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Proceedings of the 17th Workshop on Greenhouse Gas Inventories in Asia (WGIA17)

- Capacity Building for Measurement, Reporting and Verification -

30th July - 2nd August 2019, Singapore

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

Center for Global Environmental Research

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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 5th Assessment Report published by the Intergovernmental Panel on Climate Change (IPCC) in 2013 stated that "the atmospheric concentrations of the greenhouse gases carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) have all increased since 1750 due to human activity." Moreover, many GHG observatories including Mauna Loa Observatory in Hawaii have detected that the yearly mean concentration of CO_2 surpassed 400 ppm since 2015. 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 to the United Nation Framework Convention on Climate Change agreed to hold the increase in the global average temperature to well below 2°C above pre-industrial levels under the Paris Agreement in COP21 in 2015.

"Measurement, Reporting and Verification", abbreviated as MRV, and 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 under the Paris Agreement Enhanced Transparency Framework.

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), NIES, has functioned as the Secretariat for this workshop since its first session.

This CGER report serves as the proceedings of the 17th WGIA, which was held from July 30th to August 2nd, 2019, in Singapore. 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 will contribute to the further progress of inventory development in Asia.

Nobuko Saigusa

三枝信子

Director
Center for Global Environmental Research
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Preface

An important lesson that we have learned from the history of the UNFCCC is the importance of "measurement, reporting and verification" (MRV) and transparency. This includes measuring the effects of emissions reduction initiatives; reporting the results of the measurements in the international arena; and verifying the status of reductions. MRV ensures the transparency and accuracy of reports on each country's mitigation actions.

For steady implementation of MRV and transparency, it is essential to develop national systems for preparation of national greenhouse gas (GHG) inventories and to improve the accuracy of the inventories. In the Paris Agreement, the importance of establishing an enhanced transparency framework in order to build mutual trust and confidence and to promote effective implementation, is stated. The purpose of the framework for transparency of actions 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 national inventory reports and information necessary to track progress made in implementing and achieving its NDC under the Paris Agreement 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.

WGIA has contributed significantly to the construction and consolidation of a network of officials 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 17th WGIA (WGIA17) was held from 30th July to 2nd August, 2019 in Singapore. The topics set out for this workshop were based on consideration of the current situation of the member countries, and we hope that this workshop contributes to the improvement of their inventories.

The outcomes of the WGIA17 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.

In conclusion, we would like to thank all the attendees for their participation and active contribution to the workshop.

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Global Environment Bureau
Ministry of the Environment, Japan

List of Acronyms and Abbreviations

AB	WGIA Advisory Board
AD	Activity Data
AFOLU	Agriculture, Forestry and Other Land Use
BR	Biennial Report
BUR	Biennial Update Report
CDM	Clean Development Mechanism
CGE	Consultative Group of Experts on National Communications from Parties not included in Annex I to the Convention
CGER	Center for Global Environmental Research
COP	Conference of the Parties
CS	Country-Specific
EF	Emission Factor
EFDB	IPCC Emission Factor Database
ETF	Enhanced Transparency Framework
FAO	Food and Agriculture Organization of the United Nations
FSV	Facilitative Sharing of Views
FY	Fiscal year
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIO	Greenhouse Gas Inventory Office of Japan
GPG	Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories
GPG-LULUCF	Good Practice Guidance for Land Use, Land-Use Change and Forestry
GWP	Global Warming Potential
IAR	International Assessment and Review
ICA	International Consultation and Analysis
IGES	Institute for Global Environmental Strategies, Japan
INC	Initial National Communication
INDC	Intended Nationally Determined Contribution
IP	Industrial Processes
IPCC	Intergovernmental Panel on Climate Change
IPCC AR4	IPCC Fourth Assessment Report
IPCC SAR	IPCC Second Assessment Report
IPCC TFI	IPCC, Task Force on National Greenhouse Gas Inventories
JCM	Joint Crediting Mechanism
JICA	Japan International Cooperation Agency
LUCF	Land-Use Change and Forestry
LULUCF	Land Use, Land-Use Change and Forestry
ML	Mutual Learning
MOEJ	The Ministry of the Environment, Japan
MRV	Measurement, Reporting and Verification Measurable, Reportable, and Verifiable
MPG	Modalities, procedures and guidelines
NAI	Non-Annex I

NAMA	Nationally Appropriate Mitigation Action
NC	National Communication
NDC	Nationally Determined Contribution
NIES	National Institute for Environmental Studies, Japan
NIR	National Inventory Report
PA	Paris Agreement
QA	Quality Assurance
QC	Quality Control
RAC	Refrigeration and Air Conditioning
REDD	Reducing Emissions from Deforestation and forest Degradation in developing countries
REDD+	Reducing Emissions from Deforestation and forest Degradation, and the Role of Conservation, Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks
SBI	Subsidiary Body for Implementation
SLCF	Short-Lived Climate Forcer
SNC	Second National Communication
TA	Technical Analysis
TACCC	Transparency, Accuracy, Completeness, Comparability and Consistency
TNC	Third National Communication
TTE	Team of Technical Experts
UNFCCC	United Nations Framework Convention on Climate Change
WGIA	Workshop on Greenhouse Gas Inventories in Asia
1996 IPCC GLs	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories
2006 IPCC GLs	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
HFCs	Hydrofluorocarbons
PFCs	Perfluorocarbons
SF_6	Sulfur hexafluoride
NF_3	Nitrogen trifluoride
NO_X	Sum of nitrogen oxide and nitrogen dioxide
CO	Carbon monoxide
NMVOCs	Non-methane volatile organic compounds
SO_X	Sulfur oxide
CFCs	Chlorofluorocarbons
HCFCs	Hydrochlorofluorocarbons
ODS	Ozone Depleting Substance
Gg	Giga gram (10^9 g)
Mt	Million tonnes

Photos of the Workshop

Welcome Address

Mr. Suresh K,
Resource Conservation Department, National Environment Agency, Singapore

Welcome Address

Mr. Taiki Mizushima, Low-Carbon Society Promotion Office, Global Environment Bureau, MOEJ

Chairpersons for the Plenary Sessions

Opening Session

Ms. Rohaya Saharom (Singapore)

Session I

Dr. Baasansuren Jamsranjav (IPCC TFI)

Session II

Mr. Takahiko Hiraishi (IGES)

Session III

Mr. Kiyoto Tanabe (IPCC TFI)

Session IV

Prof. Rizaldi Boer (Bogor Agricultural University)

Wrap-up Session

Prof. Yukihiro Nojiri (Manager of GIO, Japan)

Mutual Learning Sessions

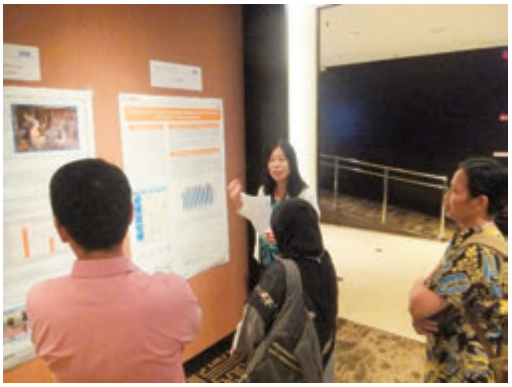
General:
Singapore - China

Energy sector:
Thailand - Japan

Agriculture sector:
Cambodia - Philippines

Discussions in the Plenary Sessions

Discussions in the Poster Session



Information Exchanges in Tea Breaks & Reception

1. Executive Summary of WGIA17

1 Executive Summary of WGIA17

The Ministry of the Environment of Japan (MOEJ) and the National Institute for Environmental Studies (NIES) convened, together with the National Environment Agency, Singapore (NEA), the "17th Workshop on Greenhouse Gas (GHG) Inventories in Asia (WGIA17)" from July 30 (Tuesday) to August 2 (Friday), 2019, in Singapore.

The annual workshops have been held since 2003 in order to support non-Annex I (NAI) Parties in Asia to develop and improve their GHG inventories and to facilitate the enhancement of cooperative relationships towards improvement of the accuracy of national GHG inventories in the Asian region. This year, in total, 89 participants attended WGIA17, including government officials and researchers from fourteen member countries (Brunei, Cambodia, China, Indonesia, Japan, Lao P.D.R., Malaysia, Mongolia, Myanmar, Philippines, Republic of Korea, Singapore, Thailand, and Vietnam), in addition to representatives of the IPCC Task Force on National Greenhouse Gas Inventories (IPCC TFI), the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC), Food and Agriculture Organization of the United Nations (FAO), and others.

Opening Session

MOEJ and NEA individually made welcome addresses. Japan made a presentation on Japan's achievements in the field of climate change. Japan succeeded in reducing greenhouse gas emissions for four consecutive years due to the progress of energy saving activities. Following this, the Greenhouse Gas Inventory Office of Japan (GIO) gave an overview of WGIA.

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

Malaysia, Vietnam, and Brunei gave presentations on their submitted National Communications (NCs) and/or Biennial Update Reports (BURs) and reported the most updated information on their emission amount, mitigation activities, and relevant data.

It is important to share the information/experience of preparation for NC/BUR in this workshop. Besides, it is important to utilize capacity building opportunities offered by UNFCCC and others, since acquisition of activity data and development of country specific emission factors remain a challenge.

Introduction to the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

IPCC TFI and authors of the 2019 Refinement gave overviews of the 2019 Refinement by sector, and changes introduced by it. Early use of the 2019 Refinement may help inventory compilation, for example through referring to the 2019 Refinement, in the context of using the 2006 IPCC GLs. However, more analysis may be needed at the technical level before the application of the 2019 Refinement.

Fluorinated Gas Emissions from non-Annex I Parties

GIO made a presentation on the F-gas-related requirements in the newly adopted Modalities, Procedures and Guidelines (MPGs) for the enhanced transparency framework, the Kigali Amendment, and the status of reporting by WGIA countries of fluorinated gases. Indonesia introduced their current methods of estimation of fluorinated gas emissions. USEPA explained the institutional arrangements for the U.S. inventory for fluorinated gases. IPCC TFI showed the estimation methodology for refrigeration and air conditioning (RAC) in the 2006 IPCC GLs and 2019 Refinement.

The reporting of HFCs, PFCs, SF_6, and NF_3 has become mandatory under the MPGs. The 2006 IPCC GLs provide the basic methodology for RAC, and together with the 2019 Refinement, would be useful to start estimating emissions for this sub-sector. With the Kigali Amendment entering into force, a closer collaboration between climate change and ozone experts is imperative.

1. Executive Summary of WGIA17

National GHG Inventory Data and Systems for the Transparency Framework Under the Paris Agreement

UNFCCC gave an overview of the enhanced transparency framework under the Paris Agreement and detailed explanations of the requirements related to inventories in the Biennial Transparency Reports (BTRs). Algeria showed their current policies on climate change and their latest national GHG inventory. Thailand shared "Thailand's Greenhouse Gas Emissions Inventory System (TGEIS)", and the Institute of Energy Economics, Japan, shared its experience of establishing Japan's energy balance table. Following this, FAO introduced its support program on the AFOLU sector for developing countries, and NIES also presented the benefits and availability of observational data.

WGIA countries should enhance their national systems to prepare inventories in the BTRs to meet the requirements, based on a clear understanding of the new requirements. To do that, available resources/capacity building opportunities should be known and utilized widely. Also, the participants recognized in the session that strengthening background statistics for inventories can significantly contribute to the improvement of GHG inventories.

Mutual Learning of each sector's GHG inventories

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 Q&A which had taken place before the Workshop. In this WGIA, the mutual learning was held on the following three GHG inventory sectors: General (F-gases-related matters between China and Singapore), Energy sector (Thailand and Japan), and Agriculture sector (Cambodia and the Philippines).

These countries partly applied the 2006 IPCC GLs, and continuously improved their own GHG inventories. 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 future improvement of their own inventories.

Poster Session

This was held to share information on institutional arrangements and latest research results, and deepen the discussion on specific issues. In one-to-one informal discussions, detailed information on latest research and international support was exchanged.

2. Workshop Report

2 Workshop Report

Please note that all presentation materials can be downloaded from the website of Greenhouse Gas Inventory Office of Japan (GIO):
http://www-gio.nies.go.jp/wgia/wg17/wg17index-e.html

2.1 Opening Session

The opening session was chaired by Ms. Rohaya Saharom (Singapore), and the rapporteur was Ms. Atsuko Hayashi (GIO).

The welcome address was delivered by Mr. Taiki Mizushima (MOEJ), followed by the welcome address delivered by Mr. Suresh K (Singapore).

Mr. Akira Yoshida (MOEJ) made a presentation on Japan's Achievement on Climate Change. He reported that Japan had succeeded in reducing greenhouse gas emissions for four consecutive years due to the progress of energy saving activities. Japan's greenhouse gas (GHG) emissions were 1,292 Mt CO_2-eq. in FY2017. In 2016, Japan set the Plan for Global Warming Countermeasures, which includes an emission reduction target to reduce GHG emissions by 26.0% below the FY2013 levels by FY2030; consistent with Japan's NDC, and will continue to make further efforts to achieve the 2030 target.

Mr. Hiroshi Ito (GIO) gave an overview of WGIAs. He introduced the historical progress of WGIA and its participants, agenda and expected outcomes. The expected outcomes of WGIA17 were:

- Capacity building of GHG inventory preparation of Asian countries,
- Enhancement of quality of GHG inventories for National Communications (NCs) and Biennial Update Reports (BURs), and future Biennial Transparency Reports (BTRs) submission,
- Enhancement of understanding of the 2019 Refinement to the 2006 IPCC GLs for National Greenhouse Gas Inventories
- Enhancement of understanding of Fluorinated gases emission estimation, and
- Improved national GHG inventory data, and the Enhanced Transparency Framework (ETF) under the Paris Agreement

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

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. Baasansuren Jamsranjav (IPCC TFI) and the rapporteur was Ms. Atsuko Hayashi (GIO).

Non-Annex I Parties shall, as per COP 16 and COP 17 decisions, submit national GHG inventories as a part of their BURs or NCs every two years. Under such circumstances, the WGIA member countries have submitted their BURs and/or NCs. In this session, Malaysia, Vietnam and Brunei gave presentations about their latest BUR and NCs.

Dr. Midori Yanagawa (GIO) made an introductory presentation of this session. She overviewed relevant articles of the Convention for NCs, BUR and ICA of the BURs. She also showed the submission status of NCs and BURs in Asian countries in recent years.

Dr. Elizabeth MP. Philip (Malaysia) gave a presentation on Malaysia's 2nd BUR. She explained that the 2006 IPCC GLs were used to estimate the emissions and removals, and clarity and transparency were enhanced through the use of GHG inventory tables, sectoral and background tables,

and disaggregation of aviation emissions. She also explained that completeness was also enhanced as new categories were included for estimation in several sectors (IPPU, AFOLU and Waste sector). Furthermore, she showed mitigation actions and their effects in Malaysia's BUR. Finally, she pointed out that collection of activity data (AD) and use of country-specific emission factors (CSEFs) remain a challenge.

Ms. Ngoc Thi Bich Tran (Vietnam) gave a presentation on Brief Summary of Vietnam's BUR2. She explained that the 1996 IPCC GLs were mainly used to estimate the emissions and removals, and both IPCC default values and CS values were used for EFs, and AD was mostly from national statistics. She also explained that net GHG emissions from Vietnam had been 259.0 Mt CO_2-eq. (with LULUCF) in 2013. Furthermore, she showed that BUR3 was under preparation and will be completed in 2020.

Mr. Muhammad Nabih Fakhri Matussin (Brunei) gave a presentation on Brunei Darussalam's Second NCs. He explained that the Tier 1 methods of the 2006 IPCC GLs and IPCC default EFs, together with AD from national statistics were used to estimate the emissions and removals. He also explained that the Energy sector was the predominant sector with 11 Mt-CO_2-eq. emissions in 2014, and half of it came from Energy Industries. Furthermore, he showed the mitigation measures in his country's inventory on Energy, AFOLU and Waste sectors.

In the discussions, it was recognized that correct and common interpretation of GLs was crucial for the preparation and continuous improvement of national GHG inventory. When applying higher tier methodologies to estimate the emissions and removals, collecting new AD is a big challenge. Some countries (e.g. Malaysia) have difficulties in calculating uncertainty. Utilizing the 2019 Refinement may be helpful because volume 1 of the 2019 Refinement provides a tool (Excel spreadsheet) for the implementation of Approach 1 for calculating uncertainty. Finally, Dr. Baasansuren Jamsranjav commented that if there were CS data for estimating emissions and removals, they could be submitted to the IPCC EFDB and utilized.

In this session, the following conclusions were shared with the participants. First, the information/experience sharing in this session is important because it helps WGIA member countries improve their capacities to meet the reporting requirements under the UNFCCC and plan for the future. Second, acquisition of AD and development of CSEFs remain a challenge. Third, it is important to utilize capacity building opportunities offered by UNFCCC and other organizations. Finally, a smooth transitioning to the enhanced transparency framework is important. Enhancing data collection, human resources and capacity, and coordination among relevant institutions, is essential.

2.3 Session II: Introduction to the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

This session was chaired by Mr. Takahiko Hiraishi (IGES) and the rapporteur was Ms. Atsuko Hayashi (GIO).

A new Methodology Report titled the 2019 Refinement to the 2006 IPCC GLs for National Greenhouse Gas Inventories (hereafter "the 2019 Refinement") was just adopted/accepted by the IPCC in May 2019 in Kyoto. This session was held in order to give an overview of the 2019 Refinement, which comprises an Overview Chapter and five volumes. The authors from each volume and representatives of IPCC were invited to cover every volume of the 2019 Refinement.

The first speaker, Mr. Kiyoto Tanabe (IPCC TFI; CGE), started off the session with a presentation about the general overview of the 2019 Refinement. He first explained about the history of published guidelines and the need for refinements to the present guidelines. Then, he introduced the Overview Chapter and Volume 1 of "General Guidance and Reporting". He stressed that the 2019 Refinement provides an updated and sound scientific basis for supporting the preparation and continuous improvement of national greenhouse gas inventories and he also showed the types of refinement in

order to give us a clear understanding of the relationship with the 2006 IPCC GLs. He also mentioned that the structure of the 2019 Refinement was the same as that of the 2006 IPCC GLs so as to make it easier for inventory compilers to use the 2019 Refinement with the 2006 IPCC GLs.

Following the presentation, the chair, Mr. Hiraishi (IGES), posed a question about any future plans for integration with the previously-published IPCC guidelines, since the 2019 Refinement is not a stand-alone guideline. Mr. Tanabe (IPCC TFI; CGE) said that it might be helpful if it was integrated, however, IPCC TFI was not able to go beyond the decision by IPCC. He also mentioned that Chapter 6 of Volume 1 presented new guidance on the use and reporting of models, however, Volume 4 should be used together when dealing with models in the LULUCF sector.

Prof. Songli Zhu (LA; Energy Research Institute, NDRC) gave an overview of the Energy sector (Volume 2). She explained that the refinements were only made on fugitive emission categories (1.B.), which were explained by systems; i.e. Coal system, Oil and Gas system and Fuel transformation. She explained each refinement by refinement type.

Ms. Deborah Ottinger (CLA; USEPA) also gave an overview of the IPPU sector (Volume 3). The refinements in the sector were related to 1) new sources, 2) new emission mechanisms, 3) evolution in technologies, 4) new F-GHGs, and 5) the need for clarification. Refinements especially for the production of fluorochemicals, aluminum, rare earths, and electronics were explained in detail.

Dr. Sirintornthep Towprayoon (CLA; AB; King Mongkut's Univ. of Technology Thonburi) also introduced the 2019 Refinement on the Waste sector (Volume 5). She explained that the Refinements were mainly corresponding to the updates in waste generation and waste composition, and improvements on estimation methodologies of waste water treatment. She also illustrated where and how to start by explaining that such points as the following were important: 1) being familiar with "Mapping tables", 2) understanding the type of refinement and 3) following the road map in related sections, tables, figures and boxes in the 2019 Refinement.

Dr. Baasansuren Jamsranjav (AB; IPCC TFI) made an overview of the 2019 Refinement for the AFOLU sector (Volume 4). Major refinements, including updated, elaborated, and new guidance, as well as new and updated default data, were introduced. The refinements were made in all chapters except Chapter 9 (Other Land).

Dr. Baasansuren Jamsranjav (AB; IPCC TFI) also made a presentation on behalf of Dr. Sumana Bhattacharya (LA; AB; IORA Ecological Solutions). She introduced the refinements related to CH_4 emissions from Rice Cultivation. The methodological refinement for this source additionally provides baseline emission factors (EFs) of methane at the global scale with new default values at the regional scale. It also provides scaling factors for water regimes before and during the cultivation periods along with default conversion factors for different types of organic amendments.

Following the presentations, there was a discussion over when and how the 2019 Refinement should be used. Mr. Tanabe said that it is up to the Party when and how to use it, however, early use of the 2019 Refinement may help inventory compilation, such as through referring to the 2019 Refinement, in the context of using the 2006 IPCC GLs.

Prof. Rizaldi Boer (AB/ Bogor Agricultural University) asked how to separate emissions from anthropogenic causes and those from natural causes, with an example of the case that "managed land" being abandoned for a number of years was affected by fire. Dr. Jamsranjav (AB; IPCC TFI) explained that the managed land proxy (MLP) was retained in the 2019 Refinement, with an option/voluntary approach newly added for the disaggregation of total MLP emissions/removals into those that were associated with human effects, and those due to natural disturbances in Chapter 2 of Volume 4.

As a conclusion, it was acknowledged that more analysis of the implication of, and potential benefits by, the use of the 2019 Refinement may be needed at the technical level.

2.4 Session III: Fluorinated Gas Emissions from non-Annex I Parties

This session was chaired by Mr. Kiyoto Tanabe (IPCC TFI), and the rapporteur was Ms. Atsuko Hayashi (GIO).

The session focused on F-gas-related requirements in the new requirements under the Modalities, Procedures and Guidelines (MPGs) for the enhanced transparency framework for action and support of the Paris Agreement, challenges/good practices in reporting/institutional arrangements, and estimation methodology for the largest gap in estimation - refrigerant and air conditioning. A wide range of national officials/experts gave presentations and participants exchanged views on how to estimate and report F-gas emissions.

Ms. Elsa Hatanaka (GIO) made a presentation on the status of reporting by WGIA countries of fluorinated gases under the UNFCCC. Although the reporting of F-gases such as HFCs, PFCs, SF_6, and NF_3 was not mandatory for Non-Annex I (NAI) countries, roughly half of the WGIA countries are reporting such gases. Under the newly adopted MPGs for the enhanced transparency framework, reporting F-gases has become mandatory, but with room to apply the flexibility clause if capacity is lacking. She noted that preparation is needed to report, with the first BTR to be submitted by the end of 2024.

Ms. Ratnasari (Indonesia) gave an overview of the F-gas Inventory in Indonesia. They are currently reporting PFCs from aluminium production. Efforts have been made to try to identify AD for stationary and mobile air conditioning. Other planned improvements are to identify other sources of F-gases, such as SF_6 from electrical equipment.

Ms. Deborah Ottinger (USEPA) gave a presentation on the institutional arrangements for the U.S. fluorinated GHG inventory. The U.S. F-gas inventory data sources include facility-level reporting, national statistics, and input from trade associations, and models are used to develop estimates for many fluorinated GHG categories. EPA takes the lead and coordinates inventory compilation, with the support of a technical team of EPA experts and consultants.

Mr. Kiyoto Tanabe (IPCC TFI) explained the estimation methodology for refrigerants and air conditioning (RAC) in the 2006 IPCC GLs and 2019 Refinement. He noted that the 2006 IPCC GLs provide a Tier 1 calculation tool based on net consumption of gases, a Tier 2 EF approach, and a Tier 2 mass balance approach for RACs. The 2019 Refinement does not change the methodology, but provides new information to help start estimation.

Following the above presentations, some comments were given and questions were raised. Ms. Deborah Ottinger (USEPA) sought clarification from Ms. Ratnasari on whether or not SF_6 could occur from a certain source in Indonesia. Mr. Kiyoto Tanabe (IPCC TFI) expressed that it would be appreciated if new sources were detected or research results were found, this information was shared with IPCC TFI and others.

In relation to a question raised by Mr. Takahiko Hiraishi (IGES) on recovery/disposal of substances, Ms. Deborah Ottinger (USEPA) stressed the importance of checking whether import/supply data matched up with the demand in the model. In response to a question from Ms. Winnie Chia (Singapore) about how to use default EFs for RACs in the 2006 IPCC GLs, she advised that if the default EF value has a range, it is good to choose the value reflecting the real practice, such as whether or not mandatory programs to control HFCs, etc. exist in that country. She also clarified to Ms. Chia that The US Vintaging Model for RACs was generally similar to the IPCC Tier 2a approach in that the Model considered the age-class of the products.

The participants acknowledged that under the newly adopted MPGs for the enhanced transparency framework of the Paris Agreement, the reporting of HFCs, PFCs, SF_6, and NF_3 have become mandatory, but with room to apply the flexibility clause if capacity was lacking. They concluded that the 2006

IPCC GLs provided the basic methodology for RACs, and together with the 2019 Refinement, would be useful to start estimating for this sub-sector. They also concluded that a close collaboration with offices dealing with Ozone Depleting Substances would be useful, in light of the fact that the Kigali Amendment to the Montreal Protocol would be controlling HFCs as well. These offices may have easier access to data providers of/information on ODS substitutes, and GHG inventory compilers should make efforts so to have good understanding of Montreal Protocol reporting activities to elaborate on such cooperation.

2.5 Session IV: National GHG Inventory Data and Systems for the Transparency Framework Under the Paris Agreement

This session was chaired by Prof. Rizaldi Boer (AB) and the rapporteur was Ms. Atsuko Hayashi (GIO).

Decision 18/CMA.1 that was adopted at COP24 last year requires the submission of BTR from 2024 for all countries under the ETF of the Paris Agreement. In the BTR, each party shall provide not only the national GHG inventory but also information to track progress in implementing and achieving its NDC under the Paris Agreement. With stronger transparency requirements put into place in the decision, WGIA countries need to further improve their compilation capacity and national systems. Under such circumstances, this session covered information sharing and discussion about the development of inventory data and systems for BTRs of WGIA countries.

First, Dr. Takefumi Oda (GIO) made a brief presentation to introduce the topics taken up in the agenda.

Mr. William Agyemang-Bonsu (UNFCCC) gave an overview of the ETF under the Paris Agreement and detailed explanations of the requirements related to inventories in BTRs. Through Decision 18/CMA.1, the MPGs for the transparency framework for action and support under the Paris Agreement were adopted. It is applicable to all Parties, but with some flexibilities.

Mr. Mohamed Sidi Moussa (Algeria) shared information on Algeria's current policies in fighting climate change and Algeria's latest national GHG inventory in the second national communication. Algeria is working to gradually integrate environmental dimensions into its development process, for example, through mitigating GHG emissions. In 2000, total emissions amounted to 117 Mt CO_2-eq, with the Energy sector being the largest sector (74%) followed by AFOLU, Waste, and IPPU sectors.

Mr. Sivach Kaewcharoen (Thailand) shared information on the development and function of "Thailand's Greenhouse Gas Emissions Inventory System (TGEIS)" to meet the requirements under the ETF under the Paris Agreement. Thailand is currently establishing the TGEIS, a 2006 IPCC GL-based system to enable data input to archiving. It is expected to be fully implemented by 2020.

Dr. Ryo Eto (IEEJ) shared experience of establishing Japan's energy balance table, the range of its objectives, methodology, procedures and referenced data. The energy balance table has been revised and improved in response to the constant change of domestic and international circumstances. The table has contributed to important policy decisions including actions to contribute to the ETF.

Dr. Mirella Salvatore (FAO) introduced FAO's support program on the AFOLU sector for developing countries. FAO has developed Capacity-building Initiative for Transparency (CBIT) projects in the AFOLU sector in order to enhance developing countries' technical and institutional capacity to meet the requirements under the ETF.

Dr. Shamil Maksyutov (NIES) introduced the benefit and availability of observational data to improve the participant countries' inventories under the ETF. The guidance in 2019 Refinement to the 2006 IPCC Guidelines for National GHG Inventories describes key components and steps that are applied when using atmospheric measurements and inverse models for comparison with inventory

emission estimates as part of inventory quality assurance and quality control procedures.

Through Q&As about the presentations, the following issues in preparation of BTRs were discussed.

Regarding the presentation from Mr. William Agyemang-Bonsu, it was identified that NIR and Adaptation Communication can be components of BTR to streamline the preparation work of these reports. Also, since there is a fair amount of work to be done to prepare for the first BTR, discussions were focused on when, how and by whom the support for BTR preparation can be provided.

Regarding the presentation from Mr. Sivach Kaewcharoen, it was revealed that there is a challenge in data collection from private sectors in Thailand, made evident from the insufficient response rate of questionnaires. To improve such circumstances, Thailand expects more responses in the future through the recent revision of the climate change law.

Regarding the presentation from Dr. Ryo Eto, it was noted that data from the demand side of the energy balance table was generally harder to collect. Also, it was mentioned that capacity-building on energy statistics was provided through International Energy Forum (IEF) and the partners of IEF such as Asia Pacific Economic Cooperation (APEC).

Regarding the presentation from Dr. Mirella Salvatore, it was pointed out that there was a difficulty to reflect mitigation effects of AFOLU to inventories due to differences between inventory and mitigation agencies in their understanding of the importance of data.

In this session, the following conclusions were made: the WGIA countries should respectively enhance their national systems to prepare inventories in BTRs to meet the requirements, based on a clear understanding of the new requirements under the ETF. To do that, available resources/capacity building opportunities should be known and utilized widely. Also, the participants recognized in the session that strengthening background statistics for inventories can significantly contribute to the improvement of GHG inventories.

2.6 Wrap-up Session

This session was chaired by Prof. Yukihiro Nojiri (GIO). In this session, the rapporteurs from the Mutual Learning sessions and plenary sessions provided summaries of the discussions including findings and conclusions, which were followed by the final discussion to conclude the workshop.

Summary of the Mutual Learning (ML)

Mr. Hiromi Yoshinaga (GIO) presented the summaries of discussions from the Mutual Leaning (ML) sessions held in this workshop after providing an overview and explaining the objective of the ML programme.

After his report, Prof. Yukihiro Nojiri, the chair of this session, asked a representative of each participant country in the ML to make a comment. Many of them expressed their appreciation. They remarked that they were impressed by the differences in their counterparts' inventory systems from those of their own and expressed interest in trying to incorporate the good points into their own inventory system. A representative commented that he hoped to continue to participate in ML.

It was suggested that a continuous discussion by the same countries' combination on future ML might also be helpful to encourage the improvement of their inventories through checking the progress with each other. Generally, it was concluded that the ML should be continued.

Summary of the Plenary Sessions

Ms. Atsuko Hayashi (GIO), the rapporteur of the Plenary Sessions, reported a summary of the presentations, discussions and conclusions of Session I through Session IV.

Following her report, Prof. Yukihiro Nojiri stated that there were many things that compilers have to do in the near future, such as fully applying the 2006 IPCC GLs, preparing for BTRs, and, if adopted,

preparing for using the 2019 Refinement. Above all, a difficulty of preparing time-series data was acknowledged by the participants. In addition, Mr. Kamal Uy (Cambodia) showed his concern about using the IPCC Inventory Software. He said that it was not easy to complete entering all the required information/data in the software, and he also said that the default EF tended to be very high and was not always suitable for the situation of the country. Furthermore, he raised a question about how to create time series data with the software. In response to his concerns and question, Dr. Baasansuren Jamsranjav (IPCC TFI) explained that the IPCC software had various functions, and it was possible to select EFs from pull-down lists. She also explained that time-series data could be imported in an Excel format. In addition, she explained that the IPCC software covered all sectors, and supported Tier 2 methodologies for some sectors. Moreover, information was shared regarding annual IPCC expert meetings and some UNFCCC regional workshops. The IPCC meetings provide opportunities for experts to experience and give feedback on the software and the EFDB.

Closing Remarks

The closing remarks were delivered by Ms. Rohaya Saharom (Singapore) and Prof. Yukihiro Nojiri. They thanked all for their active participation. They wished for the continuity of this workshop and development of good networking within the countries.

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

Japan's Achievement on Climate Change

Taiki MIZUSHIMA, Akira YOSHIDA
Ministry of the Environment, Japan

Abstract

Japan succeeded in reducing GHG emissions in the last four years due to the progress of energy saving activities and improvement of CO_2 emission intensity of electricity. Japan's total emissions in FY2017 were 1,292 megaton carbon dioxide equivalent, a 8.4% decrease compared to FY2013; and a 6.5% decrease compared to FY2005. In recent years, while GDP has been growing, GHG emissions have been decreasing, meaning a decoupling trend.

Japan is committed to achieve following emission reduction targets.
By FY2020: 3.8% or more emission reduction compared to FY2005
By FY2030: 26.0% (25.4%) reduction compared to FY2013 (FY2005) (Japan's NDC)

In 2016, Japan formulated "Plan for Global Warming Countermeasures" that defines a path to achieve a mid-term reduction target, consistent with Japan's NDC, and identifies policies and measures to be implemented. The plan has six basic concepts such as "Integrated improvements of the environment, economy and society" and "Importance of PDCA cycle," etc.

With regard to Long-term low GHG emission development strategy, Japan submitted the strategy to UNFCCC on 26th June. Japan proclaims a "decarbonized society" as the ultimate goal and aims to accomplish it ambitiously as early as possible in the second half of this century, while boldly taking measures towards the reduction of GHG emissions by 80% by 2050. Also, there are basic principles of policy such as "Realizing 'a virtuous cycle of environment and growth'" and "Action Towards a bright Society with Hope for the Future." It is extremely big challenge to realize a "decarbonized society" in the world. Japan will make its best efforts to tackle the challenge based on the strategy.

References/ Publications

1. National Greenhouse Gas Inventory Report of Japan (April 2019)
2. Third Biennial Report (December 2017)
3. Overview of the Plan for Global Warming Countermeasures (May 2016)
4. Outlines of Japan's Long-term Strategy under the Paris Agreement (June 2019)

Access to relevant information

1. https://unfccc.int/documents/194844
2. https://unfccc.int/sites/default/files/resource/9087615_Japan-BR3-3-BR3-JPN-E.pdf
3. http://www.env.go.jp/press/files/en/676.pdf
4. http://www.env.go.jp/en/earth/cc/npa/outlines_of_japanese_long-term_strategy_under_the_paris_agreement_190611.pdf

3. Abstract

Overview of WGIA 17

Hiroshi Ito
Greenhouse Gas Inventory Office of Japan, National Institute for Environmental Studies, 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 participating countries are 15 countries (Brunei, Cambodia, China, India, Indonesia, Japan, Republic of Korea, Lao P.D.R., Malaysia, Mongolia, Myanmar, Philippines, Singapore, Thailand and Vietnam). So far, WGIA achieved to strengthen a network of regional government officials and experts and to make website and proceedings.

The upcoming 17th Workshop on GHG Inventories in Asia (WGIA17) is to be held 30 July- 2 August 2019 in Singapore. The WGIA17 aims:

1) To enhance sector-specific capacity for inventory compilation,
2) To share the information of national GHG inventory for NCs and BURs,
3) To enhance the understanding of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
4) To enhance the understandings of Methodology of F-gas emissions estimation, and
5) To improve national GHG inventory data and to enhance the Transparency Framework under the Paris Agreement.

Approximately 90 participants are expected to be present in this 17th 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)), and others.

Access to relevant information

http://www-gio.nies.go.jp/wgia/wgiaindex-e.html

3.2 Session I

Malaysia's Second BUR: What's New?

Elizabeth Philip[1] and Dayang Ratnasari Abu Bakar[2]
[1]*Forest Research Institute Malaysia*
[2]*Ministry of Energy, Science, Technology, Environment and Climate Change*

Abstract

Malaysia submitted it second Biennial Update Report (BUR2) in 2018. The BUR is a summary of the 3rd National Communication and consists of four chapters and one technical annex. The technical annexes are related to additional information on greenhouse gas inventory. The Report covers an update on the National Circumstance, Greenhouse Gas Inventory, mitigation actions and their effects, level of support, constraints, gaps and needs.

The information provided includes anthropogenic emissions and removals of greenhouse gases for the 2014 with a time series from 1990-2014. Policies relating to emissions reduction and their effects are reported.

The IPCC 2006 Guidelines for Greenhouse Gas Inventories were used to estimate the anthropogenic emissions and removals. Efforts have been taken to compile a more complete and accurate GHG inventory in this report. One of the improvements is the inclusion of estimates of precursor gases (NOX, CO, NMVOCs and SO_2) for the 2014 GHG inventory. The estimate has enabled indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH3 to be estimated.

Improvements in energy sector included disaggregation of activity data for each category. This has enabled the difference between the sectoral and reference approach estimates of CO_2 to be below 5%. Disaggregation of the emissions from civil aviation was also undertaken.

For the IPPU sector, new categories namely the electronics industry and glass production were included in the estimation. For AFOLU, emissions from liming in agriculture and emissions from cropland converted to settlement were included from 1995 onwards. For the waste sector, biological treatment of solid waste, incineration and open burning of waste were estimated. Emissions from industrial wastewater treatment from petroleum refineries and pulp and paper were included in the BUR2.

Malaysia provided Summary table for GHG Inventory, sectoral and sectoral background tables, cross-sectoral tables for indirect emissions of N_2O and trends of gases. Tables were also provided for level and trend assessment of GHG inventory for 2014 and its uncertainty analysis.

Malaysia also provided information on mitigation actions and their effects, assumptions, methodology and progress in a tabular format. Constrains and gaps, needs and financial, technical and technological support needed were also presented in a tabular format.

Activity data and use of country specific emission factors remains a challenge besides capacity need.

3. Abstract

Brief summary of Viet Nam's BUR2

Tran Thi Bich Ngoc, Ly Viet Hung
Department of Climate Change, Ministry of Natural Resources and Environment of Viet Nam.

Abstract

In pursuance of Decision No.2/CP.17 dated March 15th, 2012 of the 17th Conference of the Parties to the UNFCCC, Ministry of Natural Resources and Environment, the National Focal Point of the Government of Viet Nam to implement the UNFCCC, Kyoto Protocol and Paris Agreement as well as the Standing Office of the National Climate Change Committee, in coordination with the line ministries and agencies has developed the Second Biennial Updated Report of Viet Nam (BUR2) to submit to the UNFCCC with sponsorship from such international organizations as GEF and UNEP.

Vietnam submitted BUR2 in November 2017 to UNFCCC with base year 2013 for National Greenhouse Gases (GHG) Inventory. Main contents of Viet Nam's BUR2 included 05 Chapters: National Circumstances, National Greenhouse Gas Inventory, Mitigation Actions, Measurement, Reporting and Verification System, Needs for Finance, Technology, Capacity Building and Support Received and annexes.

The institutional arrangement for implementing the 2013 National GHG inventory in accordance with the National GHG Inventory System is provided in Decision No. 2359/QD-TTg dated December 22nd, 2015 by the Prime Minister. Viet Nam has highlighted its initial establishment of a greenhouse gas inventory system as well as a BUR construction system in the report. In 2013, the total GHG emission in Viet Nam was 259.0 Mt CO_2e with LULUCF sector and 293.3 $MtCO_2e$ without LULUCF sector. The GHG emission in Energy sector is 151.4 $MtCO_2eq$, Industrial processes sector is 31.8 $MtCO_2e$, Agriculture sector is 89.4 $MtCO_2e$, Waste sector is 20.7 $MtCO_2e$, GHG removals in LULUCF sector is 34.2 $MtCO_2e$.

Based on the estimated emission of 2013, Vietnam has proposed mitigation action and effects such as Cross-sectoral mitigation actions and Mitigation actions by sectors. The report also presented obstacles and barriers on Timely and sustainable funding, Familiarity with reporting requirements, Data collection and verification, Human resources and capacity, Coordination among relevant institutions.

The development of the BUR2 was successful to contribute Viet Nam's efforts as a developing Party to the UNFCCC as well as represent our determination and active actions to respond to climate change. The report also shows our contributions to implementing the Paris Agreement, joining the international community to fulfill the ultimate goals of the UNFCCC and the Paris Agreement that aim at keeping global average temperature rise at the end of this century to below 2°C above pre-industrial levels.

References/ Publications

1. MONRE, The Second Biennial Updated Report of Viet Nam to the United Nations Framework Convention on Climate Change, 2017.
2. MONRE, The 2013 National Greenhouse Gases Inventory Report, 2017.

Brunei Darussalam's Second National Communications

Muhammad Nabih Fakhri Matussin
Brunei National Energy Research Institute (BNERI), Brunei Darussalam

Muhammad Herman bin Abdullah Sebi
Ministry of Transport and Infocommunications, Brunei Darussalam

Abstract

Brunei Darussalam's Second National Communications was submitted in 2017. This comprises the national inventory of GHG for the year 2014 and measures representing policy and actions that contribute to reduction of GHG and address climate change impact during this period. GHG emissions were estimated using the 2006 IPCC Guidelines for National GHG Inventories. Emission estimates were based on the sectoral and reference approaches and were made using the default conversion and emission factors provided for in the 2006 IPCC Guidelines. The Tier 1 methodology was used for emission estimates.

In 2014, Brunei Darussalam's gross GHG emissions (excluding Forestry) totalled 11.19 million tonnes CO_2e. Inclusive of Forestry which contributed to about 2.84 million tonnes CO_2e, net emissions were approximately 8.35 million tonnes CO_2e. Energy sector was the most dominant source of emissions, accounting for about 10.98 million tonnes CO_2e. Within the Energy sector, energy industries (electricity generation) was the most significant (5.35 million tonnes CO_2e), followed by fugitive emissions from oil and gas activities (3.79 million tonnes CO_2e), transport (1.38 million tonnes CO_2e), manufacturing industries and construction (0.38 million tonnes CO_2e), and residential sector (0.09 million tonnes CO_2e). Waste sector emitted about 0.152 million tonnes CO_2e, which was mainly from solid waste disposal sites. IPPU emitted 0.029 million tonnes CO_2e, and Agriculture and Land Use produced 0.026 million tonnes CO_2e.

Given Brunei Darussalam's vulnerability to climate change impacts, the government has developed and implemented plans and actions to build and enhance resilience and adaptation to the adverse impacts of unusual and extreme weather and climate events. These include developing Strategic National Action Plan for Disaster Risk Reduction 2012-2025 (SNAP), putting emphasis on coastal and flood protection in terms of structural and non-structural infrastructure measures, safeguarding forestry and biodiversity, and protection of water resources.

References

Brunei Darussalam's Second National Communications, 2017.

3.3 Session II

Overview Chapter and General Guidance and Reporting Volume Overview

Kiyoto Tanabe
Co-Chair, IPCC Task Force on National Greenhouse Gas Inventories

Abstract

A new Methodology Report titled the *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories* (*2019 Refinement*) was adopted/accepted by the IPCC in May 2019. It refines the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (*2006 IPCC Guidelines*) to provide an updated and sound scientific basis for supporting the preparation and continuous improvement of national greenhouse gas inventories. The *2019 Refinement* does not revise the *2006 IPCC Guidelines*, but updates, supplements and/or elaborates the *2006 IPCC Guidelines* where gaps or out-of-date science have been identified. It does not replace the *2006 IPCC Guidelines*, but should be used in conjunction with the *2006 IPCC Guidelines*.

The so-called "Katowice Climate Package" which was adopted by the UNFCCC COP24/CMA1 in December 2018 to operationalize the Paris Agreement stipulates in the decision 18/CMA.1: "*Each Party shall use the 2006 IPCC Guidelines, and shall use any subsequent version or refinement of the IPCC guidelines agreed upon by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement.*" The *2019 Refinement* may be considered by the Parties to the UNFCCC/Paris Agreement in this context.

The *2019 Refinement* consists of 5 volumes. The Volume 1 is about general guidance and reporting. It contains new guidance on implementation of a national inventory management system (Chapter 1); new guidance on activity data collection, development of country-specific emission factors and integration of greenhouse gas emissions reported from facilities into national inventories (Chapter 2); updated guidance on uncertainty assessment with more default values, calculation examples and best practices (Chapter 3); updated guidance on key category analysis to address treatment of disaggregation of categories and simplification of the equation to calculate trend assessment (Chapter 4); updated guidance on how to ensure time series consistency (Chapter 5); new guidance on use and reporting of models and updated guidance on comparisons with atmospheric measurements (Chapter 6); updated methodological guidance on indirect CO_2 inputs to the atmosphere from emissions of carbon-containing compounds (Chapter 7); and updated guidance on reporting (Chapter 8).

References/ Publications

IPCC 2019, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. (Advance version subject to final copyedit and layout is available on the website shown below.)

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.

Access to relevant information

https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html
https://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html
https://unfccc.int/documents/193408

Overview on Energy Volume in 2019 Refinement

Songli ZHU
Energy Research Institute, National Development and Reform Commission, China

Abstract

All methodological updates made in the 2019 Refinement are in the **fugitive emissions categories**. No methodological updates were made for stationary combustion, mobile combustion, or other sources other than fugitives.

Fugitive CH_4 and CO_2 emissions from mining, processing, storage and transportation of coal: The 2019 Refinement includes guidance on fugitive CO_2 emissions from underground and surface mines including CO_2 from methane utilization or flaring from underground coal mines. The 2019 Refinement adds year-specific default input values for fugitive CH_4 emissions from abandoned underground mines for 2017 through 2050 (previously the series of default values ended at 2016).

Fugitive emissions from oil and natural gas systems: The 2019 Refinement includes updates to emission factors to reflect the range of technologies and practices in use, including for unconventional oil and gas exploration. Additional detail on the appropriate selection of factors considering technologies and practices in place is provided. The 2019 Refinement includes methods and emission factors for abandoned wells. An annex provides guidance on converting activity data inputs to the standard conditions applicable to the emission factors presented. Another annex provides data that allow compilers to disaggregate factors into venting, leak, and flaring sources. As terminologies for technologies and practices can vary, an annex is provided with definitions for key terms.

Fugitive emissions from fuel transformation: The 2019 Refinement includes a new section on fugitive emissions from fuel transformation, including methods for fugitive emissions from charcoal production, bio-char production, coke production (including flaring), gasification transformation processes (coal to liquids, and gas to liquids), and methods in Appendix (biomass to liquids, biomass to gas, and wood pellet production). These have been appropriately cross-referenced with Volume 3 (IPPU) and Volume 4 (AFOLU).

Basis for future methodology development: since lack of sufficient scientific knowledge, a section on a basis for future methodological development is presented in the Appendix for fugitive emissions from abandoned surface mines and from coal exploration, and fugitive emissions from fuel transformation, i.e. wood pellet production, biomass to liquid and biomass to gas.

Disagreements on the IPCC-49 which adopted and accepted the 2019 Refinements: some parties were unhappy by "inconsistency in the treatment of oil and gas exploration and coal exploration". They argued that since the section of coal exploration locates in the Appendix, the section for oil and gas exploration should be in the appendix as well, which was opposed by other parties and expert team. In the end, the documents were approved and accepted by using the Principle 10 (b) of the Principles Governing IPCC Work.

References/ Publications

1. IPCC TFI. Overview of 2019 Refinement to the 2006 IPCC guidelines for national greenhouse gas inventories. https://www.ipcc.ch/site/assets/uploads/2019/06/19R_V0_01_Overview_advance.pdf
2. Energy Volume of 2019 refinement. https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/19R_V2_advance.zip
3. IPCC. Principles governing IPCC work. 2018. https://www.ipcc.ch/site/assets/uploads/2018/09/ipcc-principles.pdf
4. IPCC. "Decision IPCC-XLIX-9: Adoption and Acceptance of the Methodology Report "2019 Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories". 2019. https://www.ipcc.ch/site/assets/uploads/2019/05/IPCC-49_decisions_adopted.pdf
5. ENB. "Summary of the 49th Session of the Intergovernmental Panel on Climate Change (IPCC-49): 8-12 May 2019". http://enb.iisd.org/climate/ipcc49/

3. Abstract

An Overview of the Industrial Processes and Product Use Volume of the 2019 Refinement to the 2006 IPCC Guidelines

Deborah (Debbie) Ottinger
Climate Change Division, U.S. EPA, United States

Abstract

At the 49th Session of the IPCC in May 2019, the IPCC adopted and accepted the *2019 Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories,* following a two-and-a-half-year effort by the Task Force on National Greenhouse Gas Inventories (TFI) to prepare the guidance. The *2019 Refinement* includes updates or new guidance for nine industrial processes. These reflect the recognition of new source categories and emissions mechanisms, technological changes that have altered emission rates for existing source categories, and improved understanding of emission rates for existing source categories. This presentation will provide an overview of the updates included in the Industrial Processes and Product Use Volume of the *2019 Refinement*. Both the reasons for the updates and the most important features of the updates will be discussed. Special emphasis will be given to the updated guidance for production of fluorochemicals, aluminium, rare earths, and electronics.

References/ Publications

2019 Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories

Access to relevant information

https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/

2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Waste Sector Overview

Sirintornthep Towprayoon
King Mongkut's University of Technology Thonburi, Thailand

Abstract

Volume 5 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories devoted to waste sector. There are 4 chapters that are refined including Chapter 2- Waste generation, composition and management data, Chapter 3 -Solid waste disposal, Chapter 5 - Incineration and open burning of waste and Chapter 6 -Waste water treatment and discharge. The types of refinements in this volume are 'update' and 'new guidance'.

In Chapter 2, key refinements are the update of waste generation and waste composition in the year 2010 by country and regional level according to UN classification. These two parameters are key parameter used in FOD model and can change over time. Parties can construct proper 10 years' historical time series by using Table 2A.1 (updated) with the information in the year 2000 from 2006 IPCC guideline and year 2010 from 2019 Refinement. The updated waste composition by country and regional level are presented with the additional components of garden waste and nappies in Table 2A.2(New). Clarification of Definition of sludge and estimation of degradable organic carbon (DOC) values include default values of carbon nitrogen content and DOC of domestic and industrial sludge are provided.

Chapter 3 focuses on new categories of SWDS including semi-aerobic (managed poorly) and active aeration (well managed and poorly managed) with provision of their MCF values. Default data on fraction of DOC_f by types of waste are updated. This allow parties to choose DOCf that fit with country waste types. This Chapter also provides guidance on estimation of DOC lost with leachate from SWDS.

In Chapter 5, new technology on thermal treatment of MSW including pyrolysis, gasification and plasma are defined to increase understanding of thermal treatment. Their default emission factor of CH4 and N2O, to the current knowledge, are presented. In addition, default value of oxidation factor in percent of carbon input of MSW open burning is updated

Chapter 6 provides guidance and definition of wastewater treatment system including introduction of new and improved default values and emission factors with association of GHG emission mechanism from wastewater treatment (including sludge treatment that occurs within the WWTP). This Chapter updates N2O emissions from domestic wastewater including centralized treatment plants and industrial wastewater.

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
2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

3. Abstract

2019 Refinement to the 2006 IPCC Guidelines: Volume 4 (AFOLU) Overview

Baasansuren Jamsranjav
Senior Programme Officer, Technical Support Unit for the IPCC Task Force on National Greenhouse Gas Inventories

Abstract

Volume 4 of the *2019 Refinement* provides guidance for preparing national greenhouse gas inventories in the Agriculture, Forestry and Other Land Use (AFOLU) sector that have to be applied in conjunction with the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. The refinements are made in all chapters of the volume except chapter 9 (*Other Land*).

Major refinements include updated and elaborated guidance (e.g., application of Tier 3 methods; developing consistent time series for forest land), new guidance (e.g., estimation of the change in carbon (C) stock of mineral soils associated with biochar amendment (Tiers 2 and 3); estimation of the change in soil organic carbon (SOC) stock in cropland (additional Tier 2); estimation of CH_4 emissions for flooded land) and new and updated default data (e.g., for biomass and soil; emission factors and parameters for enteric fermentation, manure management, direct and indirect N_2O emissions from soil).

The presentation will provide more details on the refinements made in the Volume 4.

References/ Publications

IPCC 2019, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. (Advance version subject to final copyedit and layout is available on the website shown below.)

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.

Access to relevant information

Access to relevant information
https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html
https://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html
https://unfccc.int/documents/193408

3.4 Session III

The Status of Reporting of Fluorinated Gases in Asia: Emissions, Methods, and Gaps

Elsa Hatanaka
Greenhouse Gas Inventory Office of Japan, National Institute for Environmental Studies, Japan

Abstract

Under the newly adopted Modalities, Procedures and Guidelines (MPGs) (Annex to 18/CMA.1) for the enhanced transparency framework of the Paris Agreement, the reporting of HFCs, PFCs, SF_6, and NF_3 have become mandatory, but with room to apply the flexibility clause if capacity is lacking. Preparation is needed to report, with the first Biennial Transparency Report (BTR) to be submitted by the end of 2024.

Another backdrop to keep in mind is the fact that the Kigali Amendment to the Montreal Protocol, adopted in October of 2016, will be controlling HFCs as well, through the phase down of production and consumption. With this, three groups of countries now have different phase-down schedules set out for HFCs. Although the reporting of F-gases such as HFCs, PFCs, SF_6, and NF_3 are currently not mandatory for UNFCCC Non-Annex I countries, the F-gas emissions are expected to keep rising, and dealing with these gases is becoming increasingly important.

Roughly half of WGIA countries are currently reporting such F-gases. The attempt to do so by each country is similar across the gases. Of those, some at least partially cover a time-series of data - more so for PFCs, followed by HFCs and SF_6, and further behind, NF_3. This may be due to PFCs occurring from a limited number of sources, making it easier to acquire data for estimation.

Regarding estimation methodology, where available, reports indicated HFC methodology to be more based on *2006 IPCC Guidelines* than the *Revised 1996 IPCC Guidelines/GPG*. This was similar for both PFCs and SF_6. For NF_3, the sole country that reported emissions chose to use the *2006 IPCC Guidelines* methodology. However, we would need to be mindful that the sample size of WGIA countries reporting F-gases is not large.

Here, the emissions for HFCs, PFCs, SF_6, and NF_3 for WGIA countries were also compiled, and several observations were made. It was noted that there were isolated peaks in emissions for certain years when reporting took place. It was also noted that the size of emissions were quite different between the gases, with HFCs being over and above the largest, with PFC emissions and SF_6 emissions following behind. NF_3 was far more smaller than the above-mentioned gases. It was also noted that it is difficult to evaluate consistency across years within one country's reporting when there was no time-series data.

However, it was observed that comparison between HFC/PFC/SF_6/NF_3 emissions within one country, during one reporting, and comparison across countries for the same inventory year might be useful. It was also noted that comparison with other estimates (e.g. Global Emissions EDGAR) might also be useful, while bearing in mind that various assumptions are made to prepare the estimates. It was also noted that although other sources of estimates have uncertainties, reported emissions also seem unstable at times, as observed in some recalculations made from previous submissions.

Indonesia, as a Non-Annex I Party to the United Nations Framework Convention on Climate Change

(UNFCCC), has fulfilled one of its commitments to implement the Convention by presenting its First National Communication in 1999, Second National Communication (SNC) in 2010, First Biennial Update Report in 2016, and Third National Communication (TNC) in 2017. Following Decision 2/CP.17, Indonesia has submitted its second Biennial Update Report (second BUR) in 2018. One of information provided is National GHG Inventory which presented the information on greenhouse gas emissions and trends between 2000 and 2016.

Indonesia has estimated some sources of F-gases, namely CF_4 and C_2F_6, which released in the process of aluminium production. The other sources of F-gases are subject to be estimated in the next periods of reporting, including the biggest sources of F-gases, i.e. refrigeration and air conditioning. Also, the F-gases used in products will be estimate for improvement.

The most challenging issue for preparing the other sources of F-gases is the availability of activity data needed to estimate the GHG emissions from product uses as substitutes for Ozone Depleting Substances (ODS). All ODS used in Indonesia is imported. The import ODS has been identified, however it could not be distinguished either the ODS used in the new products or substituted the old ones.

Some efforts have been established to address the challenge, i.e. by identifying the activity data for Refrigeration and Air Conditioning in the new products. There is possibility to collect the data based on the survey established by DG of Renewable Energy (Ministry of Energy and Natural Resources) to estimate the uses of F-gases in stationary AC. Furthermore, for mobile AC, there is also opportunity to collect the data since all mobile AC service centers has been certified and registered.

Other improvement for the future is to identify the other sources of F-gases, i.e. SF_6 for electricity transformer (category of 2G1b in Inventory GLs 2006), SF_6 used in sport shoes, and SF_6 used in foam blowing, fire protection, aerosol propellant, and others.

Overview of F-Gases Inventory in Indonesia

Directorate General of Climate Change
Ministry of Environment and Forestry, Indonesia

Abstract

Indonesia, as a Non-Annex I Party to the United Nations Framework Convention on Climate Change (UNFCCC), has fulfilled one of its commitments to implement the Convention by presenting its First National Communication in 1999, Second National Communication (SNC) in 2010, First Biennial Up-Date Report in 2016, and Third National Communication (TNC) in 2017. Following Decision 2/CP.17, Indonesia has submitted its second Biennial Update Report (second BUR) in 2018. One of information provided is National GHG Inventory which presented the information on greenhouse gas emissions and trends between 2000 and 2016.

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3. Abstract

Institutional Arrangements for the U.S. Inventory of Fluorinated GHGs

Deborah (Debbie) Ottinger
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Abstract

In the US, fluorinated GHG emissions are tracked from 11 source categories. This includes six source categories where fluorinated GHGs are emitted due to their use as substitutes for ozone-depleting substances (ODSs): refrigeration and air conditioning, foam blowing agents, fire suppression, aerosols, sterilants, and cleaning solvents. It also includes five other industrial source categories where fluorinated GHGs are emitted either as by-products or due to their use in manufacturing: production of aluminium, electronics, HCFC-22, and magnesium, and production and use of electric transmission and distribution equipment. Data sources for these estimates include facility-level reporting, national statistics, and input from trade associations, among other sources, and models are used to develop estimates for many fluorinated GHG source categories. This presentation will provide an overview of the US institutional arrangements for developing the US inventory of emissions of fluorinated GHGs, focusing on the wide variety of data sources and data gathering arrangements used, the logistics of model maintenance, estimate development, and report compilation, and the history of these efforts.

References/ Publications

Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017

Access to relevant information

https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2017

Estimation Methodology for RACs in the 2006 IPCC Guidelines and 2019 Refinement

Kiyoto Tanabe
Co-Chair, IPCC Task Force on National Greenhouse Gas Inventories

Abstract

Refrigeration and air-conditioning (RAC) is one of the major application areas of fluorinated substitutes for ozone-depleting substances (ODS substitutes). It may be classified into 6 sub-application domains or categories, namely: (i) Domestic refrigeration; (ii) Commercial refrigeration; (iii) Industrial processes including chillers, cold storage, etc; (iv) Transport refrigeration; (v) Stationary air conditioning; and (vi) Mobile air-conditioning systems.

Estimation of F-gas emissions from RAC is generally challenging for inventory compilers since it is more complicated as compared to that for many other sources of greenhouse gases. This is particularly because of the considerable time lag between consumption and emission of refrigerant, or in other words, because of the necessity to take account of the "bank".

The *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (*2006 IPCC Guidelines*) provide the following three methods to estimate emissions from RAC (Chapter 7 in Volume 3).

- Tier 1: Use of spreadsheet calculation tool
- Tier 2a: Emission factor approach
- Tier 2b: Mass balance approach

If RAC is a *key category*, either Tier 2a or 2b should be used. Moreover, even if RAC is not a *key category*, inventory compilers may conclude Tier 2 provides more value with little extra work as compared to Tier 1.

The *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories* (*2019 Refinement*) include refinements of Chapter 7 in Volume 3 of the *2006 IPCC Guidelines*. In the 2019 Refinement, the methodological framework (e.g., equations to estimate emissions) remains unchanged from the *2006 IPCC Guidelines*, but more helpful "cook-book" style guidance has been added so that inventory compilers can implement Tier 1 or Tier 2a methods in a few simple steps. The *2019 Refinement* also provides updated data/information including updated default emissions factors for Tier 2a method.

References/ Publications

IPCC 2019, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. (Advance version subject to final copyedit and layout is available on the website shown below.)

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.

Access to relevant information

https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html
https://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

3.5 Session IV

Requirements for national inventory report as part of the biennial transparency report under the enhanced transparency framework of Paris Agreement

William Kojo Agyemang-Bonsu
United Nations Climate Change Secretariat, Bonn, Germany

Abstract

The Paris Agreement adopt by Parties to the United Nations Framework Convention on Climate in Paris in November 2015 and entered into force in record time of one year, is acclaimed by many, as a momentous multilateral agreement. The largest part of the rule book for the Paris Agreement which lays out the modalities, procedures and guidelines for implementation of the agreement was formally completed and adopted in December 2018. This presentation looks at the current and ongoing measurement, reporting and verification arrangements under the Climate Change Convention vis-à-vis the transparency framework under the Paris Agreement, drawing on the parallelism between them, and with particular focus on the requirements for national inventory report – a component of the biennial transparency report under the enhanced transparency framework of the Paris Agreement.

References/ Publications

None

Access to relevant information

None

NATIONAL GREENHOUSE GASES INVENTORY IN ALGERIA

SIDI MOUSSA Mohamed
Engineer within National Waste Agency, Algeria

Abstract

To give a global and representative overview of the inventories of greenhouse gases in Algeria, our presentation will be communicated as follows: an overview on Algeria, an overview on the national waste agency and the climate change department, national communications of Algeria, inventories of greenhouse gases, climate change policy.

Algeria is a country of North Africa and the Mediterranean which covers an area of 2,381,741km^2, it is at the same time the largest country of Africa, the Arab world and the Mediterranean basin. Like the countries of its region, Algeria is particularly affected by desertification and land degradation, from which the Sahara accounts for 80% of the total area. The areas of the territory receiving more than 400 mm of rain per year are limited to a band of up to 150 km deep from the coast. In addition, due to climate change, rainfall has fallen by over 30% in recent decades, in addition to recording the highest temperatures on the planet.

With a population of about 43 million (2018), 85% of this population is concentrated in the northern part of the country, making them more vulnerable to the hazards of climate change.

National Waste Agency (AND) is a state company under the supervision of the Ministry of the Environment and Renewable Energies, created in 2002, its mission is the promotion of integrated waste management, the agency also has a climate change department.

North Africa is one of the regions most impacted by climate change. Given this fact, Algeria is working to gradually integrate the environmental dimension into its development process.

In this context, Algeria has:
- Signed the UNFCCC as a Party not included in Annex 1 in 1993,
- Ratified the Kyoto Protocol in 2004,
- Submission of the Second National Communication 25 November 2010,
- Signed and ratified the Paris Climate Agreement (April and October 2016).

Because of its extreme vulnerability to climate change from both a natural and economic point of view, Algeria has decided to base this strategy on two main pillars:
• Guarantee the country's sustainable development;
• Mitigation of GHG emissions.

This national strategy is divided into several major sectorial programs, namely:
• Creation of the National Agency for Climate Change (ANCC),
• Sector Policy Program for Integrated Water Resources Management,
• National Energy Control Program (PNME),
• National Integrated Municipal Waste Management Program (PROGDEM),
• Creation of the National Waste Agency (AND),
• National Plan of Action to Combat Desertification (PAN-LCD),
• Renewable Energy and Energy Efficiency Program.

3. Abstract

Thailand Greenhouse Gas Emission Inventory System

Sivach Kaewcharoen
Office of Natural Resources and Environmental Policy and Planning, Thailand

Abstract

With support of the Australian Government, Thailand is currently establishing the Thailand Greenhouse Gas Emissions Inventory System (TGEIS), a software-based system to enable data input and estimation from the five sectors. Lead agencies from the five different sectors will compile the activity data and check the quality of the data before submitting it to ONEP. ONEP will enter the data into the system (TGEIS) which will calculate the GHG emissions. ONEP will be in charge of managing and maintaining the TGEIS which is expected to be fully implemented in 2020. This IT system will support the preparation of future GHG inventories. However, templates and guidelines for data collection from the line agencies within the five sectors are still lacking as well as guidelines for the lead agencies to assess the quality of collected data.

Thailand's climate change efforts are led by the National Committee on Climate Change Policy (NCCC), which was established by the Government in 2006 and is chaired by the Prime Minister. The NCCC is responsible for national climate change policy and strategy, determination of national positions in international negotiations under the UNFCCC as well the monitoring and evaluation of the implementation of policies and strategies by government agencies. The NCCC comprises of representatives from 12 ministries, as well as other governmental agencies such as the Bureau of Budget as well as a group of nine experts. Work in the NCCC is conducted through its four sub-committees on 1. Climate Change Policy and Planning Integration, 2. Climate Change Knowledge and Database 3. Climate Change Negotiation and International Cooperation and 4. Action for Climate Empowerment and Public Relations. Under the Subcommittee Climate Change Knowledge and Database, five sectoral working groups were set up to review the GHG inventory and provide recommendations on which Measurement, Reporting, and Verification (MRV) systems are suitable for the country. The Office of Natural Resource and Environmental Policy and Planning (ONEP), under the Ministry of Natural Resources and Environment (MoNRE), serves as secretariat to this subcommittee.

Currently, standardized templates for data collection only exist for the lead agencies of the different sectors but not for the multiple line agencies below them. In each of the sectors, more than ten agencies are involved in the data collection; in the Energy sector even 20 different agencies are involved.

Consistent and comparable GHG emission data are preconditions for a robust and transparent GHG inventory and will, through common quality requirements, also enable further improvements in data quality over time. As of now, agency is using different formats for the collection of activity data which burdens the sectoral lead agencies and most importantly ONEP, as coordinating agency, to harmonize the data and compile the overall GHG inventory to input data for estimation by the Thailand Greenhouse Gas Inventory System (TGEIS).

The Energy Balance Table of Japan

Ryo Eto
The Institute of Energy Economics, Japan, Japan

Abstract

The energy balance table of Japan is used in various ways such as monitoring the energy market, energy security analysis, planning for sustainable development, mitigation of environmental impact of energy, analysis of economic opportunities from new technologies, energy planning and policy formulation, reporting Japan's energy supply and demand to IEA, reporting Japan's energy-related CO_2 emissions to UN, and ensuring transparency framework in the Paris Agreement.

The energy balance table of Japan is built from an energy statistics table and conversion factors by Ministry of Economy, Trade and Industry and The Institute of Energy Economics, Japan (IEEJ). The energy statistics table is a compilation of energy supply and demand data which were mostly based on national statistics. Sources of primary information on supply are customs, energy importers and exporters; and companies involved in the transformation sector such as oil refineries and power plants. Sources of information on demand are survey and sales data collected from energy companies. A conversion factor table is used so that all energy sources are comparable in a uniform energy unit. CO_2 emissions can be calculated multiplying emission factors of each fuel to the energy balance table. The conversion factors and emission factors are reviewed and surveyed once per five years in Japan mainly from energy producers and consumers.

The energy balance table is reviewed and checked in three ways. First, the relation between supply and demand is checked. Total primary energy supply cannot be less than total final energy consumption and statistical difference cannot be larger than acceptable amount. Second, transformation efficiency should be technically acceptable values. Third, the energy balance table should be checked with time series and compared with previous year's balance. Normally, a reasonable change rate is expected and if there is any huge change, underlying reasons should be determined.

With the constant change of domestic and international circumstances, the efforts have been made to revise and improve the energy balance table of Japan. Primary data has been revised and as energy situation in Japan has been changing. Also, the requirements from the users and international organization has changed. As a result, the energy balance table has contributed to important energy and environment policy decisions including actions to contribute the transparency framework in the Paris Agreement.

Access to relevant information

The Energy Balance Table of Japan
https://www.enecho.meti.go.jp/statistics/total_energy/

3. Abstract

FAO support to address Transparency in Agriculture

Mirella Salvatore
Food and Agriculture Organization of the United Nations

Abstract

The Modalities, Procedures and Guidelines (MPGs) were defined in Katowice to provide clear guidance for the implementation of the Enhanced Transparency Framework of the Paris Agreement.

It is evident that developing countries will need to reinforce their own national system for measurement, reporting, and verification (MRV) and assess the extent to which they might need to be updated and improved to meet the ETF requirements. In particular, based on the FAO NDC analysis, the Agriculture Forestry and Other Land Use (AFOLU) sector is cited by a large number of countries even though it also clearly stated that the monitoring and reporting of the sector is one of the most challenging and consequently their ability of tracking results.

Therefore, it is important that countries are aware and make best use of the available international opportunities to support the establishment and consolidation of the MRV system in the AFOLU sector.

In this context, FAO designed an AFOLU programme under the GEF Capacity Building Initiative on Transparency funds that consists of three main components - Institutional Arrangements, MRV and M&E, and coordination, dissemination and knowledge sharing – to be delivered with a combination of.

1) stand-alone tools and guidance designed to help countries to overcome the challenges posed by the ETF in the agriculture sectors;
2) pilot actions aimed at validating and refining the tools while stimulating country-level capacities to comply with ETF in the agriculture sectors;
3) dissemination of knowledge and tools across a wide range of platforms and networks and coordination with other transparency practitioners to ensure a broad outreach.

Finally, in order to improve the means of support, FAO is eager to learn more from countries about the main challenges and bottlenecks in the AFOLU sector to make countries ready to develop the first Biennial Transparency Report by 2024.

References/ Publications

GEF, 2016. *Programming Directions for the Capacity-building Initiative for Transparency*, Working Document at 50th GEF Council Meeting, Available at https://www.thegef.org/council-meeting-documents/programming-directions-capacity-building-initiative-transparency

Access to relevant information

FAO Mitigation of Climate Change in Agriculture programme: www.fao.org/in-action/micca/

FAO CBIT-AFOLU programme: https://www.cbitplatform.org/projects/global-cbit-afolu

CBIT Global Coordination Platform: https://www.cbitplatform.org/

The national greenhouse gas inventory for agriculture:
https://elearning.fao.org/course/view.php?id=327

The national greenhouse gas inventory for land use: https://elearning.fao.org/course/view.php?id=453

Use of atmospheric GHG observations for comparison with inventories

Shamil Maksyutov, Tsuneo Matsunaga
National Institute for Environmental Studies, Tsukuba, Japan

Abstract

The 2019 Refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories mentions examples of countries like the UK and Switzerland, where atmospheric concentration measurements of non-CO_2 greenhouse gases (GHG) are used to estimate national emissions of those gases and to compare with national inventory estimates. In both countries, networks of continuous observations include several tall towers and one background monitoring site. The observations are used in tracer transport modeling for estimating the emissions of methane and N_2O. Emissions of several other gases such as HFCs are estimated using correlation to better-known tracers such as carbon monoxide. These estimates are used to provide additional scientific verification of emission inventory for some of the emission categories and gases and assist in reducing uncertainty, identifying possible sources of errors and improving inventory procedures. The guidance in 2019 Refinement describes key components and steps that are applied when using atmospheric measurements and inverse models for comparison with inventory emission estimates as part of an inventory quality assurance and quality control procedures. Several studies also used satellite data for estimating national emissions, as multiple satellites monitoring greenhouse gases are now in operation, including Greenhouse gases Observing SATellite (GOSAT) and GOSAT-2 by Japan, and satellite missions by USA, China, Canada and ESA. GOSAT data were used to estimate methane emissions in USA, China, India and other countries. India's CH_4 emissions were estimated for the period 2010–2015 using a combination of GOSAT satellite, surface and aircraft data (Ganesan et al, 2017). They applied a high-resolution atmospheric transport model to simulate data from these platforms to infer fluxes at sub-national scales and to quantify changes in emissions and found that average emissions over this period are consistent with the emissions reported by India to the UNFCCC.

References/ Publications

Ganesan, A. L., Rigby, M., Lunt, M. F., Parker, R. J., and coauthors: Atmospheric observations show accurate reporting and little growth in India's methane emissions, Nature Communications, 8, 836, 10.1038/s41467-017-00994-7, 2017.

Access to relevant information

Examples of using satellite data for comparison with emissions are summarized in "A Guidebook on the Use of Satellite Greenhouse Gases Observation Data to Evaluate and Improve Greenhouse Gas Emission Inventories" published online by NIES:
https://www.nies.go.jp/soc/en/documents/guidebook

3.6 Poster Session

Household Appliance Distribution in Lao PDR

BounEua Khamphilavanh
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Abstract

Based on the 2015 Housing and Population Census, approximately 77% of the rural population with road access and 88% of the rural population without road access in the Lao PDR use wood as their primary cooking fuel. The majority of these households cook on open fires using iron tri- pod pot supports and other forms of traditional cooking devices. Cooking with solid fuels such as firewood with open fires or traditional stoves have negative effects on health as the smoke from cooking contributes to high levels of household air pollution, which can lead to a number of deadly diseases. It also puts pressure on local natural resources such as forests and wooded lands which supply the firewood.

The main objective of the project is to reduce non-renewable biomass consumption for cooking and water boiling, therefore reducing greenhouse gas emissions, by introducing a more energy efficient and highly durable cookstove model in firewood using households in Lao PDR.

The general benefits of the project include reduction of deforestation, impacts of climate change (particularly, mitigate GHG emission. The benefits for the target households include: access to different cookstove technologies, improve living standard such as saving labor and time for collecting fuelwood; less smoke in the kitchen which reduces respiratory disease, particularly among women and children; and reduced risk of young children falling into open-fire.

The final results of the project can save the household around 50% fuel consumption and generates 2-3 tonnes of CO2 emission reductions per year as compared to cooking with three- stone fires and iron tri-pods.

Mongolia's forest land use, land-use change assessment result

Sanaa Enkhtaivan, Dorjzodov Nyamsuren Zolbayar Purevjav and Khongor Tsogt
Environment and Climate Fund of the Ministry of Environment and Tourism

Abstract

This study presents forest land use, land-use change assessment result for the last 30 years period of Mongolia. Totally, 123 thousand systematic-random sample points (dot-grids) with two different density strata, forest 2.25 km x 2.25 km and non-forest 9 km x 9 km were created for the national scale. A country-specific "survey form" was developed to gather LULUCF information which is consistent with IPCC guidelines. The assessment design follows certain hierarchical rules in order to reduce subjective effects on the result for the six land-use categories which are subdivided three to six sub land-use divisions further.

Totally 0.5 million ha area were changed from certain land-use category to another land out of 156.4 million ha. Grassland converted to Forest was 0.01 million ha, Cropland 0.04 million and Settlement 0.1 million ha. On the other hand, Forest land converted to Grassland was in 0.2 million ha and Cropland converted to Grassland was in 0.1 million ha in total.

All land use categories are subject to estimation of GHG emission and removal, though forest land cover assessments are focused in this study. The country supports two major forest biomes, boreal forests in the north accounting for 14.2 million ha (87%), dominated by larch and birch; and 2.0 million ha of saxaul forests (13%), a dryland woodland ecosystem in the southern arid regions of Mongolia that is considered under national definitions as 'forest'.

The four type of disturbance were assessed on the 16.2 million ha total forest area and out of which 3.3 million ha, 0.2 million ha, 0.4 million ha and 0.2 million ha were affected by fire/pest, logging, erosion and grazing disturbances, respectively.

A desktop and field quality control assessment results shown 89-95 percent consistency depends on aggregation level of land use category between result of operators and QC operators.

By using systematic sampling approach on Collect Earth to assess Mongolian land use/land cover area from high resolution imagery, it gives the possibility to reduce time consuming and costly field assessment. The results show a high degree of correlation with other national land statistics, and it is a useful complementary tool to provide necessary land information for the AFOLU/LULUCF sector of national GHG inventory as well as for the FRL.

3. Abstract

The Estimation of Emission Factors of CH_4 and N_2O by Measurement from the Biological treatment of Solid Waste

Yong-seok Kwon, Sung-yeon Yoon, Young-kyu Lee, Seon-gyoo Lee, Sun Lee
Dept. of Climate Change Action, Korea Environment Corporation

Abstract

The purpose of this study is to estimate the emission factor of biological treatment facilities of solid waste. Using the NDIR, which is a continuous measurement methods, 3 biological treatment facilities, two are composting type “A” and “B”, the other is anaerobic digestion type “C”.

CH_4 average concentration measured from stacks in composting facility “A” was 37.23 ppm_v, and N_2O was 9.45 ppm_v. In the composting facility “B”, the average concentration of CH_4 from the stack was 24.92 ppm_v, and N_2O was 6.42 ppm_v. In the anaerobic digestion at biogas facility “C”, the average concentration of CH_4 from the stack was 118.18 ppm_v, and N_2O was 18.43 ppm_v.

Using measured concentrations, the emission amounts of CH_4 and N_2O from stacks per year were calculated. The results were 18.35 kg CH_4/day and 12.45 kg N_2O/day in the composting facility “A”, 6.81 kg CH_4/day and 4.67 kg N_2O/day in composting facility “B”, and 82.94 kg CH_4/day and 35.19 kg N_2O/day in anaerobic digestion facility “C”.

Finally, the emission factors of CH_4 in the composting type were calculated using the measured concentration and the amount of treated wastes, and was 0.19 g CH_4/kg wet waste in composting type facility “A”, 0.17 g CH_4/kg wet waste in composting type facility “B”, 0.96 g CH_4/kg wet waste in anaerobic digestion type facility “C”. Also, the emission factors of N_2O were found to 0.13 g N_2O /kg wet waste in composting type facility “A”, 0.12 g N_2O /kg wet waste in composting type facility “B”, 0.41 g N_2O /kg wet waste in anaerobic digestion type facility “C”.

We know that in composition type, the emission factors of CH_4 are 20 times less than default factor for CH_4 emission from biological treatment for Tier 1 method (IPCC guideline), and the emission factors of N_2O are 3 times less than default factor. In anaerobic digestion at biogas facilities type, the emission factor of CH_4 is similar to default factor, but the emission factor of N_2O is 10 times higher than Germany and the Netherlands.

Development of Greenhouse Gas Emission Factor in Wastewater Treatment Section in Korea

Suk-Beom Kim, Sung-yeon Yoon, Young-kyu Lee, Seon-gyoo Lee, Sun Lee
Dept. of Climate Change Action, Korea Environment Corporation

Abstract

The IPCC recommend to use country-specific emission factor to improve the reliability of the national greenhouse gas inventory. So, we have been developing country-specific emission factor by field measurement since 2009. The categories are classified by type of treatment in domestic wastewater treatment. Methane (CH_4) and Nitrous oxide (N_2O) are the GHG (Green House Gases) generated from domestic wastewater treatment facilities, according to IPCC Guidelines waste sector.

Since 2000, advanced treatment ratio in domestic wastewater treatment has increased rapidly reaching to 96.5% for 2017 in Korea. The 'A^2O' type is the most used method type based on the capacity of facility among the types of advanced treatment method currently.

In this contents, we reflected the measurement result of one facility (call 'A') as an example of development procedures of emission factor made by field measurement. 'A' facility uses 'A^2O' type for domestic waste water treatment method.

We use U.S. EPA's 'Dynamic Chamber Method' for measuring system of GHG. Floating type chamber (which captures sample gases) and NDIR (Non-Dispersive Infrared Red) analyzer (which measures concentration, temperature and pressure) are used for measuring.

As a result of measurement, the emission factor of 'A' facility became 0.01158 kg CH_4 / kg BOD, 0.0130 kg N_2O / kg T-N.

As for the method of measuring GHG, further studies in various aspects (such as seasonal difference, treatment type difference, etc.) are need to be done.

3. Abstract

Observation of the GHG by GOSAT satellite, aircraft and ground-based monitoring

Rajesh Janardanan, Shamil Maksyutov, Tsuneo Matsunaga, Nobuko Saigusa
National Institute for Environmental Studies, Japan

Abstract

Measurement of greenhouse gases is essential for complying with the international agreements to mitigate climate change due to emission of these gases. Basically, the emissions and sink of these gases are important for this purpose but what remains in the atmosphere is easily measurable by ground-based, airborne or spaceborne techniques and can give indications of their emissions or sinks. The ground-based observations are very limited in number covering limited regions over the globe. Therefore, observations with airborne or spaceborne instruments can overcome the limitations of ground observations. Satellites can observe the globe with higher frequency and coverage. Greenhouse gas observing satellite (GOSAT) has been observing greenhouse gases since 2009 providing almost a decade of observations. These observations are helping in inverse estimates of the emissions and sinks of these trace gases and regional to country scale emission monitoring using other statistical methods. NIES, Japan and collaborating institutes conduct ground-based monitoring in several sites in Japan and Asia and operate measurements on passenger airplanes by Japan Airlines (CONTRAIL project). The data from multiple platforms are used in atmospheric transport modeling to estimate regional emissions in Asia. With GOSAT satellite observations, Janardanan et al (2016, 2017) have demonstrated the capability to monitor emissions of CO_2 and CH_4 from continental regions independently by comparing observations to high-resolution transport model simulation. Their results indicated regional biases in the CO_2 (~20% lower over East Asia) and CH_4 (~30% overestimation in East Asia and 30% underestimation in North America) emissions in ODIAC (CO_2) and EDGARv4.2 (CH_4) inventories respectively. A further update of this method, which includes improved transport model simulation, for country scale monitoring is presented for Asia. In this analysis, the methane emissions from India, China and the middle East countries are estimated and compared to the EDGAR 4.3.2 inventory.

References

Janardanan, R., and coauthors (2016), Comparing GOSAT observations of localized CO_2 enhancements by large emitters with inventory-based estimates, *Geophys. Res. Lett*., 43, 3486–3493, doi:10.1002/ 2016GL067843.

Janardanan, R and coauthors (2017), Assessment of Anthropogenic Methane Emissions over Large Regions Based on GOSAT Observations and High Resolution Transport Modeling. *Remote Sens. 9*, 941.

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

Greenhouse Gas Inventory Office of Japan, National Institute for Environmental Studies, Japan

Abstract

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

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

Japan's total GHG emissions in FY2017 were 1,292 million tonnes of carbon dioxide (CO_2) equivalents (Mt CO_2 eq.; the same shall apply hereafter).

This is a decrease of 8.4% (119Mt CO_2 eq.) when compared to the FY2013 emissions (1,410 Mt CO_2 eq.), mainly because of the decrease in energy-related CO_2 emissions due to the decrease in energy consumption owing to energy conservation, and the increase in the share of non-fossil fuels within the domestic energy supply brought by the wider adoption of renewable energy such as solar and wind power and the resumption of nuclear power plant operation, despite the increase in hydrofluorocarbon emissions.

This is also a decrease of 6.5% (90 Mt CO_2 eq.) when compared to the FY2005 emissions (1,382 Mt CO_2 eq.), mainly due to the decrease in energy-related CO_2 emissions due to the decrease in energy consumption owing to energy conservation, despite the increase in hydrofluorocarbon emissions.

Access to relevant information

http://www-gio.nies.go.jp/index-j.html

4. Report on Mutual Learning Session

4 Report on Mutual Learning Session

4.1 Overview of the Mutual Learning

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

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, ML has been held in the following WGIAs as one of the sessions.

Table 4.1.1 History of Mutual Learning

		General	Energy	IP	Agriculture	LULUCF	Waste
2008-2010		Trial implementation Japan- Korea					
2010	**WGIA8**	Introduction to ML (with hands-on training)					
2011	**WGIA9**	-	Indonesia-Mongolia	-	-	Japan-Lao PDR	Indonesia-Cambodia-Korea
2012	**WGIA10**	-	Cambodia-Thailand	Indonesia-Japan	Indonesia-Vietnam	-	China-Korea
2013	**WGIA11**	-	Lao PDR-Thailand	-	China-Myanmar	-	Malaysia-Vietnam
2014	**WGIA12**	-	Indonesia-Myanmar	-	China-Mongolia	Vietnam*	-
2015	**WGIA13**	Japan-Vietnam	-	-	Indonesia-Lao PDR	Cambodia-Mongolia	Korea-Myanmar
2016	**WGIA14**	-	Brunei-Korea	Myanmar-Malaysia	-	Indonesia-Lao PDR	Mongolia-Thailand
2017	**WGIA15**	-	Mongolia-Vietnam	-	-	Lao PDR - Myanmar	China-Philippines
2018	**WGIA16**	-	India-Vietnam	-	-	-	Japan-Lao PDR
2019	**WGIA17**	China Singapore	Thailand Japan		Cambodia Philippines		

*Reporting from Vietnam with comments from experts

Participants

In December 2018, the WGIA Secretariat advertised the ML to the participants of WGIA, and received applications from 17 groups from 13 parties. Considering the participants' potential interests and knowledge, an appropriate balance among sectors, and the feasibility of implementation, the WGIA Secretariat set up three pairs (China and Singapore on General sector, Thailand and Japan on Energy sector, and Cambodia and the Philippines on Agriculture sector).

Preparation

A few months before WGIA17, the chosen participants in the ML submitted the materials of their

inventories to the WGIA Secretariat, including worksheets used for estimating emissions and reports describing details of methodologies, and exchanged the materials with their partner countries through the Secretariat. 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 shared with the partner countries through the Secretariat. The partner countries responded to these comments and questions before WGIA17 took place.

Table 4.1.2 Preparation Process of Mutual Learning

Process	Schedule
Material submission	Late May to middle of June 2019
Material exchange	Early June to middle of July 2019
Studying the materials	June, July 2019
Comment exchange	Late June to July 2019
Answers to comments	July 2019
Sessions	30th July 2019

Table 4.1.3 Submitted Materials for the ML

Sector	Country	Inventory
General	China	BUR2 in 2018, NC3 in 2018
	Singapore	BUR3 in 2018, NC4 in 2018
Energy	Thailand	Third NC
	Japan	2019 NIR
Agriculture	Cambodia	Draft of National GHG inventory
	the Philippines	Drafted Agriculture sectoral report 2010

Discussions

In the WGIA17, three ML sessions were organized and implemented (General, Energy and Agriculture) to discuss sector-specific issues based on preliminary comment exchanges. In order to encourage a frank discussion and to ensure confidence, 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 to overcome the obstacles, and clarifying matters in their own inventory which should be improved. Through the discussions, they recognized that the inventories of participant countries have been continuously improved by adopting the methodologies of the 2006 IPCC GLs. Closely studying the improvement of not only methodology of the counterpart countries' inventories but also their national systems for data collection and quality assurance/quality control, participants found hints for improvements of their own inventories. To enhance further opportunities to learn from other countries' inventories, participants expressed their hope for continuous implementation of the ML programme in future WGIAs.

The points of discussions and outcomes of each individual ML session are summarized in the following sections (4.2 - 4.4).

4.2 Cross-cutting Issues (F-gases related matters)

Sector Overview

China and Singapore participated in the ML session on cross-cutting issues (F-gases related matters). The general information for the two countries is as shown in Table 4.2.1 below.

Table 4.2.1 Sector Overview for the ML on Cross-Cutting Issues (F-Gases-Related Matters)

	China	Singapore
National total GHG emissions (kt-CO_2-eq., with LULUCF)	11,186,000 (in 2014, BUR2018)	50,908 (in 2014, BUR2018)
GHG emissions of Fluorinated Gases (kt-CO_2-eq.)	291,000 (in 2014, BUR2018)	1,635 (in 2014, BUR2018)
Responsible agency for the inventory	Ministry of Ecology and Environment	National Environment Agency (NEA)
Estimation methodology	1996 IPCC GLs and GPG (2000), 2006 IPCC GLs, Tier 1/Tier 2	2006 IPCC GLs, Tier 1/Tier 2
Source of emission factors	IPCC default values and Country-specific values	IPCC default values and company-specific data
Source of activity data	Official statistics	National sources

Materials Used

In order to prepare for the ML session in WGIA17, the partner countries exchanged their documents relevant to cross-cutting issues (F-gases related matters) through the Secretariat approximately two months before the workshop. The documents exchanged were as follows:

China
- National GHG Inventory, Accounting & Reporting in China
- Regulations and Institutional Arrangements for Collection, Compilation and Reporting of Fluorinated Gas in China
- Reporting of Hydrofluorocarbons (HFCs) Emission of Refrigeration and Air Conditioning in BRs/BURs
- Summary and analysis report on the schedule and mitigation potential for HFCs phasedown in China

Singapore
- Singapore's Institutional Arrangement (in General)
- Mandatory energy management requirements brochure

Questions and Answers

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

Table 4.2.2 Classification of Questions and Comments in the ML on Cross-Cutting Issues (F-Gases-Related Matters)

Classification of questions	Number of questions/comments	
	from Singapore to China	from China to Singapore
National system	4	0
Inventory compilation processes	2	3
Data collection procedure	4	6
Quality Assurance/Quality Control	1	1
Others	3	2

Outcomes of the Mutual Learning Session

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

➢Issues and Solutions / Outstanding issues

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

1) Challenges are faced in acquiring Tier 2a activity data for certain sub-applications.
2) Challenges are faced in collecting and estimating activity data for the historical time-series.
3) Production/consumption data of F-gases, including HFCs for the inventory is based on surveys of voluntarily provided data from enterprises and expert estimation.

➢Good Practices

The following were identified as good practices:

China

1) The leading department invited experts who were not involved in the preparation of the inventory to carry out independent analysis and review of the inventory methodologies and results.
2) In order to improve information from enterprises, meetings of relevant enterprises are convened to raise awareness about how to fill out survey forms.
3) Some historical statistics can be utilized for F-gas estimations in academic research, that will inform inventory making in the future.
4) Good collaboration is established between academic institutions/industry/government in the collection and compilation of HFC data.

Singapore

1) Quality control checks are done on inventory emission estimations, and audits are conducted on companies' Emission Reports.
2) Taxable companies covered under the Carbon Pricing Act are required to provide a monitoring plan to NEA and their Emission Report would be verified by a third-party verifier.
3) A quality assurance team, that is not involved in the collection and compilation of the GHG emissions, conducts a review of the inventory compilation process.
4) An interim Tier 1b study on HFC emission estimation for refrigeration and air-conditioning (RACs) was conducted to improve the coverage and reporting of F-gases.
5) There is a structured and organized team of GHG compilers for the national inventory.

➢ Follow-up Activities

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

1) Participate in ML again to report progress of the identified issues.

➢ **Suggestions for Future MLs**

The participants' suggestions for future ML were as follows:

1) Uncertainty assessment
2) Time-series consistency

Table 4.2.3 Participants in the ML on Cross-Cutting Issues (F-Gases-Related Matters)

Parties	Name	Organization
China	Prof. Tong Qing	Institute of Energy Environment and Economy, Tsinghua University
	Ms. Yixi Li	College of Environmental Science and Engineering, Peking University (CESE-PKU)
Singapore	Ms. Rohaya Saharom	National Environment Agency (NEA)
	Mr. Lek Kong Wan	
	Ms. Diane Peng	
	Ms. Winnie Chia	
	Mr. Ng Sir Sing	Ministry of the Environment and Water Resources (MEWR)
	Ms. Alyssa Ng	National Climate Change Secretariat (NCCS)
	Ms. Kylie Liu	
Facilitators and Resource persons	Ms. Elsa Hatanaka (Facilitator)	GHG Inventory Office of Japan (GIO)
	Ms. Eriko Hirata (Sub-facilitator)	
	Dr. Takefumi Oda	
	Mr. Kiyoto Tanabe (Resource person)	IPCC TFI co-chair; CGE member
	Ms. Moeko Yoshitomi (Workshop organizer)	Ministry of the Environment, Japan (MOEJ)

4.3 Energy Sector

Sector Overview

Thailand and Japan participated in an ML session on the Energy sector. General information of the two countries is shown in Table 4.3.1 below.

Table 4.3.1 Sector Overview for the ML on the Energy Sector

	Thailand	Japan
National total GHG emissions (kt-CO_2-eq., with LULUCF)	232,560 (in 2013, NC3)	1,234,291 (in 2017, NIR2019)
GHG emissions in the Energy sector (kt-CO_2-eq.)	236,936 (in 2013, NC3)	1,137,031 (in 2017, NIR2019)
Responsible agency for the inventory	Office of Natural Resources and Environmental Policy and Planning (ONEP)	Ministry of the Environment (MOEJ)
Estimation methodology	1996 IPCC GLs	2006 IPCC GLs
Source of emission factors	IPCC default values and country-specific net calorific values	In principle, country-specific values and partially IPCC default values
Source of activity data	National Statistics	National Statistics

Materials Used

In order to prepare for the ML session in WGIA17, both countries exchanged their documents relevant to the Energy sector before and during the workshop. The exchanged documents were as follows:

Thailand
- Data collection form and work sheet of IPCC Inventory Software 2.54, 2013
- Excel files with estimation worksheets of an older IPCC Inventory Software, 2013 (provided during the session)

Japan
- Japan. 2019 National Inventory Report (NIR)
- Japan. 2019 Common Reporting Format (CRF) Table

Questions and Answers

After receiving the materials described above, both countries studied them and provided questions and comments to their partner country before and during the workshop. The classification and the number of questions are summarized in Table 4.3.2.

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

Classification of questions	Number of questions/comments	
	from Japan to Thailand	from Thailand to Japan
Acquisition of activity data	2	0
Adoption of emission factors or parameters	2	2
Estimation methods	4	3
Institutional arrangement	1	0
Others	1	0

Outcomes of the Mutual Learning Session

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

➢Issues and Solutions / Outstanding Issues

Some issues were pointed out through the ML as follows:

1) Default carbon EFs are applied for key categories.
2) Limited information is provided regarding which EFs are applied: 1996 IPCC GLs, 2006 IPCC GLs or CS.
3) Limited information is provided regarding what fuels are consumed by vehicle type in road transport.
4) Data on landing/take-off cycles by aircraft type are not available.
   - Consider utilizing ICAO data (distance on international flights, fuel consumption)
5) Uncertainty of AD should be considered.

➢Good Practices

Some good practices were pointed out through the ML as follows:

1) Country-specific net calorific values are applied.
2) Consumption and NCV of biomass-blended fuels are collected and used.
3) The IPCC Software is used to verify their own estimation.
4) Time-series data are available from 2000 to 2013, including the base year of NDC, 2005.
5) Recalculation was done in TNC from SNC.
6) The 2006 IPCC GLs will be applied for the next BUR.
   - The default value of EF in the fugitive emission category will be changed from the 1996 to the 2006 IPCC GLs.
   - Bio-fuel will be separated from gasoline and diesel.
7) Although emissions of manufacturing are aggregated in TNC, disaggregated data are available from 2000.

➢ Follow-up Activities

Participants proposed as a possible follow-up activity, participation in ML again to know other countries' experiences.

Table 4.3.3 Participants in the ML on Energy Sector

Parties	Name	Organization
Thailand	Mr. Sivach Kaewcharoen	Office of Natural Resources and Environmental Policy and Planning (ONEP)
	Dr. Pornphimol Winyuchakrit	Sirindhorn international institute of technology (SIIT-TU)
Japan	Mr. Naofumi Kosaka (Facilitator)	Greenhouse Gas Inventory Office of Japan (GIO)
	Ms. Akiko Tanaka (Facilitator)	
	Ms. Atsuko Hayashi (WGIA Secretariat)	
Resource person	Mr. Masaaki Nakamura (Resource person)	Mitsubishi UFJ Research and Consulting Co., Ltd.
Observers	Mr. Taiki Mizushima (Workshop organizer)	Ministry of the Environment, Government of Japan (MOEJ)
	Mr. Akira Yoshida (Workshop organizer)	

4.4 Agriculture Sector

Sector Overview

Cambodia and the Philippines participated in an ML session on the Agriculture sector. The general information of the two countries is shown in Table 4.4.1 .

Table 4.4.1 Sector Overview for the ML on the Agriculture Sector

	Cambodia	the Philippines
National total GHG emissions (kt-CO2-eq., with LULUCF)	-457 (in 2000, NC2)	21,767 (in 2000, NC2)
GHG emissions in the Waste sector (kt-CO2-eq.)	18,962 (in 2017, submitted documents)	27,488 (in 2010, submitted document)
Responsible agency for the inventory	General Secretariat of National Council for Sustainable Development, Department of Climate Change	Climate Change Commission
Organization in charge of Agriculture sector		Philippines Statistics Authority (PSA)
Estimation methodology	Tier 1 and Tier 2 of the 2006 IPCC GLs	Tier 1 of the 2006 IPCC GLs
Source of emission factors	Country-specific emission factors and IPCC default values	IPCC default values
Source of activity data	National statistics and Literature data	National statistics and Special studies

Materials Used

In order to prepare for the ML session in WGIA17, both countries exchanged their documents relevant to GHG emission estimation of the sector with each other one and a half months before the workshop. The exchanged documents were as follows:

Cambodia:
- 3A-3C6-Livestock.xlsx
- 3C1-Biomass burning (1).xlsx
- 3C2-3C3-3C4-3C5-Crop cultivation.xlsx
- 3C7-Rice cultivation.xlsx
  (All the above are spread sheets for the draft of the National GHG Inventory)

the Philippines:
- [Draft] Agriculture GHG Inventory Report - Philippines

Questions and Answers

After receiving the materials described above, both countries studied them and provided questions and comments to their partner country approximately two weeks before the workshop. The classification and the number of the questions are shown in Table 4.4.2.

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

Classification of question	Number of questions/comments	
	from the Philippines to Cambodia	from Cambodia to the Philippines
Acquisition of activity data	6	4
Adoption of emission factors or parameters	0	5
Estimation methods	1	10
Institutional arrangement	0	1
Others	1	1

Outcomes of the Mutual Learning Session

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

➢Issues and solutions / Outstanding issues

The main issues discussed in the session were as follows:

1) Development of the improvement plan (data collection gaps, methodology used) for Agriculture
2) Capacity building for transparency such as technical training/workshop, webinar for data collection and analysis between data users and providers
3) Development of CSEF and parameters for more accurate reporting
4) Estimation done for a single year
5) Application of Tier 2 Methodology to emissions from rice paddy fields
6) The lack of QC

➢Good Practices

Good practices of the participant countries' inventories were pointed out as follows.

Cambodia:

1) Application of the 2006 IPCC GLs
2) Estimation of emissions for the whole time series
3) Use of spread sheets including explanation of methodology for the purpose of transparency
4) Establishment of CSEF of manure management (swine)

the Philippines:

1) Application of the 2006 IPCC GLs
2) QC plan in place
3) Preparation of a Sectoral GHG Inventory report independently
4) Availability of most activity data to the public through an online database maintained by the national statistics office
5) GHG Inventory management and reporting system institutionalized

➢Follow-up activity

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

1) Application of CSEF based on IRRI data and use of enhanced characterization for livestock species
2) Participation in ML again to report progress of the identified issues
3) Monitoring of the gaps of technical capacity and time series data based on the improvement plan in place
4) Search/comparison/confirmation of the available EF and related parameter data that suit the

country's situation

➢Suggestions for future ML

Suggestions for future ML from participants were as follows.

1) Information exchange on how to reflect mitigation action in the inventory
2) Continuous communication with other countries for sharing data and best practice

Table 4.4.3 Participants in the ML on the Agriculture Sector

Parties	Name	Organization	Title
Cambodia	Mr. Sophal Leang	Department of Climate Change, General Secretariat of National Council for Sustainable Development, Ministry of Environment (MoE)	Head
	Ms. Reasey Phoeuk		Vice Head
	Ms. Baroda Neth		Deputy Director
	Mr. Kamal UY	General Directorate of Administration for Nature Conservation and Protection, Ministry of Environment (MoE)	Deputy Director
	Dr. Sam Ang Chea		Deputy Director of Department
	Mr. Chivin Leng		Deputy Director of Department
	Ms. Sotheavy Meas	Dept. Planning and Statistics, Ministry of Agriculture Forestry and Fisheries (MAFF)	Deputy Director
the Philippines	Ms. Faith Lea B. Cabrera	Environment and Natural Resources Accounts Division, Macroeconomic Accounts Service, Philippine Statistics Authority (PSA)	Statistical Specialist II
	Mr. Polaris Coching Bautista		Senior Statistical Specialist
	Ms. Manuela S. Nalugon		Supervising Statistical Specialist
Facilitators and Resource persons	Mr. Hiroshi Ito (Facilitator)	Greenhouse Gas Inventory Office of Japan (GIO)	GHG Inventory Expert
	Dr. Midori Yanagawa (Facilitator)		GHG Inventory Expert
	Mr. Hiromi Yoshinaga (Facilitator)		GHG Inventory Expert
	Mr. Takashi Morimoto (Resource person)	Mitsubishi UFJ Research and Consulting Co., Ltd. (MURC)	Chief Analyst
	Mr. Kazumasa Kawashima (Resource person)		Chief Analyst
Observers	Mr. Taiki Mizushima (Workshop organizer)	Ministry of the Environment, Government of Japan (MOEJ)	Chief Official
	Mr. Akira Yoshida (Workshop organizer)		Environmental Expert

Annex I: Agenda

Annex I: Agenda

The 17th Workshop on GHG Inventories in Asia (WGIA17)

- Capacity building for measurement, reporting and verification -
Period: 30th July – 2nd August 2019
Venue: Concorde Hotel (Singapore)

Day 1: Morning, 30h July 2019		
8:30-9:00	**Registration**	
9:00-12:30	**Mutual Learning (Closed sessions: only for countries participating in the session, facilitators, resource persons, rapporteurs and the WGIA Secretariat)**	
Sector		Energy
Combination of Participating Countries		**Thailand – Japan**
Room		Gallery 2
Facilitator		Mr. Naofumi Kosaka (GIO) Ms. Akiko Tanaka (GIO)
Rapporteur		Mr. Hiromi Yoshinaga (GIO)
Note: Mutual learning sessions are closed sessions in order to secure confidentiality of information so that countries participating in each mutual learning session can provide unpublished information. Therefore, only participating countries in each session, facilitators, resource persons and the WGIA Secretariat can enter each of the rooms. In addition, facilitators and resource persons will be registered in advance and receive confirmation of participation from the countries engaging in mutual learning and the WGIA Secretariat.		
12:00-14:00	*Lunch (at Studio 3)*	
Day 1: Afternoon, 30th July		
13:00-16:00 (14:00-17:30)	**Mutual Learning (Closed sessions: only for countries participating in the session, facilitators, resource persons, rapporteurs and the WGIA Secretariat)**	
Sector	General	Agriculture
Combination of Participating Countries	**Singapore – China**	**Cambodia - Philippines**
Room	Gallery 1	Gallery 2
Facilitator	Ms. Elsa Hatanaka (GIO) Ms. Eriko Hirata (GIO)	Mr. Hiromi Yoshinaga (GIO) Mr. Hiroshi Ito (GIO)
Rapporteur	Mr. Hiromi Yoshinaga (GIO)	Mr. Hiromi Yoshinaga (GIO)

Annex I

Day 2: Morning, 31th July			
8:30 - 9:00	**Registration**		
9:00 – 10:40	**Opening Session**		
	Room: Concorde Ballroom	**Chair: Ms. Rohaya Saharom (Singapore)**	**Rapporteur: Ms. Atsuko Hayashi (GIO)**
9:00 – 9:10	Welcome Address		Mr. Taiki Mizushima, Low Carbon Society Promotion Office (MOEJ)
9:10 – 9:25	Welcome Address		Mr. Suresh K (Singapore)
9:25 – 9:35	Japan's Achievement on Climate Change		Mr. Akira Yoshida, Low Carbon Society Promotion Office (MOEJ)
9:35 – 9:45	Overview of WGIA17		Mr. Hiroshi Ito (GIO)
9:45 – 10:10	**Questions and Answers**		**All**
10:10 – 10:40	*Group Photo & Tea Break*		
10:40– 12:00	**Session I: Updates on the National Communications (NCs) and Biennial Update Reports (BURs) from non-Annex I Parties**		
	Room: Concorde Ballroom	**Chair: Dr. Baasansuren Jamsranjav (AB/ IPCC TFI)**	**Rapporteur: Ms. Atsuko Hayashi (GIO)**
10:40 – 10:45	Introduction to the Session		Dr. Midori Yanagawa (GIO)
10:45 – 11:00	Malaysia's 2nd BUR: What's New?		Dr. Elizabeth MP. Philip (Malaysia)
11:00 – 11:15	Brief Summary of Viet Nam's BUR2		Ms. Ngoc Thi Bich Tran (Vietnam)
11:15 – 11:30	Brunei Darussalam's Second National Communications		Mr. Muhammad Nabih Fakhri Matussin (Brunei)
11:30 – 12:00	**Questions and Answers**		**All**
12:00 – 13:30	*Lunch (at Concorde 3)*		

Day 2 Afternoon, 31th July			
13:30 – 15:30	**Session II: Introduction to the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories**		
	Room: Concorde Ballroom	**Chair: Mr. Takahiko Hiraishi (IGES)**	**Rapporteur: Ms. Atsuko Hayashi (GIO)**
13:30 – 13:45	Overview Chapter and General Guidance and Reporting Volume Overview		Mr. Kiyoto Tanabe (IPCC TFI; CGE)
13:45 – 13:50	**Questions and Answers, Discussion**		**All**
13:50 – 14:05	Energy Volume Overview		Prof. Zhu Songli (LA; Energy Research Institute, NDRC)
14:05 – 14:20	IPPU Volume Overview		Ms. Deborah Ottinger (CLA; USEPA)
14:20 – 14:35	Waste Sector Overview		Dr. Sirintornthep Towprayoon (CLA; AB; King Mongkut's Univ. of Technology Thonburi)
14:35 – 14:50	**Questions and Answers, Discussion**		**All**
14:50 – 15:05	AFOLU Volume Overview		Dr. Baasansuren Jamsranjav (AB; IPCC TFI)
15:05 – 15:20	Refinements in Rice Paddy Fields, Livestock, Crop Residue Burning and Others		Dr. Baasansuren Jamsranjav (AB; IPCC TFI) on behalf of Dr. Sumana Bhattacharya (LA; AB; IORA Ecological Solutions)
15:20 – 15:30	**Questions and Answers, Discussion**		**All**
15:30 – 16:00	***Tea Break***		
16:00– 17:30	**Session III: Fluorinated Gas Emissions from non-Annex I Parties**		
	Room: Concorde Ballroom	**Chair: Mr. Kiyoto Tanabe (IPCC TFI; CGE)**	**Rapporteur: Ms. Atsuko Hayashi (GIO)**
16:00 – 16:15	The Status of Reporting of Fluorinated Gases in Asia: Emissions, Methods, and Gaps		Ms. Elsa Hatanaka (GIO)
16:15 – 16:30	Overview of F-gases Inventory in Indonesia		Ms. Ratnasari (Indonesia)
16:30 – 16:45	Development of National System of the F-gas Inventory in the USA		Ms. Deborah Ottinger (USEPA)
16:45 – 17:00	Estimation Methodology for RACs in the 2006 IPCC Guidelines and 2019 Refinement		Mr. Kiyoto Tanabe (IPCC TFI; CGE)
17:00 – 17:30	**Questions and Answers, Discussion**		**All**
19:00 – 21:00	***Welcome Reception hosted by Singapore***		

Annex I

Day 3 Morning, 1st August			
9:00 – 12:15	**Session IV: National GHG Inventory Data and Systems for the Transparency Framework Under the Paris Agreement**		
	Room: Concorde Ballroom	**Chair: Prof. Rizaldi Boer (AB/ Bogor Agricultural University)**	**Rapporteur: Ms. Atsuko Hayashi (GIO)**
9:00 – 9:05	Introduction to the Session		Dr. Takefumi Oda (GIO)
9:05 – 9:35	Requirements for National Inventory Reports as Part of the Biennial Transparency Report Under the Enhanced Transparency Framework of Paris Agreement		Mr. William Agyemang-Bonsu (UNFCCC)
9:35 – 9:50	National Greenhouse Gases Inventory in Algeria		Mr. Mohamed Sidi Moussa (Algeria)
9:50 – 10:15	**Questions and Answers, Discussion**		**All**
10:15– 10:45	*Tea Break*		
10:45 – 11:00	Thailand Greenhouse Gas Emission Inventory System (TGEIS)		Mr. Sivach Kaewcharoen (Thailand)
11:00 – 11:15	The Energy Balance Table of Japan		Dr. Ryo Eto (IEEJ)
11:15 – 11:30	FAO Support to Address Transparency in Agriculture		Dr. Mirella Salvatore (FAO)
11:30 – 11:45	Use of Atmospheric GHG Observations for Comparison with Inventories		Dr. Shamil Maksyutov (NIES)
11:45 – 12:15	**Questions and Answers, Discussion**		**All**
12:15 – 13:30	*Lunch (at Concorde 3)*		

Day 3 Afternoon, 1st August			
13:30 – 15:00	**Poster Session**		
	Room: Foyer		
15:00 – 16:30	**Wrap-up Session**		
	Room: Concorde Ballroom	**Chair: Prof. Yukihiro Nojiri (GIO)**	
15:00 – 15:15	Summary of the Mutual Learning Sessions		Mr. Hiromi Yoshinaga (GIO)
15:15 – 15:30	**Discussion**		**All**
15:30– 15:45	*Tea Break*		
15:45 – 16:00	Summary of the Plenary Sessions		Ms. Atsuko Hayashi (GIO)
16:00 – 16:10	**Discussion**		**All**
Closing Remarks			
16:10 – 16:20	Closing Remarks		Ms. Rohaya Saharom (Singapore)
16:20 – 16:30	Closing Remarks		Prof. Yukihiro Nojiri (GIO)

Day 3 Evening, 1st August		
17:00 – 18:00	**Joint Meeting of the WGIA Organizing Committee and Advisory Board (members of the OC and AB, and the WGIA secretariat are requested to attend)**	
	Room: Studio 1&2	**Chair: Mr. Hiroshi Ito (GIO)**
17:00 – 17:30	Review of Activities in WGIA17	OC/AB members
17:30 – 18:00	Discussion on Topics for WGIA18	OC/AB members

Day 4 Morning, 2nd August		
9:00 – 10:30	**Information Session: Reporting Related to Article 6 of the Paris Agreement**	
	Room: Studio 1&2	
9:00 – 10:30	Corresponding Adjustment Under the Transparency Framework	Interested Participants
11:00 – 12:00	***Lunch (at Concorde 1)***	

Study Tour, 2nd August	
12:00 – 17:30	**Study Tour – Semakau Landfill**

Annex I

Poster Sessions			
13:30 – 15:00	**Room: Foyer**		
No.	**Topic**	**Title**	**Name, Organization**
P-1	7	Emission Reduction Through Improved Cook Stove (ICS) Distribution Project	BounEua Khamphilavanh, Ministry of Natural Resources and Environment, Laos
P-2	2	Mongolia's Forest Land Use, Land-Use Change Assessment Result	Sanaa Enkhtaivan, Dorjzodov Nyamsuren Zolbayar Purevjav and Khongor Tsogt, Environment and Climate Fund of the Ministry of Environment and Tourism, Mongolia
P-3	1	The Estimation of Emission Factors of CH_4 and N_2O by Measurement from the Biological Treatment of Solid Waste	Yong-seok Kwon, Sung-yeon Yoon, Young-kyu Lee, Seon-gyoo Lee, Sun Lee, Korea Environment Corporation (K-eco)
P-4	1	Development of Greenhouse Gas Emission Factor in Wastewater Treatment Section (CH_4, N_2O) in Korea	Suk-Beom Kim, Sung-yeon Yoon, Young-kyu Lee, Seon-gyoo Lee, Sun Lee, Korea Environment Corporation (K-eco)
P-5	4	Climate Change International Technical and Training Center and ASEAN Regional Capacity Building Needs Assessment	Thawatchai Saengkhamsuk, Nareerat Thanakasem, Chanyaphak Wathanachinda, CITC, TGO
P-6	2	Observation of the GHG by GOSAT Satellite, Aircraft and Ground-based Monitoring	Rajesh Janardanan, Shamil Maksyutov, Tsuneo Matsunaga, Nobuko Saigusa, NIES
P-7	6	A Web-Based Climate Inventory and Monitoring System to Track Annual GHG Inventory and Impacts of Mitigation Actions for a State in India	Sumana Bhattacharya, Shweta Pandey, Swapan Mehra IORA Ecological Solutions
P-8	7	Preparation of Japan's National Greenhouse Gas Inventory and Trends in GHG Emissions	GIO, 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

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(Alphabetical order by family name)

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