Report of the Mutual Learning on Greenhouse Gas Inventories in 2020

21st, 22nd, and 28th July 2020

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

Center for Global Environmental Research CGER

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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. To address mitigation and adaptation to climate change, all of us on the globe must be making more efforts than ever in each of our respective fields. To this end, the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) agreed to hold the increase in the global average temperature to well below 2°C above pre-industrial levels under the Paris Agreement at COP21 in 2015.
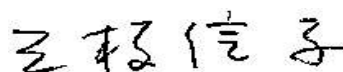
"Measurement, Reporting, and Verification", abbreviated as MRV, and transparency of mitigation actions are becoming increasingly important. In this respect, national GHG inventories, which provide information on GHG emissions and their trends over time, play a critical role as a basis for decision-makers 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 "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.

Unfortunately, this year, in light of the global pandemic, the Workshop had to be cancelled to prevent any risk of the spreading of COVID-19, and only Mutual Learning sessions (sector-by-sector discussions between pairs of countries) were conducted online on July 21st, 22nd, and 28th. Mutual Learning has been held during WGIA since WGIA9 in 2011 when it first became a regular session.

This report serves as the report of the Mutual Learning Sessions on Greenhouse Gas Inventories in 2020 (ML2020). We hope that it 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.

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Preface

An important lesson that we have learned from the history of the UNFCCC is the importance of 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 and transparency ensures and enhances the accuracy of reports on each country's mitigation actions.

For the steady implementation of MRV and transparency, it is essential to develop national systems for the preparation of national GHG inventories and to improve the accuracy of the inventories. In the Paris Agreement, the importance of establishing an enhanced transparency framework 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 the 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 of national mitigation actions.
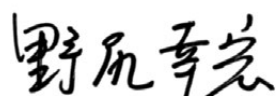
WGIA has contributed significantly to the construction and consolidation of a network of officials involved in GHG inventory preparation in Asian countries, and to the identification and provision of solutions for common issues relevant to the inventories.

This year, however, the physical workshop of WGIA was cancelled due to COVID-19, and only Mutual Learning (ML) Sessions on Greenhouse Gas Inventories were conducted online.

The outcomes of the ML2020 are summarized in this report. 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 this year's ML Sessions.

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List of Acronyms and Abbreviations

|	
BUR	Biennial Update Report
CO_2-eq.	Gas Emission in CO_2 equivalent
CGER	Center for Global Environmental Research
COP	Conference of the Parties
CRF	Common Reporting Format
CS	Country Specific
F-gases	Fluorinated Gases (HFCs, PFCs, SF_6, NF_3)
GHG	Greenhouse Gas
GIO	Greenhouse Gas Inventory Office of Japan
GWP	Global Warming Potential
HWP	Harvested Wood Products
IP	Industrial Processes
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
LULUCF	Land Use, Land-Use Change and Forestry
ML	Mutual Learning
MMS	Manure Management System
MOEJ	The Ministry of the Environment, Japan
MRV	Measurement, Reporting and Verification Measurable, Reportable, and Verifiable
NAI	Non-Annex I
NC	National Communication
NDC	Nationally Determined Contribution
NIES	National Institute for Environmental Studies, Japan
NIR	National Inventory Report
QA	Quality Assurance
QC	Quality Control
SOC	Soil Organic Carbon
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

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

Photos of the Online Meeting

Cross-Cutting Issues
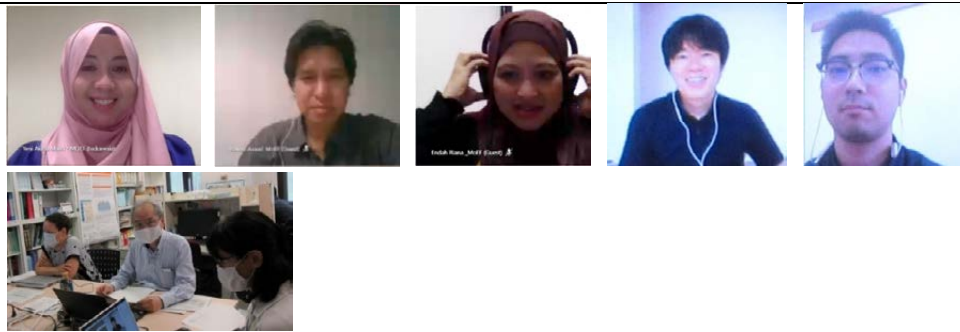
Energy Sector

Agriculture Sector

LULUCF Sector
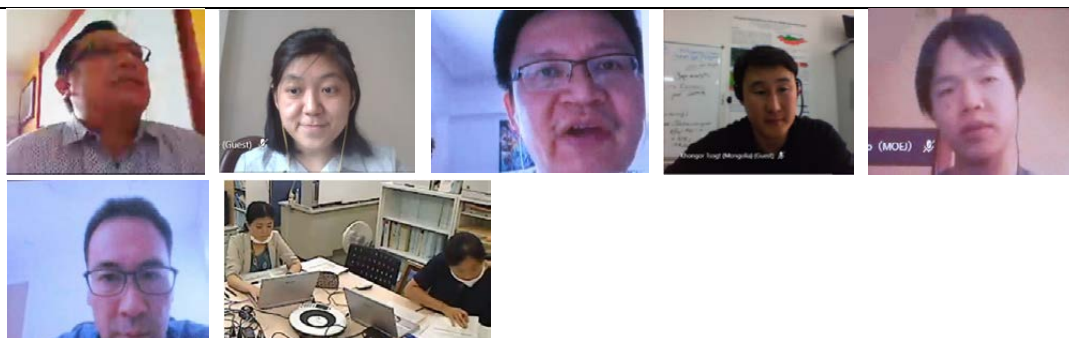
1. Executive Summary of the Mutual Learning on Greenhouse Gas Inventories in 2020

1 Executive Summary of the Mutual Learning on Greenhouse Gas Inventories in 2020

The Ministry of the Environment of Japan (MOEJ) and the National Institute for Environmental Studies (NIES) have annually convened WGIA since 2003 in order to support non-Annex I (NAI) Parties in Asia to improve the accuracy of their GHG inventories and to facilitate the enhancement of cooperative relationships in the Asian region.

This year, in light of the global pandemic, the Workshop was cancelled to prevent any risk of the spreading of COVID-19, and only ML sessions (sector-by-sector discussions between pairs of countries) were conducted online in response to interests expressed. ML has contributed to the advancement of the participants' basic knowledge of GHG inventory estimation methodology, reporting rules, data collection, institutional arrangements, including quality assurance and quality control (QA/QC), and other related issues. Since it first started in 2011, ML has been held ten times, with 29 pairs of countries participating, including four pairs this year.

This year's session has succeeded in enhancing capacity-building in MRV/Transparency, and strengthening the network of inventory experts and others in Asia.

A total of 36 participants attended the ML this year, including government and research representatives from Cambodia, China, Indonesia, Japan, Mongolia, Myanmar, and Singapore.

Mutual Learning of each sector's Greenhouse Gas Inventories

This year's ML was held for the following four sectors: Cross-cutting issues (Indonesia-Japan), Energy sector (Cambodia-Myanmar), Agriculture sector (China-Japan), and Land Use, Land-Use Change and Forestry (LULUCF) sector (Singapore-Mongolia). Inventory personnel from participating countries posed questions and provided answers on the development of each other's inventory and national system by e-mail in advance, and then engaged in online discussions to make improvements through learning about each other's inventory in detail and exchanging views.

The participating countries expressed interest in continuously improving their inventory through developing their own country-specific calculation methods and introducing methodologies based on the 2006 IPCC Guidelines (GLs), which will be mandatory under the rules of the Paris Agreement. Through learning in depth about the methodology and the national system for data collection and inventory development of the other country, each country used their newly-acquired knowledge as a reference for future inventory improvements to regularly report under the Paris Agreement.

Although this online meeting was a first-time attempt, detailed discussions between the pairs of countries led to the strengthening of the network among inventory experts. In order to provide many learning opportunities in the future, it was requested that mutual learning be held on an ongoing basis.

2. Report on the Mutual Learning Sessions

2 Report on the Mutual Learning Sessions

2.1 Overview of the Mutual Learning

ML is an activity to improve the individual countries' inventories through the following series of processes: 1) exchanging inventories between two countries, 2) perusing a partner'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 and follow-ups through direct conversation.

The first ML was held on the Waste sector between GIO and Korea Environment Corporation (KECO) in the annual workshop in 2008. The Secretariat of WGIA introduced this activity in WGIA8 held in 2010. With the participants' agreement, ML has been held as a regular session since WGIA9 in 2011. In this year 2020, however, in light of the global pandemic of COVID-19, the physical meeting of WGIA was cancelled to prevent any risk of spreading the COVID-19. Instead, the WGIA ML Secretariat who concurrently serves as the ML Secretariat planned and conducted the remote ML sessions via the Internet.

Table 2.1.1 History of ML

		General	Energy	IP*[1]	Agriculture	LULUCF	Waste
2008-2010		Trial implementation Japan - Korea					
2010	**WGIA8**	Introduction to ML (with hands-on training)					
2011	**WGIA9**	-	Indonesia-Mongolia	-	-	Japan-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*[2]	-
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	-	-
2020	**ML2020**	Indonesia-Japan	Cambodia-Myanmar	-	China-Japan	Mongolia Singapore	-

*[1]Industrial Processes
*[2]Reporting from Vietnam with comments from experts

Participants

In December 2019, the WGIA Secretariat advertised the ML to the participants of WGIA and received applications from 22 groups from eight parties. Considering the participants' potential

interests and knowledge, an appropriate balance among sectors, and the feasibility of implementation, the Secretariat set up four pairs (Indonesia and Japan on the General sector, Cambodia and Myanmar on the Energy sector, China and Japan on the Agriculture sector, and Mongolia and Singapore on the LULUCF sector).

Preparation

A few months before the remote session of the ML, the chosen participants submitted the materials of their inventories to the 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 the ML sessions took place.

Table 2.1.2 Preparation Process of the ML

Process	Schedule
Material submission	Middle of May to middle of June 2020
Material exchange	End of May to middle of June 2020
Studying the materials	June, July 2020
Comment exchange	Late June to middle of July 2020
Answers to comments	July 2020
Sessions	21st, 22nd, and 28th July 2020

Table 2.1.3 Submitted Materials for the ML

Sector	Country	Inventory
General	Indonesia	BUR2[*1] in 2018, NC3[*2] in 2017
	Japan	NIR in 2020
Energy	Cambodia	NC2 in 2015
	Myanmar	NC1 in 2012, National GHG Inventory of the Energy Sector in Myanmar
Agriculture	China	BUR2 in 2018
	Japan	NIR in 2020
LULUCF	Mongolia	BUR1 in 2017, NC3 in 2018
	Singapore	NC4 and BUR3 in 2018

[*1]Biennial Update Report
[*2]National Communication

Discussions

In the ML2020, four ML sessions were organized and implemented on July 21st (General, Agriculture), 22nd (Energy), and 28th (LULUCF) to discuss sector-specific issues based on preliminary comment exchanges. To encourage a frank discussion and to ensure confidence, these sessions were held as closed-door discussions in a virtual meeting room on the Internet.

In these sessions, participants discussed their counterpart's inventory and national system, sharing their own technical issues (e.g., data collection, adoption of emission factors, national system, etc.)

with the partner country to overcome the obstacles, and clarifying matters in their own inventory which should be improved. Through the discussions, they recognized that the inventories of participant countries have been continuously improved by adopting the methodologies of the 2006 IPCC GLs. Closely studying the improvement of not only the 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 increase opportunities to learn from other countries' inventories, participants expressed their hope for the continuous implementation of the ML programme in the future.

The points of discussions and outcomes of each individual ML session are summarized in the following sections (2.2 - 2.5).

2. Report on Mutual Learning Session

2.2 Cross-Cutting Issues

Sector Overview

Indonesia and Japan participated in the ML session on cross-cutting issues. The general information for the two countries is as shown in Table 2.2.1 below.

Table 2.2.1 Sector Overview for the ML on Cross-Cutting Issues

	Indonesia	Japan
National total GHG emissions (kt-CO$_2$-eq., with LULUCF)	1,457,774 (3 gases, in 2016, BUR2)	1,183,016 (7 gases and indirect CO$_2$, in 2018, CRF2020)
Responsible agency for the inventory	Ministry of Environment and Forestry (MoEF)	Ministry of the Environment (MOEJ)
Methodological basis	2006 IPCC GLs	2006 IPCC GLs

Materials Used

To prepare for the ML 2020, the partner countries exchanged their documents relevant to cross-cutting issues through the Secretariat approximately six weeks before the remote session. The documents exchanged were as follows:

Indonesia
- Indonesia Third National Communication (NC3), 2017
- Indonesia Second Biennial Update Report (BUR2), 2018
- Summary of "Guidance to the Implementation and Reporting of National Greenhouse Gases Inventories", Director General of Climate Change Regulation No. 73/2017
- Summary of "Guidance of Quality Assurance and Quality Control (QA/QC) of Greenhouse Gas Inventories", Director General of Climate Change Regulation No. 10/2018

Japan
- National Greenhouse Gas Inventory Report of JAPAN, 2020

Questions and Answers

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

Table 2.2.2 Classification of Questions and Comments in the ML on Cross-Cutting Issues

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

Outcomes of the Mutual Learning Session

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

➢**Issues and Solutions / Outstanding issues**

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

1) There is a time lag for institutions in publishing data needed for inventory. The inventory schedule, in certain cases, cannot match the publication periods of the data provider. (Indonesia/Japan)
2) Utilizing the bottom-up approach (using data reported from local governments) in inventory compilation is an ongoing process and the gap with the top-down approach (using national data) still needs to be narrowed. (Indonesia)
3) There is a challenge for the general public to fully understand the process of recalculations (e.g., recalculations due to changes in Global Warming Potential (GWP) or methodology). (Indonesia).
4) From the viewpoint of speeding up data provision, data provided by ministries are preferred to data published by the Centralized Statistical Bureau. (Indonesia)

➢**Good Practices**

The following were identified as good practices:

Indonesia
1) A legal system for the institutional arrangement of the National GHG Inventory has been developed by MoEF Regulation No. 73/2017.
2) Responsibilities are clearly defined in the institutional arrangement to prepare the inventory by sector and led by Directorate General of Climate Change (DGCC), Ministry of Environment and Forestry (MoEF).
3) An annual GHG estimation cycle is established, including estimating preliminary figures.
4) A national inventory system has been set up to promote the ministries' ownership of mitigation in their relative sectors.
5) National Industry Information System (SINAS) has been set up to collect activity data, mitigation actions, energy uses, and as a compliance monitoring system for industries.
6) QA activities have been steadily implemented under DGCC Regulation No. 10/2018.

Japan
1) The QA mechanism of Japan is feasible to implement.
2) There is a process in place to engage various stakeholders in the inventory process without specific regulation/enforcement.
3) Japan's emission reduction has been reflected in the GHG inventory through the use of Country Specific (CS) Emission Factor for N_2O from sewage sludge incineration, etc.

➢**Suggestions for Future ML**

The participants' suggestions for future ML were as follows:

1) Learn more about the Japanese F-gas inventory system.
2) Learn more about the Japanese QA activities.
3) Engage in remote ML if circumstances similar to the current COVID-19 pandemic occur.

2. Report on Mutual Learning Session

Table 2.2.3 Participants in the ML on Cross-Cutting Issues

Parties	Name	Organization
Indonesia	Ms. Masri Akma Yeni	GHG Inventory Unit, Ministry of Environment and Forestry of Indonesia (MoEF)
	Ms. Oktavia Endah Riana	
	Dr. Irawan Asaad	
Japan	Dr. Takefumi Oda (Facilitator)	GHG Inventory Office of Japan (GIO)
	Ms. Elsa Hatanaka	
	Ms. Eriko Hirata	
	Mr. Takashi Morimoto (Resource person)	Mitsubishi UFJ Research and Consulting Co., Ltd.
	Mr. Yoshihiro Okada (Workshop organizer)	Ministry of the Environment, Japan (MOEJ)

2.3 Energy Sector

Sector Overview

Cambodia and Myanmar participated in the ML session on the Energy sector. The general information for the two countries is as shown in Table 2.3.1 below.

Table 2.3.1 Sector Overview for the ML on the Energy Sector

	Cambodia	Myanmar
National total GHG emissions (kt-CO_2-eq., with LULUCF)	-457 (in 2000, NC2)	-67,820 (in 2000, NC1)
GHG emissions of the Energy sector (kt-CO_2-eq.)	2,767 (in 2000, NC2)	7,863 (in 2000, NC1)
Responsible agency for the inventory	Ministry of Environment	Environmental Conservation Department
Estimation methodology	1996 IPCC GLs[1], Tier 1	2006 IPCC GLs, Tier 1
Source of emission factors	IPCC default values	IPCC default values
Source of activity data	National statistics	National statistics

Note:
1) Cambodia plans to apply the 2006 IPCC GLs in the next NC submission.

Materials Used

To prepare for the ML 2020, the partner countries exchanged their documents relevant to the Energy sector through the Secretariat approximately two months before the workshop. The documents exchanged were as follows:

Cambodia
- Spreadsheet

Myanmar
- Sectoral reporting tables exported from the IPCC Inventory Software version 2
- National GHG Inventory of Energy Sector in Myanmar (PDF document)

Questions and Answers

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

2. Report on Mutual Learning Session

Table 2.3.2 Classification of Questions and Comments in the ML on the Energy Sector

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

Note:
1) Myanmar provided additional 25 questions after the exchange of the Q&A sheet.

Outcomes of the Mutual Learning Session

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

➢**Issues and Solutions / Outstanding issues**

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

1) Smuggling of fuel across the border makes the emission estimates of the reference approach uncertain. (Cambodia)
2) The archiving of calculation sheets is not fully sufficient. (Cambodia)
3) Disaggregated data are not available for the sectoral approach, especially for each manufacturing industry. (Myanmar)
4) Disaggregated data are not available for the sectoral approach. (Cambodia)
5) It is difficult to make data providers understand the necessity of data. (Myanmar)

➢**Good Practices**

The following were identified as good practices:

Cambodia
1) Fuel supply and demand data from ministries (e.g. Ministry of Mines and Energy) have been compared with international data (International Energy Agency, and Economic Research Institute for Asia).
2) All types of fuel have been included in the worksheets.
3) The UNFCCC software has been used.
4) Key Category Analysis has been conducted.
Myanmar
1) The National Inventory Report has been prepared.
2) The IPCC Inventory Software has been used for emission estimation as well as Uncertainty Assessment, Key Category Analysis, and archiving.
3) The national data have been compared with IEA data from 1990 to 2015.
4) The IPCC Emission Factor Database has been used for EFs that are not available in the IPCC software (e.g. transport and residential).

➢**Follow-up Activities**

The following were identified as possible follow-up activities:
1) Participate in ML again to report the progress of the identified issues.

2) Provide written answers to additional questions. (Cambodia)
3) Check the methodology of fuelwood in the LULUCF sector to avoid omission of the fuelwood emissions between energy and LULUCF sectors. (Myanmar)

➢**Suggestions for Future ML/WGIAs**

The participants' suggestions for future ML were as follows:
1) Continue to conduct WGIA in each country.
2) Discuss the difference between Revised 1996 IPCC GLs and 2006 GLs in the plenary session of WGIA.
3) Conduct ML again by the same pair of countries.

Table 2.3.3 Participants in the ML on the Energy Sector

Countries	Name	Organization
Cambodia	Mr. Sophal Leang	Department of Climate Change
	Ms. Reasey Phoeuk	
	Mr. Sokhim Pich	
Myanmar	Ms. Thi Thi Soe Min	Environmental Conservation Department
	Ms. Yu Yu Khing	
	Ms. Swe Lin Myint	Ministry of Electricity and Energy
	Mr. Kyaw Moe Aung	Project Coordinator, Second National Communication project
	Dr. San Win	Environmental Conservation Department
Facilitators	Mr. Naofumi Kosaka (Facilitator)	GHG Inventory Office of Japan (GIO)
	Mr. Hiroshi Ito (Secretariat)	
	Ms. Eriko Hirata (Secretariat)	
Observer	Mr. Yu Gonda (Workshop organizer)	Ministry of the Environment, Japan (MOEJ)

2. Report on Mutual Learning Session

2.4 Agriculture Sector

Sector Overview

China and Japan participated in an ML session on the Agriculture sector. The general information of the two countries is shown in Table 2.4.1.

Table 2.4.1 Sector Overview for the ML on the Agriculture Sector

	China	Japan
National total GHG emissions (kt-CO_2-eq., with LULUCF)	11,186,000 (in 2014, BUR2)	1,183,016 (in 2018, NIR2020)
GHG emissions in the Agriculture sector (kt-CO_2-eq.)	830,000 (in 2014, BUR2)	33,252 (in 2018, NIR2020)
Responsible agency for the inventory	The National Leading Group on Climate Change, Energy Conservation, and Emissions Reduction	Ministry of the Environment (MOEJ)
Estimation methodology	1996 IPCC GLs, Tier 1/Tier 2, and CS model	2006 IPCC GLs
Source of emission factors	Country-specific values and IPCC default values	Country-specific values and IPCC default values
Source of activity data	National statistics China Agriculture Yearbook	National statistics

Materials Used

To prepare for the ML session, both countries exchanged their documents relevant to GHG emission estimation of the sector with each other two months before the remote session. The exchanged documents were as follows:

China:
- The People's Republic of China Second Biennial Update Report on Climate Change
- Agro-GHG Platform for Planting or Breeding Enterprises
- GHG Emissions from China Croplands in 2014
- Yao Huang et al., Modeling methane emission from rice paddies with various agricultural practices, 2004
- Yao Huang et al., Estimates of methane emissions from Chinese rice paddies by linking a model to GIS database, 2006
- Xunhua Zheng et al., Description and Application of a Model for Simulating Regional Nitrogen Cycling and Calculating Nitrogen Flux, 2008
- Yao Huang et al., Agro-C: A biogeophysical model for simulating the carbon budget of agroecosystems, 2009

Japan:
- Japan. 2020 National Inventory Report (NIR)
- Japan. 2020 Common Reporting Format (CRF) Table

Questions and Answers

After receiving the materials listed above, both countries studied them and provided questions and

comments to their partner country approximately four weeks before the remote session. The classification and the number of questions are shown in Table 2.4.2.

Table 2.4.2 Classification of Questions and Comments in the ML on the Agriculture Sector

Classification of questions	Number of questions/comments	
	from China to Japan	from Japan to China
Acquisition of activity data	2	5
Adoption of emission factors or parameters	3	2
Estimation methods	5	4
Institutional arrangement	0	2
Others	4	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) The N_2O estimation method for N mineralization in mineral soils is not in line with the 2006GLs, and therefore efforts have been made to improve the method. (Japan)
2) Some data are from the statistical yearbook, but other minor data are from sources that are not publicly available. (China)
3) It is difficult to acquire certain statistical data. (China)
4) Some surveys to collect statistical data have been cancelled, and therefore solutions are being explored. (Japan)
5) Estimation for grains cultivated in upland fields needs to be further disaggregated. (China)
6) Consistency of data across sectors is subject to improvement. (Japan/China)

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

China:
1) The organizations involved in the preparation of GHG inventory must report their work progress to the Leading Group every three months during inventory compilation, and a core team of experts has been established and they work with persistent efforts.
2) The Tier 3 methods, which are based on comprehensive estimation models, were applied for Cropland.
3) CS emission factors and estimation methodology for rice paddy field and agricultural soils were developed.

Japan:
1) The emission factors of cattle are categorically provided according to factors such as animal growth stages, feeds, body weights, and milk.
2) Emissions from livestock manure management systems (MMS) are very detailed and the inventory utilizes a lot of local MMS information in Japan.
3) Data used for soil carbon stock estimation is very comprehensive in the LULUCF sector.

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➢**Follow-up activities**

The following were proposed as possible follow-up activities:

1) Results from a new survey of Soil Organic Carbon (SOC) in land converted to grassland will be reflected soon. (Japan)
2) More information on live stocks can be shared in future WGIAs/ML. (China)

➢**Suggestions for future ML**

Suggestions for future ML from participants were as follows.

1) Exchange information to reflect emission reduction based on mitigation action in the agriculture sector.
2) Continue communication with other countries and share data and best practices.

Table 2.4.3 Participants in the ML on the Agriculture Sector

Parties	Name	Organization
China	Dr. Han Shenghui	Institute of Atmospheric Physics, Chinese Academy of Sciences
	Prof. Zhang Wen	
	Dr. Yu Yongqiang	
Japan	Mr. Hiromi Yoshinaga (Facilitator)	Greenhouse Gas Inventory Office of Japan (GIO)
	Mr. Hiroshi Ito	
	Dr. Wakana Taki	
	Ms. Atsuko Hayashi	

2.5 Land Use, Land-Use Change and Forestry (LULUCF) Sector

Sector Overview

Mongolia and Singapore participated in the ML session on the LULUCF sector. The general information for the two countries is as shown in Table 2.5.1 below.

Table 2.5.1 Sector Overview for the ML on the LULUCF Sector

	Mongolia	Singapore
National total GHG emissions (kt-CO_2-eq., with LULUCF)	10,030.80 (in 2014, BUR1)	50,908.13 (in 2014, BUR3)
GHG emissions/removals of the LULUCF sector (kt-CO_2-eq.)	-24,451.93 (in 2014, BUR1)	62.03 (in 2014, BUR3)
Responsible agency for the inventory	Ministry for Environment and Tourism (MET)	National Parks Board (NParks)
Estimation methodology	2006 IPCC GLs, Tier 1/Tier 2	2006 IPCC GLs, Tier 2/Tier 3
Source of emission factors	IPCC default values and country-specific values	IPCC default values and country-specific values
Source of activity data	Mainly National statistics and International data source statistics	National statistics

Materials Used

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

Mongolia
- Mongolia Third National Communication (NC3)
- Mongolia's Initial Biennial Update Report (BUR1)
- Mongolia Sustainable Development Vision 2030
- Intended Nationally Determined Contribution of Mongolia
- Calculation sheet-exported from IPCC Inventory Software for 2006 IPCC Guidelines
Singapore
- Singapore's Fourth National Communication (NC4) and Third Biennial Update Report (BUR3)
- Chave, et al., Improved allometric models to estimate the above-ground biomass of tropical trees (2014) referenced for biomass estimation
- Field survey sheet example for inventory data collection

Questions and Answers

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

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Table 2.5.2 Classification of Questions and Comments in the ML on the LULUCF Sector

Classification of questions	Number of questions/comments	
	from Singapore to Mongolia	from Mongolia to Singapore
National system	0	0
Inventory compilation processes	8	4
Data collection procedure	6	3
Quality Assurance/Quality Control	0	0
Others	2	0

Outcomes of the Mutual Learning Session

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

➢**Issues and Solutions / Outstanding issues**

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

1) There is a lack of detailed information for uncertainty analysis (Mongolia).
2) Some categories are not estimated (Mongolia).
3) It is difficult to differentiate between anthropogenic and natural forest fires (Mongolia).
4) It is difficult to align data from satellite surveys / data from different agencies with data from national statistics (Mongolia).
5) It is difficult to collect data for year X-2 (Mongolia, Singapore).

➢**Good Practices**

The following were identified as good practices:

Mongolia
1) The 2006 IPCC GLs were applied.
2) In accordance with the 2006 IPCC GLs, Key category analysis was conducted for the data of 2014.
3) Uncertainty analysis was conducted qualitatively.
4) Memorandums of Understanding (MoU) on data exchange are made with major line ministries.
5) Harvested Wood Products (HWP) emissions/removals were estimated using the Kyoto Protocol (KP) Supplement.
6) Systematic surveys are conducted to detect land use and land-use change in forest areas.
7) Land use classification is aligned with that of the 2006 IPCC GLs.
8) Data collection for National Forest Inventory (NFI) has been improved to detect changes occurring every 5 or 10 years.

Singapore
1) The 2006 IPCC GLs were applied.
2) The IPCC (2014) Wetlands Supplement was applied.
3) Key category and Uncertainty analysis were conducted qualitatively.
4) An institutionalized MRV system, including QA/QC process, is in place.
5) All land use and land-use change categories and all five carbon pools were included in the inventory.
6) High-resolution satellite images were acquired, covering 100% of the country and all land uses.

7) Annual land-use change including small and dynamic land-use changes within Settlements was analyzed over the time series based on the satellite images acquired every 2 years.

8) Sampling methods in national studies are used for collecting data, including that for soil carbon in Stocked Forest Areas and Tree-Covered Areas in Settlements.

➤**Follow-up Activities**

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

1) Contact each other to continuously share more information.

➤**Suggestions for Future ML**

The participants' suggestion for future ML was as follows:

1) Have ML again with a country with similar land circumstances.

Table 2.5.3 Participants in the ML on the LULUCF Sector

Parties	Name	Organization
Mongolia	Mr. Khongor Tsogt	Climate Change Project Implementing Unit Environment and Climate Fund (CCPIU, ECF) Ministry of Environment and Tourism
Singapore	Ms. Lorraine Tan	National Parks Board
	Mr. Fairoz Mohamed	
	Mr. Hassan Ibrahim	
	Mr. Lek Kong Wan	National Environment Agency
Facilitators and Resource persons	Dr. Midori Yanagawa (Facilitator)	GHG Inventory Office of Japan (GIO), National Institute for Environmental Studies (NIES)
	Ms. Atsuko Hayashi (Sub-facilitator)	
	Ms. Elsa Hatanaka (Secretariat)	
	Mr. Atsushi Sato (Resource person)	Environment and Energy Dept., Mitsubishi UFJ Research and Consulting Co., Ltd.
	Mr. Akihiro Goto (Workshop organizer)	Ministry of the Environment, Japan (MOEJ)

Annex I: Agenda

Annex I: Agenda

Mutual Learning on GHG Inventories in 2020
Date: 21, 22, and 28 July 2020
Meeting Style: ONLINE

11:00 - 15:15 (JST) on 21st July		
Sector	**Agriculture**	
Combination of Countries	China	Japan
Local Time (including 1h lunch break)	10:00-14:45 (CST)	11:00-15:15 (JST)
Subjects	● **Discussion on the Agriculture sector inventory (China)** ・Q&A, explanation, comments, future improvements, etc. ● **Discussion on the Agriculture sector inventory (Japan)** ・Q&A, explanation, comments, future improvements, etc. ● **Overall discussion** ・Issues and solutions, Outstanding issues, Good practices, Follow-up activities, Suggestions for future ML	

12:00 - 16:15 (JST) on 21st July		
Sector	**General**	
Combination of Countries	Indonesia	Japan
Local Time (including 1h lunch break)	10:00-14:45 (WIB)	12:00-16:15 (JST)
Subjects	● **Discussion on the General sector inventory** 1) National system 2) Inventory compilation processes 3) Data collection procedure 4) QA/QC 5) Other issues ・Q&A, explanation, comments, future improvements, etc. ● **Overall discussion** ・Issues and solutions, Outstanding issues, Good practices, Follow-up activities, Suggestions for future ML	

Annex I

16:00 – 19:30 (JST) on 22ⁿᵈ July		
Sector	**Energy**	
Combination of Countries	Cambodia	Myanmar
Local Time (including 15min. break)	14:00-17:30 (ICT)	13:30-17:00 (MMT)
Subjects	● **Discussion on the Energy sector inventory (Cambodia)** ・Q&A, explanation, comments, future improvements, etc. ● **Discussion on the Energy sector inventory (Myanmar)** ・Q&A, explanation, comments, future improvements, etc. ● **Overall discussion** ・Issues and solutions, Outstanding issues, Good practice, Follow-up activities, Suggestions for future ML	

11:00 – 15:15 (JST) on 28ᵗʰ July		
Sector	**LULUCF**	
Combination of Countries	Singapore	Mongolia
Local Time (including 1h lunch break)	10:00-14:15 (SGT)	10:00-14:15 (ULAT)
Subjects	● **Discussion on the LULUCF sector inventory (Mongolia)** ・Q&A, explanation, comments, future improvements, etc. ● **Discussion on the LULUCF sector inventory (Singapore)** ・Q&A, explanation, comments, future improvements, etc. ● **Overall discussion** ・Issues and solutions, Outstanding issues, Good practices, Follow-up activities, Suggestions for future ML	

Annex II: List of Participants

Annex II: List of Participants

BY PARTICIPATING COUNTRIES
(Alphabetical order by family name)

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Ms. Lorraine TAN
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