Q&A sessions.

In the concluding remarks, Ms. Hatanaka Elsa (GIO) offered some observations on the online format of WGIA used for these past couple of years during the pandemic and its pros and cons. She noted that it was difficult to know what the future held but expressed her hope to continue to engage effectively with all kinds of participants, such as government officials and experts/academics, in the field of national inventories through appropriate means that matched the circumstances of the time. As for the content of the workshop, she expressed that the secretariat of WGIA would continuously aspire to offer a forum of honest exchange on challenges and possible solutions as well as to provide the latest and most relevant information on developments surrounding national inventories.

Finally, she thanked all the participants for their active participation and a fruitful meeting that was eye-opening and inspiring. She ended the session with a wish for everyone's good health and for seeing them again at the next WGIA.

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 the WGIA 19

ITO Hiroshi

Greenhouse Gas Inventory Office of Japan (GIO/CGER/NIES), Japan

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 proving information to the public by making presentations and proceedings available on GIO's website.

Unfortunately, the ongoing status of the global COVID-19 pandemic still makes it hard to hold an in-person workshop. This year, therefore, we will be holding WGIA online again.

The upcoming 19th Workshop on GHG Inventories in Asia (WGIA19) is to be held 7 - 13 July 2022. The WGIA19 aims:

1) To enhance the quality of GHG inventory for NCs and BURs and in future BTRs
2) To enhance understanding of the new Common Reporting Tables (CRT) format, National Inventory Documents (NID) outlines, and tools to support the development of national inventories, and
3) To strengthen the participants' understanding of the cross-cutting guidance for reporting under the Paris Agreement.

Participants are government officials and researchers from 16 countries in Asia (the WGIA member countries) and experts from international organizations (the IPCC Task Force on National GHG Inventories (IPCC/TFI), the secretariat of UNFCCC, Food and Agriculture Organization of the United Nations (FAO), United States Environmental Protection Agency (USEPA)), and others.

Access to relevant information

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

Japan's Current Progress on Global Warming Countermeasures

SENOO Kohei, MATSUBARA Minoru, YAMAZAKI Tomoya, SASAKI Ken,
MIYATA Kazuaki, SASAGAWA Mai
Decarbonized Society Promotion Office, Global Environment Bureau,
Ministry of the Environment, Japan

Abstract

Japan's greenhouse gas emissions have decreased seven years in a row since FY2014 mainly due to the decrease in energy consumption and decarbonization of electricity. In FY2020, Japan's total greenhouse gas emissions were estimated at 1,150 Mt CO_2 eq. (reflecting a 18.4% decrease compared to FY2013), falling to a record low since FY1990. On the other hand, our GDP has been on the rise in recent years, but it decreased in 2020. Greenhouse gas emissions per unit of GDP have decreased eight 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 businesses and the public *etc.*, 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, 89% are evaluated as progressing at a pace that meets or exceeds the target levels.

As transition to carbon neutrality becomes a global agenda, Japan supports the efforts of partner countries by promoting comprehensive cooperation from upstream strategy planning to downstream project development. At the ASEAN-Japan Summit Meeting in October 2021, Prime Minister Kishida put forward the "ASEAN-Japan Climate Change Action Agenda 2.0." Taking into account the three pillars of transparency, mitigation, and adaptation, the Government of Japan has significantly expanded and strengthened its efforts to co-create a decarbonized society in the region.

Japan's new 2030 target will certainly not be an easy task. However, by defining a top-level ambitious target befitting to a next growth strategy of the nation which underpins manufacturing in the world, Japan is ready to demonstrate its leadership for world-wide decarbonization.

References/Publications

1. National Greenhouse Gas Inventory Report of Japan (April 2022)
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. ASEAN-Japan Climate Change Action Agenda 2.0 (October 2021)

Access to relevant information

1. https://unfccc.int/documents/461933
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. https://www.env.go.jp/en/headline/2547.html

3.2 Session I

Bhutan National Greenhouse Gas Inventory
Third National Communication to UNFCCC

National Environment Commission, Royal Government of Bhutan

Abstract

Total GHG emissions in 2015 was 3,814.098 Gg CO_2e that includes 707.917 Gg CO_2e from energy, 796.423 Gg CO_2e from IPPU, -7203.346 from AFOLU (552.87 Gg CO_2e from agriculture and -7756.220 Gg CO_2e from Land Use, Land Use Change and Forestry) and 126.506 Gg CO_2e from waste. The total sequestration of forest in 2015 is estimated at 9,386.597 Gg CO_2e However, removals from non-forest lands are not estimated in the inventory due to lack of data. The total carbon sink or sequestration by LULUCF in 2015 has increased from the previous estimate of 6,309.6 Gg CO_2e for the year 2000 reported in SNC. The gain in total carbon sink is attributed mainly to change in use of definition of managed forest, natural expansion and plantations. As a result of increase in forest area, the actual gain is estimated to be about 1,000 Gg CO_2e from 2000 to 2015.

Bhutan's GHG emission excluding removals by sink has been increasing and has almost doubled from 1994, in 2015 period. Table 8 shows trend in Bhutan's GHG emissions from sectors and removals by the sink.

Emissions of perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulfur hexafluoride (SF_6) are not estimated in the inventory as product containing these gases are not produced in the country.

Bhutan's net emission including removals by LULUCF has decreased by 23.11% compared from base year (1994) to inventory year of TNC (2015) and increased by 3.56% when compared from inventory year of SNC (2000) to that of the TNC.

References/ Publications

Third National Communication to UNFCCC- 2020

India's Third Biennial Update Report to UNFCCC

Ajay Raghava
Ministry of Environment, Forest and Climate Change, India

Abstract

Climate change is a global collective action problem. As per the report by Global climate risk index 2020, India is one of the most affected countries due to climate change. India has a diverse geography which manifests varied climate regimes. In 2016, India's total GHG emissions, excluding Land Use Land-Use Change and Forestry (LULUCF) were 2,838.89 million tonne CO_2e and 2,531.07 million tonne CO_2e with the inclusion of LULUCF. India's share of current and historical cumulative GHG emissions is very low even with 17% of the global population. India has strived to ensure that it follows a growth path that delivers sustainable development and protects the environment by investing in various schemes aligned with its Nationally Determined Contribution (NDC). India has progressively continued decoupling of economic growth from greenhouse gas emissions. India is implementing one of the largest renewable energy expansion programmes with a target of achieving 175 GW of renewable energy capacity by 2022 and later up to 500 GW. Share of coal in electricity generation is progressively decreasing and we are employing clean coal technologies, however coal will continue to be an integral part of India's energy requirements, both for electricity generation and non-electricity uses for some time. This is in keeping with India's claim to a fair share of the global carbon budget and India's significant underutilization of this share thus far. Forest and tree cover has increased by 1.3 million ha between the 2015 and 2019 assessments of the Forest Survey of India. India's climate actions are significant in the background of its huge development needs. India's emission intensity of gross domestic product (GDP) has reduced by 24 per cent between 2005 and 2016. Taken together, India's mitigation actions speak of the enormous effort that the country is undertaking, through its own resources. India's commitment to multilateral efforts and global cooperation in climate action is amply demonstrated by its initiation of, and the provision of resources to, the ISA, CDRI & Lead IT. India will continue to take strong climate action and also remain focused on its key development imperatives, strengthening its current efforts, including poverty eradication, provision of basic amenities, especially water and sanitation, and livelihoods and employment generation for its entire population.

References/ Publications

MoEFCC. (2021). *India: Third Biennial Update Report to the United Nations Framework Convention on Climate Change.* Ministry of Environment, Forest and Climate Change, Government of India.

Indonesian Third Biennial Update Report

Syaiful Anwar
Green House Gas Inventory and Monitoring Reporting and Verification, Indonesia

Abstract

Indonesian Third Biennial Updated Report (3rd BUR) is a part of country's commitment to the UNFCCC as mandated on COP Decision 2/CP. 17 Annex III. The 3rd BUR was prepared through series of development process and coordination with related ministries and institutions, scientists and experts. These report contains of updated and improvements of Indonesian Second Biennial Updated Report (2nd BUR) on National greenhouse gas inventories including a national inventory report that provides information on greenhouse gas emissions and trends between 2000 and 2016; information on mitigation actions that reports the progress made toward achieving the GHG emission reduction targets and mitigation actions carried out to achieve the targets; Domestic of Measurement, Reporting, and Verification that describes the institutional structures for MRV and MRV process in Indonesia as well as Finance, Technology and Capacity Building Needs and Support Received, reports information on the financial, technological, and capacity building needs and supports received related to the implementation of climate change measures. In addition, the 3rd BUR also includes the REDD+ Technical Annex pursuant to Decision 14/CP.19.

4th BUR (Republic of Korea)

Sohyang Lee
Greenhouse gas Inventory and Research Center (GIR), Republic of Korea

Abstract

The Republic of Korea has ratified the Paris Agreement on November 2016 and has formulated and improved domestic policies and measures. To fulfill the long-term temperature goal set in Article 2, paragraph 1 of the Paris Agreement, the Republic of Korea declared to move towards the goals of carbon neutrality by 2050 in December 2020 and finalized its 2050 carbon-neutrality scenarios as a follow-up measures. In line with the declaration, the Republic of Korea communicates the enhanced update of its first NDC.

The 4th BUR includes the goals of 2050 carbon neutrality, follow-up policies and measures, the enhanced update of its first NDC and the national GHG inventories from 1990 to 2018 which were applied as basic data for the establishment of the enhanced update of its first NDC.

In the presentation, it will be presented that the GHG emission trends and MRV process for preparing GHG inventories included in the 4th BUR. The contents of the presentation are as follows;

- (Institutional arrangement) Responsible institutions and their roles in MRV for preparing greenhouse gas emissions by law.
- (Scope and methodology) Applied IPCC guidelines, and the GWP etc.
- (GHG emission trends) 727.6 million tonCO_2eq. in 2018.
- (GHG emissions by sector) 86.9% of the energy sector, 7.8% of the industrial processes sector, 2.9% of the agriculture sector, and 2.4% of the waste sector in 2018.
- (GHG emissions by gas) 91.4% of CO_2, 3.8% of CH_4, 2.0% of N_2O, and 1.3% of HFCs, 0.4% of PFCs, 1.2% of SF_6 in 2018.
- (GHG emissions per capita) 14.1 tonCO_2eq. in 2018.
- (GHG emissions per GDP) 401.6 tonCO_2eq. in 2018.
- (Appendix) Greenhouse gas emissions by sub-sector and gas from 1990 to 2018, the list of country-specific emission factors and sources of activity data, the result of key-category analysis.

References/ Publications

Republic of Korea Biennial Update Report (BUR): https://unfccc.int/documents/418616

Thailand's third Biennial Update Report

Sivach Kaewcharoen
Office of Natural Resources and Environmental Policy and Planning (ONEP)
Ministry of Natural Resources and Environment, Thailand

Abstract

Thailand has submitted 3 National Communications and 3 Biennial Update Reports. The latest report was the third BUR, submitted in December 2020. The national GHG inventory in this report was compiled in accordance with the 2006 IPCC Guidelines. It comprised 3 direct emissions (CO_2, CH_4, N_2O) and 4 indirect emissions (NO_X, CO, NMVOCs, and SO_2) from 5 sectors including Energy, IPPU, Agriculture, LULUCF, and Waste sectors.

Institutional arrangement of the national GHG inventory involves relevant agencies from all 5 sectors. ONEP, the national focal point, is responsible for emission calculation using Thailand GHG Emissions Inventory System (TGEIS) and preparation of sectoral inventory reports. Following the 5 Working Groups' approval, the GHG inventory is included in the draft NC or BUR which will be approved by the Subcommittee on Climate Change Knowledge and Database and the National Committee on Climate Change Policy, respectively, before submission.

The 2016 GHG inventory showed emissions without LULUCF totaling 354,357.61 $GgCO_2eq$, with the energy sector as the main emission source at 253,895.61 $GgCO_2eq$ followed by the agriculture sector at 52,158.70 $GgCO_2eq$. Emissions from the IPPU sector and the waste sector were estimated to be 31,531.41 and 16,771.89 $GgCO_2eq$, respectively, while the LULUCF sector contributed to a net removal of 91,134.15 $GgCO_2eq$.

For the transition to Enhanced Transparency Framework, TGEIS is being updated to support the Common Reporting Tables (CRTs) as well as to integrate functions of uncertainty analysis and QA/QC into the system. The CBIT project and other projects are also being implemented to strengthen national capacity and support BTR preparation.

To address current gaps and needs, international support should focus on 3 main areas: development and update of country-specific emission factors and parameters, development of activity data collection methods for upper tiers, and capacity-building for national experts and agencies involved in the inventory process.

International partners have been supporting Thailand to enhance its national GHG inventory. TGEIS was developed with the Australian Government's support, and QC templates for activity data and parameters were designed by GIZ. Recently, GEF has also supported Thailand to implement the CBIT project which will strengthen data collection processes and data quality for the AFOLU and the energy sectors.

References/ Publications

Thailand's third biennial Update Report (BUR3) (https://unfccc.int/documents/267629)

3.3 Session II

Overview on GHG inventory reporting under the Paris Agreement GHG inventory requirements under the Enhanced Transparency Framework (ETF)

Tomoyuki Aizawa
System & Tool unit, Transparency Division, UNFCCC secretariat

Abstract

Transparency and the MPGs

The Paris Agreement established an Enhanced Transparency Framework (ETF) designed to build trust and confidence that all countries are contributing their share to the global effort. Decision 18/CMA.1 (Katowice) adopted the Modalities, Procedures and Guidelines (MPGs) pursuant to Art. 13 of the Paris Agreement. The ETF builds on the current measurement, reporting and verification (MRV) system under the Convention: GHG inventories and the International Assessment and Review (IAR) for developed countries, and International Consultation and Analysis (ICA) for developing countries. The ETF offers a common set of MPGs and introduces flexibilities to take into account that countries are at different starting points and have different capacities. Common and yet flexible and supported ETF system is built on over two decades experience of reporting, review and multilateral consideration.

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 2006 IPCC Guidelines provides national GHG inventory principles, which are Transparency, Accuracy, Consistency, Completeness, and Comparability (TACCC). Also, the 2006 IPCC Guidelines encourage continuous improvement and rigor through QA/QC and verification activities.

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.

Access to relevant information

https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-paris-agreement
https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf#page=74
https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf#page=75
https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf#page=76

GWPs to be used for GHG inventories according to 5/CMA.3, §25 (*Extracted from table 8.A.1 of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*)

Acronym, Common Name or Chemical Name	Chemical Formula	GWP 100-year
Carbon dioxide	CO_2	1
Methane	CH_4	28
Fossil methane‡		
Nitrous Oxide	N_2O	265

Acronym, Common Name or Chemical Name	Chemical Formula	GWP 100-year
Hydrofluorocarbons		
HFC-23	CHF_3	12,400
HFC-32	CH_2F_2	677
HFC-41	CH_3F	116
HFC-125	CHF_2CF_3	3170
HFC-134	CHF_2CHF_2	1120
HFC-134a	CH_2FCF_3	1300
HFC-143	CH_2FCHF_2	328
HFC-143a	CH_3CF_3	4800
HFC-152	CH_2FCH_2F	16
HFC-152a	CH_3CHF_2	138
HFC-161	CH_3CH_2F	4
HFC-227ca	$CF_3CF_2CHF_2$	2640
HFC-227ea	CF_3CHFCF_3	3350
HFC-236cb	$CH_2FCF_2CF_3$	1210
HFC-236ea	CHF_2CHFCF_3	1330
HFC-236fa	$CF_3CH_2CF_3$	8060
HFC-245ca	$CH_2FCF_2CHF_2$	716
HFC-245cb	$CF_3CF_2CH_3$	4620
HFC-245ea	$CHF_2CHFCHF_2$	235
HFC-245eb	$CH_2FCHFCF_3$	290
HFC-245fa	$CHF_2CH_2CF_3$	858
HFC-263fb	$CH_3CH_2CF_3$	76
HFC-272ca	$CH_3CF_2CH_3$	144
HFC-329p	$CHF_2CF_2CF_2CF_3$	2360
HFC-365mfc	$CH_3CF_2CH_2CF_3$	804
HFC-43-10mee	$CF_3CHFCHFCF_2CF_3$	1650
HFC-1132a	$CH_2{=}CF_2$	<1
HFC-1141	$CH_2{=}CHF$	<1
(Z)-HFC-1225ye	$CF_3CF{=}CHF(Z)$	<1
(E)-HFC-1225ye	$CF_3CF{=}CHF(E)$	<1
(Z)-HFC-1234ze	$CF_3CH{=}CHF(Z)$	<1
HFC-1234yf	$CF_3CF{=}CH_2$	<1
(E)-HFC-1234ze	trans-$CF_3CH{=}CHF$	<1
(Z)-HFC-1336	$CF_3CH{=}CHCF_3(Z)$	2

Acronym, Common Name or Chemical Name	Chemical Formula	GWP 100-year
HFC-1243zf	$CF_3CH{=}CH_2$	<1
HFC-1345zfc	$C_2F_5CH{=}CH_2$	<1
3,3,4,4,5,5,6,6,6-Nonafluorohex-1-ene	$C_4F_9CH{=}CH_2$	<1
3,3,4,4,5,5,6,6,7,7,8,8,8-Tridecafluorooct-1-ene	$C_6F_{13}CH{=}CH_2$	<1
3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-Heptadecafluorodec-1-ene	$C_8F_{17}CH{=}CH_2$	<1
Chlorocarbons and Hydrochlorocarbons		
Methyl chloroform	CH_3CCl_3	160
Carbon tetrachloride	CCl_4	1730
Methyl chloride	CH_3Cl	12
Methylene chloride	CH_2Cl_2	9
Chloroform	$CHCl_3$	16
1,2-Dichloroethane	CH_2ClCH_2Cl	<1
Bromocarbons, Hydrobromocarbons and Halons		
Methyl bromide	CH_3Br	2
Methylene bromide	CH_2Br_2	1
Halon-1201	$CHBrF_2$	376
Halon-1202	CBr_2F_2	231
Halon-1211	$CBrClF_2$	1750
Halon-1301	$CBrF_3$	6290
Halon-2301	CH_2BrCF_3	173
Halon-2311 / Halothane	$CHBrClCF_3$	41
Halon-2401	$CHFBrCF_3$	184
Halon-2402	$CBrF_2CBrF_2$	1470
Fully Fluorinated Species		
Nitrogen trifluoride	NF_3	16,100
Sulphur hexafluoride	SF_6	23,500
(Trifluoromethyl) sulphur pentafluoride	SF_5CF_3	17,400
Sulphuryl fluoride	SO_2F_2	4090
PFC-14	CF_4	6630
PFC-116	C_2F_6	11,100
PFC-c216	c-C_3F_6	9200
PFC-218	C_3F_8	8900
PFC-318	c-C_4F_8	9540

Acronym, Common Name or Chemical Name	Chemical Formula	GWP 100-year
PFC-31-10	C_4F_{10}	9200
Perfluorocyclopentene	c-C_5F_8	2
PFC-41-12	n-C_5F_{12}	8550
PFC-51-14	n-C_6F_{14}	7910
PFC-61-16	n-C_7F_{16}	7820
PFC-71-18	C_8F_{18}	7620
PFC-91-18	$C_{10}F_{18}$	7190
Perfluorodecalin (cis)	Z-$C_{10}F_{18}$	7240
Perfluorodecalin (trans)	E-$C_{10}F_{18}$	6290
PFC-1114	$CF_2{=}CF_2$	<1
PFC-1216	$CF_3CF{=}CF_2$	<1
Perfluorobuta-1,3-diene	$CF_2{=}CFCF{=}CF_2$	<1
Perfluorobut-1-ene	$CF_3CF_2CF{=}CF_2$	<1
Perfluorobut-2-ene	$CF_3CF{=}CFCF_3$	2

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

Dominique Revet,

UNFCCC Secretariat

Abstract

The GHG Support Unit from the Transparency Division of the UNFCCC Secretariat aims at providing efficient and innovative technical support on the development of national greenhouse gas (GHG) inventories to developing countries for an effective implementation of the measurement, reporting and verification system and the enhanced transparency framework under the Paris Agreement. It performs the following main functions aimed at assisting developing countries:

- Supporting, through in-country quality assurance (QA) activities and regional training workshops, the establishment and maintenance of sustainable national GHG inventory management systems in developing countries;
- Building, through regional training workshops and online training and certification programme, the technical capacity of developing countries' national experts on GHG inventory related issues;
- Facilitating the submission by developing countries of high-quality national GHG inventory reports that meet the reporting requirements under the Convention and the Paris Agreement.

The GHG Support Unit is implementing many evolving capacity-building activities under a funding project entitled "Strengthening the capacity of developing countries to prepare and manage national greenhouse gas inventories as a basis for effective Enhanced Transparency Framework under the Paris Agreement". The project is mostly funded by the *Swedish International Development Cooperation Agency*, and aims to assist developing countries to develop and maintain sustainable national GHG inventory management systems and apply the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (2006 IPCC Guidelines), including in direct response to requests for assistance received from developing countries.

Update on IPCC Inventory Software

Baasansuren Jamsranjav

Technical Support Unit of the IPCC Task Force on National Greenhouse Gas Inventories

Abstract

IPCC Inventory Software was launched in 2012 with the aim to implement default methodologies provided in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines) including cross-cutting elements such as uncertainty analysis and key category analysis. It also allows database administration, data export/import and reporting (2006 IPCC Guidelines reporting tables).

Its version 2.691 released in 2020 which is currently available at our website https://www.ipcc-nggip.iges.or.jp/software/index.html implements Tier 2 methods for most categories of Energy, Industrial Processes and Product Use (IPPU) and Waste sectors, and Agriculture categories of the Agriculture, Forestry and Other Land Use (AFOLU) sector.

The upgraded version 2.80 of the software which is currently under testing implements all methodological tiers and approaches in the 2006 IPCC Guidelines and 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands (Wetlands Supplement) for Energy and AFOLU sectors. It includes new elements such as Land Representation Manager and Fuel Manager and has new functionalities (e.g., Fuel consumption validation), and allows subnational disaggregation at a category level.

In addition, there are a number of other ongoing and planned activities to further enhance the software and support users e.g., to complete the updates/upgrades to IPPU and Waste sectors and to ensure interoperability with the UNFCCC reporting tool for national greenhouse gas inventory referred to in UNFCCC Decision 5/CMA.3, and development of a guidebook for inventory compilers.

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.

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Access to relevant information

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

FAO Support on Transparency: Country Experiences in Asia

Mirella Salvatore

Food and Agriculture Organization (FAO)

Abstract

Since 2018 FAO is supporting countries in raising awareness and addressing the new reporting requirements under the Enhanced Transparency Framework of the Paris Agreement. This support was possible thanks to the financial support of the Global Environment Facility through the Capacity Building Initiative for Transparency (CBIT) fund. The actual CBIT portfolio at FAO consists of two global projects and 16 national projects corresponding to around 25 million dollars. FAO, together with UNEP and UNDP, is one of the main agencies implementing CBIT projects (GEF, 2022). FAO engaged in this fund to ensure a special attention to the agriculture, forestry and other land use (AFOLU) sector, that holds almost 25 percent of the global emissions. Almost 85 percent of the countries included AFOLU in their nationally determined contributions, even though countries face the major challenges in estimating and monitoring the emissions from this sector. The support provided by FAO is reflecting the main objectives of the CBIT fund, as described in the programming directions (GEF, 2016) and the main activities can be summarized as following:

1. Strengthening **country capacity** in terms of institutional arrangements, MRV and M&E
2. Developing ***ETF-enhanced* tools,** addressing country needs
3. Building **knowledge sharing** and peer-to-peer exchange
4. Enhancing **coordination** among all transparency actors.

In Asia and the Pacific, FAO is directly supporting nine countries, namely Afghanistan, Bangladesh, Bhutan, Cambodia, Mongolia, Papua New Guinea, Sri Lanka, Salomon Islands and Vanuatu. The FAO Global CBIT-AFOLU project serves as an umbrella programme for the overall portfolio, providing technical guidance from the design to the implementation of the project, developing tools according to country specific needs, and offering platforms, events, and case studies for peer exchange and mutual learning. The presentation will highlight the activities in some of the national projects carried out in collaboration with the global project, from which lessons learned were derived and shared worldwide.

References/ Publications

FAO, 2021. Building capacity worldwide to increase transparency in the agriculture, forestry and other land use (AFOLU) sector, Italy.
GEF, 2016. Programming directions for the capacity-building initiative for transparency, USA
GEF, 2022. Progress report on the capacity-building initiative for transparency, USA.

Access to relevant information

FAO Transparency: www.fao.org/climate-change/our-work/what-we-do/transparency/en/
FAO Transparency in agriculture and land use sectors network: www.fao.org/climate-change/our-work/what-we-do/transparency/network/en/?
FAO Roster of transparency practitioners: www.fao.org/climate-change/our-work/what-we-do/transparency/roster/en/?
FAO tools and resources: https://www.fao.org/climate-change/our-work/what-we-do transparency/tools-resource?

Evaluation of changes in CO_2 emissions associated with Mongolia's raw coal to briquette conversion policy using GOSAT satellites

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Abstract

The Paris Agreement (2015) requires each country to submit the climate action plans for emission reduction targets known as Nationally Determined Contributions (NDCs) to the UNFCCC. The global stocktake in 2023 (GST 2023) on the Paris Agreement will be an excellent opportunity for GHG observation satellites to demonstrate their substantial advantages in monitoring the reduction of GHG emissions from cities in terms of accuracy, speed, and transparency.

In Ulaanbaatar, the capital of Mongolia, about 29% of the total anthropogenic CO_2 emissions are stoves in the ger area, which is the second-highest source in the city. In winter, the temperature reaches -40 °C, and the atmospheric inversion layer develops due to its location in the valley topography. The smoke emitted from the ger area is trapped below the inversion layer, causing the world's most severe air pollution. The city of Ulaanbaatar introduced a policy to ban the use of raw coal to prevent air pollution on May 15, 2019, and introduced briquettes with high combustion efficiency instead of raw coal, which roughly reduced up to 50% of coal usage in the ger area. Therefore, analyzing changes in GHG concentrations before and after this policy is essential to evaluate the effect of briquettes. However, since CO_2 emissions vary depending on the combustion efficiency of the stove used, it is not easy to accurately estimate CO_2 emission reductions in the ger area where the majority of stoves used are old ger stoves.

Since 2018, the LT (Lower Troposphere) and the UT (Upper Troposphere) partial columns have been available at 14 sampling points in Ulaanbaatar city, defined as 0.6–1 Psurf (surface pressure) and 0.2–0.6 Psurf, respectively (Kuze et al., 2022). It is reasonable to assume that the boundary layer is below the UT and LT boundaries during the winter months in Ulaanbaatar due to the development of the solid atmospheric inversion layer. Therefore, we used the monthly area-averaged $XCO2^{UT}$ for reference because $XCO2^{UT}$ is much less impacted by local surface emissions than $XCO2^{LT}$ and has minor day-to-day variations.

This presentation will introduce qualitative but simple estimation of surface CO_2 emissions result in Ulaanbaatar city: concentration enhancement $\Delta XCO2^{LT}$ in winter to surface CO_2 emissions as $XCO2^{LT}$ minus $XCO2^{UT}$ obtained from the GOSAT satellite indicated a significant decrease in the 2019 and 2020 winter (after the policy) compared with the 2018 winter. Quantitative measures should be applied using inverse analysis (Watanabe et al., 2022).

References/ Publications

Kuze, A., Nakamura, Y., Oda, T., Yoshida, J., Kikuchi, N., Kataoka, F., Suto, H., Shiomi, K., 2022, Examining partial-column density retrieval of lower-tropospheric CO2 from GOSAT target observations over global megacities. Remote Sensing of Environment. 273, 1-18. https://doi.org/10.1016/j.rse.2022.112966.

Watanabe, M., Oba, A., Batjargal, Z., Gomboluudev, P., 2022, Estimation of GHG emission/absorption using GOSAT satellite data in Mongolia. The 18th International Workshop on Greenhouse Gas Measurements from Space.

Access to relevant information

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3.4 Session III

Transparency and Completeness: Using Notation Keys

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Abstract

Notation keys have been used to report on completeness in national reports submitted under the current MRV system and will continue to be required in common reporting tables to transparently convey completeness under the new enhanced transparency framework. Use of notation keys and documentation of the rationale for notation key choices explain to inventory users and reviewers what is or is not estimated in the inventory and why. They also explain where emissions or removal estimates are included if they are not disaggregated. Clear documentation helps define the scope of the inventory and avoids misrepresentation of data. Examples from the U.S. Greenhouse Gas Inventory experience will be shared to illustrate the use of each notation key.

References/ Publications

2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 1, Chapter 8 Reporting Guidance and Tables, Section 8.2.5 Notation keys and Completeness information, available at https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_8_Ch8_Reporting_Guidance.pdf

Technical handbook for developing country Parties on Preparing for implementation of the enhanced transparency framework under the Paris Agreement, available at https://unfccc.int/documents/267112

Transparency Reporting Guidelines (i.e., MPGs)

- Katowice decisions: Annex to 18/CMA.1, Chapter II, Section C, Subsection 5 Assessment of completeness, available at https://unfccc.int/sites/default/files/resource/CMA2018_03a02E.pdf
- Glasgow decisions: 5/CMA.3, available at https://unfccc.int/documents/460951

Philippines: Experience on National QA/QC

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Abstract

The Philippines has operationalized the Philippine GHG Inventory Management and Reporting System (PGHGIMRS) under Executive Order No. 174 series of 2014 to enable the country to generate data and track its emissions, which are essential to its design and development of climate mitigation solutions.

In 2018, the Climate Change Commission adopted Commission Resolution No. 2018-003 which provides the Implementing Rules and Regulation of the above-mentioned issuance. This policy also provides the enabling system for the Quality Control and Quality Assurance (QA/QC) of the Philippines' National GHG Inventory.

The resource person shall share the country's milestones in implementing GHG Inventory QA/QC measures through (1) National GHG Inventory Policies, Processes, and Institutional Arrangements; (2) Institutionalization of the NIR Preparation; (3) Laying the groundwork for NIR improvement: Philippine QA/QC Workshop in 2019; and (4) Updates on QA/QC implementation in the country.

References/ Publications

Philippine Climate Change Commission, 2021: Executive Summary. In: *2010 Philippine Greenhouse Gas Inventory Report* [S. Recabar, A. Evangelista, J. Ebora, A. Alonzo, A. Leyba, J. Francisco].

Access to relevant information

www.niccdies.climate.gov.ph

Fugitive emissions from fuels in Mongolia and Comparison between reference and sectoral approaches

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Abstract

Mongolia submitted its Initial Biennial Update Report in 2017. Historically, the national GHG inventories have been conducted by national consultants three times for the Initial National Communication in 2001, Second National Communication in 2010, Initial Biennial Update Report in 2017 (BUR1), and Third National Communication in 2018, respectively. Mongolia is currently preparing BUR2 and will submit it in late 2022.

In accordance with the IPCC guidelines, all Parties shall make every effort to improve their inventories. In this regard, since the submission of IBUR, Mongolia has implemented a capacity-building project supported by JICA for the period 2017-2022 (almost 2 years of them were ineffective due to covid-19). The main three outputs of the project were brief: 1. Capacity-building and improvement of cross-cutting issues; 2. Capacity-building and improvement of the energy sector; 3. Capacity-building and improvement of the LULUCF sector. As part of the project, the entire GHG inventory was reviewed by project consultants and, as a result, long and short lists of the issues were developed. Within output 2, one of the improvement issues identified was finding the reasons for discrepancies between Reference and Sectoral approaches in the energy sector and improving them.

The main reasons for occurrences of significant discrepancies and/or large time series deviation are:

- Large statistical differences between the energy supply and the energy consumption,
- Missing information on combustion of specific transformation outputs,
- The misallocation of the quantities of fuels used for conversion into derived products or quantities combusted in the energy sector,
- High distribution losses from gas and coal are causing higher RA and SA.

Since the energy sector is a key sector, Mongolia has applied a Tier 2 method. The country-specific NCVs and CO_2 EFs for coal types such as coking coal, other bituminous coal, and lignite were used. By order of the Energy Regulatory Commission of Mongolia, national experts developed country-specific values in 2021.

Mongolia used an IEA energy balance table as activity data for its GHG inventories. The coal consumption by types is disaggregated into subcategories in the IEA energy balance table, which is not the case in national statistics. Meanwhile, Mongolia is developing the national energy balance table, which is under improvement. It is planned to be used in subsequent inventories.

Discrepancies due to energy balance table (IEA):

- Starting from 2005, the distribution losses have been recorded in the national statistics,
- Starting from 2006, coke oven coke and coke oven gas were being produced as by-products of coking coal transformation,
- Starting from 2011, there has been an occurrence of coal consumption in the processing industries on the coal balance table

Discrepancies due to country-specific (CS) CO_2 emission factors (EFs):

- The CS CO_2 EFs of coal are not the same for all subcategories according to national experts, e.g., 1.A.1-Main activity electricity and heat production, 1.A.2-Manufacturing industries and construction (e.g., for lignite: 1.A.1 – 97,100 kg CO_2/TJ, 1.A.2 – 95,400 kg CO_2/TJ).

One of the improvements made in BUR2 is the inclusion of a subcategory that was not estimated in BUR1, 1.B.2.a.ii-Fugitive emissions from oil flaring.

In conclusion, Mongolia will continue striving to improve GHG inventories further.

Access to relevant information

www.1212.mn – The web-based statistical database of the National Statistics Office of Mongolia (NSO).
https://1212.mn/tables.aspx?tbl_id=DT_NSO_1100_010V1&CL_AY4_select_all=1&CL_AY4SingleSelect=&YearY_select_all=1&YearYSingleSelect=&viewtype=table

Recalculations in the National GHG Inventory: Japan's Case

HIRATA Eriko

Greenhouse Gas Inventory Office of Japan

Abstract

Performing recalculations is one of the key elements in ensuring time-series consistency of national GHG inventories. Parties to the Paris Agreement shall report national GHG inventories in accordance with the modalities, procedures and guidelines (MPGs) starting from 2024 submission (Decision 18/CMP.1). Recalculations is a mandatory requirement under the MPGs and is therefore a significant change for developing countries compared to previous reporting. This presentation shares Japan's examples of recalculations and experiences of Quality Checks by confirming recalculations.

Recalculations due to methodological changes/refinements include when: 1) available data have changed, 2) a category has become key, 3) new inventory methods become available, and 4) follow-up to a recommendation from inventory reviews is needed. Typical examples of recalculations in Japan are when the statistics/surveys are updated or when existing data used in previous submissions are revised/corrected. Inventory compilers need to check for updated/corrected data and perform recalculations when necessary.

The reason for the recalculation and the effect of the recalculation on the time-series etc. should be explained. Decision 5/CMA.3, Annex V contains National Inventory Document (NID) outlines that will be used for reporting under the Paris Agreement. Recalculation section of the NID outlines is similar to that of the NIR of Annex I Parties to the Convention, therefore they could be useful references/examples.

Japan's inventory quality is controlled by performing QC activities at each step, in accordance with the 2006 IPCC Guidelines. The general Quality Checks are conducted by checking recalculations of emissions/removals by gas/category using a summarizing file during the estimation process. Confirmation of the recalculations can be a useful check of the quality of data/estimates.

References/ Publications

1. National Greenhouse Gas Inventory Report of JAPAN (April 2022)
2. 2006 IPCC Guidelines for National Greenhouse Gas Inventories
3. Decision 5/CMA.3, Annex V
4. Decision 18/CMA.1, Annex

Access to relevant information

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

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 GHG inventory in cooperation with private consultant companies under a contract with the Ministry of the Environment. Before preparing GHG inventories, GIO collects data from relevant ministries, agencies and organizations to estimate emissions and removals. Based on these data together with other data from different publications, GIO then compiles the GHG inventory.

Japan's total GHG emissions in FY2020 were 1,150 million tonnes of carbon dioxide (CO_2) equivalents (Mt CO_2 eq.).

This is a decrease of 18.4% (259 Mt CO_2 eq.) compared to the FY2013 emissions (1,409 Mt CO_2 eq.), mainly because of the reduced energy consumption (due to improved energy conservation, the effects of the spread of COVID-19, 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, resumption of nuclear power plant operations), despite the increase in hydrofluorocarbon emissions.

Access to relevant information

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

High-resolution inverse model estimates of country level methane emissions inferred using GOSAT and surface observations

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Abstract

We report the country level analysis of anthropogenic methane emissions estimated with a high-resolution inverse model using observational data from global surface observation network and Greenhouse gases Observing SATellite (GOSAT; NIES Level 2, v02.95) for the period 2009-2020. The high-resolution inverse model is implemented by coupling a Lagrangian particle dispersion model FLEXPART to the global Eulerian transport model NIES-TM. The surface observational data include Obspack CH_4 (v4.0) and observations from ICOS network. For the anthropogenic prior emissions in the inversion, we used monthly data from Emissions Database for Global Atmospheric Research (EDGAR v6.0). For emission from biomass burning, Global Fire Emissions Database (GFED v4.1s) was used. Emissions from wetland and soil sink were taken from Saunois et al (2020). Other flux categories include emission from termites, geological and ocean sources, all fluxes at 0.1° spatial resolution. Flux corrections were estimated for six categories such as agriculture, biomass burning, waste, oil and gas sector, coal and wetlands on a bi-weekly time step. Variational optimization was applied to obtain flux corrections for the six categories as scaling factors multiplied by monthly varying prior uncertainty fields. For the GOSAT-based inversion, potential biases were removed from satellite retrievals using a surface-data optimized forward simulation, on monthly basis, for 5° latitude bands. The prior and posterior anthropogenic methane emissions were analyzed for major emitting countries such as China, US, India, Russia. The anthropogenic methane emissions inferred from GOSAT observations for these countries were, China 57.0 Tg CH_4 yr^{-1} (52.0-60.6, min-max), USA 25.9 (24.4-27.7), India 25.6 (22.3-26.9), Brazil 18.7 (15.3-21.6), Russia 13.9 (13.4-14.8), Indonesia 11.9 (9.6-13.8). Similar estimates were arrived by inversion using surface observations, with China having 55.6 (48.8-58.3), USA 29.0 (27.1-30.7), India 24.5 (21.3-26.8), Brazil 19.2 (17.0-22.8), Russia 14.5 (13.6-15.6) and Indonesia 11.9 (9.6-13.8). The largest corrections were for China (-11.7%/-9.6%; surface/GOSAT), USA (15.7%/3.6%), India (-17.4%/-13.8%), Canada (16.4%/3.0%) and Bangladesh (-17%/-10%). These corrections are mostly within the reported country-specific uncertainties for anthropogenic methane emissions (e. g. Worden et al, 2022), but slightly exceeds the upper bound of uncertainty for China (7.4 Tg) and the United States (3.9 Tg) compared to 7.1 and 3.3 Tg uncertainties.

References

Worden et al., The 2019 methane budget and uncertainties at 1◦ resolution and each country through Bayesian integration of GOSAT total column methane data and a priori inventory estimates, Atmos. Chem. Phys., 22, 6811–6841, 2022

Understanding countries' status and challenges for estimation of soil carbon stock changes in national greenhouse gas inventories: survey findings

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Abstract

Despite the growing global support for capacity building to improve soil management, estimation and reporting of carbon stock changes (CSCs) in mineral soils in national GHG inventories (GHGI) is still very limited. Understanding of the main difficulties allows to define targeted support to help countries to fulfill the completeness requirement of the Enhanced Transparency Framework.

The estimation of CSCs provides insights for developing targeted policies to encourage ambitious nationally determined contributions and tracking their implementation.

IGES and FAO jointly conducted an online survey targeting GHGI experts and soil scientists in government or research and academic institutes.

<outline of the survey>

- 21 September to 8 October 2021
- 226 responses from 104 countries (88 developing countries, 16 developed countries)
- Of the 226, 139 respondents (109 GHGI experts and 30 soil scientists from 70 developing and 12 developed countries) were involved in GHGI preparation.

The results of the preliminary analysis of these 139 responses suggest:

- Estimation of CSCs in mineral soils is conducted in most of the developed countries while it is done in only one third of the developing countries.
- Lack of data and infrastructure are the main challenges limiting CSCs estimation.

  On the contrary, the least frequently selected challenges were difficulty in understanding the IPCC methodology, and limited knowledge on soil carbon dynamics.
- National and international collaborative approach on data collection efforts, coupled with enhanced cooperation between GHGI experts and soil scientists are the solutions.

The least frequently indicated approaches for addressing the challenges were: training on soil carbon dynamics, allocating/applying for new funding, and enhancing international and bilateral cooperation.

From these findings, the authors provide recommendations including:

- Provide clear technical guidance on how to collect and analyze data
- Ensure financial and human resources for data collection
- Conduct joint training programs for GHGI experts and soil scientists
- Share good practices and learning at regional level

References/ Publications

https://www.fao.org/publications/card/en/c/CB9075EN/
https://www.iges.or.jp/en/pub/mineral-soil-2022/en

Comprehensive Assessment of Greenhouse Gas Emissions from Thai Beef Cattle Production and the Effect of Rice Straw Amendment on the Manure Microbiome

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Abstract

We measured the greenhouse gas (GHG) emissions following beef cattle feeding and evaluated the manure management in northeast Thailand (Khon Kaen) to obtain the country-specific emission factor (EF) and replace the Intergovernmental Panel on Climate Change (IPCC) default value. We fed four Thai native cattle their typical diet of the region and then used the head-cage and dynamic chamber methods to measure the enteric methane (CH_4) and GHG emissions during manure storage, respectively. The effect of amending the cattle manure with rice straw on the manure's GHG emission was evaluated. The manure microbiome was monitored by 16S rRNA gene amplicon sequencing and qPCR assay of the functional genes that are required for the methanogenesis and nitrification/denitrification process. The estimated CH_4 conversion factor (Ym: 6.87 ± 0.11% gloss energy intake (GEI)) was slightly higher than the IPCC default value. The CH_4 emission from the manure accounted for 0.69 ± 0.26% GEI. The addition of rice straw slightly lowered the CH_4 emission from the manure, but the manure microbiome analysis results showed that it significantly reduced the relative abundance of methanogens (*Methanobacteriales*), and the functional estimation of manure microbiome agreed with this inhibition effect. The addition of rice straw also showed potential mitigation of the N_2O emission with lowered nitrification activity and lower nitrifier abundance, but the results were not consistent between runs. Together these findings will be useful for the higher-tier approach to GHG emissions from beef cattle production systems in tropical regions.

References/ Publications

Front. Environ. Sci. 10:872911. doi: 10.3389/fenvs.2022.872911

Emission factors for Vietnamese beef cattle manure sun-drying and the effects of drying on manure microbial community

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Abstract

Livestock manure and its management are significant sources of greenhouse gas (GHG). In most Southeast Asian countries, the current GHG emissions are estimated by the Intergovernmental Panel on Climate Change (IPCC) Tier 1 approach using default emission factors. Sun-drying is the dominant manure treatment in Vietnam, and in this study, we measured GHG emissions during manure drying using a chamber-based approach. Results show the emission factors for CH_4 and N_2O were 0.295 ± 0.078 g kg^{-1} volatile solids (VS) and 0.132 ± 0.136 g N_2O-N kg^{-1} $N_{initial}$, respectively. We monitored the total bacterial/archaeal community using 16S rRNA gene amplicon sequencing and measured the abundance of functional genes required for methanogenesis (*mcrA*), nitrification (*amoA*) and denitrification (*nirK*, *nirS* and *nosZ*) processes. Methane emission occurred only at the beginning of the drying process (days 1 to 3). The results of amplicon sequencing indicated that the relative abundance of methanogens also decreased during this period. Although some nitrification activity was detected, there was no significant N_2O emission. These findings well describe the manure management system in south Vietnam and the GHG emission from this manure category, paving the way for higher Tier estimations using country-specific values.

References/ Publications

PLoS ONE 17(3): e0264228. https://doi.org/10.1371/journal. pone.0264228

Greenhouse gas emission from composting process: a case study in Thailand

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The Joint Graduate School of Energy and Environment (JGSEE), King Mongkut's University of Technology Thonburi, Bangkok, Thailand

Abstract

Organic waste disposed of in landfills and manure slurries is a significant contributor to world greenhouse gas emissions. In Thailand, manufacturing fertilizer or soil conditioners often follows the method from foreign composting systems. However, MSW in Thailand is different from the MSW in other countries due to its higher moisture content and wet organic waste. Additionally, different weather conditions result in variable degradation rates. There is a lack of clarity regarding the emissions reduction and emission factor that results from the commercial-scale composting process in developing countries, which make uncertain opportunity of organic composting waste as an effective strategy to reducing greenhouse gas emissions. Composting and soil conditioning technologies for waste management were compared with the prevalent Thailand anaerobic landfill technique. The calculation was done using national average solid waste composition data and the calculation methods from the 2006 IPCC Guidelines and the T-VER-TOOL-WASTE-01 published by Thailand greenhouse gas management organization; TGO, Thailand. Two study sites were selected in (1) Bangkok and (2) Buriram province. The GHG reductions are 11.99% and 33.09% compared with BAU. The emission factors (EF) of the composting process were calculated and found at 0.26 tCO_2e/t_{ww} and 0.22 tCO_2e/t_{ww}, according to the data retrieved from Bangkok and Buriram, respectively. The average EF of the composting process was 0.24 tCO_2e/t_{ww} with a standard deviation of 0.17.

Application of Rice GHG Application for MRV system

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Abstract

This study focused on the Rice GHG application which is a tool to help farmers set up their baseline and tracking their cultivation activities to ease the MRV system. The application can collect farmer data and show real time estimation of the GHG emission at spacial level. Data in comparison to real measurement in continuous flooding and alternative wetting and drying (AWD) practices at Chainat Province showed reliability at acceptable level. From cultivation practice at Chainat province, GHG emissions from the data input in the application ranged from 0.81-5.01 kg CH_4/ha/day and from real measurement using closed flux chamber ranged from 1.23-5.69 kg CH_4/ha/day. It is noted that the average discrepancy between these two methods is approximately 30% depending on location and cultivation practices.

Keywords: Mobile application, Rice GHG Application, AWD

4. Report on 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 the 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 (KECO) 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 this year (2022) and for the last two years.

Table 4.1.1 History of the Mutual Learning

		General	Energy	IP*[1]	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*[2]	-
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*[3]	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	

*[1]Industrial Processes
*[2]Reporting from Viet Nam with comments from experts
*[3]The physical meeting of WGIA was cancelled to prevent the risks of the COVID-19 in 2020 but the Mutual Learning sessions were conducted online.

Participants

In January 2022, the WGIA Secretariat advertised ML to the participants of the WGIA 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 two pairs this year (China and Malaysia on the Energy sector, Singapore and Viet Nam on the LULUCF sector).

Preparation

A few months before WGIA19, 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 studying 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 WGIA19 took place.

Table 4.1.2 Submitted Materials for the ML

Sector	Country	Inventory
Energy	China	NC3 and BUR2 in 2019
	Malaysia	BUR3 in 2020
LULUCF	Singapore	NC4 and BUR3 in 2019, BUR4 in 2020
	Viet Nam	BUR3 in 2021

Discussion

In the WGIA19, two ML sessions were held on July 7th (Energy Sector) and 8th (LULUCF Sector) 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, participants discussed their counterpart's inventory and national system, sharing their own technical issues (e.g., data collection, adoption of emission factors, institutional arrangements, etc.) with the partner country to overcome the obstacles, and clarifying matters in their own inventory which should be improved. Through the discussions, they recognized that there were some challenges to overcome in preparing for future BTRs: in the estimation of GHG emissions/removals from categories currently not estimated, in the preparation of elements that should be newly reported, and in the need for earlier reporting of GHG emissions/removals - two years prior to the year of submission. To increase opportunities to learn from other countries' inventories, participants expressed their hope for the continuous implementation of the Mutual Learning program in future WGIAs.

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

4.2 Energy Sector

Sector Overview

China and Malaysia participated in the ML session on the Energy sector. The general information for the two countries is shown in Table 4.3.1 below.

Table 4.2.1 Sector Overview of the ML on the Energy Sector

	China	Malaysia
National total GHG emissions (Mt CO_2 eq., with LULUCF)	11,186 (in 2014, BUR2)	75 (in 2016, BUR3)
GHG emissions of the Energy sector (Mt CO_2 eq.)	9,559 (in 2014, BUR2)	252 (in 2016, BUR3)
Responsible agency for the inventory	Ministry of Ecology and Environment	Ministry of Environment and Water
Estimation methodology	Revised 1996 IPCC Guidelines, GPG 2000, 2006 IPCC Guidelines, Tier 1, 2, and 3	2006 IPCC Guidelines, Tier 1
Source of emission factors	IPCC default values and country-specific values	IPCC default values
Source of activity data	National statistics from the National Bureau of Statistics; relevant ministries and agencies; industrial associations	National statistics

Materials Used

To prepare for the ML session, the partner countries exchanged their materials relevant to the Energy sector through the Secretariat approximately two months before the workshop. The materials exchanged were as follows:

<u>China</u>

- China's Third National Communication and Second Biennial Update Report
- Presentation "China's National GHG Inventory"[1]

<u>Malaysia</u>

- Malaysia's Third Biennial Update Report
- Presentation "Malaysia's GHG Inventory: The Energy Sector 1A1a & 1A1b"

Questions and Answers

After receiving the materials listed above, the countries studied them and submitted questions and comments to the partner country approximately two weeks before the session. The classification and the number of questions are as follows.

[1] It was provided about one week before the workshop as an additional material.

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

Classification of questions	Number of questions/comments	
	from China to Malaysia	from Malaysia to China
Acquisition of activity data	3	1
Adoption of emission factors or parameters	0	0
Estimation methods	2	1
Institutional arrangement	1	1
Others	0	0

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) The data of the National Bureau of Statistics (NBS) and the Carbon Trading Market don't match exactly the IPCC definition, such as in petroleum refining (China).
2) It is challenging to obtain X-2 data for some categories (both countries).
3) It is not easy to obtain the activity data of some new categories in the 2006 IPCC Guidelines, which were not included in the Revised 1996 IPCC Guidelines (China).
4) Default emission factors are used for fuel combustion, although the category is a key category (Malaysia).
5) The amounts of fuels are not disaggregated for transport (Malaysia).

- **Good Practices**

The following were identified as good practices:

<u>China</u>

1) Higher tier methods are applied (e.g., Tier 2 for CO_2 from fuel combustion, Tier 3 for fugitive CH_4 from oil and gas systems).
2) Emissions calculated based on the National Energy Balances are verified by facility-specific data obtained from the Carbon Trading Market system.
3) In 2013, NBS established a sector-statistical reporting system for GHG inventory.
4) Recalculation is implemented for the base year of NDC.

<u>Malaysia</u>

1) Time-series emissions are available from 1990.
2) Improvement plan is clear.
3) Detailed tables are attached in the Technical Annex of BUR.

- **Follow-up Activities**

None.

- **Suggestions for Future ML**

The participants suggested that a discussion on the following topics would be useful:

1) How to develop CSEFs
2) How to use facility-level data
3) How to build CRT tables

Table 4.2.3 Participants in the ML on the Energy Sector

Party	Name	Organization
China	Ms. MA Cuimei	National Center for Climate Change Strategy and International Cooperation (NCSC), Ministry of Ecology and Environment
	Ms. XU Danhui	
	Ms. SHOU Huantao	
	Mr. MIAO Weijie	
	Mr. ZHANG Xi	
	Ms. LI Xiang	
	Ms. GAO Minhui	
	Ms. CHU Zhenhua	
	Ms. ZHOU Yuan	
Malaysia	Ms. Nur Hazirah CHE ITHNIN	Ministry of Environment and Water (KASA)
	Dr. Sugumari SHANMUGAM	
	Dr. Kok Seng YAP	
	Ms. Dayang Ratnasari ABU BAKAR	
	Ms. Rafidah HASBULLAH	
	Mr. Mohamad Firdaus NAWAWI	
	Ms. Wan Nur Syuhada WAN ATA	
	Ms. Wan Nurlalia Yusra MAT DESA	
	Dr. Elizabeth PHILIP	Forest Research Institute Malaysia
	Mr. Zaharin ZULKIFLI	Energy Commission (ST)
	Ms. Aimi Hazwanie NORDIN	
	Dr. Siti Indati	National Energy University (UNITEN)
Facilitators, etc.	Mr. KOSAKA Naofumi (Facilitator)	GHG Inventory Office of Japan (GIO)
	Mr. ITO Hiroshi (Facilitator)	
	Ms. HATANAKA Elsa (Secretariat)	
	Mr. MORIMOTO Takashi (Resource person)	Mitsubishi UFJ Research and Consulting Co., Ltd. (MURC)
	Ms. FUKUDA Maya (Resource person)	
	Mr. MIYATA Kazuaki (Workshop organizer)	Ministry of the Environment, Japan (MOEJ)
	Mr. SASAKI Ken (Workshop organizer)	
	Ms. SASAGAWA Mai (Workshop organizer)	
	Mr. SAKOGUCHI Sadamitsu (Workshop organizer)	
	Ms. KURODA Kotoe (Workshop organizer)	

4.3 LULUCF Sector

Sector Overview

Singapore and Viet Nam 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

	Singapore	Viet Nam
National total GHG emissions (kt-CO_2 eq., with LULUCF)	50,702.71 (in 2016, BUR4)	316,734.96 (in 2016, Viet Nam's NIR)
GHG emissions in the LULUCF sector (kt-CO_2 eq.)	17.12 (in 2016, BUR4)	-39,491.24 (in 2016, Viet Nam's NIR)
Responsible agency for the inventory	National Parks Board (NParks)	Department of Climate Change (DCC) under the Ministry of Natural Resources and Environment (MONRE)
Estimation methodology	The 2006 IPCC Guidelines, Wetlands Supplement, Tier 1, Tier 2, Tier 3	The 2006 IPCC Guidelines, Tier 1, Tier 2, Tier 3
Source of emission factors	IPCC default values and country-specific values	IPCC default values and country-specific values
Source of activity data	National statistics and data from land-use maps derived from remote sensing	Remote sensing maps and national statistics

Materials Used

In order to prepare for the ML session in WGIA19, both countries exchanged their documents relevant to the LULUCF sector through the Secretariat starting approximately two months before the workshop. The documents exchanged were as follows:

Singapore

- Singapore's 4th Biennial Update Report
- Singapore's 4th National Communications and 3rd Biennial Update Report
- Excel files with estimation worksheets for the LULUCF sector
- J. Chave et al., "Improved allometric models to estimate the aboveground biomass of tropical trees", Global Change Biology (2014) 20, 3177-3190 [A paper that Singapore references for biomass estimation]
- Field sheet example - for inventory data collection

Viet Nam

- Viet Nam Report on National GHG Inventory for 2016
- Worksheet of Viet Nam's 3rd Biennial Update Report

Questions and Answers

After receiving the materials described above, the countries studied them and submitted questions and comments to the partner country approximately a month 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 Singapore to Viet Nam	from Viet Nam to Singapore
National system	0	0
Inventory compilation processes	11	2
Data collection procedure	1	0
Quality Assurance / Quality Control	0	0
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) Difficulties are faced in collecting appropriate activity data due to issues regarding land transition periods for the subcategories "remaining" and "converted" (Viet Nam).
2) CSCs in mineral soils for all land use categories are not estimated due to incomplete data (lack of land conversion data for 20 years) (Viet Nam).
3) Biomass losses from fuelwood removals are not included (Viet Nam).
4) Difficulties are faced in dealing with differences between remote sensing data and statistics (e.g., area of Mangroves) (Viet Nam).
5) Adapting the remote sensing workflow to be able to work with different remote sensing data for inventory compilation is a challenge (Singapore).
6) Data to estimate CSC for Mangroves is lacking (Singapore).

➢ **Good Practices**

The following were identified as good practices:

<u>Singapore</u>

1) Higher tier and country-specific CSC factors were applied in some categories (i.e., Forest land and Settlements).
2) Estimation accuracy was improved from the previous BUR due to the improvement in resolution with updating of the remote sensing data to accommodate for the dynamic and short-term land-use changes taking place in Singapore.
3) Estimations were made at very detailed subcategory levels for each "converted" category (e.g., Forest land converted to Settlements) using the 20-year transition period consistently.

Viet Nam

1) The NIR describing detailed estimation methodologies of GHG was prepared.
2) Remote sensing maps together with soil map layers were applied to calculate the area of organic soil. This enabled the detection of a change in the area of organic soil.
3) Country-specific CSC parameters for all types of forest (bamboo, mangrove, mix, woody, etc.) were developed.

➢ **Follow-up Activities**

The following were identified as follow-up activities:

1) To offer continued open communications between countries that have participated in mutual learning including the host country Japan.

➢ **Suggestions for Future ML**

Participants suggested the following topics for future ML:

1) Having exchanges among three countries, possibly including Japan as the third country.
2) Holding hybrid ML sessions with both in-person and online participation.

Table 4.3.3 Participants in the ML on the LULUCF sector

Party	Name	Organization
Singapore	Ms. Ester SUEN	International Biodiversity Conservation, National Parks Board
	Mr. Fairoz MOHAMED	
	Ms. Lorraine TAN	
	Mr. Hassan IBRAHIM	
Viet Nam	Ms. TRAN Thu Huyen	Ozone Layer Protection and Low Carbon Economy Development Center, Department of Climate Change
	Mr. LY Viet Hung	
	Mr. TRUONG Nam Thang	
	Ms. TANG Quynh Anh	
	Ms. TRAN Thi Thu Trang	Responding to Climate Change Center, Department of Climate Change
	Ms. NGUYEN Thi Minh Hue	
Facilitators and Resource persons	Dr. YANAGAWA Midori (Facilitator)	GHG Inventory Office of Japan (GIO), National Institute for Environmental Studies (NIES)
	Ms. HAYASHI Atsuko (Facilitator)	
	Ms. HATANAKA Elsa (Secretariat)	
	Mr. ITO Hiroshi (Secretariat)	
	Dr. SATO Atsushi (Resource person)	Mitsubishi UFJ Research and Consulting Co., Ltd.
	Mr. SENOO Kohei (Workshop organizer)	Ministry of the Environment, Japan (MOEJ)
	Mr. MATSUBARA Minoru (Workshop organizer)	
	Mr. YAMAZAKI Tomoya (Workshop organizer)	
	Mr. SAKOGUCHI Sadamitsu (Workshop organizer)	
	Ms. KURODA Kotoe (Workshop organizer)	

Annex I: Agenda

Annex I: Agenda

Period: 7th July – 13th July 2022
Venue: On-line

JST: Japan Standard Time
ICT: Indochina Time

Day 1: Thursday, 7th July 2022		
PM 2:00 - 2:30 JST **(PM 1:00 - 1:30 China, Malaysia)**	**Connection test**	
PM 2:30 - 6:00 JST **(PM 1:30 - 5:00 China, Malaysia)**	**Mutual Learning**	
Sector	Energy	
Combination of Participating Countries	**China – Malaysia**	
Note: These sessions are closed in order to secure confidentiality of information. Therefore, only participating countries in each session, facilitators, resource persons and the WGIA Secretariat are allowed to connect.		
Day 2: Friday, 8th July 2022		
PM 2:00 - 2:30 JST **(PM 1:00 - 1:30 Singapore)** **(PM 12:00 - 12:30 Viet Nam)**	**Connection test**	
PM 2:30 - 6:00 JST **(PM 1:30 - 5:00 Singapore)** **(PM 12:30 - 4:00 Vietnam)**	**Mutual Learning**	
Sector	LULUCF	
Combination of Participating Countries	**Singapore – Viet Nam**	
Note: These sessions are closed in order to secure confidentiality of information. Therefore, only participating countries in each session, facilitators, resource persons and the WGIA Secretariat are allowed to connect.		

Day 3: Monday, 11th July 2022		
PM 2:30 - 3:00 JST (PM 12:30 - 1:00 ICT)	**Connection test**	
PM 3:00 - 3:40 JST (PM 1:00 - 1:40 ICT)	**Opening Session**	
PM 3:00 - 3:05	Welcome Address	Ms. Nishikawa Junko (MOEJ)
3:05 - 3:20	Introduction to WGIA19	Mr. Ito Hiroshi (GIO)
3:20 - 3:30	Japan's Current Progress on Global Warming Countermeasures	Mr. Senoo Kohei (MOEJ)
3:30 - 3:35	**Questions and Answers**	**All**
3:35 - 3:40	*Group Photo*	
PM 3:40 - 6:00 JST (PM 1:40 - 4:00 ICT)	**Session I: Updates on the GHG Inventory of National Communications (NCs) and Biennial Update Reports (BURs) from non-Annex I Parties**	
	Chair: Dr. Sirintornthep Towprayoon (AB/ King Mongkut's University of Technology Thonburi)	**Rapporteur: (GIO)**
3:40 - 3:55	Bhutan's National Greenhouse Gas Inventory, Third National Communication to UNFCCC	Mr. Rinzin Namgay (Bhutan)
3:55 - 4:10	India's Third Biennial Update Report to UNFCCC	Mr. Ajay Raghava (India)
4:10 - 4:30	**Questions and Answers**	**All**
4:30 - 4:45	*Break*	
4:45 - 5:00	Indonesian Third Biennial Update Report	Dr. Syaiful Anwar (Indonesia)
5:00 - 5:15	4th BUR of the Republic of Korea	Mrs. Sohyang Lee (Korea)
5:15 - 5:30	Thailand's Third Biennial Update Report	Mr. Sivach Kaewcharoen (Thailand)
5:30 - 6:00	**Questions and Answers**	**All**
PM 6:00 - 6:30 JST (PM 4:00 - 4:30 ICT)	**Poster Session**	
6:00 - 6:30	**Poster**	**All**
Note: Posters will be made available throughout the duration of WGIA, however, those who have provided the posters will be on stand-by during the poster session to respond to any questions/comments. Please visit the poster page on the dedicated WGIA19 site for each poster's meeting address.		

Day 4: Tuesday, 12th July 2022		
PM 2:30 - 3:00 JST (PM 12:30 - 1:00 ICT)	**Connection test**	
PM 3:00 - 6:00 JST (PM 1:00 - 4:00 ICT)	**Session II: New Reporting Formats and Tools Under the Paris Agreement**	
	Chair: Prof. Rizaldi Boer (AB/ Bogor Agricultural University)	**Rapporteur: (GIO)**
3:00 - 3:30 (AM 8:00 - 8:30 CEST Bonn)	Overviews on GHG Inventory Reporting (CRT and NID) Under the Paris Agreement	Mr. Aizawa Tomoyuki (UNFCCC)
3:30 - 3:45	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)
3:45 - 4:15	**Questions and Answers, Discussion**	**All**
4:15 - 4:45	*Break*	
4:45 - 5:00	Update on the IPCC Inventory Software	Dr. Baasansuren Jamsranjav (AB, IPCC/TFI)
5:00 - 5:15	FAO Support on Transparency: Country Experiences in Asia	Dr. Mirella Salvatore (FAO)
5:15 - 5:30	Evaluation of Changes in CO_2 Emissions Associated with Mongolia's Raw Coal to Briquette Conversion Policy Using GOSAT Satellites	Prof. Watanabe Masataka (Chuo University)
5:30 - 6:00	**Questions and Answers, Discussion**	**All**

Annex I

Day 5: Wednesday, 13th July 2022		
PM 2:30 - 3:00 JST (PM 12:30 - 1:00 ICT)	**Connection test**	
PM3:00 - 4:30 JST (PM 1:00 - 2:30 ICT)	**Session III: Cross-cutting Guidance for Reporting Under the Paris Agreement**	
	Chair: Mr. Tanabe Kiyoto (IPCC/TFI)	**Rapporteur: (GIO)**
3:00 - 3:15 JST	Transparency and Completeness: Using Notation Keys in the U.S. GHG Inventory	Ms. Amanda Chiu (US-EPA)
3:15 - 3:30	Philippines: Experience on National QA/QC	Ms. Sandee Recabar (Philippines)
3:30 - 3:45	**Questions and Answers, Discussion**	**All**
3:45 - 4:00	Fugitive Emissions from Fuels in Mongolia and Comparison Between Reference and Sectoral Approaches	Ms. Tegshjargal Bumtsend (Mongolia)
4:00 - 4:15	Recalculations in the National GHG Inventory: Japan's case	Ms. Hirata Eriko (GIO)
4:15 - 4:30	**Questions and Answers, Discussion**	**All**
PM 4:30 - 5:00 JST (PM 2:30 - 3:00 ICT)	**Closing Session**	
4:30 - 4:45	**Summary and Closing remarks**	Ms. Hatanaka Elsa (GIO)
4:45 - 5:00	***Break***	

Day 5: Wednesday, 13th July 2022		
PM 5:00 - 6:00 JST (PM 3:00 - 4:00 ICT)	**Joint Meeting of the WGIA Organizing Committee and Advisory Board (members of the OC and AB, and the WGIA secretariat are requested to attend)**	
	Chair: Mr. Ito Hiroshi (GIO)	
5:00 - 5:30	Review of Activities in WGIA19	OC/AB members
5:30 - 6:00	Discussion on Topics for WGIA20	OC/AB members

Abbreviations:

AB: WGIA Advisory Board
BUR: Biennial Update Report
CRTs: Common Reporting Tables
FAO: Food and Agriculture Organization of the United Nations
GHG: Greenhouse Gas
GIO: Greenhouse Gas Inventory Office of Japan, NIES
IPCC: Intergovernmental Panel on Climate Change
IPCC/TFI/TSU: IPCC, Task Force on National Greenhouse Gas Inventories, Technical Support Unit
MOEJ: Ministry of the Environment, Japan
NC: National Communication
NID: National Inventory Document
NIES: National Institute for Environmental Studies, Japan
OC: WGIA Organizing Committee
UNFCCC: United Nations Framework Convention on Climate Change
US-EPA: United States Environmental Protection Agency

Poster Sessions			
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	2	High-resolution Inverse Model Estimates of Country-level Methane Emissions Inferred Using GOSAT and Surface Observations	Rajesh Janardanan, Shamil Maksyutov, Fenjuan Wang, Tsuneo Matsunaga Satellite Observation Center, Earth System Division, NIES
P-3	3	Understanding Countries' Status and Challenges for Estimation of Soil Carbon Stock Changes in National Greenhouse Gas Inventories: Survey Findings	Chisa Umemiya[1], Mirella Salvatore[2], Iordanis Tzamtzis[2], Akiko Nagano[2] 1 IGES, 2 FAO
P-4	6	Actions related to inventories in Lao PDR	Xailee Xayaxang, Laos
P-5	3	Application of Rice GHG Application for MRV System	Nittaya Cha-un[1], Amnat Chidthaisong[1], Kittipong Chaimanuskul[2], Sirintornthep Towprayoon[1], 1 JGSEE-KMUTT, Thailand, 2 Atthajariya Co., Ltd
P-6	1	Greenhouse Gas Reduction from Composting Process: Case Study in Thailand	Panida Payomthip, Komsilp Wangyao, Awassada Phongphiphat, Salita Kamsook, Thichakorn Pudcha, Sirintornthep Towprayoon, JGSEE-KMUTT, Thailand
P-7	1	Emission Factors for Vietnamese Beef Cattle Manure Sun-drying and the Effects of Drying on Manure Microbial Community	Van Thanh Nguyen[1], Koki Maeda[2*], Yukiko Nishimura[2], Trinh Thi Hong Nguyen[1], Kinh Van La[1], Dien Duc Nguyen[3], Tomoyuki Suzuki[2,4], 1 IASVN, 2 JIRCAS, 3 Tay Nguyen University, 4 NARO
P-8	1	Comprehensive Assessment of Greenhouse Gas Emissions from Thai Beef Cattle Production and the Effect of Rice Straw Amendment on the Manure Microbiome	Wanna Angthong[1], Akinori Mori[2], Haruthairat Kitwetcharoen[3], Ornvimol Kaeokliang[1], Sukanya Kamphayae[1], Tomoyuki Suzuki[2], Yimin Cai[4] and Koki Maeda[4], 1 DLD, 2 NARO, 3 Khon Kaen University, 4 JIRCAS

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

Annex II: List of Participants

BY PARTICIPATING COUNTRIES
(Alphabetical order by FAMILY NAME)

BHUTAN
Mr. Rinzin NAMGAY
IT Division, National Environment Commission

Mr. Dorji WANGDI
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