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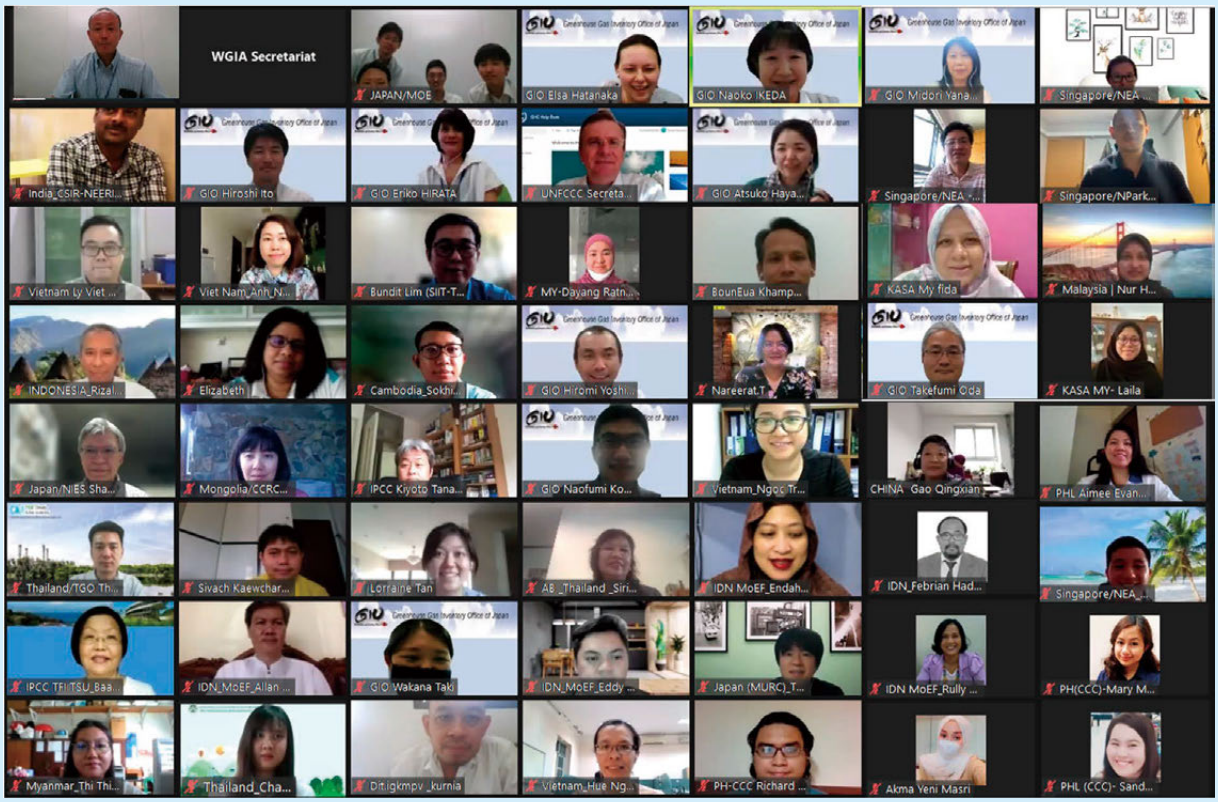
Proceedings of the 18th Workshop on Greenhouse Gas Inventories in Asia (WGIA18)

8th July – 14th July 2021



Greenhouse Gas Inventory Office of Japan (GIO)

Center for Global Environmental Research
Earth System Division

National Institute for Environmental Studies, Japan

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Foreword

The international community now recognizes increases in anthropogenic emissions of greenhouse gases (GHGs) as the primary cause of climate change and its impacts. The Working Group I contribution to the Sixth Assessment Report (AR6) published by the Intergovernmental Panel on Climate Change (IPCC) this 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 Nation 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 are 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 of their countries' mitigation actions for reducing 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).

In order to support the enhancement of 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 the Asian countries to develop and improve their GHG inventories through enhancing 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 18th WGIA (WGIA18), which was held online from 8th to 14th July, 2021. 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

三枝信子

Director
Earth System Division
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Preface

The Paris Agreement established an enhanced transparency framework in order 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 greenhouse gas (GHG) inventory and information necessary to track progress made in implementing and achieving its NDC in Biennial Transparency Reports. 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 essential 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 18th WGIA (WGIA18) was held online from 8th to 14th July, 2021. The topics set out for this workshop were based on consideration of the current situation of the member countries.

The outcomes of the WGIA18 are summarized in this report as Proceedings. We hope that this report will be found useful and will contribute to the further improvement of the GHG inventories of the WGIA-member countries.

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

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Ministry of the Environment, Japan

List of Acronyms and Abbreviations

AB	WGIA Advisory Board
AFOLU	Agriculture, Forestry and Other Land Use
BTR	Biennial Transparency Report
BUR	Biennial Update Report
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
COVID-19	Coronavirus Disease 2019
CRF	Common Reporting Format
EBT	Energy Balance Tables
ESD	Earth System Division
ETF	Enhanced Transparency Framework
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	FAO Statistical Database
FOLU	Forestry and Other Land Use
FY	Fiscal year
GHG	Greenhouse Gas
GIO	Greenhouse Gas Inventory Office of Japan
GOSAT	Greenhouse Gases Observing Satellite
GPG	Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories
GPG-LULUCF	Good Practice Guidance for Land Use, Land-Use Change and Forestry
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
IPCC AR5	IPCC Fifth Assessment Report
IPCC TFI	IPCC, Task Force on National Greenhouse Gas Inventories
IPPU	Industrial Process and Product Use
LULUCF	Land Use, Land-Use Change and Forestry
MOEJ	Ministry of the Environment, Japan
MPG	Modalities, procedures and guidelines
MRV	Measurement, Reporting, and Verification Measurable, Reportable, and Verifiable
NAI	Non-Annex I
NC	National Communication
NDC	Nationally Determined Contribution
NIES	National Institute for Environmental Studies, Japan
NIR	National Inventory Report
QA	Quality Assurance
QC	Quality Control
SBI	Subsidiary Body for Implementation
TGEIS	Thailand Greenhouse Gas 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
2019 Refinement	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Chemical terms

CO_2	Carbon dioxide
CH_4	Methane
N_2O	Nitrous oxide
NF_3	Nitrogen trifluoride
kt	kilo tonnes
Mt	Million tonnes

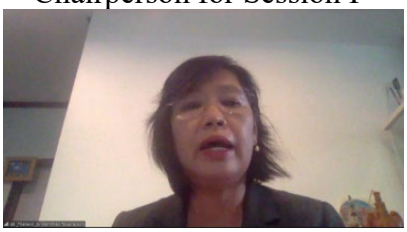
Photos of the Workshop

The Plenary Sessions

Welcome Address

Mr. Sakaguchi Yoshiteru
(Decarbonized Society Promotion Office, Global Environment Bureau, MOEJ)

Chairperson for Session I



Dr. Sirintornthep Towprayoon
(King Mongkut's University of Technology Thonburi)

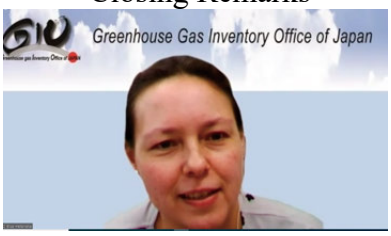
Chairperson for Session II

Prof. Rizaldi Boer
(Bogor Agricultural University)

Chairperson for Session III

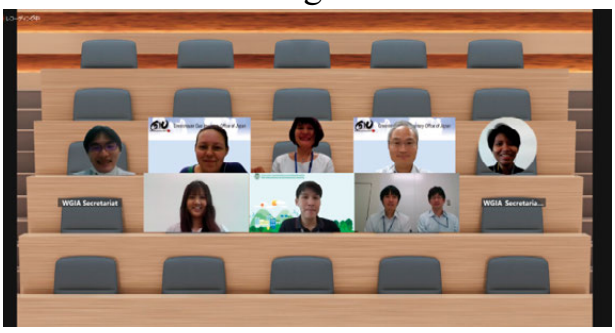
Dr. Baasansuren Jamsranjav
(IPCC TFI)

Closing Remarks



Ms. Hatanaka Elsa
(GHG Inventory office of Japan, NIES)

The Mutual Learning Sessions



General: Thailand – Japan

Energy: Brunei – Mongolia

LULUCF: Bhutan – Indonesia

Waste: China – Indonesia

1. Executive Summary of WGIA18

1 Executive Summary of WGIA18

The Ministry of the Environment of Japan (MOEJ) and the National Institute for Environmental Studies (NIES) convened the "18th Workshop on Greenhouse Gas Inventories in Asia (WGIA18)" online from July 8 (Thursday) to July 14 (Wednesday), 2021.

The annual workshops have been held since 2003 in order to support non-Annex I (NAI) Parties in Asia in developing and improving their greenhouse gas (GHG) inventories and to facilitate the enhancement of cooperative relationships towards the improvement of the accuracy of national GHG inventories in the Asian region. This year, approximately 100 participants in total attended WGIA18, including government officials and researchers from 15 member countries (Bhutan, Brunei, Cambodia, China, India, Indonesia, Japan, 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), 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 six years in a row since fiscal year (FY) 2014 mainly due to the decrease in energy consumption and decarbonization of electricity. Japan will aim for net-zero by 2050. Japan also aims to reduce the GHG emissions by 46% in FY2030 from the FY2013 levels, and will continue strenuous efforts in its challenge to meet the lofty goal of cutting its emissions by 50%.

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

Cambodia, Laos, China, Malaysia, and Viet Nam 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.

It was confirmed that countries still faced common challenges regarding the acquisition of activity data, uncertainty analysis, development of country-specific emission factors, and establishment of Quality Assurance and Quality Control (QA/QC) procedures and national systems. It was also stressed that it was important to share the information/experience of preparation for NC/BUR in this workshop since it will be the basis for the compilation and preparation of the Biennial Transparency Reports (BTRs) under the Enhanced Transparency Framework (ETF). Besides, it is important to utilize capacity-building opportunities offered by UNFCCC and others.

Transition to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and Resources That Will Facilitate Compilation

Thailand, Singapore, and the Philippines gave presentations on their experiences of transitioning to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines). After these presentations, IPCC TFI introduced their software to estimate GHG emissions/removals for the Agriculture, Forestry, and Other Land Use (AFOLU) sector. FAO gave an overview of the FAOSTAT, which provides GHG emissions/removal estimates in the AFOLU sector by country, and Japan (Chuo University) gave an overview of CO_2 emission estimates using

satellite data in Mongolia.

BTR, whose first submission year is 2024, should include the inventory to which the 2006 IPCC Guidelines are applied. They recognized the importance of building robust national systems through developing the data collection and QA/QC systems, making internal manuals for inventory compilers, archiving the documents, and continuing the capacity building. They confirmed the relevance of drawing from various international resources and capacity-building opportunities for the preparation of the BTR under the ETF.

National GHG Inventory for the Transparency Framework Under the Paris Agreement

UNFCCC gave an overview of the requirements for national GHG inventories as parts of the BTRs under the ETF of the Paris Agreement. Japan shared its experience in compiling and reporting the national GHG inventory, and USEPA described how they addressed time-series consistency/recalculations within the AFOLU sector of the U.S. GHG inventory.

New emission sources and removal sinks, additional gases, and methodologies are issues for transitioning to the inventory under the Paris Agreement. The participants confirmed the importance of allocating sufficient time to the preparation for the transition from early stages based on a clear understanding of the new requirements. In addition, they identified the necessity to fill data gaps in the time series by using techniques such as splicing, provided in the IPCC Guidelines, to assure data quality.

The Mutual Learning on each sector's GHG inventories

In this WGIA, the Mutual Learning was held on the following four GHG inventory sectors: General (Thailand and Japan), Energy sector (Brunei and Mongolia), Land Use, Land-Use Change and Forestry (LULUCF) sector (Bhutan and Indonesia), and Waste sector (China and Indonesia). 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 partly applied the 2006 IPCC Guidelines which is necessary under the Paris Agreement, and continuously improved their GHG inventories through measures such as applying country-specific emission factors. Methodology of the partner country and progress made in institutional arrangements including data collection systems and QA/QC systems were shared, and these were referred to for the future improvement of their own inventories. Furthermore, there was an encouraging example from one of the participating countries where they had listed the issues identified in a prior Mutual Learning and started working on resolving them.

Poster Session

This was held to share information on institutional arrangements and the latest research results and deepen the discussion on specific issues. This year's WGIA18 was held online, therefore, posters were displayed on the designated website.

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/18.html

2.1 Opening Session

The welcome address was delivered by Mr. Sakaguchi Yoshiteru (MOEJ).

Mr. Ito Hiroshi (GIO) gave an introduction of WGIA18. He introduced the historical progress of WGIA, as well as its participants, agenda, and expected outcomes. The expected outcomes of WGIA18 were:

- Enhancement of the quality of GHG inventories for NCs, BURs, and future BTRs;
- Enhancement of the understanding of the transition to the 2006 IPCC Guidelines;
- Improved understanding of the Transparency Framework under the Paris Agreement and how to prepare for it.

Mr. Ito Hiroshi emphasized that an accurate inventory in the NCs, BURs, and BTRs will contribute to future planning and assessment of the progress towards emission reduction targets under the Paris Agreement.

Dr. Hayashi Toru (MOEJ) made a presentation on Japan's Current Progress on Global Warming Countermeasures. He reported that Japan's GHG emissions have decreased six years in a row since FY2014 mainly due to the decrease in energy consumption and decarbonization of electricity. Japan's total GHG emissions in FY2019 were estimated at 1,212 Mt CO_2 eq.

In 2020, Japan announced that Japan would aim to achieve net-zero GHG emissions by 2050. The amended Act on Promotion of Global Warming Countermeasures was unanimously passed by the Diet, with the realization of net-zero GHG emissions by 2050 positioned as a basic principle in May 2021. Additionally, the Prime Minister announced that Japan aimed to reduce its GHG emissions by 46% in FY2030 from its FY2013 levels. Furthermore, Dr. Hayashi Toru emphasized that Japan would continue strenuous efforts in its challenge to meet the lofty goal of cutting its emissions by 50%.

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

This session was chaired by Dr. Sirintornthep Towprayoon (advisory board (AB); King Mongkut's University of Technology Thonburi).

Non-Annex I Parties are required, as per COP16 and COP17 decisions, to submit national GHG inventories every two years as a part of their BURs or NCs. Under such circumstances, the WGIA member countries have submitted their BURs and/or NCs. In this session, Cambodia, Laos, China, Malaysia, and Viet Nam gave presentations about their latest BURs and NCs.

The chair of this session, Dr. Sirintornthep Towprayoon, introduced the objective of this session as exchanging experiences of preparing/updating the WGIA member countries' GHG inventories in their NCs and BURs, and learning from each other in light of future BTRs.

Mr. Sokhim Pich (Cambodia) gave a presentation on Cambodia's first BUR. He summarized the history of Cambodia's GHG inventory submissions until BUR1 under the UNFCCC and the

institutional arrangements for the inventory compilation. He also explained the estimated emissions from 1994 to 2016 in the national GHG inventory in their BUR1. The national total GHG emissions from Cambodia including the Forestry and Other Land Use (FOLU) were 163,592 Gg CO_2 eq. in 2016. This was 285% higher than the 1994 emissions mainly due to major deforestation in the FOLU sector after 2010. He also introduced mitigation actions and their effects in Cambodia.

Mr. BounEua Khamphilavanh (Laos) gave a presentation on the national GHG inventory of Laos. He first gave an overview of the institutional arrangement for GHG inventory compilation and reporting process, and secondly, he detailed the GHG emissions of the national total and each sector for 2014. The national total GHG emissions in Laos were 24,099.98 Gg CO_2 eq. The largest emission sector was AFOLU with 18,793.41 Gg CO_2 eq. and the second largest sector was energy with 3,729.42 Gg CO_2 eq. The emissions from Industrial Process and Product Use (IPPU) and Waste sectors were 1,151.89 and 423.68 Gg CO_2 eq., respectively.

Dr. Gao Qingxian (China) gave a brief introduction to China's BUR2. He first explained the very diverse regional circumstances followed by an explanation of the national GHG inventory. He mentioned that 40 key categories were identified, the most often used method was Tier 2, and a lot of country-specific emission factors were used. As for total national emissions, he explained that the Energy sector accounted for 78% of it in 2014. He also showed that QA/QC had been conducted to reduce uncertainties.

Ms. Nguyen Van Anh (Viet Nam) gave a presentation on Viet Nam's national GHG inventory under BUR3. She explained that Viet Nam's newest BUR3 with data for 2016 was submitted to UNFCCC in April 2021 and Viet Nam has already started the preparation for NC4 with 2018 data and for BTR1 with 2022 data. She also explained that the 2006 IPCC Guidelines and the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2019 Refinement) were mainly used as estimation methodologies, and Global Warming Potentials (GWPs) in the IPCC Fifth Assessment Report (AR5) were applied for estimation. QA/QC were implemented, key category analysis and uncertainty assessment were conducted, and recalculation for the years reported in past inventories was also conducted. She acknowledged challenges such as unavailability of some activity data necessary for the application of the 2006 IPCC Guidelines, and limited country-specific emission factors.

Ms. Dayang Ratnasari Binti Abu Bakar (Malaysia) gave a presentation on Malaysia's BUR3 and the GHG inventory for 2016 included in it which was estimated by using the 2006 IPCC Guidelines. Total emissions without LULUCF for Malaysia were 316,833.23 Gg CO_2 eq. and the Energy sector represented 79% of it. She also explained the major sources for each GHG, results of key category analysis and uncertainty analysis, trends of GHG emissions throughout the time series for the total and for each sector, and mitigation actions and quantified emissions reductions.

In the presentations above, some countries reported the challenges they faced, such as collection of activity data and establishment of institutional arrangements. Mr. Dominique Revet (UNFCCC) suggested that the reason for the problems of accessing data occurred because the national GHG inventory management system had not been established soundly. He also encouraged countries to register and access the UNFCCC Secretariat GHG Help Desk, which was recently established to support developing countries by providing a communication platform allowing GHG practitioners to resolve the issues they face and access useful information on the sound development of national GHG inventories whenever they encountered any trouble and/or had questions. There were also some questions on AFOLU sector-related matters, such as the reason for a large change in time series emission data, future plans for mitigation actions, and improvement/reduction of uncertainty, since AFOLU is a major sector for Southeast Asian countries.

The conclusions of this session are the following. First, countries still face common challenges regarding acquisition of activity data, uncertainty analysis, development of country specific emission factors, and establishment of QA/QC procedures and national systems, although each country has different circumstances. Second, it is important to share information on / experience in the preparation for NCs/BURs, especially given the soon-approaching BTRs under the Paris Agreement, which will build on these earlier experiences, and it is encouraged to utilize capacity-building opportunities.

2.3 Session II: Transition to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and Resources That Will Facilitate Compilation

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

Decision 18/CMA.1, adopted at COP24, requires all Parties to use the 2006 IPCC Guidelines for their inventories from 2024 under the ETF of the Paris Agreement. Although some WGIA member countries have already applied the 2006 IPCC Guidelines in their inventories, not a few WGIA member countries are facing difficulties to use the guidelines. This session took up the transition to the 2006 IPCC Guidelines and resources that could facilitate compilation. The first half of this session focused on the actual application of the 2006 IPCC Guidelines for WGIA member countries' GHG inventories.

Mr. Sivach Kaewcharoen (Thailand) made a presentation of the experience of building a national system including the Thailand Greenhouse Gas Emission Inventory System (TGEIS) to apply the 2006 IPCC Guidelines to Thailand's GHG inventory. By organizing the national system and inventory compilation process, TGEIS assists in the compilation of the national GHG inventory in Thailand. He also described the challenges in improving data collection and methodologies that Thailand is currently facing.

Ms. Winnie Chia (Singapore) made a presentation of the experiences of methodological changes in the transition from the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (1996 IPCC Guidelines) to the 2006 IPCC Guidelines in Singapore. Revising the carbon content of refinery gas in CO_2 emission estimates, including the new gas of NF_3, and applying new GWPs in AR5 were some of the highlights in the transition, where Singapore recalculated its GHG emission estimates for whole time series. She also stated that Singapore had faced some challenges in the acquisition of needed data for the transport sector as well as historical data for other emission streams. The former was addressed by shifting to a lower tier while the latter was addressed by using splicing techniques to estimate historical data.

Ms. Sandee G. Recabar (Philippines) made a presentation of the details of the measures that were undertaken to help the government as a whole to decide on shifting to the use of the 2006 IPCC Guidelines to compile the national GHG inventory report. Based on Executive Order 174 in 2014 and relevant inter-agency meetings, the Philippines started to use the 2006 IPCC Guidelines. In the presentation, she focused on the experience of establishing a national system and conducting capacity building, which included the UNFCCC QA Workshop (2019) to compile the 2010 inventory.

Following the above presentations, the participants had a discussion and Q&A about applying the 2006 IPCC Guidelines in these countries. During the Q&A, in response to a question from Dr. Bundit Limmeechokchai (Thailand) about the timeline of inventory compilation, Ms. Recabar

explained that the Philippines had prioritized efforts to build a sustainable national system: the calculation work was once done by private consultants, however, it is currently done by the government. Related to this, Mr. Dominique Revet (UNFCCC) provided additional information on the QA in-country workshops which the UNFCCC Secretariat is able to organize upon request from a National Focal Point in order to improve the quality and transparency of national GHG inventories reported by developing countries.

In the discussion, Prof. Rizaldi Boer, the chairperson, pointed out that the three countries that made presentations in this session have built robust national systems to compile GHG inventories in line with the 2006 IPCC Guidelines. He indicated that, to make it possible, it was necessary to maintain personnel responsible for the national inventory.

Mr. Irawan Asaad (Indonesia) asked these presenters how QA/QC was conducted. Ms. Sandee G. Recabar responded that the Philippines was discussing internally the possibility to prepare sectoral inventory reports as documentation activities. Ms. Winnie Chia and Mr. Sivach Kaewcharoen explained that they provided a checklist to data owners to fill out.

The second half of the session focused on providing information on resources that could facilitate compilation.

Dr. Baasansuren Jamsranjav (AB; IPCC TFI) made a presentation on the IPCC inventory software for the estimation of GHG emissions/removals in line with the 2006 IPCC Guidelines. The latest version 2.691 of the software has functions of not only Tier 2 estimation methodology for most categories in Energy, IPPU, Agriculture, and Waste sectors, but also uncertainty assessment and key category analysis. In the presentation, she specifically explained how to use the software for the AFOLU sector. She also described future update plans of the software.

Mr. Francesco N. Tubiello (FAO) made a presentation on the FAOSTAT. The FAOSTAT provides GHG emission/removal estimates in the AFOLU sector by country over long time series by using IPCC Tier 1 methodology. He noted that in the FAOSTAT, users can obtain both activity data and GHG emissions on the AFOLU sector and can use the database as a verification tool for GHG emission estimates.

Prof. Watanabe Masataka (Chuo University) made a presentation on CO_2 emission estimates by using Greenhouse Gases Observing Satellite (GOSAT) and GOSAT-2. The GOSAT series provide GHG emission estimates independent of national GHG inventories and aim to support the verification of GHG inventories. After showing preliminary comparison results between satellite observation of CO_2 and inventory data in Mongolia, he expressed interest in contributing to the improvement of national GHG inventories.

During the Q&A, in response to questions from Ms. Hayashi Atsuko (GIO) and Mr. Hassan Ibrahim (Singapore) about the IPCC software, Dr. Baasansuren Jamsranjav explained that the current version of the IPCC software was in line with the 2006 IPCC Guidelines and allowed for exporting Table 1 and 2 of the NAI NCs guidelines, but was not adjusted to accommodate Common Reporting Tables (CRT) reporting because the tables were not agreed on yet.

In response to a question from Dr. Bundit Limmeechokchai about mitigation measures in the Agriculture sector to achieve net-zero emissions, Mr. Francesco Tubiello suggested that there was mitigation potential for the FAO's Land-Use Change category (narrower than IPCC's LULUCF sector) through ecosystem management such as reduction of deforestation, although there was almost no mitigation potential for the FAO's Farm Gate category (farm-related categories in IPCC's Agriculture, LULUCF and Energy sectors).

In response to questions from Dr. Bundit Limmeechokchai, Dr. Gao Qingxian (China), and Prof. Rizaldi Boer about new remote sensing technology and its accuracy, Prof. Watanabe Masataka gave additional explanations of how to identify current anthropogenic CO_2 from satellite data from the GOSAT series, and how the comparison between GOSAT data and Mongolian GHG inventory was ongoing and still improving.

Through the above discussions, the participants concluded that, for the transition to the 2006 IPCC Guidelines and the modalities, procedures and guidelines (MPGs), it was important to build robust national systems that would allow sustainable compilation of GHG inventories. The necessary elements identified for a robust national system were: 1) establishing a good data collection system, 2) developing QA/QC processes, 3) maintaining internal manuals and documentation to safeguard against personnel changes, and 4) conducting capacity building for inventory compilers. For the countries facing difficulties in the application of the 2006 IPCC Guidelines in their GHG inventories, various international resources were offered to support and enhance compilation.

2.4 Session III: National GHG Inventory for the Transparency Framework Under the Paris Agreement

This session was chaired by Dr. Baasansuren Jamsranjav (AB; IPCC TFI).

All countries will be required to submit BTRs from 2024 under the ETF of the Paris Agreement. WGIA member countries will need to continuously enhance their national systems and compilation capacity to prepare national GHG inventories in the BTRs to meet the requirements under the ETF. This session was held with the aim of sharing the information of the new requirements, capacity-building opportunities, and experience-based good practices from developed countries.

Mr. Dominique Revet (UNFCCC) gave an overview of the ETF and a detailed explanation of the reporting requirements related to national GHG inventories. He emphasized that the MPGs for the transparency framework for action and support under the Paris Agreement (Annex to Decision 18/CMA.1) are applicable to all Parties.

Following the presentation, Ms. Hatanaka Elsa (GIO) suggested that it would also be helpful for inventory compilers to be certified as inventory reviewers or team of technical experts (TTE) members and participate in inventory reviews / Technical Analysis (TA) of BURs before submission under the ETF starts. She noted that the depth and wealth of experiences previously gained regarding the thinking on inventories will be the basis for the inventory portion of the BTRs, and the above-mentioned opportunities will function as internal capacity building for each national system.

Mr. Kosaka Naofumi (GIO) provided information on the Japanese 2015 submission to help inventory compilers plan for the transition to the MPGs, including the timeline for the submission, institutional arrangements, and general considerations for updating methodologies. Japan initiated the consideration of applying the 2006 IPCC Guidelines in the Committee for GHG Emissions Estimation Methods in 2012. In the 2015 submission, there were new emission sources or removal sinks in all sectors. As a result of the recalculation from the 2014 submission, the national total (incl. LULUCF) increased about 3–4% for the whole time series. He also explained Japan's calculation system using Microsoft Excel as well as reporting through the Common Reporting Format (CRF) Reporter.

Mr. John Steller (USEPA) described how the U.S. addressed data gaps using splicing techniques contained in the 2006 IPCC Guidelines for ensuring time-series consistency in the U.S. GHG inventory. He provided an example of how the surrogate data method was applied to estimate the CH_4 emissions from rice cultivation by filling the gap in the key activity data at the end of the time series before obtaining the newest survey results.

Following the presentations, Dr. Baasansuren Jamsranjav (AB; IPCC TFI), the chair of this session, noted that data in the LULUCF sector whose estimation of emissions/removals needs to take into consideration past land use and data of at least 20 years before the reporting years most likely require some splicing techniques and it is good practice to determine the best approach based on a clear understanding of the splicing techniques and data circumstances.

In response to a question from Mr. Hassan Ibrahim (Singapore) asking for additional experiences of addressing data gaps, Mr. John Steller explained that they applied the interpolation method for certain years for cropland and grassland estimations and used a different data set to address the data gaps that occurred when the statistics did not cover all U.S. land. Mr. Kosaka Naofumi said that they addressed the data gaps for CH_4 emission estimation from fuel combustion by using the interpolation and the trend extrapolation methods because the publishing interval of statistics was longer than annual.

In relation to a question raised by Mr. Tanabe Kiyoto (IPCC TFI; Consultative Group of Experts (CGE)) on separating emissions between the Agriculture and LULUCF sectors to fulfill the reporting requirement under the MPGs, Mr. John Steller explained how the U.S. GHG inventory was divided. Mr. Kosaka Naofumi mentioned that the current CRF (which is already divided between the Agriculture and LULUCF sectors) was based on the Good Practice Guidance for Land Use, Land-Use Change and Forestry (GPG-LULUCF), so mapping between the categories in the GPG-LULUCF and the 2006 IPCC Guidelines would probably be helpful to separate the AFOLU sector.

Regarding the presentation of Mr. Dominique Revet, Ms. Nguyen Van Anh (Viet Nam) asked how to receive continuous support for developing BTRs, as well as BURs/NCs. He suggested contacting the implementing agency of the Global Environment Facility (GEF) because it should be already available.

Concerning a question from Dr. Sirintornthep Towprayoon (Thailand) about how to apply the surrogate data method and how to deal with the uncertainty assessment, Mr. John Steller clarified that they had tested the interpolation approach and the surrogate data approach with weather data and harvest area data, etc., and selected the surrogate data method with rice commodity data as the better option. Regarding the uncertainty assessment, he explained that an additional part of the uncertainty caused by partial adoption of the surrogate data method was separately conducted.

In relation to a question from Mr. Irawan Asaad (Indonesia) about the frequency and the process of recalculations in the U.S. GHG inventory, Mr. John Steller described that they conducted recalculation annually and most of the recalculations were made when new/updated data became available, and that they discussed whether the new data should be incorporated or not and then estimated the impact of recalculations. Regarding recalculations due to methodology changes, a more detailed documentation of the new methodology is needed.

For this session, the following conclusions were made.

The transition to new guidelines leads to considerable changes for inventories with new sources/sinks, gases, and methodologies, and therefore it is important to allocate enough time from early stages and utilize practical solutions based on a clear understanding of the new requirements under the ETF. Data availability for the whole time series is a common challenge,

but data gaps can be addressed by using techniques such as splicing provided in the 2006 IPCC Guidelines. It is important to ensure the data quality of the time series and it is encouraged to take advantage of the WGIA network to learn from countries already using the 2006 IPCC Guidelines.

2.5 Closing Session

First, Ms. Hatanaka Elsa (GIO) gave summaries of all the sessions including the Mutual Learning sessions and plenary sessions during WGIA18. Regarding the Mutual Learning, she highlighted an example from one of the participating countries where they had listed the issues identified in a prior Mutual Learning and started working on resolving them. She suggested that other countries follow suit if they were interested in doing so. She also expressed appreciation to the chairs of the plenary sessions for their guidance during the discussions.

Mr. Tanabe Kiyoto (IPCC TFI; CGE) acknowledged the progress made in the GHG inventories of WGIA member countries and stressed the importance of the role of the WGIA network for the next period of inventory preparation under the ETF.

Mr. Dominique Revet (UNFCCC) emphasized the importance of continuous development of the GHG inventories to meet the new requirements under the ETF by utilizing all the available opportunities and resources provided by Japan, IPCC, UNFCCC, etc.

Dr. Gao Qingxian (China) commented that WGIA provided a great opportunity for linking all the Asian countries together by sharing experiences and knowledge and providing advice to each other. He also noted that the Mutual Learning was the best way to learn from each other.

Mr. Francesco N. Tubiello (FAO) expressed FAO’s willingness to continuously take part in the efforts of WGIA, including those related to the GHG inventory in the AFOLU sector, by providing linkages to food and agriculture-related matters in general, especially because AFOLU/Agriculture plays a large role in developing countries' inventories and mitigation/adaptation strategies.

Finally, Ms. Hatanaka Elsa (GIO) thanked all for their active participation and wished for the further strengthening of the network within the countries as well as for seeing everyone at the next WGIA in person, if possible.

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 18

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 Report (BURs) and future Biennial Transparency Report (BTRs) to be periodically submitted to the Conference of the Parties (COP) under the UNFCCC. It becomes important to develop reliable GHG inventory of NAI countries and to enhance its further improvement.

To support developing and improving GHG Inventories of NAI Parties in Asia, the Workshop on GHG Inventories in Asia (WGIA) was organized by the Ministry of the Environment of Japan (MOEJ) and the National Institute for Environmental Studies (NIES), and has been held on annually since 2003. 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). So far, WGIA achieved to strengthen a network of regional government officials and experts and to make website and proceedings.

Unfortunately, last year's WGIA could not be held due to the global COVID-19 pandemic, and its ongoing status still makes it hard to hold an in-person workshop. This year, therefore, we will be holding WGIA online.

The upcoming 18th Workshop on GHG Inventories in Asia (WGIA18) is to be held 8 - 14 July 2021. The WGIA18 aims:

1) To enhance sector-specific capacity for inventory compilation,
2) To enhance the quality of GHG inventory for NCs and BURs and in future BTR
3) To enhance the understanding of transition to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and resources that will facilitate compilation, and
4) To improve the understanding of the Transparency Framework under the Paris Agreement and how to prepare for it.

Approximately 100 participants are expected to be present in this 18th workshop. Participants are government officials and researchers from 15 countries in Asia (the participating 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

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

Japan's Current Progress on Global Warming Countermeasures

HAYASHI Toru, GONDA Yu, YAMAZAKI Tomoya, MIYATA Kazuaki

Decarbonized Society Promotion Office, Global Environment Bureau, Ministry of the Environment, Japan

Abstract

Japan's greenhouse gas emissions have decreased six years in a row since FY2014 mainly due to the decrease in energy consumption and decarbonization of electricity. In FY2019, Japan's total greenhouse gas emissions were estimated at 1,212 Mt CO_2 eq. (reflecting a 14.0% decrease compared to FY2013 and a 12.3% decrease compared to FY2005), falling to a record low since FY1990. On the other hand, our GDP has been on the rise in recent years. Greenhouse gas emissions per unit of GDP have decreased seven 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 May 2016. 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 110 policies and measures listed in the Plan, in terms of reductions, 84% are evaluated as progressing at a pace that meets or exceeds the target levels. The Plan is currently under review with these results taken into consideration.

Last year, Japan announced that Japan will aim to achieve net-zero greenhouse gas emissions by 2050. In May, the amended Act on Promotion of Global Warming Countermeasures was unanimously passed by the Diet, with the realization of net-zero greenhouse gas emissions by 2050 positioned as a basic principle. Additionally, in April, the Prime Minister announced that Japan aims to reduce its greenhouse gas emissions by 46% in FY2030 from its FY2013 levels, setting an ambitious target which is aligned with the long-term goal. Furthermore, Japan will continue strenuous efforts in its challenge to meet the lofty goal of cutting its emission by 50%.

Japan's new 2030 target reflects an over 70% increase of its previous target, and it 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 2021)
2. Japan's Fourth Biennial Report (December 2019)
3. Submission of Japan's Nationally Determined Contribution (May 2020)
4. Overview of the Plan for Global Warming Countermeasures (May 2016)
5. Outlines of Japan's Long-term Strategy under the Paris Agreement (June 2019)

Access to relevant information

1. https://unfccc.int/documents/271503
2. https://unfccc.int/sites/default/files/resource/BR4_JPN_v1.1.pdf
3. https://www4.unfccc.int/sites/NDCStaging/Pages/All.aspx
4. https://www.env.go.jp/press/files/en/676.pdf
5. https://www.env.go.jp/en/earth/cc/npa/outlines_of_japanese_long-term_strategy_under_the_paris_agreement_190611.pdf

3.2 Session I

Cambodia's first Biennial Update Report (fBUR)

PICH Sokhim

Department of Climate Change, General Secretariat of the National Council for Sustainable Development, Ministry of Environment, Cambodia

Abstract

Cambodia was a party to the United Nations Framework Convention on Climate Change (UNFCCC) through the ratification in December 1995 and officially became a member on 17 March 1996. The country ratified the Kyoto Protocol in 2002, which entered into force in February 2005. Cambodia also signed the Paris Climate Agreement on 22 April 2016 and ratified it on 6 February 2017. This demonstrates Cambodia´s active participation with the global communities to address the adverse impacts of climate change.

Cambodia is one of the lowest contributors to the causes of climate change, but the country still remains one of the most vulnerable countries to its impact. Hence, Cambodia takes climate change seriously in her development agenda to ensure a greener, low-carbon and climate-resilient, equitable, sustainable, and knowledge-based society, while contributing to global efforts to addressing climate change. This is reflected in the Rectangular Strategy Phase IV (2018-2023) and the National Strategic Development Plan (2019-2023). As result of its effort, Cambodia prepared a number of policies, regulations, and reports related climate change and aligned and responded to the international conventions such as UNFCCC, Paris agreement, and Kyoto protocol, etc.

Cambodia prepared and submitted its first BUR to the UNFCCC secretariat in August 2020. The report includes relevant data and information regarding Cambodia´s major sources of GHG emissions and sinks, coupled with necessary mitigation measures already implemented or planned; thus, furthering her contribution to global efforts to reducing GHG emissions. The report is also developed in accordance with the UNFCCC BUR Guidelines. The total emissions of greenhouse gases (GHG) estimated are 163 592 Gg.CO2-eq in 2016, which is 285% higher than that of in 1994. The main driver for this increase in GHG emissions is the deforestation reflected in the emissions of the FOLU sector. Agriculture represents the second largest emitter sector in the country, which runs by Energy and waste sector, the third and fourth respectively. Emissions per capita have increased from 4 to 10.42 tons CO2-eq/person/year. This increase is due mainly to the high deforestation occurring in the country. Conversely, GHG emissions per unit of GDP have been reduced from 15.41 to 8.24 tons CO2-eq/thousand USD/year. This reduction is due to GDP expansion, which is significantly higher than the increase of GHG emissions.

References/ Publications

2020 the General Secretariat of the National Council for Sustainable Development/Ministry of Environment, the Kingdom of Cambodia.

Access to relevant information

1. https://unfccc.int/documents/232019
2. https://ncsd.moe.gov.kh/resources/document/cambodia%E2%80%99s-1st-BUR

Lao National Greenhouse Gas Inventories

BounEua Khamphilavanh

Ministry of Natural Resources and Environment, Lao PDR.

Abstract

The 2014 national inventory was, under first BUR preparation project, conducted based on the 2006 IPCC Guidelines and software for National Greenhouse Gas Inventories and the base year was 2014. Tier 1 method and default emission factors (EFs) were used for estimation of GHGs since the country-specific data, especially EFs were not available. However, Transparency, Accuracy, Consistency, Completeness, and Comparability (TACCC) were taken into account in the inventory. This inventory covered emissions and removals for four sectors, namely Energy, Industrial Process and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU) and Waste. The GHG emissions estimated were only CO2, CH4, and N2O since data on halocarbon products and use were inadequate, while the emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6) were possibly small.

Total emissions are also small in comparison with other country in the regions. The net emission was 24,099.98 GgCO2eq in 2014. AFOLU was the highest carbon sources and sink. The net emission of the AFOLU sector was 18,793.41 GgCO2eq, accounting for about 78% of the total emissions. Second largest source of emissions was Energy Sector, 3,729.42 GgCO2eq (15%). The rest, IPPU and Waste shared 5% and 2% of the total emissions, respectively.

Brief Introduction on The People's Republic of China Second Biennial Update Report on Climate Change (BUR2)

Gao Qingxian
Chinese Research Academy of Environmental Sciences (CRAES)

Abstract

Recalling Articles 4 and 12 of the United Nations Framework Convention on Climate Change (UNFCCC), each Party shall submit its national communication. As a non-Annex I party to the Convention, the People's Republic of China has actively fulfilled its international obligations. China submitted The People's Republic of China Initial National Communication on Climate Change (INC), The People's Republic of China Second National Communication on Climate Change (SNC) and The People's Republic of China First Biennial Update Report on Climate Change (BUR1) in 2004, 2012 and 2017 respectively, in which policies and actions for addressing climate change and related information were comprehensively stated, and the 1994, 2005 and 2012 national greenhouse gas inventories were reported.

According to decisions 1/CP.16 adopted at COP 16 in 2010 and 2/CP.17 at COP 17 in 2011, non-Annex I Parties, consistent with their capabilities and the level of support received for reporting, should submit their biennial update reports, containing updates of national greenhouse gas inventories, mitigation actions, and needs and support received. The biennial update report should be subject to international consultation and analysis (ICA). Upon receiving the grants from the Global Environment Facility in 2015, the Chinese government organized the departments and research institutions concerned and by following UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention. The People's Republic of China Second Biennial Update Report on Climate Change（BUR2）was completed in 2018.

The BUR2 of China approved by the Chinese government, is divided into six Parts: National Circumstances and Institutional Arrangements, National Greenhouse Gas Inventories, Mitigation Actions and Their Effects, Funds, Technology and Capacity-Building Needs and Support Received, Basic Information of the Hong Kong Special Administrative Region SAR on Addressing Climate Change, Basic Information of the Macao SAR on Addressing Climate Change, and other information, presenting a full picture of China's national efforts on addressing climate change.

The national greenhouse gas inventory presented herein is of 2014, while the relevant data and information in other parts are generally updated to 2016. In accordance with the relevant principles set down in the Basic Law of the Hong Kong SAR and the Basic Law of the Macao SAR, the basic information of these two SARs on addressing climate change in this report is provided by the Environmental Protection Department of the Hong Kong SAR Government and the Meteorological *and* Geophysical Bureau of the Macao SAR Government, respectively. Considering its basic national circumstances and the characteristics of its development stage, China is vigorously promoting eco-civilization, and executing a national strategy for actively addressing climate change by integrating climate change into its medium- and long-term national socio-economic development planning. China is trying to accelerate green low-carbon development and actively controlling greenhouse gas emission by resorting to legal, administrative, technical and market means. The Chinese government will continue, as always, to fulfill its own obligations under UNFCCC on the basis of equity and in accordance with common but differentiated responsibilities and respective capabilities, and to fulfill the international commitments actively.

China will implement its Nationally Appropriate Mitigation Actions and Nationally Determined Contributions comprehensively, participate in negotiations on global climate change actively, promote the establishment of an equitable, rational, cooperative and win-win global climate governance, deepen bilateral dialogues and pragmatic cooperation on climate change, support other developing countries to enhance their capacity building in response to climate change, and promote to build a community with a shared future for mankind.

Malaysia's Third Biennial Update Report to the UNFCCC

Dayang Ratnasari Binti Abu Bakar

Ministry of Environment and Water, Malaysia

Abstract

The presentation includes information reported in Malaysia's Third Biennial Update Report (BUR3) to the United Nations Framework Convention on Climate Change (UNFCCC) submitted in 2020. The greenhouse gas (GHG) inventory details the anthropogenic emissions and removals for the year 2016 of four sectors: energy; industrial processes and product use (IPPU); agriculture, forestry and other land use (AFOLU); and waste. These GHG inventory estimates were obtained following to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The total GHG emissions for 2016 were 316,833 Gg CO2 eq for emissions without LULUCF and 75,488 Gg CO2 eq with LULUCF. The major sources of CO2, CH4 and N2O, along with the key category and uncertainty analyses, and the time series estimates from 1990 to 2016 for all the sectors are presented. The mitigation actions in 2016 are also presented briefly, followed by the issues and challenges in reporting.

National GHG Inventory under Viet Nam's BUR3

NGUYEN Van Anh
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Abstract

The national GHG inventory is an important part of the Biennial Updated Report (BUR) as well as the National Communications (NC) to the United Nations Framework Convention on Climate Change (UNFCCC). In Viet Nam, the Ministry of Natural Resources and Environment (MONRE) is assigned by the Government to be the National Focal Point for the implementation of UNFCCC, Kyoto Protocol, Paris Agreement (PA) and other international commitments related to climate change in Viet Nam including the development of periodically national reports and national GHG inventories to the UNFCCC.

Viet Nam has implemented national GHG inventories for the inventory years of 1994 (INC), 2000 (SNC), 2010 (BUR1), 2013 (BUR2) and 2014 (TNC) for five sectors, including energy; industrial processes (IP); agriculture, land use, land use change and forestry (LULUCF); and waste funded from GEF through UNEP. Under the framework of the BUR3 project, Viet Nam conducted a national GHG inventory for year 2016 and recalculated the national GHG inventory for year 2010 and 2014 among sectors: energy, IPPU, AFOLU and waste based on 2006, 2019 refinement to the 2006 IPCC Guidelines with the global warming potential (GWP) value for 100 years according to the fifth IPCC Assessment report on climate change (AR5).

The institutional arrangements for the 2016 national GHG inventory are in accordance with the national GHG inventory system specified under the Prime Minister Decision No.2359/2015/QD-TTg dated December 22, 2015. The Department of Climate Change (DCC) under MONRE is responsible for GHG inventory development; lead and coordinate with relevant agencies in the GHG inventory implementation system and compile technical reports.

Total GHG emissions/removals in 2016 in Viet Nam was 316,734.96 thousand tCO_2eq. Among which, the energy sector accounted for biggest share of 65% while IPPU takes second, 14.6%. The third biggest sector went to AFOLU, 13.9%, followed by the waste sector, 6.5%. In the framework of developing BUR3, recalculation of the national GHG inventories for 2010 and 2014 was conducted including updating AD according to national statistics as well as EFs and some parameters, conversion factors were applied in the 2016 national GHG inventories to ensure principles of the GHG inventory such as transparency, accuracy, completeness, comparability, consistency.

The 2016 national GHG inventory under Viet Nam's BUR3 had some improvements in comparison with previous time. Some main improvements are 2006 IPCC Guidelines application; more detailed AD, country specific EFs/parameters and sub-sectors calculation.

The national GHG inventory for 2016 marks an important step forward in improving transparency of national GHG inventory reports. Some lessons learnt from this GHG inventory in order to meet the requirements of the ETF for the next time in the country are allocation of the permanent budget for the national GHG inventory; maintain of the national GHG inventory institutional arrangement on a continuous basic, legislation of the GHG inventory process; enhancement of the technical assistance and cooperation with the international donors (UNEP) as well as others and between National Focal Point and related Ministries/agencies in the country; plan of the country specific EFs development by suitable roadmap; capacity building for the expert team through learning by doing.

References/ Publications

MONRE (2020), Viet Nam's BUR3 to the UNFCCC.
MONRE (2020), Viet Nam's NIR 2016 to the UNFCCC.

Access to relevant information

https://unfccc.int/documents/273504
https://unfccc.int/documents/273503

3.3 Session II

Transition to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories in Thailand

Sivach Kaewcharoen

Office of Natural Resources and Environmental Policy and Planning (ONEP), Thailand

Abstract

The Office of Natural Resource and Environmental Policy and Planning (ONEP) through the Climate Change Management and Coordination Division is the National Focal Point (NFP) for the UNFCCC and KP at national and international levels. In fulfilling its reporting requirements, the country submitted its Initial National Communication, Second National Communication, and Third Communication in November 2000, March 2011, and August 2018, respectively. The First Biennial Update Report and the Second Biennial Update Report were submitted to the UNFCCC in December 2015 and December 2017, respectively.

Thailand established the National Committee on Climate Change Policy (NCCC) in 2007 in order to fulfill Thailand's commitments under the UNFCCC and to define national climate policies. Currently, the NCCC is composed of 5 subcommittees: 1) Subcommittee on Climate Change Policy and Planning Integration, 2) Subcommittee on Climate Change Knowledge and Database, 3) Subcommittee on Climate Change Negotiation and International Cooperation, 4) Subcommittee on Public Relations and Actions for Climate Empowerment, and 5) Subcommittee on Climate Law (added in 2019). Furthermore, Thailand has updated its National Greenhouse Gas Inventory in accordance with the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines, including by applying Thailand Greenhouse Gas Emission Inventory System (TGEIS). Adjustments have also been made to the sub-sectoral working groups responsible for data collection in estimating GHG emissions for 5 sectors in the GHG inventory.

To compliment these efforts and the achievement of the country's Sustainable Development Goals on climate change and Thailand 4.0 national development policy, Thailand also initiated the "Thailand Greenhouse Gas Emission Inventory System (TGEIS)" project. Institutional arrangement is a critical part of the national GHG inventory system. TGEIS provides structure, assists in institutionalizing inventory process, and improves national capacity to generate national GHG inventory in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventory. In addition, Thailand will be able to better manage GHG emission estimation and its approval process. Systematic estimation will also yield tremendous benefits for Thailand in achieving accurate calculation outcome and supporting policy makers to formulate national climate change policy as well as measures in comprehensive manner.

National Greenhouse Gas Inventory of Thailand

The estimation of greenhouse gas (GHG) emissions in this report comprises of both direct emission (CO_2, CH_4, N_2O) and indirect emission (NO_X, CO, NMVOCs and SO_2). In 2016, Thailand's total direct emissions (excluding those from the Land Use and the Land-Use Change and Forestry – LULUCF – sector) were 354,357.61 $GgCO_2eq$, while the net removal of CO_2 was 91,134.15 $GgCO_2eq$. Net GHG emissions were therefore 263,223.46 $GgCO_2eq$ and resulted from 1) Energy (253,895.61 $GgCO_2eq$), 2) Industrial Processes and Product Use (IPPU) (31,531.41 $GgCO_2eq$), 3) Agriculture (52,158.70 $GgCO_2eq$) and 4) Waste (16,771.89 $GgCO_2eq$). The proportion of GHG emissions in the energy sector accounted for 71.65% of total emission sources in 2016, followed by the agriculture, IPPU and waste sectors. Overall, Thailand's GHG emissions represent less 1% of global emissions and lower than world average.

During the TBUR's national GHG inventory development, Thailand faced several constraints and gaps that need to be addressed. This includes limitations and barriers that affect the quality of GHG inventory estimation and compilation. It is important to improve the quality of the national statistics compiled by relevant agencies to further improve the overall quality of the national GHG inventory.

References/ Publications

Thailand Third Biennial Update Report.

Transition to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

National Environment Agency, Singapore

Abstract

To build capacity to facilitate the transition to 2006 IPCC Guidelines for National Greenhouse Gas (GHG) Inventories, Singapore has been actively participating in training programmes organised by the UNFCCC Secretariat, IPCC and other technical expert organisations.

To enhance the transparency of the National GHG inventory, Singapore transitioned from using a mix of the Revised 1996 IPCC Guidelines for National GHG Inventories and 2006 IPCC Guidelines for National GHG Inventories for sectors/categories (i.e. energy, manufacturing industry, commercial, residential and transport) in the Biennial Update Reports (BURs) to using the 2006 IPCC Guidelines for all sectors in the Fourth BUR. In addition, the Global Warming Potentials (GWPs) applied to all GHGs now take reference from the IPCC Fifth Assessment Report (AR5) instead of the IPCC Second Assessment Report (SAR), to take into account the findings of the AR5. Furthermore, in addition to the six GHGs, Singapore had taken the initiative to include a seventh GHG, NF3, into the national GHG inventory for subsequent NCs and BURs.

In line with IPCC Good Practice Guidance to continually review the GHG inventory, Singapore's GHG inventory has been updated in a consistent manner. Where historical data is unavailable, the splicing techniques prescribed in the 2006 IPCC Guidelines, such as extrapolation and surrogate method, were applied to ensure time series consistency. Where default conversion and emission factors were used, they were referenced from the 2006 IPCC Guidelines.

The transition to the 2006 IPCC Guidelines, inclusion of NF3 gas and change in GWPs values from SAR to AR5 had resulted in a 1-2% decrease in GHG emissions across the time series for the later years. For 1994 and 2000, the increase in GHG emissions by approximately 1 to 5% was largely due to revision in data or unavailability of data in the earlier years which had now been included through splicing techniques.

Singapore will continue to participate in technical workshops, and consult subject experts at the UNFCCC Secretariat, think-tanks, academia and international organisations to further enhance our Measurement, Reporting and Verification (MRV) processes and climate policies. Having learnt much from these efforts, we continue to pay it forward by sharing our experiences and best practices with fellow developing countries.

References/ Publications

Singapore's Fourth Biennial Update Report

Philippine Case for Transitioning to the 2006 IPCC Guidelines

Sandee G. Recabar

Climate Change Commission, Philippines

Abstract

With the enactment of the Climate Change Law of 2009, creating the Climate Change Commission, the Philippine Government worked towards institutionalizing the conduct of the greenhouse gas inventories. The issuance of Executive Order 174 effectively lays down the establishment of the Philippine Greenhouse Gas Inventory Management and Reporting System (PGHGIMRS) which includes the institutional arrangement as well as roles and responsibilities of identified national government agencies in the conduct of the national GHG inventory. For its first national exercise, it was decided by the EO -174 agencies that the 2006 IPCC Guidelines will be used for producing the 2010 national GHG inventory report. This presentation will provide details on the measures that were undertaken to help the government decide on shifting to the use of the 2006 IPCC Guidelines. It will also focus on the development of reference manuals, protocols and templates including the process for the conduct of capacity building initiatives designed towards preparing the agencies in using the 2006 IPCC Guidelines. Lessons learned from the first national exercise and preparations for the next inventory cycles of 2015 and 2020 shall also be presented. Putting premium in sustaining the GHG inventory process and gearing up towards transparency reporting, the Philippine Government established the National Integrated Climate Change Database Information and Exchange System (NICCDIES) portal designed to report and track climate action and support. This system will not only provide critical inputs towards mainstreaming climate change in domestic development planning process but also assist in generating climate reports for the UNFCCC. The system also includes pertinent data information and visualization of the greenhouse gas inventories that the Philippine Government communicated to the UNFCCC including the 2010 GHG inventory which used the 2006 IPCC Guidelines.

References/ Publications

Office of the President. (November 24, 2014). Institutionalizing the Philippine Greenhouse Gas Inventory Management and Reporting System. Manila. Executive Order No. 174 series of 2014.

Access to relevant information

https://niccdies.climate.gov.ph/ghg-inventory/national

IPCC Inventory Software
Agriculture, Forestry and Other Land Use (AFOLU) sector

Baasansuren Jamsranjav

Senior Programme Officer, 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* including cross-cutting elements of a national greenhouse gas (GHG) inventory such as uncertainty analysis, key category analysis and quality control. It also allows database administration, data export/import and data reporting (*2006 IPCC Guidelines* reporting tables).

The latest version 2.691 released in 2020 implements Tier 2 methods for most categories of Energy, Industrial Processes and Product Use (IPPU) and Waste sectors as well as Agriculture categories of the AFOLU sector.

The software has two dedicated functionalities as data managers for the AFOLU sector: i) the Land Type Manager and ii) the Livestock Manager. Parameters entered in the data managers are used across relevant worksheets to calculate GHG emissions and removals from source/sink categories of the AFOLU sector. The software also supports constructing Land Use Matrix (a complete view of area transitions between land use categories) for 3B Land categories of the AFOLU sector.

There are several ongoing and planned updates of the IPCC Inventory Software including those for the AFOLU sector (e.g., updates to land representation (all 3 approaches), implementation of stock-difference approach, implementation of methods provided in the *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*).

References/ Publications

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

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

Access to relevant information

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

FAOSTAT Emissions data: Agriculture and Forest Land, 1990–2019

Francesco N Tubiello, Giulia Conchedda and Griffiths OblyLayrea

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Abstract

The goals of FAO in terms of statistics for supporting its member countries on GHG data include: i) to enhance capacity of countries to collect, analyse and report data on food and agriculture and food systems, consistently with UNFCCC and SDG processes; ii) to provide global knowledge products that enable analysis of food and agriculture trends at regional and world level (e.g., IPCC AR6); and iii) to disseminate data and tools in support of country QAQC and validation processes for their NGHGIs (e.g., IPCC GLs, UNFCCC Lead reviewers meeting 2021). The new FAOSTAT Emissions database provides emissions estimates at IPCC Tier 1, by country and over long time series. It offers a global knowledge product useful to assess trends in food and agriculture emissions at country, regional and global level, which complements the information that countries regularly provide to the UNFCCC. In this context, the FAO data are used regularly in academic reports in international journals, including the upcoming IPCC AR6. The new FAOSTAT update, up to the year 2019, includes for the first time the possibility to compare the FAO estimates to the most recently available UNFCCC country data, with functionalities allowing users to analyse both emissions and activity data, in support of QAQC and validation processes within NGHGI development.

New features of the FAOSTAT data include new functionalities to also link the estimated national statistics to underlying geospatial information generated by FAO in the area of drained organic soils, burning biomass and peatland fires, and disseminated via the new Hand-in-Hand geospatial platform, the Google Earth Engine and Earth Map.

Estimation of GHG emission/absorption using satellite data in Mongolia

Masataka Watanabe[1], Akihiro Oba[1], Zamba Batjargal[2] and Gomboluudev Purevjav[3]

[1]Chuo University (Japan), [2]Ministry of Environment and Tourism (Mongolia), [3]Information and Research Institute for Meteorology, Hydrology and Environment (Mongolia)

Abstract

The Paris Agreement requires each country to report anthropogenic emissions of greenhouse gases (GHG). However, there is a gap between actual GHG emission/sink and reported emission/sink due to the data quality of national statistics and limitation of the emission factor of the IPCC guideline. Therefore, it is necessary to identify missing-source/missing sink to increase the accuracy of the inventory. To make this report more transparent, we propose comparing and verifying their emission reports using the satellite data observed by GOSAT and GOSAT-2.

Biennial Update Report (BUR) is rather difficult for many countries, non-Annex I party, in particular, due to human resource limitation, internally long process for completing reports, and budget shortage. Vital needs exist in supporting accurate GHG national inventory by GOSAT based estimation of GHG emission/absorption, supporting biennial reporting, and supporting validation for global stocktake.

We co-developed the model, which employs inverse analysis based on the Green function using GOSAT-series satellite observation results and estimates posterior emissions volumes of a GHG emissions inventory using GOSAT series data. Compared with the Mongolian National GHG emissions inventory (estimated by GDP growth rate), we need to continue efforts for LULUCF even more than for anthropogenic emissions. The approach with this co-development is ideal for establishing a sustainable approach when Mongolia uses it as the standardized methodology.

Furthermore, by jointly preparing emissions by satellite observation using the above methodology for countries with insufficient inventory data, highly transparent emission reports can be realized in the BUR. Participating countries will be able to conduct the demonstration project jointly with the Ministry of the Environment of Japan. Those countries can also request the targeted observation of GOSAT and GOSAT-2 to the desired area and city.

3.4 Session III

Requirements of NIRs for BTRs under the ETF of the Paris Agreement and Support available from the GHG Support Unit of the UNFCCC Secretariat

Dominique Revet

UNFCCC Secretariat

Abstract

With decision 18/CMA.1, Parties adopted common Modalities, Procedures and Guidelines (MPGs) for the transparency framework for action and support applicable to all Parties, which includes some flexibility for LDCs and SIDS. Although the MPGs are building on, and enhancing, the transparency arrangements under the Convention, recognizing the special circumstances of the LDCs and SIDS, and implementing the transparency framework in a facilitative, non-intrusive, non-punitive manner, respecting national sovereignty and avoiding placing undue burden on Parties, they represent a major challenge for almost all developing countries who will have to overcome many difficulties in order to implement them as expected.

This is why the GHG Support Unit of the Transparency Division from the UNFCCC Secretariat has designed, raised and continues to raise funding to implement, since 2018, a project aimed at strengthening the capacity of developing countries to prepare and manage national GHG inventories as a basis for effective enhanced transparency framework under the Paris Agreement. The numerous, as well as innovative, activities undertaken under this project are designed to directly respond to the needs expressed by developing countries, including through voluntary requests received for direct assistance, and implemented in close collaboration with relevant partner institutions to deliver the best possible technical solution in a cost-effective manner.

Access to relevant information

Decision 1/CP.21 (https://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf)
Decision 18/CMA.1 (https://unfccc.int/sites/default/files/resource/CMA2018_03a02E.pdf)
GHG Support Unit (https://unfccc.int/process-and-meetings/transparency-and-reporting/support-for-developing-countries/ghg-support)

Japan's Experience in Compiling and Reporting the National GHG Inventory

KOSAKA Naofumi

Greenhouse Gas Inventory Office of Japan

Abstract

Parties to the Paris Agreement shall report national GHG inventories in accordance with the modalities, procedures and guidelines (MPG) starting from 2024 submission (Decision 18/CMP.1). Annex I Parties to the UNFCCC experienced transition of the reporting guidelines on annual greenhouse gas inventories between 2014 and 2015 submissions. This presentation shares the experience of the 2015 submission to help inventory compilers plan the transition to the MPG.

The Conference of the Parties revised the UNFCCC reporting guidelines on annual greenhouse gas inventories (Decision 24/CP.19), beginning for use since the 2015 submission.

The main focus of the revision was that Annex I Parties shall use the 2006 IPCC Guidelines instead of the Revised 1996 IPCC Guidelines, GPG2000, and GPG-LULUCF. The impact on the change of the IPCC Guidelines can be categorized as three aspects. Firstly, sectors and categories are reallocated. Secondly, methodologies are newly provided (e.g., harvested wood products). Thirdly, methodologies and emission factors are updated.

Also, according to the revised reporting guidelines, new gases such as NF_3 need to be estimated. The Global Warming Potentials were changed from the Second Assessment Report of IPCC to the Fourth Assessment Report. The guidelines also clarify how to report indirect CO_2 and N_2O emissions and introduce the use of notation key NE for insignificant emissions/removals.

In Japan, country-specific methodologies were developed at the time of transition to the guidelines. For example, the DNDC-Rice model was introduced for the CH_4 emission estimation from rice cultivation. (In the past, the EF-based method had been applied.)

As a result, the total emissions increased about 3-4% for all time-series.

The CRF Reporter, produced by the UNFCCC secretariat, was renewed at the time of the revision of the reporting guidelines. The way of transferring data from domestic calculation files to the CRF Reporter was changed. It was a lot of work, but it wasn't technically difficult.

The transition of the guidelines leads to a huge change for inventories, so it is important to allocate enough time to discuss methodologies and implement quality control.

References/ Publications

1. National Greenhouse Gas Inventory Report of JAPAN (April 2014)
2. National Greenhouse Gas Inventory Report of JAPAN (April 2015)
3. Updated UNFCCC reporting guidelines on annual inventories following incorporation of the provisions of decision 14/CP.11, FCCC/SBSTA/2006/9, https://unfccc.int/documents/4406
4. Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention, Decision 24/CP.19, https://unfccc.int/documents/8105

Access to relevant information

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

Addressing time-series consistency/recalculations within the AFOLU sector of the U.S. GHG Inventory

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Abstract

Data availability across an inventory time-series is a common challenge in compiling and reporting inventories in the Agriculture and LULUCF sectors consistent with 2006 IPCC Guidelines. Key data sources such as natural resource surveys are often conducted and published on a periodic basis resulting in data gaps. Methods to ensure time-series consistency and recalculate estimates to address gaps or incorporate new data and science are often necessary and useful when compiling time-series inventories for this sector. Examples from the U.S. Greenhouse Gas Inventory experience may illustrate how application and use of these methods can address common data circumstances for this sector.

References/ Publications

2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 1: General Guidance and Reporting, Chapter 5: Time Series Consistency.
(https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_5_Ch5_Timeseries.pdf)

2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 1: General Guidance and Reporting, Chapter 5: Time Series Consistency.
(https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/1_Volume1/19R_V1_Ch05_Timeseries.pdf)

3.5 Poster Session

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

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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 FY2019 were 1,212 million tonnes of carbon dioxide (CO_2) equivalents (Mt CO_2 eq.; the same shall apply hereafter).

This is a decrease of 14.0% (197Mt CO_2 eq.) compared to the FY2013 emissions (1,408 Mt CO_2 eq.), mainly because of the decrease in energy consumption (due to improved energy conservation etc.) and the decrease in CO_2 emissions from electricity production due to the wider use of low-carbon electricity (wider adoption of renewable energy, resumption of nuclear power plant operations), despite the increase in hydrofluorocarbon emissions.

This is also a decrease of 12.3% (170 Mt CO_2 eq.) compared to the FY2005 emissions (1,381 Mt CO_2 eq.), mainly due to the reduced energy consumption (owing to improved energy conservation etc.), despite the increase in hydrofluorocarbon emissions.

Access to relevant information

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

Agro-GHG Platform

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Institute of Atmospheric Physics, Chinese Academy of Science, China

Abstract

The Agro-GHG Platform (web site: agro-ghg.lapc.ac.cn) is a comprehensive accounting platform for quantifying the greenhouse gas emissions from agricultural enterprise / organization. The Platform can provide a quantification assessment for the GHG reduction technology or project implementation and provide technical support for agricultural emission reduction strategy.

Agro-GHG Platform has adopted the most advanced compiling methods of agricultural greenhouse gas inventory in China, which are including CH4MOD model for paddy methane emission (IPCC Tier3 recommended), regional nitrogen cycle model IAP-N (farmland part) for cropland nitrous oxide emission (IPCC Tier2) and soil carbon model Agro-C for farmland soil carbon change (IPCC Tier3), IPCC Tier2 method for methane emission from enteric, and IPCC method for methane and nitrous oxide emissions from manure management system.

The Agro-GHG Platform has been tried by 20 planting examples in North China, and 105 pig enterprises (about 582 thousand pigs) and 94 dairy enterprises (about 155.7 thousand dairies) covering 11 provinces and cities.

Access to relevant information

http://agro-ghg.lapc.ac.cn/

Challenges to Greenhouse Gas Inventory training for Thai and Southeast Asian countries under the COVID-19 Situation

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Thailand Greenhouse Gas Management Organization (Public Organization), Thailand

Abstract

Due to the COVID-19 pandemic since year 2020 to present Thailand Greenhouse Gas Management Organization (Public Organization) or TGO decided to implement our Greenhouse Gas Inventory (GHGI) training course in an online training format to prevent the spread and social distancing.

Year 2020 TGO/CITC and Japan International Cooperation Agency or JICA designed the online workshop for Regional Climate Change Online Training on "GHG Inventory Management" for Southeast Asian countries" We composed for three parts for this online training (1) Online lecture using recorded lecture videos (2) Live online consultation sessions and (3) Country presentation session. The training targets are practitioners from government agencies who have working experience in national GHG inventory management. The training was delivered online between 13-30 July 2020 by using the Microsoft team program, 49 training participants (Cambodia, Malaysia, Myanmar, Philippines, Singapore and Thailand). Most of them were from the UNFCCC focal point of each country, while participants including experts from private companies, universities and research institutes. Training participants from 5 countries (Cambodia, Malaysia, Myanmar, Philippines and Singapore) attended online consultation sessions.

Year 2021 at the beginning of the year, the situation in Thailand has improved, TGO cooperated with Office of Natural resources and environmental policy and planning (ONEP) and GIZ organized training sessions to the government agencies of Thailand on quality control for activity data and activity data factor collecting of national GHG inventory for energy sector between 1-2 April 2021, 28 training participants from energy government sector participated in this training program but when coming to 4th quarter of 2021 right now the COVID-19 situation has worsen and the number of infected people began to increase. TGO, ONEP and GIZ urgently needed to adjust the training plan in an online format to support the learning needs of relate government agency who need the knowledge gained from the training to use in collecting data and QA QC for GHGI. Recently, we have organized online training through Zoom application on workshop for quality control on activity data and activity data factor collecting of national GHG inventory for waste sector between 29-30 June 2021, more than 30 training participants from government who related for waste sector participated in this training program

Even though, The COVID-19 pandemic challenge is on the rise, TGO will continue to provide capacity building and knowledge on GHGI for all sectors to support Thailand to achieve our commitment to the Paris Agreement to combat climate change which poses greater threat than the COVID-19 pandemic.

Comparison of methane emissions estimated with inverse model using GOSAT and ground-based observations with national inventories.

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National Institute for Environmental Studies, Japan

Abstract

We report a comparison of national methane emission inventories with the flux estimates by a global high-resolution inverse model using satellite and surface observations of methane concentrations. Using the high-resolution inverse model NTFVAR (NIES-TM–FLEXPART-variational), we optimize CH_4 emissions using Greenhouse gas Observing Satellite (GOSAT) and surface observation data over the period 2011-2017 for the two main source categories of anthropogenic and natural emissions. As input fluxes to the model, we used the Emission Database for Global Atmospheric Research (EDGAR v4.3.2) for anthropogenic methane emission, scaled (as in Wang et al, 2019) to match the national emissions reported to the United Nations Framework Convention on Climate Change (UNFCCC). Wetland and soil sink fluxes were simulated using Vegetation Integrative Simulator of Trace gases (VISIT) model and biomass burning emissions by the Global Fire Assimilation System (GFAS). We estimate a mean (2011-2017) global total anthropogenic and natural methane emissions of 340.9 Tg CH_4 yr^{-1} and 232.5 Tg CH_4 yr^{-1}, respectively which are close to recent Global Carbon Project (GCP) estimates of 357 and 215 Tg CH_4 yr^{-1}, respectively. Large emitting countries such as China, Russia and the United States have mean estimated anthropogenic emission of 45.7±8.6, 31.9±7.8 and 29.8±7.8 Tg CH_4 yr^{-1}, respectively. For Asian countries with annual emission of 5 Tg yr^{-1} or above, we estimate 11.8±2.5 Tg for Indonesia, 7.4±1.0 Tg for Pakistan, 5.5±0.8 Tg for Iran, 5.2±1.7 Tg for Bangladesh and 5.0±1.0 Tg for Thailand. For emissions from natural sources, we estimate large emissions for Brazil (39.8±12.4 Tg CH_4 yr^{-1}), the United States (25.9±8.3 Tg CH_4 yr^{-1}), Russia (13.2±9.3 Tg CH_4 yr^{-1}), India (12.3±6.4 Tg CH_4 yr^{-1}), and Canada (12.2±5.1 Tg CH_4 yr^{-1}). In both natural and anthropogenic emission categories, our emission estimates for major emitting countries are matching national inventories within the uncertainty range of the inventories and the inverse model uncertainty (Janardanan et al, 2020). Additionally, we validate our anthropogenic emission estimates for India (24.2±5.3 Tg yr^{-1}) with aircraft observation data over urban regions over India. We simulated the vertical profiles of aircraft observations with the unadjusted fluxes (as input to the inverse model) and with the inverse model corrected fluxes. The simulation with the inverse model corrected fluxes was in better agreement with the observation than the simulation using unadjusted fluxes, especially in the boundary layer, confirming improved flux estimates by the inverse model for India.

References/ Publications

Janardanan, R.; Maksyutov, S.; Tsuruta, A.; Wang, F. et al. Country-Scale Analysis of Methane Emissions with a High-Resolution Inverse Model Using GOSAT and Surface Observations. **Remote Sens. 2020**, **12**, 375. doi:10.3390/rs12030375

Wang, F.; Maksyutov, S.; Tsuruta, A.; Janardanan, R. et al. Methane Emission Estimates by the Global High-Resolution Inverse Model Using National Inventories. **Remote Sens. 2019**, **11**, 2489. doi:10.3390/rs11212489.

4. Report on Mutual Learning Session

4 Report on the Mutual Learning Sessions

4.1 Overview of the Mutual Learning

The Mutual Learning 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 the Mutual Learning 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. The Mutual Learning is also expected to foster and strengthen a cooperative relationship among GHG inventory experts. Since the aim of the Mutual Learning is not criticism or audit, participants can conduct a two-way communication and follow-up through direct conversation.

The first Mutual Learning 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, the Mutual Learning has been held in the following WGIAs as a regular session since WGIA9 in 2011. Because of the global pandemic of coronavirus disease 2019 (COVID-19), this year (2021) and last year's Mutual Learning were held online.

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	**Mutual Learning 2020***[3]	Indonesia–Japan	Cambodia–Myanmar	-	China–Japan	Mongolia–Singapore	-
2021	**WGIA18**	Thailand–Japan	Brunei–Mongolia	-	-	Bhutan–Indonesia	China–Indonesia

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

Participants

In January 2021, the WGIA Secretariat advertised the Mutual Learning to the participants of WGIA and received applications from 10 groups from seven parties. Considering the participants' potential interest and knowledge, an appropriate balance among sectors, and the feasibility of implementation, the WGIA Secretariat set up four pairs (Thailand and Japan on the General sector, Brunei and Mongolia on the Energy sector, Bhutan and Indonesia on the LULUCF sector, and China and Indonesia on the Waste sector).

Preparation

A few months before WGIA18, the chosen participants for the Mutual Learning 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. Through 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 wrote such findings as comments and questions to their partner countries onto "Question and Answer Sheets". After that, the "Question and Answer Sheets" were exchanged with the partner countries through the Secretariat. The partner countries responded to these comments and questions before WGIA18 took place.

Table 4.1.2 Preparation Process of the Mutual Learning

Process	Schedule
Material submission	Late April to the middle of June 2021
Material exchange	End of April to the middle of June 2021
Studying the materials	May, June 2021
Comment exchange	June 2021
Answers to comments	Middle of June to early July 2021
Sessions	8th and 9th July 2021

Table 4.1.3 Submitted Materials for the Mutual Learning

Sector	Country	Inventory
General	Thailand	BUR3 in 2020
	Japan	NIR* in 2021
Energy	Brunei	NC2 in 2017
	Mongolia	BUR1 in 2017, NIR in 2017
LULUCF	Bhutan	NC3 in 2020
	Indonesia	NC3 in 2017, BUR2 in 2018
Waste	China	NC3 in 2019, BUR in 2019
	Indonesia	BUR2 in 2018

*National Inventory Report

Discussions

In the WGIA18, four Mutual Learning sessions were organized and implemented on July 8th (Energy and Waste) and 9th (General and LULUCF) 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, national system, 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 the inventories of the participant countries have been continuously improved by adopting the methodologies of the 2006 IPCC Guidelines. Closely studying the improvement of not only the methodology of the counterpart countries' inventories but also their national systems for data collection and QA/QC, participants found hints for improvements of their own inventories. To increase opportunities to learn from other countries' inventories, participants expressed their hope for the continuous implementation of the Mutual Learning programme in future WGIAs.

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

4.2 Cross-Cutting Issues

Sector Overview

Thailand and Japan participated in the Mutual Learning session on cross-cutting issues. The general information for the two countries is shown in Table 4.2.1 below.

Table 4.2.1 Sector Overview for the Mutual Learning on Cross-Cutting Issues

	Thailand	Japan
National total GHG emissions (kt CO_2 eq., with LULUCF)	263,223 (3 gases in 2016, BUR3)	1,161,417 (7 gases and indirect CO_2, in 2019, CRF2021)
Responsible agency for the inventory	Office of Natural Resources and Environmental Policy and Planning (ONEP)	Ministry of the Environment (MOEJ)
Methodological basis	2006 IPCC Guidelines	2006 IPCC Guidelines

Materials Used

The partner countries exchanged their documents relevant to cross-cutting issues through the Secretariat approximately four weeks before the session. The documents exchanged were as follows:

Thailand
- Thailand Third Biennial Update Report, 2020

Japan
- National Greenhouse Gas Inventory Report of JAPAN, 2021

Questions and Answers

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

Table 4.2.2 Classification of Questions and Comments in the Mutual Learning on Cross-Cutting Issues

Classification of questions	Number of questions/comments	
	from Japan to Thailand	from Thailand to Japan
National system	2	2
Inventory compilation processes	1	0
Data collection procedure	2	0
QA/QC	1	1
Others	1	3

Outcomes of the Mutual Learning Session

Through the Mutual Learning session, several issues and good practices in the participating countries' preparation of GHG inventories were identified.

➢Issues and Solutions / Outstanding issues

The following was identified as an issue:

1) The annual inventory cycle may be affected if methodology/GWP change is required, due to upgrades needed for the TGEIS. (Thailand)

➢Good Practices

The following were identified as good practices:

Thailand

1) QC is implemented from the initial stage to the final stage: 1) data collecting, data screening, and data transferring to TGEIS (which has QC functions for activity data and emission factors), 2) calculation of emissions/removals, 3) compilation of emissions/removals, 4) reviews of the methodology of the GHG emission estimation by the Working Groups on GHG Inventory.
2) There is an annual inventory compilation process in place (including the gathering of activity data, input to TGEIS, submission to the Working Groups on GHG Inventory) since 2017 with roles/responsibilities in the national system clearly defined.
3) Thailand's first Climate Change Act is now being drafted for approval by the cabinet.
4) Activity data collection templates that include QC functions are implemented for some sectors and are being developed for the remaining sectors.
5) The historical inventories are archived as a snapshot of each submission in an external server outside of TGEIS and are accessible at any time.

Japan

1) Japan has in place QC activities by relevant ministries and agencies, where they check whether their data are correctly applied to estimation files and NIR prepared by GIO.

Table 4.2.3 Participants in the Mutual Learning on Cross-Cutting Issues

Parties	Name	Organization
Thailand	Ms. Tippawan Photiwut	Office of Natural Resources and Environmental Policy and Planning (ONEP)
	Ms. Chanitsa Warachit	
	Mr. Suphat Phengphan	
Japan	Ms. Hatanaka Elsa (Facilitator)	GHG Inventory Office of Japan (GIO)
	Ms. Hirata Eriko (Facilitator)	
	Dr. Oda Takefumi (Secretariat)	
	Mr. Kosaka Naofumi (Secretariat)	
	Dr. Hayashi Toru (Workshop organizer)	Ministry of the Environment, Japan (MOEJ)
	Mr. Yamazaki Tomoya (Workshop organizer)	

4.3 Energy Sector

Sector Overview

Brunei and Mongolia participated in the Mutual Learning session on the Energy sector. The general information for the two countries is shown in Table 4.3.1 below.

Table 4.3.1 Sector Overview for the Mutual Learning on the Energy Sector

	Brunei	Mongolia
National total GHG emissions (kt CO_2 eq., with LULUCF)	8,352 (in 2014, NC2)	10,031 (in 2014, NIR)
GHG emissions of the Energy sector (kt CO_2 eq.)	11,192 (in 2014, NC2)	17,268 (in 2014, NIR)
Responsible agency for the inventory	Brunei Climate Change Secretariat	Climate Change Research and Cooperation Center (CCRCC)
Estimation methodology	2006 IPCC Guidelines, Tier 1&2	2006 IPCC Guidelines, Tier 1&2
Source of emission factors	IPCC default values and country-specific values	IPCC default values and country-specific values
Source of activity data	National statistics	National statistics

Materials Used

To prepare for the Mutual Learning session, the partner countries exchanged their materials relevant to the Energy sector through the Secretariat approximately a month before the workshop. The materials exchanged were as follows:

Brunei
- Brunei Darussalam's GHG inventory for 2010–2020 Excel sheets (summary from the IPCC inventory software)
- Brunei Darussalam's Second National Communication

Mongolia
- Mongolia's Initial Biennial Update Report, Mongolia's National Inventory Report – 2017
- Mongolia CRF 1990–2014

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.

Table 4.3.2 Classification of Questions and Comments in the Mutual Learning on the Energy Sector

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

Outcomes of the Mutual Learning Session

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

➢Issues and Solutions / Outstanding issues

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

1) It's necessary to establish institutional arrangements to collect activity data on a regular basis. (Both countries)
2) Completeness (fugitive (Brunei), venting and flaring (Mongolia))
3) Reliable Energy Balance Tables (EBT) are not available before 2010. (Brunei)
4) Reliable activity data of international aviation are not available. It's necessary to consider if it's appropriate to extrapolate current data over a decade. (Mongolia)
5) The difference between the reference approach (RA) and sectoral approach (SA) is larger than 5%. (Both countries)

➢Good Practices

The following were identified as good practices:

Brunei
1) The 2006 IPCC Guidelines are applied.
2) Time-series data are available from 2010.
3) A country-specific emission factor is used for sub-bituminous coal.

4) Fuel consumption of domestic transport is separated from international bunker fuels.
5) Domestic aviation is newly estimated.
6) Mandatory monthly and yearly reporting for all facilities that emit GHGs will be launched from 2022.

Mongolia
1) The 2006 IPCC Guidelines are applied.
2) NIR is prepared.
3) CRF is prepared.
4) Time-series data are available from 1990.
5) A country-specific emission factor was used for coal and is going to be updated.
6) The Article/Regulation for inventory preparation was issued in 2020.
7) EBT is going to be developed for the whole time series.
8) Since the previous participation of the Mutual Learning (2017), the following issues have been identified as high priority: collecting data on civil aviation, reducing the difference between RA and SA, estimating fugitive emissions from other than oil production, establishing EBT for whole time-series, disaggregating the fuel consumption of manufacturing industries.

➢Follow-up Activities

None.

➢Suggestions for Future Mutual Learning/WGIAs

Online meeting works well, although the internet connection is sometimes unstable.

Table 4.3.3 Participants in the Mutual Learning on the Energy Sector

Country	Name	Organization
Brunei	Ms. Atikah Ismail	Brunei Climate Change Secretariat
	Ms. Nabilah Pungut	
	Ms. Amal Ezzati Yussof	
Mongolia	Ms. Tegshjargal Bumtsend	Climate Change Research and Cooperation Center (CCRCC)
	Ms. Davsambuu Ulzii-Orshikh	
	Ms. Gerelmaa Shaariibuu	
Facilitators	Mr. Kosaka Naofumi (Facilitator)	GHG Inventory Office of Japan (GIO)
	Mr. Ito Hiroshi (Facilitator)	
	Ms. Hirata Eriko (Secretariat)	
	Dr. Hayashi Toru (Workshop organizer)	Ministry of the Environment, Japan (MOEJ)
	Mr. Miyata Kazuaki (Workshop organizer)	

4.5 LULUCF Sector

Sector Overview

Bhutan and Indonesia participated in the Mutual Learning session on the LULUCF sector. The general information for the two countries is shown in the Table below.

Table 4.5.1 Sector Overview for the Mutual Learning on the LULUCF Sector

	Bhutan	Indonesia
National total GHG emissions (kt CO_2 eq., with LULUCF)	-5,573 (in 2015, NC3)	1,457,774 (in 2016, BUR2)
GHG emissions in the LULUCF sector (kt CO_2 eq.)	-7,756 (in 2015, NC3)	752,138 (in 2016, BUR2)
Responsible agency for the inventory	National Environment Commission Secretariat (NECS)	Ministry of Environment and Forestry (MoEF)
Estimation methodology	2006 IPCC Guidelines and GPG, Tier 1/Tier 2	2006 IPCC Guidelines, Tier 1/Tier 2
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 surveys	National statistics (major sources), international statistics and official report

Materials Used

To prepare for the Mutual Learning session in WGIA18, 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:

Bhutan
- Third National Communication to the UNFCCC (NC3) (Final Draft Report)
- Bhutan's Proposed National Forest Reference Emission Level and National Forest Reference Level Submission for technical assessment to UNFCCC
- Excel files with estimation worksheets for the LULUCF sector

Indonesia
- Indonesia's Third National Communication (NC3), 2017
- Indonesia's Second Biennial Update Report (BUR2), 2018
- 1st Forest Reference Emission Level
- Summary of "Guidance to the Implementation and Reporting of National Greenhouse Gases Inventories", Director General of Climate Change Regulation No. 73/2017
- Summary of "Guidance of QA/QC of Greenhouse Gas Inventories", Director General of Climate Change Regulation No. 10/2018

Questions and Answers

After receiving the materials listed 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 4.5.2 Classification of Questions and Comments
in the Mutual Learning on the LULUCF Sector

Classification of questions	Number of questions/comments	
	from Indonesia to Bhutan	from Bhutan to Indonesia
National system	5	2
Inventory compilation processes	6	5
Data collection procedure	3	5
QA/QC	3	0
Others	5	0

Outcomes of the Mutual Learning Session

Through the Mutual Learning 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) Collecting data and information is still a challenge when compiling the GHG inventory.
2) Some categories and gases are not estimated.
3) Notation keys are not fully applied.
4) Misunderstanding of the counting of the cumulative area of land converted categories leads to crucial mistakes in estimation.
5) There is a lack of a national system and commitment from stakeholders for preparing the national GHG Inventory.
6) Limited technical capacity and lack of finance restrict the improvement of the AFOLU sector.

➢Good Practices

The following were identified as good practices:

Bhutan

1) The 2006 IPCC Guidelines are applied.
2) In accordance with the 2006 IPCC Guidelines, both the level and trend assessments are performed for the key category analysis.
3) Uncertainty analysis is conducted qualitatively.
4) A higher tier and country-specific emissions factors are applied in selected categories (i.e., forestland and forestland converted to other land use (deforestation)).
5) The same methodologies and data for forestland and deforestation are consistently used between the national GHG inventory report and forest reference emission level (FREL) & forest reference level (FRL) report.
6) Domestic land-use categories are allocated into six land-use categories in accordance with the IPCC classification.
7) Remeasurement for the National Forest Inventory (NFI) has just started.

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Indonesia

1) The 2006 IPCC Guidelines are applied.
2) IPCC (2014) Wetlands Supplement is applied.
3) Key category and uncertainty analysis are conducted quantitatively.
4) Time series estimations are applied and recalculation for time series is being conducted for the next submission.
5) There is a plan for improving emission factors for peatland and wetland.
6) Methodologies are consistently used between NC3 and BUR2.
7) Uncertainty analysis for land-use change is progressing.
8) Estimation of carbon stock change in mangrove forests is conducted as a part of forestland.
9) Actual areas of peat burning are determined monthly from the delineation of the burn scar area.

➢ **Follow-up Activities**

The following was identified as a follow-up activity:

1) Sharing the outcomes of the analysis for soil carbon pools discussed during the Mutual Learning meeting.

➢ **Suggestions for Future Mutual Learnings**

The participants suggested the following for future Mutual Learning:

1) More general issues, such as application of the 2019 Refinement, data archiving, and uncertainty analysis.

Table 4.5.3 Participants in the Mutual Learning on the LULUCF Sector

Parties	Name	Organization
Bhutan	Mr. Rinzin Namgay	National Environment Commission Secretariat (NECS)
	Mr. Dorji Wangdi	Department of Agriculture and Forest
Indonesia	Dr. Irawan Asaad	Ministry of Environment and Forestry (MoEF)
	MSc. Budi Harto	
	Dr. Wawan Gunawan	
	MSc. Endah Riana Oktavia	
	MSc. Heri Purnomo	
	MSc. Anna Tosiani	
Facilitators and Resource persons	Dr. Yanagawa Midori (Facilitator)	GHG Inventory Office of Japan (GIO)
	Ms. Hayashi Atsuko (Facilitator)	
	Mr. Ito Hiroshi (Secretariat)	
	Mr. Yoshinaga Hiromi (Secretariat)	
	Dr. Sato Atsushi (Resource person)	Global Environment Department, Mitsubishi UFJ Research and Consulting Co., Ltd.
	Mr. Gonda Yu (Workshop organizer)	Ministry of the Environment, Japan (MOEJ)
	Mr. Miyata Kazuaki (Workshop organizer)	

4.6 Waste Sector

Sector Overview

China and Indonesia participated in the Mutual Learning session on the Waste sector. The general information for the two countries is shown in Table 4.5.1 below.

Table 4.6.1 Sector Overview for the Mutual Learning on the Waste Sector

	China	Indonesia
National total GHG emissions (kt CO_2 eq., with LULUCF)	11,185,410 (6 gases, in 2014, NC3/ BUR2)	1,457,774 (3 gases, in 2016, BUR2)
GHG emissions of the Waste sector (kt CO_2 eq.)	194,768 (in 2014, NC3/ BUR2)	112,351 (in 2016, BUR2)
Responsible agency for the inventory	Ministry of Ecology and Environment of the People's Republic of China	Ministry of Environment and Forestry (MoEF)
Estimation methodology	1996 IPCC Guidelines/ GPG, Tier1/ Tier 2 and 2006 IPCC Guidelines, Tier 1	2006 IPCC Guidelines, Tier 1/ Tier 2
Source of emission factors	Country-specific emission factors and IPCC default values	Country-specific emission factors and IPCC default values
Source of activity data	National statistics (Yearbook of Urban Developments, Annual Report on Urban Environmental Statistics, China Statistics Yearbook) and other sources	National statistics (ADIPURA) and Data from the Ministry of Industry and (pulp and paper) association

Materials Used

To prepare for the Mutual Learning session in WGIA18, the partner countries exchanged their documents relevant to the GHG emission estimation of the Waste sector through the Secretariat more than two months before the session. The documents exchanged were as follows:

China
- The People's Republic of China Second Biennial Update Report on Climate Change, 2018
- The People's Republic of China Third National Communication on Climate Change, 2018
- "Summary of GHG Inventory Compilation (the Waste Sector)" [A revised version was also provided during the Mutual Learning session.]
- "Emissions Summary for China", GHG Profiles for Annex I Parties and Non-Annex I Parties - UNFCCC, 2021
- "The People's Republic of China First Biennial Update Report on Climate Change", 6th workshop of the facilitative sharing of views during the 49th Subsidiary Body for Implementation (SBI49), 2018
- "Research on the Methane Estimation and Its Emission Factor from Landfill in China", poster and abstract of WGIA15, 2017
- "Technical analysis of the second biennial update report of China submitted on 25 June 2019", FCCC/SBI/ICA/2019/TASR.2/CHN, 2020

Indonesia
- Indonesia Second Biennial Update Report, 2018
- First Nationally Determined Contribution, Republic of Indonesia, 2016
- Resume of GHGI MRV Regulation
- Report of Greenhouse Gas Inventory and Measurement, Reporting and Verification, 2019 (in Indonesian)
- "Online platforms related to GHG Inventory & National Registry System in Indonesia" [provided during the Mutual Learning session]

Questions and Answers

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

Table 4.6.2 Classification of Questions and Comments in the Mutual Learning on the Waste Sector

Classification of questions	Number of questions/comments	
	from Indonesia to China	from China to Indonesia
Acquisition of activity data	4	2
Adoption/development of emission factors/parameters	1	1
Estimation methods	1	5
Institutional arrangement	1	0

Note: For the topics including both aspects of activity data and emission factors, 0.5 as the number of questions/comments was allocated to each classification: "Acquisition of activity data" and "Adoption/-development of emission factors/parameters".

Outcomes of the Mutual Learning Session

Through the Mutual Learning 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 2006 IPCC guidelines will be fully applied to the Waste sector GHG inventory from the next inventory. (China)
2) The possibility of using proxy data should be explored for historical activity data estimation for medical/hazardous waste incineration. (Indonesia)
3) Improvement of estimation methods is ongoing to reflect emission reduction by mitigation action (power generation etc.). (Both countries)
4) It is difficult to acquire sludge data. (Both countries)
5) The waste incineration data included in the Energy sector need to be identified. (China)
6) The subnational-level data need to be further improved especially for the SWDS category, but also for general MSW. (Indonesia)

➢ **Good Practices**

The following were identified as good practices:

China

1) Historical data since 1956 for the category SWDS are precisely estimated by specifying the parameters for each of the five periods, based on survey data, literature, and expert judgement.
2) Statistical data, which meet the requirement of compiling GHG inventory, are available from 2000 onward from "China Urban Construction Statistics Yearbook".
3) Appropriate parameters based on investigation are adopted in GHG estimations for solid waste: country-specific k values, varying MCFs throughout the time series, and regional DOCs.
4) The waste incineration for power generation is facilitated by the introduction of "A Catalogue of Value-Added Tax (VAT) Concessions for the Comprehensive Utilization of Products and Services" (Cai Shui [2015] No. 78).

Indonesia

1) NIR which describes the detailed methodology of GHG estimation is already prepared.
2) Investigated parameters of MSW composition and their dry matter content for each waste type by region are adopted in GHG estimation.
3) Data related to industrial solid waste is collected through the cooperation of the Ministry of Industry and the Pulp and Paper Association.
4) A wide range of improvements is planned in estimation methodology and data acquisition.
5) Sector-specific key category analysis was carried out for the BUR2.
6) Bottom-up data collecting systems are developed concerning MSW (SIPSN), hazardous wastes (SIRAJA), national statistics (SIRuSa), and GHG emission estimates (SIGN SMART), as well as National Registry System (NRS).
7) Local emission factors are utilized for GHG estimation of composting of MSW.

➢ **Follow-up Activities**

The following was identified as a possible follow-up activity:

1) The experience of inventory improvements, which are currently planned, could be shared in future WGIAs/Mutual Learning.

➢ **Suggestions for Future Mutual Learnings**

The participants' suggestions for future Mutual Learning were as follows:

1) Share experience on establishing statistical data for the GHG inventory.
2) Further share experience on developing country-specific parameter values for solid waste disposal and wastewater treatment.
3) Filling the data gaps in the Waste sector, especially the category of waste incineration.
4) Need to further discuss the uncertainty assessment of the Waste sector.

Table 4.6.3 Participants in the Mutual Learning on the Waste Sector

Country	Name	Organization
China	Dr. Gao Qingxian	Chinese Research Academy of Environmental Sciences
	Dr. Ma Zhanyun	
	Mr. Li Yingxin	
Indonesia	Mr. Harry Wibowo	Directorate of Green House Gas Inventory and Monitoring Reporting and Verification, Ministry of Environment and Forestry
	Ms. Ratnasari Wargahadibrata	
	Mr. Allan Rosehan Yamani	
	Ms. Rully Dhora Carolyn Sirait	
	Mr. Prasetyadi Utomo	
	Dr. Syaiful Anwar	
	Dr. Febrian Hadinata	Sriwijaya University
	Ms. Vir Katrin	Directorate of Waste Management, Ministry of Environment and Forestry
	Mr. Eddy Nur Akmal	
Facilitators and Resource persons	Dr. Oda Takefumi (Facilitator)	GHG Inventory Office of Japan (GIO)
	Dr. Taki Wakana (Facilitator)	
	Ms. Hatanaka Elsa (Secretariat)	
	Mr. Ueda Hiroyuki (Resource person)	Mitsubishi UFJ Research and Consulting Co., Ltd.
	Mr. Kawanishi Satoshi (Resource person)	
	Mr. Oyama Seiya (Resource person)	
	Mr. Gonda Yu (Workshop organizer)	Ministry of the Environment (MOEJ)
	Mr. Yamazaki Tomoya (Workshop organizer)	

Annex I: Agenda

Annex I: Agenda

Period: 8th July – 14th July 2021
Venue: Online

JST: Japan Standard Time
ICT: Indochina Time

Day 1: Thursday, 8th July 2021		
PM 2:00-2:30 JST **(PM 12:00-12:30 Indonesia)** **(PM 1:00-1:30 Brunei, China, Mongolia)**	**Connection test**	
PM 2:30-6:00 JST **(PM 12:30-4:00 Indonesia)** **(PM 1:30-5:00 Brunei, China, Mongolia)**	**Mutual Learning**	
Sector	Energy	Waste
Combination of Participating Countries	**Brunei – Mongolia**	**China – Indonesia**
Note: These sessions are closed in order to secure the confidentiality of information, therefore only participating countries in each session, facilitators, resource persons, and the WGIA Secretariat are allowed to connect.		
Day 2: Friday, 9th July		
PM 2:30-3:00 JST **(AM 11:30-PM 12:00 Bhutan)** **(PM 12:30-1:00 Indonesia, Thailand)**	**Connection test**	
PM 3:00-6:30 JST **(PM 12:00-3:30 Bhutan)** **(PM 1:00-4:30 Indonesia, Thailand)**	**Mutual Learning**	
Sector	LULUCF	General
Combination of Participating Countries	**Bhutan – Indonesia**	**Thailand – Japan**
Note: These sessions are closed in order to secure the confidentiality of information, therefore only participating countries in each session, facilitators, resource persons, and the WGIA Secretariat are allowed to connect.		

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Day 3: Monday, 12th July		
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**	
3:00 – 3:05	Welcome Address	Mr. Sakaguchi Yoshiteru, Director of Decarbonized Society Promotion Office (MOEJ)
3:05 – 3:20	Introduction to the WGIA18	Mr. Ito Hiroshi (GIO)
3:20 – 3:30	Japan's Current Progress in Global Warming Countermeasures	Dr. Hayashi Toru, Decarbonized Society Promotion Office (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	Cambodia's first Biennial Update Report (fBUR)	Mr. Sokhim Pich (Cambodia)
3:55 – 4:10	Lao National Greenhouse Gas Inventories	Mr. BounEua Khamphilavanh (Laos)
4:10 – 4:30	**Questions and Answers**	**All**
4:30 – 4:45	*Break*	
4:45 – 5:00	Brief Introduction on The People's Republic of China Second Biennial Update Report on Climate Change (BUR2)	Dr. Gao Qingxian (China)
5:00 – 5:15	Malaysia's Third Biennial Update Report to the UNFCCC	Ms. Dayang Ratnasari Binti Abu Bakar (Malaysia)
5:15 – 5:30	National GHG Inventory Under Vietnam's BUR3	Ms. Nguyen Van Anh (Vietnam)
5:30 – 6:00	**Questions and Answers**	**All**

Day 4: Tuesday, 13th July		
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: Transition to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and Resources That Will Facilitate Compilation**	
	Chair: Prof. Rizaldi Boer (AB/ Bogor Agricultural University)	**Rapporteur: (GIO)**
3:00 – 3:15	Transition to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories in Thailand	Mr. Sivach Kaewcharoen (Thailand)
3:15 – 3:30	Transition to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories	Ms. Winnie Chia (Singapore)
3:30 – 3:45	Philippines: Experience Transitioning to 2006 IPCC GL	Ms. Sandee G. Recabar (Philippines)
3:45 – 4:15	**Questions and Answers, Discussion**	**All**
4:15 – 4:30	*Break*	
4:30 – 5:00	IPCC Inventory Software Agriculture, Forestry, and Other Land Use (AFOLU) sector	Dr. Baasansuren Jamsranjav (AB/ IPCC TFI)
5:00 – 5:15	FAOSTAT Emissions data: Agriculture and Forest Land, 1990–2019	Mr. Francesco N. Tubiello (FAO)
5:15 – 5:30	Estimation of GHG Emission/Absorption Using Satellite Data in Mongolia	Prof. Watanabe Masataka (Chuo University)
5:30 – 6:00	**Questions and Answers, Discussion**	**All**

Day 5: Wednesday, 14th July		
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: National GHG Inventory for the Transparency Framework Under the Paris Agreement**	
	Chair: Dr. Baasansuren Jamsranjav (AB/ IPCC TFI)	**Rapporteur: (GIO)**
3:00 – 3:25 JST (AM 8:00 – 8:25 CEST Bonn)	Requirements for National Inventory Reports as Part of the Biennial Transparency Report Under the Enhanced Transparency Framework of Paris Agreement	Mr. Dominique Revet (UNFCCC)
3:25 – 3:35	**Questions and Answers, Discussion**	**All**
3:35 – 3:55	Japan's Experience in Compiling and Reporting the National GHG Inventory	Mr. Kosaka Naofumi (GIO)
3:55 – 4:15 JST (AM 2:55 – 3:15 EDT Washington D.C.)	Addressing Time-series Consistency/Recalculations within the AFOLU Sector of the U.S. GHG Inventory	Mr. John Steller (USEPA)

Annex I

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**	GIO
4:45 – 5:00	***Break***	
Day 5: Wednesday, 14th July		
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 WGIA18	OC/AB members
5:30 – 6:00	Discussion on Topics for WGIA19	OC/AB members

Abbreviations:
AB: WGIA Advisory Board
AFOLU: Agriculture, Forestry, and Other Land Use
BUR: Biennial Update Report
CEST: Central European Summer Time
EDT: Eastern Daylight Time
FAO: Food and Agriculture Organization of the United Nations
GHG: Greenhouse Gas
GIO: Greenhouse Gas Inventory Office of Japan, NIES
GOSAT: Greenhouse Gases Observing Satellite
ICT: Indochina Time
IPCC: Intergovernmental Panel on Climate Change
IPCC TFI: IPCC, Task Force on National Greenhouse Gas Inventories
JST: Japan Standard Time
LULUCF: Land Use, Land-Use Change and Forestry
MOEJ: Ministry of the Environment, Japan
NC: National Communication
NIES: National Institute for Environmental Studies, Japan
OC: WGIA Organizing Committee
UNFCCC: United Nations Framework Convention on Climate Change
USEPA: 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		Agro-GHG Platform	Shenghui Han, Wen Zhang, Yongqiang Yu Institute of Atmospheric Physics, Chinese Academy of Science, China
P-3		Challenges of Greenhouse Gas Inventory training for Thailand and Southeast Asian Countries under the COVID-19 Situation	Nareerat Thanakasem, Thawatchai Saengkhamsuk Thailand Greenhouse Gas Management Organization (Public Organization), Thailand
P-4		Comparison of Methane Emissions Estimated with Inverse Model Using GOSAT and Ground-based Observations with National Inventories	Rajesh Janardanan, Shamil Maksyutov, Fenjuan Wang, Tsuneo Matsunaga Satellite Observation Center, Earth System Division, NIES

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. Others

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 Secretariat

Mr. Dorji WANGDI
Department of Forests and Park Services, Ministry of Agriculture and Forests

BRUNEI
Ms. Atikah ISMAIL
Brunei Climate Change Secretariat, Ministry of Development

Ms. Nabilah PUNGUT
Brunei Climate Change Secretariat, Ministry of Development

Ms. Amal Ezzati YUSSOF
Brunei Climate Change Secretariat, Ministry of Development

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Mr. Wawan GUNAWAN
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MSc. Anna TOSIANI
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