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Proceedings of the 9th Workshop on Greenhouse Gas Inventories in Asia (WGIA9)

- Capacity building for measurability, reportability and verifiability -

13-15 July 2011, Phnom Penh, Cambodia

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

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Foreword

The 4th Assessment Report published by the IPCC in 2007 stated that the human-induced climate change is taking place in reality and the increase in anthropogenic greenhouse gas (GHG) concentrations in the atmosphere is "very likely" the cause. Since then, all of us on the globe have been making more efforts than ever to address this issue in both scientific and political fields. At the latest Conference of the Parties under the UNFCCC (COP16), the Cancun Agreements created a foundation to go forward by taking into account the "below two degrees Celsius", and formally anchoring targets of Annex I Parties and actions of Non-Annex I Parties in the Copenhagen Accord. In the Cancun Agreements, the submission of biennial reports including the updated GHG inventory and information on mitigation actions by all Parties was also decided. Considering the progress in the international negotiations, preparing and maintaining reliable national GHG inventories is of critical importance for all 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. 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 workshop supports government officials and researchers to develop and improve their GHG inventories through enhancing regional information exchange.

The CGER has been engaged in global environmental issues including climate change since its foundation in 1990. CGER conducts environmental monitoring, maintains global environment databases, and acts as a focal point for a number of international and domestic innovative environmental research projects. Moreover, CGER publishes reports on its research findings and activities regularly.

This CGER report serves as the proceedings of the 9th WGIA, which was held on July 13-15, 2011. in Phnom Penh, Cambodia. We hope that this report will be useful for all those who work in the field of GHG inventory as well as climate change and will contribute to further progress of inventory development in Asia.

Yasuhiro Sasano

Director
Center for Global Environmental Research
National Institute for Environmental Studies

Preface

As awareness in regards to global warming is increasing, the GHG inventories are being more and more accepted as being worthwhile, since the inventories support implementing the national mitigation actions in a measurable, reportable and verifiable manner. Furthermore, frequent reporting as stated in the Cancun Agreements (i.e., biennial reports) also encourages all Parties to consider improving the inventory quality and developing appropriate institutional arrangements and inventory processes.

Since its first session in 2003, the Workshop on GHG Inventories in Asia (WGIA) has been held eight times so far in order to support the WGIA-member countries in developing and improving their national GHG inventories through enhancing the regional information exchange by strengthening the experts' network in Asia.

This time, the 9th WGIA (WGIA9) was held from 13 to 15 July, 2011 in Phnom Penh, Cambodia as a capacity building workshop for measurability, reportability and verifiability. The items set out for this workshop by taking into consideration the current situations of member countries were all essential for the improvement of their inventories.

The outcomes of the WGIA9 are summarized in the present Proceedings. It is our hope that this report will be found useful and will contribute to further improvement of the GHG inventories in the WGIA-member countries.

In conclusion, we would like to express our sincere appreciation to the members of the local host organization, the Ministry of Environment of Cambodia, for their excellent support and kind hospitality in hosting the WGIA9. We would also like to thank all the attendees for their participation and active contribution to the success of the workshop.

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Ayako Suzuki

Deputy Director
Low-Carbon Society Promotion Office
Global Environment Bureau
Ministry of the Environment, Japan

List of Acronyms and Abbreviations

AD	Activity Data
AIM	Asia-Pacific Integrated Model
ALU	Agricultural Land Use
CDM	Clean Development Mechanism
CGE	Consultative Group of Experts
CGER	Center for Global Environmental Research
CH_4	Methane
CO_2	Carbon dioxide
COP	Conference of the Parties
CS-EF	Country-Specific Emission Factor
DNDC Model	DeNitrification-DeComposition Model
EF	Emission Factor
EFDB	Emission Factor Database
FOD	First Order Decay
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIO	Greenhouse Gas Inventory Office of Japan
GIS	Geographic Information System
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
HFCs	Hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
IPCC-EFDB	IPCC Emission Factor Database
IPPU	Industrial Process and Product Use
LUCF	Land Use Change and Forestry
LULUCF	Land Use, Land Use Change and Forestry
MOEJ	Ministry of the Environment of Japan
MRV	Measurability, Reportability, and Verifiability
MSW	Municipal Solid Waste
NAI	Non Annex I
NAMA	Nationally Appropriate Mitigation Action
NC	National Communication
N_2O	Nitrous oxide
NIES	National Institute for Environmental Studies
MCF	Methane Correction Factor
PFCs	Perfluorocarbons
QA	Quality Assurance
QC	Quality Control
REDD	Reducing Emissions from Deforestation and forest Degradation in developing countries
Revised 1996 IPCC	Revised 1996 IPCC Guidelines for National Greenhouse Gas

Guidelines	Inventories
RoK	Republic of Korea
RS	Remote Sensing
SBI	Subsidiary Body for Implementation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SEA GHG Project	Regional Capacity Building Project for Sustainable National Greenhouse Gas Inventory Management Systems in Southeast Asia
SF_6	Sulphur hexafluoride
SPM	Summary for Policymakers
SWDS	Solid Waste Disposal Site
SWGA	Workshop on Improvement of Solid Waste Management and Reduction of GHG Emissions in Asia
UA	Uncertainty Assessment
UNFCCC	United Nations Framework Convention on Climate Change
WGIA	Workshop on Greenhouse Gas Inventories in Asia
WREA	Water Resources & Environment Administration, Lao P.D.R.
2006 IPCC Guidelines	2006 IPCC Guidelines for National Greenhouse Gas Inventories

Photos of the Workshop

Welcome Address

Ms. Ayako Suzuki

Welcome Address

H.E. Thuk Kroeun Vutha

Overall Chairperson

Mr. Kiyoto Tanabe

Main Room for Opening Session, Session I,II and Wrap-up

Tea Break and Lunch

Session III Working Group 1

Working Group 2

Working Group 3

Working Group 4

Mutual Learning 1

Mutual Learning 2

Mutual Learning 3

Closing Remarks

Dr. Yukihiro Nojiri

1. Executive Summary of WGIA9

MOEJ and NIES, jointly with the Ministry of Environment of Cambodia (MOEC), convened WGIA9 on 13-15 July 2011 in Phnom Penh, Cambodia, as a capacity building workshop for MRV. The workshop was attended by 75 experts from fourteen WGIA-member countries (Cambodia, China, India, Indonesia, Japan, the Republic of Korea (RoK), Lao P.D.R., Malaysia, Mongolia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam), as well as the Technical Support Unit of the Task Force on National Greenhouse Gas Inventories (TFI TSU) of IPCC, the United States Environmental Protection Agency (USEPA) and the Regional Capacity Building Project for Sustainable National Greenhouse Gas Inventory Management Systems in Southeast Asia (SEA GHG Project). The GIO under the CGER, NIES, functioned as WGIA Secretariat.

The objectives of the workshop were:

- to report the latest National Communications (NCs) (inventories) being submitted to the UNFCCC Secretariat,
- to discuss future activities beyond the latest inventories,
- to clarify the relationship between inventory and mitigation measures,
- to implement mutual learning, and
- to discuss sector-specific issues.

The welcome address was delivered by Ms. Ayako Suzuki, Deputy Director of the Low-carbon Society Promotion Office, MOEJ, followed by the welcome address delivered by H.E. Thuk Kroeun Vutha, Secretary of State, MOEC. The workshop was chaired by Mr. Kiyoto Tanabe, NIES Researcher of the GIO.

The experts discussed various subjects of interest to Asian countries, including the recent progress made by member countries, possible future activities in each member country and the WGIA itself, and sector-specific issues. In addition, the mutual learning by means of the latest inventories between countries, which was suggested by the WGIA Secretariat and supported by the participants at the WGIA8, was conducted for the first time during the WGIA9. The outcomes of the discussions about each subject are summarized below.

Through the discussions of these subjects, the experts reaffirmed the importance of the inventory as a key tool for promoting MRV mitigation actions. They also recognized that one needed to keep in mind the relationship between inventory and mitigation when developing a mitigation measure and collecting data for inventories in order to reflect the effects of mitigation actions on the inventory in a timely manner. Taking into account the fact that many WGIA member countries have submitted or are about to submit their latest NCs in the near future, it was recommended that member countries start or get ready for the preparation of the next inventory. The mutual learning by means of the latest inventories implemented by some of the WGIA member countries demonstrated that it could be a good opportunity for inventory compilers to find out efficiently the points to be improved in their next inventories. Those who joined the mutual learning found this activity useful and supported its continuation. For the next workshop, the WGIA Secretariat was recommended to review the progress of the last ten years' activity of WGIA and set the agenda by taking into account the outcome of the upcoming seventeenth session of the Conference of the Parties under the UNFCCC (COP17). Through this workshop, the network of WGIA-member countries was further strengthened.

The workshop was closed with closing remarks by Mr. Sum Thy, Director of Department of Climate Change of MOEC, and by Dr. Yukihiro Nojiri, Manager of GIO.

Report of the latest NCs (inventories) recently submitted

From the six member countries which recently submitted their latest NCs, Indonesia, Malaysia, Thailand and Viet Nam reported an overview of their latest NCs (i.e., second NC). The reports were made in regards to the inventory data of year 2000, which is a requirement under the second NC, points of improvement compared to the initial NCs, issues still to be addressed, and the perspective and actions being taken for the next inventory preparation. All four countries have enhanced the completeness of their inventory as well as their institutional arrangements for the inventory preparation and data collection compared to those for the initial NCs.

Relationships between inventory and mitigation measures

The relationship between inventory and mitigation measures was discussed in accordance with the previous workshop's summary stating the importance of expanding the WGIA activities to enhance the usefulness of the inventory, e.g., activities to link inventories to mitigation planning and policy making support, and with the Cancun Agreements stating that all parties should report biennial reports including an updated inventory and information on mitigation actions. China, Malaysia and Thailand introduced how they used their national inventory to develop mitigation measures. Experts were of the view that the inventory, if it is appropriately compiled, could be used as a basis for developing mitigation measures and as an index for evaluating the effects of mitigation measures being implemented; therefore, the inventory was found to be useful to support the implementation of mitigation actions in a sustainable manner. On the other hand, it was also recognized that care should be taken in using inventory methodologies for mitigation planning and implementation so as to avoid unsound overestimation of mitigation effects. Furthermore, India and the Philippines reported their research activities for developing emission factors that could improve their inventory and contribute to the evaluation of mitigation measures. In the overall discussions, it was recommended that inventory compilers and those who develop mitigation measures strengthen their cooperation in order to assure the close linkage between inventory and mitigation measures.

Mutual Learning among WGIA-member Countries

Mutual learning was conducted in order to improve the individual countries' own inventories through exchanging inventories between two to three countries, learning from each others' inventories and exchanging comments between each other. The target sectors in this workshop were: Energy (Indonesia and Mongolia), LULUCF (Lao P.D.R. and Japan), and Waste (Cambodia, RoK and Indonesia). The approach of this activity was: 1) exchanging worksheets used for estimating emissions and reports describing details of methodologies, 2) raising good points as well as issues of a partner country and asking questions, 3) answering to the questions. A series of processes were started three months prior to the workshop. At the workshop, further exchange of comments and clarification were made between the countries concerned in small groups for each sector. The discussions concerned not only estimation methodology but also institutional arrangements as well as background information on the emission sources and removal sinks in each country. Through the discussions, experts could understand the inventory of the partner country, and simultaneously, realize again the

characteristics of their own inventory as well. Through this activity, experts confirmed that mutual learning could contribute to enhancing the quality of the MRV of the inventory, since this activity provided hints for improving not only the estimation methodologies but also the transparency of the inventory.

Continuation of Inventory Development

As was also the case in the previous workshop, the experts were strongly encouraged to take advantage of one of the conclusions made by the Subsidiary Body for Implementation under the UNFCCC at its 30th session (June, 2009)[1] which allows non-Annex I Parties to submit project proposals to the Global Environmental Facility (GEF) for the funding of their subsequent NCs before the completion of their current NCs.

Sector-specific / Inter-Sectoral Issues

(Waste Sector, Inventory [non-CO_2], Transport Sector and Inventory [QA/QC])

Waste Sector

In this working group, the WGIA Secretariat reported the result of the analysis of the questionnaire survey conducted prior to the workshop and introduced the categorization for the accuracy of waste inventory of each member country. Following that, member countries presented their latest inventories. The issues in regards to the elaboration of activity data and the discrepancy between emission factors and the actual condition of waste management were pointed out. For regions, where waste statistics are not fully established, a number of assumptions are included when calculating activity data. Therefore, it was pointed out that searching for statistics by region through the collaboration between departments in charge of waste, regional offices and experts of waste sector and outcomes of research and survey was needed to be conducted. Also, in regards to the regional characteristics of emission factors, enhancement of information sharing through the WGIA- and IPCC-database was suggested.

Inventory (Non-CO_2 gases)

Experts exchanged information on non-CO_2 gases (CH_4, N_2O, HFCs, PFC and SF_6) reported in the latest inventory of the member countries. Considering the fact that CH_4 from the Agriculture sector is the most significant emission source in many of the member countries, it was recognized that continuous discussions on how to improve estimation methodologies and on mitigation measures were needed. Furthermore, for those courtiers which have not reported F-gases yet, it was recommended that they estimate those gases, especially HFCs used as refrigerant, with a Tier 1 methodology given in the 2006 IPCC Guidelines, even though reporting of those gases was currently not required for Non-Annex I Parties.

Transport Sector

With the increase in the number of automobiles in Asian countries, GHG emissions from the transportation sector have been rapidly increasing. In this working group, experts shared information on the emission status of each member country with special emphasis on CO_2, details of estimation methodologies and mitigation measures, and also confirmed the status of this sector in each member country based on the questionnaire survey conducted prior to the

[1] See FCCC/SBI/2009/8, paragraph 21.

workshop. The experts recognized, among others, that in order to better contribute to future mitigation work, it would become necessary to generate more precise and real-time emission inventories because the number and type of vehicles, traffic patterns, etc. were rapidly changing.

Inventory (QA/QC)

Against the backdrop of the Cancun Agreements, the importance of inventory preparation by developing countries has been growing and the assurance of inventory quality is expected to be a challenge. In this working group, it was confirmed that each member country had some activities practically functioning as QA/QC, even though those activities were not recognized as QA/QC activities of inventory at this moment. Also, experts reaffirmed the importance of documenting these activities and archiving, and they confirmed that these activities could become the basis for official QA/QC plans in the future.

2. Introductory Notes

2.1. Background

Parties to the UNFCCC are required to prepare and submit GHG inventories as part of NCs to the COP. Inventories are important for all Parties, as they show a Party's status of emissions/removals and become a basis for the mitigation measures for that Party. The frequency of inventory submission is different for Annex I (AI) and non-Annex I (NAI) Parties in accordance with the principle of "common but differentiated responsibilities" as stated in the Convention.

The importance of inventories has been recognized more and more in the international negotiation process since 2007, as they are crucial to measurable, reportable and verifiable Nationally Appropriate Mitigation Actions (NAMAs). Assuming that all Parties submit in the future biennial reports, which include information on inventory and mitigation actions (Cancun Agreement, 2010), and that these reports would become a basis for reporting and verifying NAMAs, the improvement of inventories as well as the development of appropriate institutional arrangements for that within a country need to be considered and enhanced.

MOEJ and NIES have been organizing "Workshop on GHG Inventories in Asia" on an annual basis since 2003[2] for NAI Parties within Asia[3]. Since its 6th session, the workshop has been held as part of the "Kobe Initiative"[4] launched by the G8 Environmental Ministers' Meeting in May 2008. These workshops have always aimed at supporting NAI Parties in Asia to develop and improve their GHG inventories through enhancing information flow and experience exchange as well as by obtaining cooperation of experts from both in and out of member countries. So far, WGIA has not only contributed to inventory improvement of member countries but also has developed and strengthened a regional network of experts. In the upcoming WGIA9, the agenda items listed in the following section will be discussed.

These introductory notes are intended to inform the prospective participants of the objectives and expected outcomes of the workshop as well as the details of each session. We would like to encourage participants to provide the WGIA secretariat with suggestions and comments during the on-going preparation process.

2. 2 Major themes of WGIA9

- Reporting the latest NCs (inventories) being submitted to the UNFCCC secretariat,
- Discussing future activities beyond the latest inventories,
- Clarifying the relationships between inventory and mitigation measures,
- Mutual learning, and
- Group discussions on the sector-specific issues.

2.2.1. Opening session (July 13)

Session Style: Plenary

Overview: After introducing the workshop overview, both host countries (MOEs of

[2] (WGIA1) Phuket, Thailand on 13-14 November 2003; (WGIA2) Shanghai, China on 7-8 February 2005; (WGIA3) Manila, Philippines on 23-24 February 2006; (WGIA4) Jakarta, Indonesia on 14-15 February 2007; (WGIA5) Kuala Lumpur, Malaysia on 6-8 September 2007; (WGIA6) Tsukuba, Japan on 16-18 July 2008; (WGIA7) Seoul, Republic of Korea on 7-10 July 2009; (WGIA8) Vientiane, Lao P.D.R. on 13-16 July 2010

[3] Cambodia, China, India, Indonesia, Republic of Korea, Lao PDR, Malaysia, Mongolia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam.

[4] Chair's Summary, G8 Environment Ministers Meeting (http://www.env.go.jp/en/focus/attach/080610-a2.pdf)

Japan and Cambodia) will present their policy schemes to combat climate change. In addition, representatives of UNFCCC and IPCC will share updated information considered to be useful for participants in inventory preparation.

2.2.2. Session I: Report of the latest NCs (inventories) recently submitted (July 13)

Objectives: To share experiences gained through the preparation of the latest NCs being submitted and plans for the next inventories

Session Style: Plenary

Overview: Some of member countries have submitted their latest NCs. Experts from those countries will present overviews of their NCs with a focus on the inventories and will also share good practices regarding inventory preparation. Furthermore, they will share their plans for the next inventory preparation.

2.2.3. Session II: Relationships between inventory and mitigation measures (July 13)

Objectives: To clarify the relationships between inventories and mitigations in order to develop inventories that are not only a basis for mitigation actions but also are an index of the impact of mitigation actions.

Session Style: Plenary

Overview: The importance of continues improvement of inventories in the sense of transparency, accuracy, consistency, completeness, comparability has been stressed so far, since inventories can show a country's emission/removal status and are often referred to as a basis for developing mitigation measures for a country. Theoretically speaking, inventories should also reflect the impact of mitigation measures on emissions/removals; however, in order to do so, certain points should be taken into consideration while developing inventories (e.g., adoption of appropriate emission factors, activity data, and influence of CDM). In this session, participants will try to clarify the relationships between inventories and mitigation actions (incl. CDM) and discuss as to how we can better estimate emissions/removals that reflect the impact of mitigation measures.

2.2.4. Session III: Working Group (WG) Discussions (14 July)

Objectives: To discuss sector-specific issues and possible ways to solve them

Session Style: Group discussions

Overview: Participants will join two of the following WGs to discuss sector-specific issues. A brief guidance will be provided prior to the discussion. The detailed discussion topics are:

1) Waste (Sector-Specific issues)

Discussion topic: Development of waste statistics to estimate activity data

One of the major obstacles in the way of improving GHG emission estimates from the waste sector is the insufficiency of statistics to obtain activity data. Focusing on the importance of key elements to compile statistics (relevant domestic laws, statistical survey methods, and survey implementing agencies setup), participating countries will share their information on the current status of solid waste statistics referred in the most current inventory including industrial waste, discuss the issues to be addressed, seek effective actions or outline the direction towards the future improvements of their national GHG inventories.

2) Inventory (Inter-Sectoral issues)

Discussion topic: The latest and future NCs focusing on estimation of non-CO_2 gases

Many WGIA member countries do not only estimate and report emissions of CO_2, CH_4 and N_2O, but also ambitiously those of HFCs, PFCs, SF_6. In this working group, participants will

share the latest information on emissions of non-CO_2 gases using questionnaire-sheets prepared in advance. Furthermore, some countries, including Japan, will present detailed estimation methodologies, good practices, and unique and/or important challenges for estimating emissions of non-CO_2 gases (CH_4, N_2O, HFCs, PFCs, SF_6). Finally, the future plans of each country focusing on non- CO_2 gases will be discussed.

3) Transportation (Sector-Specific issues)

Discussion topic: Estimation of CO_2 emissions from transportation sector

With the increase in the number of automobiles in Asian countries, GHG emissions from the transportation sector have been rapidly increasing. A GIO member will present an overview of GHG emissions with a focus on CO_2 from this sector in the member countries and exchange information on the details of estimation methodologies and mitigation measures used by each country.

4) Inventory (Inter-Sectoral issues)

Discussion topic: Sharing experiences gained through preparing NCs and identifying key elements for QA/QC systems

By taking into account that many of the WGIA member countries have started or are almost starting to plan for their next inventories, participants will exchange information on their institutional arrangements, including QA/QC systems, for inventory preparation.

2.2.5. Session III: Mutual Learning (14 July)[5]

Objectives: To improve our inventories through exchanging questions and comments among experts from countries involved in mutual learning activities.

Session Style: Group discussions

Overview: This session aims at improving our next inventories by learning from other inventories including data used in their compilation and by exchanging questions and comments with experts from two or three member countries. Target sectors and participating countries for this activity this time are:

- Energy (Indonesia and Mongolia),
- LULUCF (Lao PDR and Japan), and
- Waste (Cambodia, Republic of Korea and Indonesia).

2.3. Wrap-up Session (July 15)

Objectives: To wrap up the discussions of the previous days and discuss future activities

Session Style: Plenary

Overview: The rapporteurs will present outcomes of each plenary session, WG session and mutual learning session. Based on the outcomes, the future perspective of the WGIA member countries as well as the WGIA activity will be discussed. Also, we will discuss how to disseminate our knowledge and recommendations to other NAI Parties.

[5] Mutual learning and WG discussions will be held concurrently (Session III).

3. Workshop Report

Please note that all presentation materials can be downloaded from the website of GIO:
http://www-gio.nies.go.jp/wgia/wg9/wg9index-e.html

3.1. Opening Session

The opening session was chaired by the overall workshop chair, Mr. Kiyoto Tanabe (Japan) and the rapporteur was Ms. Takako Ono (JICA Viet Nam).

The welcome address was delivered by Ms. Ayako Suzuki, Deputy Director of Low-Carbon Society Promotion Office, Global Environment Bureau, MOEJ. She welcomed everyone and expressed her gratitude to the government of Cambodia, among others the Ministry of Environment (MOE, Cambodia), for hosting this workshop. She also took this opportunity to acknowledge the sympathy and valuable support from all over the world including the countries attending the WGIA9 by recalling the massive earthquake that hit Japan on 11 March 2011. She stressed the importance of an inventory for mitigation actions in a measurable, reportable and verifiable (MRV) manner for the “below two degrees Celsius”. Since the WGIA is a capacity building workshop for the MRV and data collection, she wished everyone fruitful discussions in these matters.

H.E. Thuk Kroeun Vutha, Secretary of State of MOE, Cambodia, welcomed everyone to Cambodia. With regard to the NCs, he pointed out that the capacity of every level, both regional and national levels, needed to be raised in Cambodia. He also pointed out that financial support was indispensable for organizing and improving the national GHG inventory of developing countries, specifically of the least developed countries. He wished all participants to join in sharing their knowledge and experiences in order to effectively achieve the aims of this workshop.

Mr. Hiroshi Ito (Japan) gave an overview of the WGIA and introduced the objectives, participants and the agenda of WGIA9. The objectives of the workshop were:

- To report on the latest NCs (inventories) being submitted to the UNFCCC Secretariat,
- To discuss future activities beyond the latest inventories,
- To clarify the relationships between inventory and mitigation measures,
- To conduct mutual learning, and
- To conduct group discussions on sector-specific issues.

Ms. Ayako Suzuki (Japan) made a presentation on Japan's climate change policies as well as the current situation of Japan after the disaster. She recalled the crisis of nuclear power plants in Japan and introduced the movements that followed in Europe and Japan on their nuclear power generation and energy policy, as they might affect GHG emissions in those countries. She also introduced actions taken at the MOEJ, to ride out the electricity shortage (e.g., “Super Cool Biz” campaign). Regarding Japan’s emissions status, the FY 2009 data indicated that the Industrial and Transport Sectors, which were the first and second largest emission sources in Japan, have achieved their reduction targets set by the Kyoto Target Achievement Plan (Revised in 2008), while the Commercial and other sector (office buildings, etc.) and Residential sector still remained as the major issue. Although it was not yet clear how the earthquake disaster affected the outcome of Japan’s GHG emissions estimates, she

stated that MOEJ would make every effort to promote various mitigation actions to achieve Japan's reduction target under the Kyoto Protocol.

Regarding Ms. Suzuki's presentation, Dr. Nik (Malaysia) asked how much Japan considered using credits obtained through Clean Development Mechanism (CDM) for the reduction commitment. Ms. Suzuki answered that Japan tried to cover its reduction target (-6% compared to the KP base year) with Kyoto units (1.6%) and with forest sinks (3.8%) based on the Kyoto Target Achievement Plan (All revised in 2008).

Mr. Sum Thy (Cambodia) talked about climate change activities in Cambodia. Cambodia started its climate change activities in 1999 by preparing its Initial National Communication (INC) supported by the UNDP/GEF. Since then, Cambodia has promoted actions to mitigate the climate change by establishing the Climate Change Department (CCD) within the MOE, Cambodia, which develops NCs and the national inventory, the National Climate Change Committee (NCCC) hosted by the MOE, Cambodia, and the Cambodia Climate Change Alliance (CCCA) with support from EU, UNDP, Sida and Danida. Since 2007, Cambodia has been preparing its Second National Communication (SNC) supported by the UNDP/GEF at its own discretion. He mentioned that the inventory chapter has been completed; however, the rest of the SNC was still to be completed. He also introduced the results of emissions data included in the INC (1994) and SNC (2000), the emissions projections and mitigation options in Cambodia. [Abstract, not available]

Regarding Mr. Sum Thy's presentation, Mr. Hiraishi (Japan) asked if Cambodia considered applying GPG-LULUCF to the LUCF sector. Mr. Thy answered that Cambodia used the revised 1996 guidelines for LUCF sector, since data were more demanding for the GPG-LULUCF. Ms. Hatanaka (Japan) asked the reason why there was no data for Industrial Processes in 2000. Mr. Thy answered that there was no industrial activity subject to estimation in that year. Mr. Nouansyvong (Lao PDR) asked about the functions of CCCA. Mr. Thy answered that the CCCA, consisting of multiple donors, supported the government of Cambodia to develop actions for dealing with climate change issues such as supporting NCCC and establishing a national strategic plan.

Mr. Kiyoto Tanabe (Japan) introduced the activities of the consultative group of experts (CGE) on NAI-NCs, which was reconstituted at COP15 (December 2009). CGE's objective is to improve the process and preparation of NCs from NAI Parties, by providing them with technical advice and support. He stated that CGE has currently been trying to analyze the progress of NAI Parties. He also introduced the recommendations made by the CGE after the questionnaire survey conducted in 2010. Although there were various recommendations, he stressed, among others, that the experts' networking was important. He pointed out that the WGIA was a good example of this kind of networking. Reports from CGE as well as further information on CGE are available from UNFCCC website [Abstract, not available]:

http://unfccc.int/documentation/items/2643.php

- ✓ FCCC/SBI/2010/INF.2
- ✓ FCCC/SBI/2010/21
- ✓ FCCC/SBI/2010/21/Add.1
- ✓ FCCC/SBI/2011/5/Rev.1
- ✓ FCCC/SBI/2011/5/Add.1
- ✓ FCCC/SBI/2011/5/Add.2

http://unfccc.int/national_reports/non-annex_i_natcom/cge/items/2608.php

Furthermore, Mr. Tanabe made a report on Subsidiary Body for Implementation (SBI) 34 held in June 2011 on behalf of Mr. Dominique Revet (UNFCCC secretariat). He reminded of the conclusion of SBI 30, i.e., NAI Parties were encouraged to submit project proposals for funding of their subsequent NCs before completing their current NCs in order to avoid disruption in project financing. Finally, he reported on the outcomes of SBI 34, especially those regarding the provision of financial and technical support, which are as follows. [Abstract, not available]

- ✓ The SBI invited the GEF to continue to provide information on the approximate completion date of the draft NCs and the approximate submission date of the NCs to the secretariat, for consideration by the SBI at its thirty-fifth session.

- ✓ The SBI took note, with appreciation, of the information provided by the GEF in its oral report to the SBI on the expanded possibilities and options available to NAI Parties to access resources for their NCs, and looked forward to receiving further information on this issue in the report of the GEF to the COP17 .

- ✓ The SBI invited NAI Parties to submit the detailed costs they had incurred for the preparation of their most recent NCs, as well as the financial resources received through the GEF by 19th September, 2011.

Regarding Mr. Tanabe's presentation, Mr. Nik (Malaysia) asked about the base year for the inventory to be included in the Third NCs (TNCs). Mr. Tanabe answered that there was no agreement on the base year for the TNCs. Since the Republic of Korea is already preparing its TNC, Mr. Jin (RoK) made a comment that Korea has not decided a base year and it varied for inventory, mitigation and adaptation. Mr. Buendia (SEA GHG Project) asked the purpose of the SBI with collecting detailed information on costs incurred by NAI Parties for the preparation of their most recent NCs and on financial resources received though the GEF. Although Mr. Tanabe stressed that he was not the right person to answer this kind of question, he presumed that the UNFCCC secretariat might want to analyze what kind of improvements should be made to the current mechanisms for financing and resources based on the information provided by NAI Parties, since the demand for those Parties on reporting NCs has been growing because of the MRV discussions.

Dr. Simon Eggleston (IPCC TFI TSU) informed about the IPCC's recent inventory developments. Emphasis was placed on the work plan for developing supplements to the 2006 IPCC guidelines for Wetlands. The methodological guidance will be provided for subcategories of peatland rewetting and restoration as well as anthropogenic emissions and removals from additional coastal and freshwater wetland types, with the exception of flooded lands. The work has already started and is expected to be completed before the 39th session of Subsidiary Body for Scientific and Technological Advice (SBSTA) in 2013. He also introduced the features of the software for the 2006 IPCC guidelines. He announced that the new version was available on the TFI website[6] and encouraged comments from the users. The expert meetings on software will be held in Japan and Brazil in 2011 and the TFI is aiming to release the first version of the software before the end of 2011. He also reminded about the

[6] http://www.ipcc-nggip.iges.or.jp/support/support.html

emission factor database (IPCC-EFDB)[7] and informed about the upcoming expert meetings. [Abstract, not available]

Regarding Dr. Eggleston's presentation, Mr. Thy (Cambodia) and Dr. Oda (Japan) asked about the possible overlapping of categories e.g., wetlands and agricultural land, and wetlands and lands for wastewater treatment. Dr. Eggleston answered that clear guidance would be given probably in chapter one of the supplements to ensure avoiding double counting. He also stressed that one needed to be careful about land clarification. Dr. Philip (Malaysia) asked for the elaboration of the chapters on wetlands. Dr. Eggleston said that there were a number of wetland types but wetlands, especially for those enough scientific papers were available and also those considered to be significant sources/sinks, should be covered in the guidelines. Mr. Thy (Cambodia) further asked how to differentiate anthropogenic emissions from national flux. Dr. Eggleston said that there were clear cases of emissions from human activities such as land-use conversion from wetlands to other land-use categories and this covers significant emissions from wetlands. The chair supported the IPCC's work, as wetlands are important for WGIA member countries.

3.2. Session I: Report on the latest NCs (inventories) recently submitted

Session I was chaired by Mr. Kamal Uy (Cambodia), and the Rapporteur was Mr. Kazumasa Kawashima (Japan).

From the six member countries which had recently submitted their latest NCs[8], Dr. Retno Gumilang Dewi (Indonesia), Dr. Abdul Rahim Nik (Malaysia), Dr. Woranuch Emmanoch (Thailand) and Mr. Cuong Mong Nguyen (Viet Nam) presented an overview of their latest NCs with a special emphasis on the inventory chapter. Their presentations covered the following issues: emission/removal status in 2000, methodologies applied, limitations and constraints, improvements from INC and improvement plan for TNC (Table 1). [Abstracts: Dr. Dewi, not available; Mr. Nguyen, not available]

[7] http://www.ipcc-nggip.iges.or.jp/EFDB/main.php
[8] Indonesia, Malaysia, Mongolia, Singapore, Thailand and Viet Nam (as of 13 July 2011)

Table 1: Summary of GHG inventory for SNC

	Indonesia	**Malaysia**	**Thailand**	**Viet Nam**
Submission date After the UNFCCC-HP	14 January 2011	14 April 2011	24 March 2011	7 December 2010
Reporting year	2000 Estimated also for 2000-2005	2000 Estimated also for 1990-2007	2000 Estimated also for 1994, 2000-2004	2000
Coverage (sector & gas)	Energy; IP; Agri.; LUCF; Waste CO_2; CH_4; N_2O; PFC	Energy; IP; Agri.; LUCF; Waste CO_2; CH_4; N_2O; HFC; SF_6	Energy; IP; Agri.; LUCF; Waste CO_2; CH_4; N_2O	Energy; IP; Agri.; LUCF; Waste CO_2; CH_4; N_2O
National total in 2000	w/o LUCF: 556.5 Mt CO_2 eq. Energy 50.5%; Waste 28.3%; Agriculture 13.6%; IP 7.7% with LUCF: 1,377.8 Mt CO_2 eq. LUCF and peat fires 59.6%; Energy 20.4%; Waste 11.4%; Agriculture 5.5%; IP 3.1%	w/o LUCF: 193.4 Mt CO_2 eq. Energy 76.0%; Waste 13.6%; IP 7.3%; Agriculture 3.1% with LUCF: -26.8 Mt CO_2 eq. Removals offset national total emissions completely	w/o LUCF: 237.0 Mt CO_2 eq. Energy 67.3%; Agriculture 21.9%; IP 6.9%; Waste 3.9% with LUCF: 229.1 Mt CO_2 eq. Removals offset 3.3% of national total emissions	w/o LUCF: 135.8 Mt CO_2 eq. Agriculture 47.9%; Energy 38.9%; IP 7.4%; Waste 5.8% with LUCF: 150.9 Mt CO_2 eq. Agriculture 43.1%; Energy 35.0%; LUCF 10.0%; IP 6.6%; Waste 5.3%
Characteristics	LUCF is the major emission source Large fluctuation in emissions from peat fires Indonesia is among the world's 10 largest emitters of GHGs	LUCF is the major removal sink Emissions from Energy sector have been increasing since 1990 Per capita CO_2 emissions increased; while per GDP CO_2 emissions decreased from 2000 to 2007	LUCF is the major removal sink Emissions from Energy, IP and Waste sectors have been increasing since 1994	Agriculture sector is the major emission source Emissions from Energy sector have increased more than other sectors from 1994 to 2000
Methodology	Guidelines: 2006 IPCC GL (Tier 1 and 2) AD: Published (official) data from Indonesian statistics EF: Country-specific EFs and default EFs from the 2006 IPCC GL	Guidelines: 1996 Revised IPCC GL	Guidelines: 1996 Revised IPCC GL (Tier 1 and 2) AD: From domestic sources EF: Country-specific EFs and default EFs from the IPCC 1996 Revised GL	Guidelines: 1996 Revised IPCC GL (Tier 1 and 2) AD: Published data in national statistics and research results EF: Country-specific EFs and default EFs from the IPCC 1996 Revised GL
Uncertainty assessment	w/o LUCF: 16.3%; with LUCF: 1.5% Tier 1 of GPGs The levels of uncertainty for AD & EF were assessed based on expert judgment and consultation with the Centre for Data and Information in the related sectors.		The aggregate uncertainty of GHG emissions for 2000 was estimated at 7.39%.	With LUCF: 14.9% Tier 1 of the 2006 IPCC GL

Key category analysis (Level assessment, Top 3)	w/o LUCF 1) energy production (CO_2) 19.8%; 2) industrial wastewater treatment and discharge (CH_4) 18.7%; 3) manufacturing industries and construction (CH_4) 12.4% with LUCF 1) forest and grassland conversion (CO_2) 39.6%; 2) peat fires (CO_2) 25.6%; 3) CO_2 emissions and removals from soils 14.1% (all from the LUCF sector)	w/o LUCF 1) energy industries (CO_2) 30.0%; 2) transport (CO_2) 18.4%; 3) manufacturing industries and construction (CO_2) 13.5% with LUCF (excl. sinks) 1) energy industries (CO_2) 26.2%; 2) transport (CO_2) 16.0%; 3) manufacturing industries and construction (CO_2) 11.7%		The number of key categories in each sector: Energy (6); IP (2); Agriculture (4); LUCF (5); Waste (1)
Legal basis for the GHGI	Law Number 6/1994 Concerning Ratification of the UNFCCC → GHGI development as part of NC Law Number 31/2009 Concerning Meteorology, Climatology and Geophysics → GHGI development for CC policy Law Number 32/2009 Concerning Environmental Protection and Management → GHGI development at the national, provincial and city levels Presidential Decree Concerning National GHGI (On Going Process)			
Improvements from INC	Application of 2006 IPCC GL Improvements in AD and EF Implementation of uncertainty assessment Application of both sectoral and reference approaches to energy sector	Completeness of AD and EFs Clear description of data sources, definitions and methodologies Enhancement of the coverage of categories Implementation of key category analysis	Inventory processes carried out based on decision tree of the GPGs Essential pathways involved the completeness, accountability, and transparency of data used. Implementation of key category analysis	Database (AD & EF) and archive in DMHCC (MONRE) Implementation of key category analysis & uncertainty assessment Source by source documentation for Agriculture Surveys to develop local EF Compilation of the technical report on GHGI for 2000
Improvement plan for TNC	Application of satellite data Establishment of a special division in the MoE (already done in 2010) and strengthening the current system of NGHGI Capacity building of personnel in key ministries & regional offices Conducting primary surveys to reduce uncertainty in key sources	Institutionalization of GHGI process Development of local EFs Development of a national template for data compilation Development of procedures for national GHGI Referencing on-going mitigation actions with GHGI		Institutional arrangements for national inventory systems as well as QA/QC procedures and systems Enhancing documentation of method, AD, and EF for all categories Improving the system for data collection, analysis, verifying and updating for GHGI

Information source: Presentation material, Chapter 2 of SNC, Answers to the questionnaire

3.3. Session II: Relationships between inventory and mitigation measures

Session II was chaired by Mr. Leandro Buendia (SEA GHG Project), and the rapporteur was Dr. Simon Eggleston (IPCC TFI TSU).

This session was arranged by taking into account the previous workshop's summary stating the importance of expanding the WGIA activities to enhance the usefulness of the inventory, e.g., activities to link inventories to mitigation planning and policy-making support. Also the Cancun Agreements, stating that all parties should report biennial reports including an updated inventory and information on mitigation actions, was taken into consideration. In addition, two research activities for developing country-specific EFs in the Philippines and India were presented as examples that would support NAMAs and the inventory.

Dr. Junko Akagi (Japan) made an introductory presentation. Since this was the first time to deal with mitigation matters at the WGIA, she tried to find out how national inventories were utilized for developing or monitoring mitigation measures in the member countries (Figure 1). Following the introductory presentation, she also introduced examples of Japan and pointed out that the selection of appropriate data was important to assure the linkage between inventory and mitigation actions.

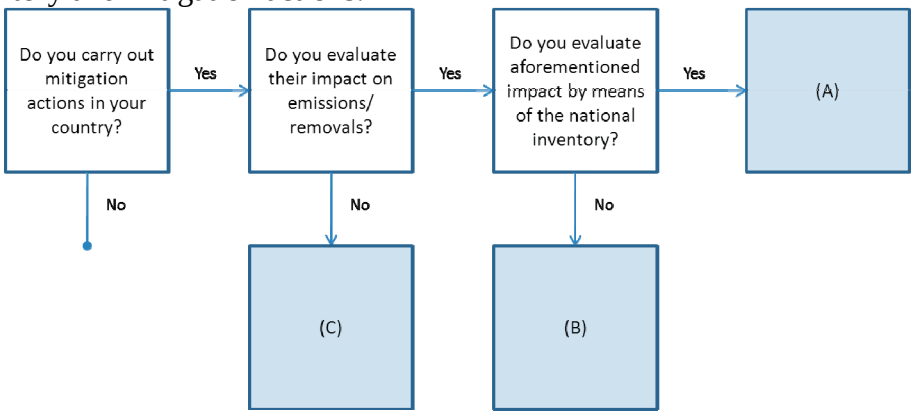

Figure 1 Chart to find out the status of member countries

Regarding Dr. Akagi's presentation, Mr. Hiraishi (Japan) added one more point to be considered in this session, namely, how inventory experts could contribute to the discussions in the international negotiations for developing guidelines to support MRV NAMAs. The parties in negotiations do not always know well about the potentials of inventories, even though they discuss Biennial Reports (BRs) and NCs that include inventories.

Dr. Qingxian Gao (China) reported on China's waste inventory for the SNC, mitigation actions and related pilot studies in China to achieve the action targets set by the government, and on the situation related to CDM projects that are also considered to be important mitigation actions in China. He pointed out that the reduction in GHG emissions must be deducted from the national inventory in order to keep track of the influence of mitigation actions. Since the Chinese government pays attention to mitigation actions, China has a status of "A" based on figure 1. However, detailed examples in this regard were not presented, as the SNC was not yet published.

In regards to Dr. Gao's presentation, Mr. Tanabe commented that inclusion of emissions reduction from CDM might not be so difficult taking into account the fact that China has

already applied tier 2 First Order Decay (FOD) method to the solid waste management system. Dr. Gao answered that the lack of historical data and the fact that emissions from this category were currently not evaluated at the level of each site but at the city level did not allow to do so; nevertheless, this matter would be considered for the next inventory.

Dr. Chart Chiemchaisri (Thailand) presented an overview of the waste inventory for the SNC and mitigation options in the waste sector. The waste sector covered about 4% of the national total in Thailand in 2000, and the emissions from this sector have been increasing. Emissions from solid waste disposal on land, wastewater handling and waste incineration covered 52.2%, 47.5% and 0.2%, respectively. He also introduced mitigation policies and technologies for each category of the waste sector in Thailand. By taking various assumptions into account, emission projections with and without various measures were considered based on the methodologies used for the inventory, and the effectiveness of each mitigation option was evaluated.

In relation to Dr. Chiemchaisri's presentation, Dr. Akagi asked why Thailand used tier 2 for the inventory and tier 1 for the mitigation analysis for the category of solid waste disposal on site. Dr. Chiemchaisri answered that this was because the FOD was site specific and, therefore, it was difficult to foresee the effects of mitigation options with tier 2 method. Dr. Akagi also asked if Thailand had already been evaluating the impact of mitigation measures being implemented with the national inventory or any other indices. Dr. Chiemchaisri answered that this was not yet done, since the influence was considered still to be minor. Mr. Buendia noted that Thailand considered the mitigation options based on factors such as economic growth, technology development, etc., and wondered if political consideration would be taken into account in the future. Dr. Chiemchaisri answered that all options were already based on political considerations, and to be in line with the policy, such options were considered. Mr. Hiraishi pointed out that the word "conservative" that was used by Dr. Chiemchaisri several times was not good for the "inventory world", but reasonable for the "CDM world". One should keep in mind that there are certain differences in the way of thinking in different fields. Furthermore, he asked if Thailand had evaluated required funding for introducing technology for mitigation analysis. Dr. Chiemchaisri answered that he used the word "conservative" in a sense that the emissions reduction caused by mitigation actions was not included in the national inventory. He also said that costs were considered while considering mitigation options. The option with lower costs could be preferentially employed.

Dr. Elizabeth Philip (Malaysia) reported on the status of Malaysia. She pointed out that there was a close linkage between inventory and mitigation when processes such as implementation, monitoring and reporting of mitigation actions were considered. She also introduced how Malaysia used the results of key category analysis to prioritize categories where potential mitigation options were considered.

Dr. Damasa Magcale-Macandog (Philippines) presented an overview of her research entitled "N_2O and CH_4 emissions from hedgerow systems (agroforestry) in Claveria, Misamis Oriental, Philippines". She investigated how management practices (e.g., varying hedgerow spacing, tree age, tree species and rate of fertilizer applied) could affect N_2O and CH_4 emissions from agricultural soils in the region. Applied estimation methodologies were those indicated in the AFOLU of the 2006 IPCC guidelines. The results suggested that N_2O emissions from these hedgerow systems could be minimized with proper design of the

hedgerow system, proper component tree species and soil fertility management.

Dr. Sultan Singh (India) presented an overview of his research entitled “Inventory and mitigation measures for enteric CH_4 emissions from livestock in India”. He investigated how CH_4 emissions from buffalo, sheep and goats could be affected by thirty different types of diet. The study indicated that: 1) a wide variability existed in the CH_4 emissions potential of dry roughages, green fodders, concentrate feeds and diets (consisting of different dry fodder, green fodder and concentrates), and 2) diets based on tree leaves as green fodder and coconut cake as protein source exhibited low CH_4 emissions as well as low conversion of gross energy of these diets to CH_4 production. Thus, the enteric CH_4 production inventories of Indian livestock are based on the dietary means of CH_4 mitigation.

In regard to these presentations, the Chair recommended the presenters to contribute to the IPCC-EFDB.

In the overall discussions, the Philippines, Malaysia, India and Indonesia gave additional information on how they used inventory for developing mitigation measures and making future projections, or how these actions linked to the inventory. Ms. Desai (USEPA) commended that some of the WGIA member countries had already exhibited good practice by using inventory to identify and prioritize categories where mitigation measures could work. The Chair pointed out that one of the difficulties in linking inventory and mitigations was the difference in scales: inventory data were often collected at the national level while mitigation data were collected at the regional level. Furthermore, he mentioned that it would be ideal if inventory and mitigation teams were the same to assure the consistency of methodologies and data used for reporting and assessment. However, even if this was not the case, it was recommended that these teams have a close contact with each other.

3.4. Session III: Working Group (WG) Discussion

The participants split into four WGs (Waste, Non-CO_2, Transportation and QA/QC) to discuss sector-specific or inter-sectoral issues. The points of discussions and the outcomes of the individual WGs are summarized in the following sections (3.4.1. - 3.4.4.).

3.4.1. Waste Working Group

Introduction

Prior to the WGIA8, the secretariat conducted a questionnaire survey about the compilation status of the latest waste sector inventory of each party. Representatives from Myanmar, Mongolia, Indonesia, China, Korea and Thailand made presentations of their own methodology of waste sector inventory in the working group at WGIA8, and the participants shared experiences of inventory compilation with each other. The discussion of the working group and the results of the survey revealed that most of the parties had not obtained sufficient activity data in their inventory compilation, and had not completed estimations of GHG emissions from each source.

In the WGIA9, the participants shared experiences of waste statistics compilation and data collection to estimate activity data used for their latest inventory. The participants from Cambodia, Malaysia and the Philippines, who had not made presentations at WGIA8, made presentations of their experiences of the latest inventory compilation and data collection in this WG. Also, the participants from Thailand and Korea, countries which have established a well-arranged data collection system, provided additional topics of their experiences.

Presentations

Dr. Takefumi Oda (Japan), made a presentation on the results of a comparative analysis of each country's waste sector inventory and their data collection status. Data were obtained from the questionnaire survey conducted prior to the workshop. He introduced the following categorization for the accuracy of waste sector inventory of each member country;

- Default method with not enough activity data (Cambodia, Viet Nam, Mongolia, Malaysia)
- High tier method, but partially enough activity data (Philippines)
- Low tier method, but many accounting sub-categories with not enough category data (Indonesia)
- High tier method (excluding FOD) with enough activity data (Korea)
- High tier method (including FOD) with enough activity data (China, Thailand)

After that, overviewing the theme of "Development of Waste Statistics to estimate Activity Data", he explained that the aim of the WG was to address the difficulties in providing sufficient data and identification of waste categories.

Mr. Kamal Uy (Cambodia) made a presentation on estimation methodology of GHG emissions from Solid Waste Disposal Site (SWDS) and wastewater treatment in Cambodia. Cambodia employed the Revised 1996 IPCC guidelines for GHG estimation methodology in the inventory compilation of their SNC. Net annual CH_4 emissions from SWDS in 2000 were estimated at 9.69 Gg, CH_4 from wastewater handling of domestic/commercial wastewater and sludge was 0.46 Gg, CH_4 from industrial wastewater & sludge streams was 0.03 Gg, and N_2O from human sewage was 0.05Gg. He mentioned difficulty in calculation due to different units of source data to be input in the calculation system.

Dr. Elizabeth Phillips (Malaysia) made a presentation on estimation methodology of GHG emissions in Malaysia. Malaysia estimated GHG emissions in the SNC by using the same activity data as those of the INC and emission factors from the emission factor data base compiled by IPCC. They made some assumptions about municipal solid waste stream, e.g. all MSW in urban areas goes to dumpsite, no data on recycling, and waste generation rate was based on state figures except for east Malaysia. Emissions from the waste sector were estimated to a total of 26,357.18 Gg CO_2-eq in the inventory of the SNC.

Dr. Teresita Ramos Perez (Philippines) made a presentation on estimation methodology of GHG emissions and institutionalization in the waste sector inventory compilation. According to the preliminary report for the SNC, GHG emissions from the waste sector in the Philippines in 2000 were 11,556 Gg CO_2. Approximately half of the total emissions came from solid waste disposal. In estimation of CH_4 emissions from SWDS, the Philippines employed the First Order Decay (FOD) method in the inventory of their SNC instead of mass balance approach employed in their INC. In the Philippines, solid waste incinerations are prohibited by the government except for clinical waste. Inventory compilers in the Philippines obtained activity data from published articles and website of related agencies.

Dr. Chart Chiemchaisri (Thailand) made a presentation on their experience of data collection. Thailand has established a compilation system of MSW statistics. The amount of waste disposal in big cities is measured by a responsible agency, however, small cities estimate waste generation by using waste generation ratio per capita. Waste composition is surveyed by academics, but it is not regularly surveyed by the government. Also, the conditions of each disposal site are surveyed in cooperation with the regional environmental office. To estimate CH_4 emissions from SWDS, inventory compilers in Thailand employ FOD model with these well-collected data.

Mr. Wonseok Baek (RoK) made a walk-in short presentation on waste statistics in Korea. He presented a comparison of waste category between the IPCC guidelines and Korean domestic law. Korean waste statistics are compiled under relevant law; the statistics for solid waste are controlled by the “Waste Control Act” and those for wastewater are controlled by the “Sewage Law”. He also introduced an example of actual waste statistics in Korea. [Abstract, not available]

Summary of Discussions

Mr. Uy noted that they had compiled the inventory in the SNC not under law, but under a legal document of sub-decree. Mr. Purboyo informed that the guidelines for inventory compilation in Indonesia were based on the IPCC guidelines in their mother tongue. Ms. Ono reported that Viet nam’s data collection system was to be managed by MONRE, which has not started operation yet, but would be established in the future.

Mr. Ueda stressed the importance of surveying the dry matter content in solid waste to establish country specific emission factors. Dr. Philip suggested that the data base of local emission factors is very useful for the development of country specific emission factors. Also, Dr. Ishigaki asked the secretariat to promote information sharing for regional characteristics of emission factors by using the database of WGIA and IPCC.

Dr. Perez stressed the importance of carefully examining regional statistics and previous studies in cooperation with responsible agencies for waste management, municipalities and experts.

Conclusion & Recommendations from the Working Group

The participants concluded that since the methodology to estimate GHG emissions often includes many assumptions about the region in which waste statistics are insufficiently compiled, it is important to carefully study regional statistics in cooperation with responsible agencies for waste management and waste experts. They also recommended that information sharing for regional characteristics of emission factors by using the database of the WGIA and IPCC should be promoted by the secretariat in order to develop country specific emission factors for each party.

Annex

Participants:	Mr. Sothea KOK	(Cambodia)
	Mr. Chin SOTHUN	(Cambodia)
	Mr. Kamal UY	(Cambodia)
	Dr. Qingxian GAO	(China)
	Ms. Rias PARINDERATI	(Indonesia)
	Mr. Wiryawan PURBOYO	(Indonesia)
	Ms. Wukir Amintari RUKMI	(Indonesia)
	Dr. Tomonori ISHIGAKI	(Japan)
	Dr. Takefumi ODA	(Japan)
	Ms. Ayako SUZUKI	(Japan)
	Mr. Hiroyuki UEDA	(Japan)
	Ms. Masako WHITE	(Japan)
	Mr. Won-Seok BAEK	(RoK)
	Ms. Jinyoung CHO	(RoK)
	Dr. Eunhwa CHOI	(RoK)
	Mr. Joonki LEE	(RoK)
	Ms. Mi-Hyeon LEE	(RoK)
	Dr. Elizabeth M.P. PHILIP	(Malaysia)
	Dr. Teresita Ramos PEREZ	(Philippines)
	Ms. Nurita ABD RAHMAR	(Singapore)
	Dr. Chart CHIEMCHAISRI	(Thailand)
	Mr. Takahiko HIRAISHI	(IGES)
	Ms. Takako ONO	(JICA Viet Nam)
	Mr. Leandro Valmonte BUENDIA	(SEA GHG Project)

3.4.2. Inventory (Non-CO_2) Working Group

Introduction

Japan shall report 6 gases, CO_2 , CH_4, N_2O, HFCs, PFCs and SF_6, to the UNFCCC annually. NAI Parties are required to prepare GHG inventories of 3 gases, CO_2 , CH_4 and N_2O, in periodically submitted NCs. However, some WGIA member countries estimate and report emissions of not only these 3 gases, but also ambitiously HFCs, PFCs, SF_6 emissions. Until now, there has been no session or work shop focusing on Non-CO_2 gases. In this new work shop, participants shared the latest information on emissions of Non-CO_2 gases using questionnaire-sheets prepared in advance. Following this, Japan presented detailed estimation methodologies, trend analyses and mitigation measures of F gases (HFCs, PFCs, SF_6). Furthermore, 3 countries presented details of their most concerned Non-CO_2 gas (mainly CH_4 from Agriculture). Finally, the future plans of each country focusing on Non- CO_2 gases were discussed.

There were 24 participants of experts in the field, representing 11 countries (Cambodia, China, India, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam) and a member of IPCC-NGGIP TSU. This session was chaired by Dr. Damasa Magcale Macandog (Philippines) and the rapporteur was Mr. Atsushi Sato (MURC, Japan).

Presentations

Dr. Keizo Hirai (Japan) made an introductory presentation of this WG including an overview of Non-CO_2 emissions in 8 countries based on the preliminary questionnaire feedback. The representatives of 3 countries added their information by oral report.

- The most dominant Non-CO_2 gas for all 11 countries was CH_4 from agriculture.
- Except Japan, only Mongolia showed relatively high HFCs emissions.
- The most concerned Non-CO_2 gas for Japan and China is HFCs from refrigeration and air-conditioning, because these emissions have been recently increasing.
- China already started to estimate F-gases for their next NCs.

Dr. Keizo Hirai (Japan) made a presentation on methodology, emissions trend and mitigation measures of F-gases in Japan.

- Only HFCs-emissions from commercial refrigeration and air-conditioning have been increasing continuously since 2005.
- The installation of a destruction unit to the F-gases production line and an F-gases recycling system from scrapped cars seem to be the most effective mitigation measures.
- Japan demonstrated that there is a big gap between the emissions estimated by Tier 1 and Tier 2 method of the1996 Revised Guidelines.
- HFCs-leak during car-production in Japan is lower than 1% of the total emissions from automobile air-conditioning. Therefore, the member countries which do not produce cars were encouraged to estimate the emissions from cars.

Mr. Phirium Am (Cambodia) made a presentation on CH_4 and N_2O emissions in Cambodia.

- CH_4-emissions in Cambodia are as high as 42% and N_2O-emissions are 6% of the total GHG. Agriculture is the dominant category for Non-CO_2 gas emissions.
- Issues to be improved: 1) Some areas are cultivated once per year but other areas are

cultivated multiple times per year. This situation has not been reflected in the GHG Inventory. 2) Soil-type data are old and have not been updated, and the definition of soil-type is also problematic. 3) Cultivation of histosol is not estimated.

Mr. Mone Nouansyvong (Lao PDR) made a presentation on methodology focusing on emissions from agriculture in Lao PDR.

- The agriculture GHG inventory in 2000 was based on Tier 1 method and default EF. Some parameters were derived from expert judgment.
- Issues to be improved: Subscribed burning of savanna is linked to shifting cultivation but is not estimated due to lack of illegal activity data.

Lao PDR is interested in mitigation measures for rice cultivation and livestock.

Dr. Khin Lay Swe (Myanmar) made a presentation on emissions from agriculture in Myanmar.

- Myanmar was a net sink country in the INC.
- Issues to be improved: 1) CO_2 emissions from deforestation are calculated based on official data, however, this may be an underestimation of emissions due to the existence of illegal activity. 2) Savanna burning is not estimated.

Summary of Discussions

●HFCs, PFCs and SF_6

It was recognized by the attendees that F-gases emissions was a potential and important missing emissions source, and they showed interest in estimating F-gases emissions. Even though the problem of data collection still remained in some countries, the IPCC TFI TSU suggested that the Tier.1 method of the “2006GL (NOT the 96GL)” was very helpful for calculation.

●CH_4 and N_2O

Methodologies and data for INC and SNC are not always consistent for some countries. This situation causes difficulties in trend analysis for emissions reduction and evaluation of mitigation measures. Some countries conducted recalculation and their estimations have been improved. However, the data collection problem still remains and it was noted that the institutional arrangement was important.

Conclusions & Recommendations from the Working Group

- F-gases emissions, especially HFCs-emissions, should be estimated, if not yet done.
- A workshop focusing on “F-gases calculation based on 2006GL” may be helpful in next WGIA .
- A workshop focusing on “Research and/or Mitigation Measures of CH_4/N_2O from Agriculture” may be helpful in next WGIA.

Participants:	Mr. Phirium Am	(Cambodia)
	Mr. Chivin Leng	(Cambodia)
	Mr. Chealy Pak	(Cambodia)
	Dr. Ma Zhanyun	(China)
	Dr. Sultan Singh	(India)
	Dr. Keizo Hirai	(Japan)
	Dr. Junko Akagi	(Japan)

Ms. Elsa Hatanaka	(Japan)
Mr. Akihiro Tamai	(Japan)
Dr. Yukihiro Nojiri	(Japan)
Mr. Kiyoto Tanabe	(Japan)
Mr. Atsushi Sato	(Japan)
Mr. Kazumasa Kawashima	(Japan)
Mr. Immala Inthaboualy	(Lao PDR)
Mr. Mone Nouansyvong	(Lao PDR)
Ms. Canthamany Siliya	(Lao PDR)
Dr. Abdul Rahim Bin Nik	(Malaysia)
Dr. Khin Lay Swe	(Myanmar)
Ms. Hnin Hnin Aye	(Myanmar)
Dr. Damasa Magcale Macandog	(Philippines)
Mr. Raymond Kuan	(Singapore)
Dr. Woranuch Emmanoch	(Thailand)
Mr. Cuong Mong Nguyen	(Vietnam)
Mr. Nguyen Van Minh	(Vietnam)

3.4.3 Transport Working Group

Introduction

Transport WG has not been held in the WGIA before.
With the increase in the number of automobiles in Asian countries, GHG emissions from the transportation sector have been rapidly increasing. Therefore, in WGIA9, we held a Transport WG for the first time.

The theme of the Transport WG was "Estimation of CO_2 emissions from theTransport Sector ". The discussion points were the following:

- Current Country Status for Transport,
- Estimation Methods,
- Statistics Development,
- Issues and Challenges,
- Mitigation Actions.

Three participants from Japan, Indonesia and Myanmar made a presentation about their respective countries, and the results of a questionnaire survey conducted prior to the workshop were introduced in this WG.

The Transport WG was attended by 16 participants from 7 WGIA member countries (Cambodia, China, Indonesia, Japan, Mongolia, Myanmar, and the Philippines) and also from IPCC and JICA Cambodia. The chairperson of this session was Mr. Taka Hiraishi (Japan) and the rapporteur was Mr. Kohei Sakai (Japan).

Presentations

Mr. Sakai made an introductory presentation. He introduced the background information and the theme of the WG, as well as the points of discussion. [See Introduction]

Mr. Sakai made a presentation on GHG emissions, statistics and mitigation for the Transport Sector in Japan. He introduced the hierarchy of transport statistics and estimation of CO_2 emissions. Primary statistics for transport, such as the Statistical Yearbook of Motor Vehicle Transport, which compiles fuel combustion data of road transport, are developed by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), and these data are input to the General Energy Statistics by the Agency for Natural Resources and Energy (ANRE), which then becomes secondary statistics.

Mr. Agus Gunawan (Indonesia) made a presentation on Indonesia's GHGs emissions from the transportation sector (part of Energy Sector) in their SNC. He introduced mitigation potentials in the transport sector and a comparison between BAU case and mitigation action case. In addition, he introduced available technology to reduce GHGs from the utilization of energy in the transportation sector (e.g. fuel efficiency improvement).

Ms. Hnin Hnin Aye (Myanmar) made a presentation on the Transport Sector in Myanmar. She introduced the transport status in Myanmar including policy and measures, and mitigation projects. She summarized issues for transport in Myanmar, for example, the growth of the motor vehicle population, difficulties to promote non-motorized transport, and inadequate capacity to enforce standards and regulations. She used a lot of pictures in her presentation which made it easy for us to understand Myanmar's situation.

Questionnaire survey

The WGIA secretariat collected questionnaires from WGIA member countries prior to the workshop. Mr. Sakai summarized and introduced the results. Detailed results are described in "Results of the Questionnaire survey of the Transport Working Group".

Summary of Discussions

Following each presentation, some clarifications and comments were made. Mr. Gunawan explained that biofuel would be made from Jatropha in Indonesia in the future. Ms. Aye noted that a part of the bus fuel was converted to Natural Gas (NG), leading to a decrease of CO_2 emissions.

The Transport WG participants reconfirmed that 1) availability of activity data, including accurate energy balance data, continues to be problematic, 2) updated emission factors needed to be obtained for higher-tier estimation and regional collaboration on this might be beneficial, and 3) capacity building of inventory compilers in this field was particularly important.

The WG participants recognized that 1) transport CO_2 is an important emission source in most countries, 2) transport volume (ton-km and passenger-km) data are often used by transport experts especially in consideration of mitigation, and 3) in order to contribute better to future mitigation work, it will become necessary to generate more precise and real-time emission inventories because the number and type of vehicles, traffic patterns, etc. are rapidly changing.

Conclusions & Recommendations from the Working Group

The WG participants recommend that WGIA10 should review the developments in international climate actions, including the Durban outcome. In addition, the participants also recommend that in the inter-sessional period, transport inventory experts should continue

exchanges and collaboration for inventory improvement, including : “Experiences in data acquisition and improvement”, “New emission factors” (if higher tier methods are employed).

Participants:	Mr. Sothea KOK	(Cambodia)
	Dr. Zhanyun MA	(China)
	Mr. Agus GUNAWAN	(Indonesia)
	Mr. Mulkan Abdul GANI	(Indonesia)
	Mr. Akira OSAKO	(Japan)
	Mr. Kazumasa KAWASHIMA	(Japan)
	Mr. Kohei SAKAI	(Japan)
	Dr. Keizo HIRAI	(Japan)
	Mr. Masakazu OKADA	(Japan)
	Dr. Yuriko HAYABUCHI	(Japan)
	Ms. Dorjpurev DELGERMAA	(Mongolia)
	Ms. Hnin Hnin AYE	(Myanmar)
	Dr. Teresita Ramos PEREZ	(Philippines)
	Dr. Simon EGGLESTON	(IPCC)
	Mr. Takahiko HIRAISHI	(IPCC)
	Mr. Salpiseth HENG	(JICA Cambodia)

3.4.4 Inventory (QA/QC) Working Group

Introduction

NAI Parties under the UNFCCC are required to prepare GHG inventories, as part of their NCs to be periodically submitted to the COP under the UNFCCC. Against the backdrop of the Cancun Agreements, the importance of inventory preparation by developing countries has been growing. Under these circumstances, the assurance/control of inventory quality are required more than ever, in order to improve GHG inventories for future NCs. Previously, in WGIA4 (2006), the necessity to identify key areas on which to focus QA/QC activities were discussed, and at WGIA5 in 2007, the importance of improving QA/QC procedures was recognized.

The main topics of the discussion in this WG were as follows:

- What kind of QA/QC systems, programs, and procedures are currently in place, and
- What could be the key elements for QA/QC systems in the future.

There were 25 participants with a mixture of inventory experts and others who joined this WG to learn more about QA/QC and inventory issues in general. The WG was attended by representatives of 12 countries (Cambodia, China, India, Japan, RoK, Malaysia, Mongolia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam), and members of the SEA GHG Project, USEPA, and JICA Viet Nam. This session was chaired by Ms. Mausami Desai (USEPA) and the rapporteur was Ms. Elsa Hatanaka (Japan).

Presentations

Ms. Elsa Hatanaka (Japan) made a brief introductory presentation. She summarized the political background for why QA/QC systems will be increasingly important, and explained how QA and QC were defined in the IPCC Guidelines, how QA/QC was taken up in WGIA4

and 5 sessions, and the points for discussion at this session. [See Introduction]

Ms. Elsa Hatanaka gave an overview of Japan's QA/QC system. She explained that QC was done mainly by GIO, MOEJ, relevant ministries/agencies/organizations, the Committee for the Greenhouse Gas Emission Estimation, and private consultants. QC activities include General QC procedures (Tier 1) by compilers, and Category-specific QC (Tier 2) procedures by private consultants and relevant ministries and agencies. Relevant organizations and the Committee for the Greenhouse Gas Emission Estimation Methods also provide QC functions. Ms. Hatanaka also noted that the QA process was reformed in 2009, by inviting experts who were not involved in the inventory preparation process to conduct expert peer review, through 1) confirming the soundness of estimation methods, activity data, emission factors, and other items, and 2) confirming the soundness of content reported in the CRF and NIR.

Dr. Dorjpurev JARGAL (Mongolia) made a presentation on planned inventory QA/QC in Mongolia. He noted that difficulties encountered in inventory preparation included the lack of system for data collection and checking, but that General QC procedures (Tier 1) had already been implemented for the INC. QA/QC planning for the next NC had also started, and category-specific QC (Tier 2) procedures were proposed for the Energy (stationary combustion of fossil fuels and mobile combustion) and Industry sectors. Work has started in the Agriculture and Waste Sectors too. The Category-specific QC plans developed for the Energy and Industry Sectors specify the QC activity, QC procedure, responsible organization, contributing organization, and a time frame.

Ms. Min-Hyeon Lee (RoK) presented an overview of the GHG inventory QA/QC system in Korea. The Waste sector inventory report is annually being prepared by the Ministry of Environment and submitted from Korea Environment Corporation (KECO) to Greenhouse Gas Inventory & Research Center (GIR). KECO is responsible for preparing local government GHG inventory reports together with the waste sector portion of the national inventory, and is therefore in the process of developing QA/QC procedures in accordance with the 2006 IPCC Guidelines. Ms. Lee explained that for the national inventory (Waste Sector), QC is currently conducted by personnel compiling the inventory, and QA is conducted by foreign experts, including expert reviewers, in the case of the Korea-Japan inventory peer review, in addition to internal or domestic QA. KECO also conducts QC for local inventories which effectively serve to check the national level inventory, even though the sum of local inventories emissions is not designed to add up to be emissions reported in the national level inventory.

Ms. Takako Ono (JICA Viet Nam) presented the improvements made in QA/QC under JICA's Project for Capacity Building for National Greenhouse Gas Inventory in Vietnam. She explained the findings from a survey conducted under the JICA project on what QA/QC activities were performed during the SNC preparation. Activities which could contain QA/QC elements included: 1) preparing initial estimates and the draft GHG inventory, 2) organizing thematic workshops for GHG Inventory results and receiving reviews, comments, and in turn incorporating those comments, and 3) finalizing the GHG inventory for submission to the UNFCCC as part of the SNC. These activities were implemented not only by the Ministry of Natural Resources and Environment, but with the participation of other ministries etc, and were implemented following the work plan for the SNC. They could be, therefore, the basis for a future QA/QC system. Ms. Ono also noted that there were plans for further improvement

of the QA/QC activities under the JICA project. [Abstract, not available]

Ms. Mausami Ashok Desai (USEPA) made a presentation on the highlights of QA/QC procedures applied in the U.S. GHG Inventory System. As for QC, Tier 1 QC is conducted on all sources and sinks, and at a minimum, a QC checklist is filled out. Tier 2 QC is recommended for key categories, or categories with significant methodological change, and may be implemented over multiple years. QA is conducted through expert review and public review. Expert review is done prior to publication and to public review, where expert reviewers are sent the draft inventory and annex. Improvements are implemented as required prior to the public review, or added to the next year's inventory improvement plan. Public review is conducted prior to submission to UNFCCC and publication, where a draft GHG inventory is made available on the EPA website, and comments received are posted on EPA's website as well. She explained that similarly to expert review, improvements are implemented as required for the final report, or added to the next year's inventory improvement plan. [Abstract, not available]

Summary of Discussions

The participants discussed possible options for conducting QA/QC. After making clarifications on each country’s institutional arrangements for GHG inventory preparation, they noted that the QA/QC systems differed for each country depending on national circumstances (institutional arrangements, stage of NC preparation, inventory preparation cycle etc.), and in both AI and NAI contexts. Some participants pointed out possible modifications that could be made to each country’s QA/QC processes for smooth implementation.

It was noted that, either formal or informal, many countries had some form of QA/QC procedures in place for inventory preparation. The key difference was in whether the procedures were documented in QA/QC plans or QC checklists etc.

As for QC, some countries are just starting the process of drafting QA/QC plans and procedures, although already implementing General QC procedures (Tier 1), whereas in other countries, the organizing of workshops on GHG Inventory results and receiving reviews and comments are functioning as QC. In the two AI countries participating in this WG, General QC procedures (Tier 1) are implemented for all sources and sinks, with results documented, whereas category-specific QC (Tier 2) procedures are implemented in a more prioritized manner. In the case of Korea, the preparation of inventories at the local government level, which is a bottom-up process, has served to check the estimations in the national level inventory

.

As for QA, some countries have considered voluntary peer review with foreign inventory compilation entities as QA, in addition to internal or domestic QA, whereas in other cases, workshops on GHG Inventory results are organized to receive reviews and comments, which functions as QA. In the two AI countries, distinct external review is conducted, by inviting experts who are not involved in the inventory preparation process to conduct expert peer review, or by posting the draft GHG inventory for public review and comments.

Conclusions & Recommendations from the Working Group

The participants noted that QA/QC programs/procedures varied in both AI and NAI

contexts according to national circumstances, and that a lot of QA/QC activities were already undertaken in each country. They were in the forms of, for instance: 1) preparation of local inventories, which effectively serve as checks for the national inventory, 2) stakeholder consultations with ministries, agencies, relevant organizations, and experts, at the various stages of inventory preparation, 3) preparing initial estimates and draft GHG inventory for comments, either for the closed/open setting. Some countries have implemented Tier 1 QC for their INCs, and are moving on to plan for category-specific QC (Tier 2) in the future.

Participants agreed that documentation of procedures, or what the source/sink categories are, or what AD and EFs are used etc., and archiving of this documentation was the key. They also noted that the existing activities could be used as a basis for developing more formal QA/QC plans that define the roles/responsibilities for those involved in inventory preparation.

Participants:	Mr. Sophal LEANG	(Cambodia)
	Mr. Touch SIM	(Cambodia)
	Dr. Qingxian GAO	(China)
	Dr. Sultan SINGH	(India)
	Mr. Byong-Bok JIN	(RoK)
	Ms. Min-Hyeon LEE	(RoK)
	Dr. Abdul Rahim Bin NIK	(Malaysia)
	Dr. Elizabeth M. P. PHILIP	(Malaysia)
	Dr. Dorjpurev JARGAL	(Mongolia)
	Dr. Khin Lay SWE	(Myanmar)
	Ms. Hnin Hnin AYE	(Myanmar)
	Dr. Damasa Magcale MACANDOG	(Philippines)
	Mr. Raymond Wen Sheng KUAN	(Singapore)
	Ms. Nurita ABD RAHMAN	(Singapore)
	Dr. Chart CHIEMCHAISRI	(Thailand)
	Dr. Woranuch EMMANOCH	(Thailand)
	Mr. Cuong Mong NGUYEN	(Viet Nam)
	Mr. Leandro Valmonte BUENDIA	(SEA GHG Project)
	Mr. Mausami Ashok DESAI	(USEPA)
	Mr. Nguyen Van MINH	(JICA Viet Nam)
	Ms. Takako ONO	(JICA Viet Nam)
	Ms. Ayako SUZUKI	(Japan MOE)
	Ms. Elsa HATANAKA	(Japan)
	Mr. Hiroshi ITOH	(Japan)

3.5 Session III: Mutual Learning (ML) Discussion

The participants split into three sessions (Energy, LUCF and Waste) to discuss sector-specific issues. The points of discussions and the outcomes of the individual ML are summarized in the following sections (3.5.1. - 3.5.3.).

Originally, the first mutual learning was held in the annual workshop on waste sector between NIES and KECO in 2007. The primary purpose of the mutual learning is to improve GHG inventories by providing details of methods and data between or among a few countries. Mutual learning is also expected to foster and strengthen a cooperative relationship among experts. Since the aim of the mutual learning is not criticism or audit, participants can conduct a two-way communication, not a one-way communication like examiner versus examinee.

The subject of discussion was not only estimation methodology but also institutional arrangements as well as background information on the emission sources and removal sinks in each country. Through the discussions, experts could understand the inventory of the partner country, and simultaneously, realize again the characteristics of one's own inventory as well. Regarding the remaining problems in the discussion, participants agreed to follow up the solution after the workshop. Also, by the counterpart's good practice, participants could be more motivated to improve the inventories.

It is recommended that this mutual learning should be held in future WGIA as well.

3.5.1 Mutual Learning (ML), Energy Sector

Sector Overview

Indonesia and Mongolia attended the mutual learning in energy sector. General information of the two countries is as follows.

Table 1 Sector Overview

	Indonesia	Mongolia
National total GHG emission ($Gg\text{-}CO_2$ eq., without LUCF)	556,354 (in 2000)	17,712 (in 2006)
GHG emission in energy sector ($Gg\text{-}CO_2$ eq.)	280,354 (in 2000)	10,220 (in 2006)
Responsible agency for inventory	Ministry of Environment	Ministry of Nature, Environment and Tourism
Entity in charge of GHG emission calculation	Department of Chemical Engineering Faculty of Industrial Technology	Energy Environmental Research and Consulting Services
Origin of estimation method in the energy sector	IPCC 2006 guideline, mainly Tier 1	IPCC 1996 guideline, Tier 1
Activity data source	Mainly energy balance data	Mainly energy balance data

Materials Used

In order to prepare for the mutual learning of the workshop, both countries submitted their estimation documents of the sector to each other three months before the workshop. The exchanged documents are as follows.

Indonesia:

- Second National Communication (June 2010)
  - 1_Energy 2000 – SNC 2010 (excel)
  - 1_Energy 200X – SNC 2010 (excel)
  - Neraca Energi Indonesia 200X – 11 March 2009 (excel)
  - Summary of Energy 11 March 2009 (excel)

Mongolia:

- Second National Communication (Dec. 1, 2010)
  - Energy Sector Greenhouse Gas Inventory of Mongolia (2010)
    - 1990-2006 (excel)
    - Overview (excel)

Questions and Answers

After receiving the inventory documents, both countries studied them and submitted questions and comments to the partner country approximately two months before the workshop. The answers to the questions were submitted prior to the workshop. The classification and the number of the questions are as follows.

Table 2 Classification of questions

Classification of question	Number of questions	
	from Mongolia to Indonesia	from Indonesia to Mongolia
Acquisition of activity data	9	6
Adoption of emission factor	12	1
Quality assurance & quality control	2	4
Responsible system structuring	1	4
Mitigation plan	3	2
Others	2	8

Outcomes of Mutual Learning

Through the mutual learning, several issues and good practices of the GHG inventory have been pointed out for each country.

- **Issues and solutions**

Most of the issues raised during the mutual learning were not immediately solved, but declared to be carefully reexamined after the participants return to their countries.

The issues raised for Indonesia were; 1) Some inventory data and emissions factor should be corrected , and 2) Stock change should be considered.

The issues raised for Mongolia were; 1) The activity data on sub-bituminous and lignite coal were collected from power plants. There is a possibility of other usage of coal than the collected data, and 2) The necessity and importance of QA/QC through the mutual learning was stressed.

- **Unsettled issues**

It was pointed out as a remaining issue that both countries had estimated the activity data of biomass in their inventories, but could not collect any data. Also a few unsettled issues were pointed out for Mongolia, those were the necessity of structuring the permanent organization for the annual estimation in future inventories, and the necessity of

strengthening the capacity building for the expected CDM projects.

- **Good Practice**

Some good practices of Indonesia were pointed out through the mutual learning. For example, confidential data from only one company of each energy industry were properly treated by aggregating them with the data of other categories. The energy balance data was the same as the IEA data, thus confusion or misunderstanding between those data can be avoided.

As for Mongolia, a close discussion was conducted between the inventory authority and related ministries or agencies. This was also assessed as a good practice.

- **Possible follow-up activities**

Indonesia has the potential to provide the country-specific emission factor used for the IPCC Emission Factor Database. Also, if necessary, on-line (or e-mail) follow-up discussion is possible for both countries.

Participants

Country	Name	Organization	Title
Indonesia	Dr. Retno Gumilang DEWI	Center For Research on Energy Policy, Institut Teknologi Bandung (Bandung Institute of Technology)	Researcher
	Mr. Agus Gunawan	Development of Climate Change Mitigation Instrument, Ministry of Environment, Republic of Indonesia	Head of Sub Division
	Mr. Mulkan Abdul Gani	GHG Inventory Division, Ministry of Environment Republic of Indonesia	Head of Sub Division of GHG Inventory of Non Energy Sector
Mongolia	Dr. Dorjpurev JARGAL	EEC Co., Ltd	Director and senior consultant
	Ms. Dorjpurev DELGERMAA	EEC Co., Ltd	Assistant Fellow
Japan	Dr. Yuriko HAYABUCHI	GIO	GHG Inventory Expert
	Mr. Akira OSAKO	GIO	GHG Inventory Expert
	Mr. Hiroshi ITO	GIO	GHG Inventory Expert
	Mr. Kohei SAKAI	GIO	GHG Inventory Expert
	Mr. Masakazu OKADA	Project Development Team, Suuri-Keikaku Co., LTD	Analyst

3.5.2 Mutual Learning (ML), LUCF Sector

Sector Overview

Lao P.D.R. and Japan joined the mutual learning for LUCF sector. The general information of the two countries is as follows.

Table 1 Sector Overview

	Lao P.D.R.	Japan
National total ($Gg\text{-}CO_2$ eq., including LUCF/ LULUCF)	52,856 (in 2000)	1,137,690 (in 2009)
Net GHG emissions / removals in LUCF sector ($Gg\text{-}CO_2$ eq.)	43,929 (in 2000)	-71,523 (in 2009)
Responsible agency for inventory	Water Resources and Environment Administration (WREA)	Ministry of the Environment
Entity in charge of GHG emission calculation	WREA	NIES
Origin of estimation method in LUCF sector	IPCC 1996 guideline, Tier 1	GPG-LULUCF Tier 1 to 3
Activity data source	National statistics	Forestry Agency Ministry of Agriculture Forestry and Fisheries Ministry of Land, Infrastructure, Transport and Tourism

Materials Used

In order to prepare for the mutual learning of the workshop, both countries submitted their estimation documents of the sector to each other three months before the workshop. The exchanged documents are as follows.

Lao P.D.R:

- National Greenhouse Gas Inventory for Lao PDR, 2000 for Second National Communication (as of March 2011)
  - module5 (excel)
  - Review of the Greenhouse Gas Inventory Report of Lao PDR (PDF)

Japan:

- National Inventory Report of Japan (of FY2009, submitted in April 2011)
- Common Reporting Format

Questions and Answers

After receiving the inventory documents, both countries studied them and submitted questions and comments to the partner country approximately two months before the workshop. The answers to the questions were submitted prior to the workshop. The classification and the number of the questions were as follows.

Table 2 Classification of questions

Classification of question	Number of questions	
	from Japan to Lao P.D.R.	from Lao P.D.R. to Japan
Acquisition of activity data	15	1
Adoption of emission factor	8	0
Quality assurance & quality control	0	0
Responsible system structuring	0	1
Others	1	0

Outcomes of the Mutual Learning

- **Issues and solutions**

During the preliminary comments exchange, Lao P.D.R. was interested in the data collection scheme of Japan while Japan asked about land-use data, carbon stock change factors and so on.

Lao P.D.R. accounts for removals only in plantation, however, the table of national land-use data did not distinguish natural forest and plantation. Thus Japan pointed out that the inventory of Lao P.D.R. might have double counting or neglect in the area of forest plantation that could result in under/overestimation of removals. Lao P.D.R. explained that it was largely due to the availability of land-use data.

In most cases, Lao P.D.R. used default values for estimating carbon stocks in spite of showing research results on country specific data in NIR. Since those values were derived from a number of local sites, it could not be applied directly to the whole country. It could be applied only when the precise area of the forest management was available and distinguishable from other forests. According to Lao P.D.R., the northern region of the country has a significant proportion of teak plantation where country-specific values may be applicable. They had recognized that the default value of biomass stock for rubber had a large gap with country-specific value. Some of these issues might be modified before submission of the SNC.

- **Good Practice**

Japan pointed out that the inventory of Lao P.D.R. was in accordance with the 1996 GL. At the same time, both Japan and Lao P.D.R. confirmed that the GHG inventory of the partner country was well-documented and reasonable. Despite a potential problem in identifying the area of plantation as described above, Lao P.D.R. prepared comprehensive land-use data for the years 1982, 1992 and 2002 that clearly shows the national circumstances and trends in general.
Also as mentioned above, Lao P.D.R. showed some regional carbon stock values on NIR. These documentations represented progress in the development of country-specific factors.

- **Possible follow-up activities**

The representatives of Lao P.D.R. are still improving their inventory both in response to the suggestions from Japan and within their ongoing plan. In the near future they will apply some of their regional carbon stock factors. They also mentioned that they would apply the 2006 GL in the future.

Participants

Country	Name	Organization	Title
Lao P.D.R.	Mr. Immala Inthaboualy	WREA	Technical Officer
	Mr. Mone Nouansyvong	WREA	Greenhouse Gases Compiler
	Ms. Canthamany Siliya	WREA	Assist to Project Manager of Second National Communication Project
Japan	Dr. Junko Akagi	GIO	GHG Inventory Expert
	Mr. Atsushi Sato	MURC	Senior Analyst
	Mr. Akihiro Tamai	GIO	GHG Inventory Expert

3.5.3 Mutual Learning (ML), Waste Sector

Brief Overview of the ML Process for the Waste Sector

After having completed the application process including determining partner countries, the ML for the Waste sector was implemented among Cambodia, Indonesia, and the Republic of Korea proceeding with the following stages:

First stage
The said three countries studied the national waste sector inventories of partner countries in view of transparency, consistency, comparability, completeness, and accuracy in their inventories by exchanging materials to be studied (refer to Table 1 for details of the materials).
Second stage
Based on the study conducted at the first stage, the completed Q&A templates were exchanged among the three countries in order to identify the items for comments and/or clarification. The Q&A template for the Waste sector consisted of some comment boxes for questions and answers on sector general, methodology, activity data, emission factor, uncertainty analysis, key category analysis, and QA/QC for each category, such as solid waste disposal on land, wastewater treatment, waste incineration, and others.
Final stage (Discussion session at WGIA9)
A three and a half hours' discussion session was conducted in a small group during WGIA9 focusing on further clarification of details for the answers and comments stated on the completed Q&A templates.

Since three countries were engaged in this ML, one country answered the questions from the other two countries by turns following the discussion agenda shown below:

Discussion agenda

1. Sector general (approx. 60 min.)
2. Solid waste disposal land (approx. 40 min.)
3. Wastewater treatment (approx. 40 min.)
4. Waste incineration and other (approx. 30 min.)
   Tea Break (10 min.)
5. Feedback from participants (approx. 30 min.)

Suggestions and/or requests for:
- Possible follow-up activities such as provision of data and reference materials or referral to experts in the field, etc.
- Future Mutual Learning in terms of approach, process to a final discussion, goals or outcomes, any difficulties or concerns, etc.

Inventories Subjected to Study

The first stage proceeded with the materials exchanged among the said three countries as shown in Table 1.

Table 1 Material used for Mutual Learning, Waste Sector

Country	**Inventory Report**	**Spreadsheets**
Cambodia	National Greenhouse Gas Inventory for the year 2000 Technical Report (from SNC in 2009)	Revised 1996 IPCC GL Workbook (Module 6)
Indonesia	National Inventory for 2000 – 2005 (from SNC in 2010)	2006 IPCC GL Worksheets
Republic of Korea	National Inventories for 1990 – 2008 (published by KECO in 2011)	UNFCCC CRF Table (Sectoral Report and Background Data)

Waste Sector Overview

Based on the information obtained from the materials used, the sector overview for the three countries can be briefly summarized as shown in Table 2-4 which illustrates considerable differences in national circumstances among the three countries.

Table 2 Cambodia

Reporting year	Year 2000
Total GHG emissions from Waste sector (without LUCF)	229 Gg-CO_2 (273 Gg-CO_2 in 1994) Accounts for 1% of total GHG emissions
Percentage of GHG emissions by sub-category	- Solid waste disposal (89.0%) - Wastewater handling (11.0%) - Waste incineration (0%)
Key Category	N_2O from wastewater treatment
Waste generation per capita	270 kg/person/year
Methodology	- Revised 1996 IPCC Guidelines - IPCC Good Practice Guidance, 2000 (applying default method with insufficient activity data)
Primary national entity responsible for the national GHG inventory	Ministry of Environment
Responsible entity for national Waste sector inventory	GHG Inventory and Mitigation Office, Climate Change Department, MoEC

Table 3 Indonesia

Reporting year	Year 2000
Total GHG emissions from Waste sector (without LUCF)	157,328 Gg-CO_2 (166,831 Gg-CO_2 in Year 2005) Accounts for 28% of total GHG emissions
Percentage of GHG emissions by sub-category	- Unmanaged waste disposal sites & unmanaged dumpsites (11.5%) - Domestic and industrial wastewater and discharge (86.2 %) - Open burning waste (2.2%) - Biological treatment of solid waste (0.1%)
Key Category	Industrial wastewater and discharge
Waste generation per capita	223 kg/person/year
Methodology	2006 IPCC Guidelines (applying low tier but accounting for many sub-categories despite insufficient activity data
Primary national entity responsible for the national GHG inventory	Ministry of Environment
Responsible entity for national Waste sector inventory	Working group on GHG inventory under the coordination of Deputy of Nature Conservation Enhancement & Environmental Destruction Control of the Ministry of Environment

Table 4 Republic of Korea

Reporting year	Year 2008
Total GHG emissions from Waste sector (without LULUCF)	13,395 Gg-CO_2 Accounts for 3% of total GHG emissions
Percentage of GHG emissions by sub-category	- Disposal on land (24.0%) - Wastewater handling (9.0%) - Waste incineration (63.0%) - Biological treatment solid waste (4.0%)
Key Category	Waste incineration
Waste generation per capita	280 kg/person/year
Methodology	- Revised 1996 IPCC Guidelines - IPCC Good Practice Guidance, 2000 (applying high tier excluding FOD) - Applying 2006 IPCC Guidelines only for Biological treatment solid waste
Primary national entity responsible for the national GHG inventory	Ministry of Environment, Greenhouse Gas Inventory & Research Center of Korea (GIR)
Responsible entity for national Waste sector national inventory	Korea Environment Corporation (KECO)

Good Practice

Having undergone the first two stages and the discussion session, examples of good practice in the preparation for the national GHG inventory were seen in each country. These were:

Cambodia

Estimating emissions from all of the categories for the waste sector; no "Not Estimated (NE)" categories reported in their national GHG inventory despite the unavailability of activity data in order to ensure the completeness of an inventory.

Indonesia

Eagerly striving to comply with the most recent Guidelines, the 2006 IPCC Guidelines, in order to particularly improve the completeness and transparency of the inventory with an utmost effort to account for as many sub-categories as possible.

Republic of Korea

Achieving annual preparation for the national GHG inventory by establishing a well-designed and operated waste and statistics management practice.

Benefits obtained from Participating in the ML for the Waste Sector

The active discussion session gave full recognition to the useful and valuable information obtained by participating in the ML as listed below:

- The use of different IPCC Guidelines in the partner countries was acknowledged.
- Useful information and knowledge on the case-specific application of the 2006 IPCC Guidelines in the partner countries was found to be particularly informative for Cambodia and Republic of Korea since they are primarily applying the earlier Guidelines and IPCC Good Practice Guidance.
- Well-managed data collection and statistics management practices were identified for specific emission sources, eminently reflecting the waste management policy and/or strategy implementation in the partner countries.
- The current position of each country in relation to the other participating countries in terms of overall national GHG inventory preparation system was recognized with a focus on issues such as institutional arrangements, data collection, and the development of emission factors.
- Common issues and concerns of financial, technical and human resources were shared and reaffirmed. These issues lie ahead of the participating countries although they are not directly tackled under the Mutual Learning programme.
- The difference in the level of commitment of each country toward actions on climate change issues was recognized by learning about the current status of the national inventory preparation system in the partner countries.

Advantages of engaging in ML for the Waste Sector

The discussion session served for the participating countries also to confirm the advantages of engaging in the Mutual Learning in order to enhance their own capacity for inventory compilation. The advantages are listed below:

- Obtaining valuable and rare opportunities to learn from other countries' national GHG inventories by means of exchanging good practice and experiences, presenting concrete examples, and conducting practical comparisons focusing on specific issues or concerns that one's country is facing.
- Learning from other countries, not only neighboring countries under similar national circumstances, but also those under considerably different and/or much more advanced national circumstances, attained by exploring the possibility of applying the findings to their own national circumstances and future national inventories.

Having facilitated the session, the secretariat reaffirmed that one of the major advantages of this cooperative and collaborative learning programme was not only promoting positive interdependence by striving to show how to help each other resolve issues and overcome obstacles, but also fostering encouragement to keep one another highly motivated to improve their future inventories.

Feedback from Participants

As indicated below, constructive comments and suggestions for future Mutual Learning were exchanged during the session which could help the secretariat improve the Mutual Learning programme. These comments are summarized below:

- Good experience: the participants supported the continuous implementation of this kind of activities to improve their national GHG inventories.
- The bilateral approach instead of tripartite approach was preferred in order to achieve a greater advantage in closer collaboration with each other.
- In terms of setting goals or producing outcomes, the participants preferred more detailed technical study and discussion on specific issues rather than the study on the entire national inventory, such as activity data collection and comparison and/or development of emission factors for specific emission sources. They also wished more time for a more detailed preliminary survey or study at each stage of the whole process.
- It was noted that more elements of national circumstances would be taken into consideration when determining the combination of partner countries.
- Given the requirements for the study intended for the most recent national inventory for each other, the importance and necessity of studying it with a focus on specific issues for non-first-time participants also needed to be considered.
- The participants wished to encourage the local host country to participate in the Mutual Learning in order to fully take advantage of opportunities for national inventory experts and compilers to be involved with the program.
- The participants expressed that they wanted to share emission factors developed from CDM projects for the purpose of reference and consideration.

  During the wrap-up session, some concern about the use of emission factors derived from CDM projects was expressed. The indispensability of a considerable degree of deliberate judgement required for the application of the said emission factors to a national GHG inventory was stressed, considering the facts that CDM projects are

conducted locally or regionally, and that one of the principles for the CDM was conservativeness (i.e. the use of conservative assumptions, values and procedures in accordance with the applicable methodology to ensure that GHG emission reductions or removal enhancements are not over-estimated).

Fully utilizing these comments and suggestions, the secretariat of the Mutual Learning programme intends to provide the participating countries with more opportunities to fulfill their needs for workable solutions, develop their potentials, and as its name indicates, mutually benefit for the improvement of their national GHG inventories, which could consequently contribute to enhancing the quality of MRV for the national inventory.

Participants

Cambodia

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Indonesia

Name	Organization	Title
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Republic of Korea

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Japan

Name	Organization	Title
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Dr. Takafumi ODA(Chair)	GIO/CGER/NIES	GHG Inventory Expert
Mr. Hiroyuki UEDA	Project Development Team, Suuri-Keikaku Co., LTD	Manager
Ms. Masako WHITE (Rapporteur)	GIO/CGER/NIES	GHG Inventory Expert

3.6 Wrap-up Session

This session was chaired by Mr. Kiyoto Tanabe (Japan). In this session, the rapporteurs from the plenary sessions, working groups and mutual learning groups provided summaries of the discussions including findings and recommendations, which were followed by the final discussion to conclude the workshop. The following is a summary of this workshop.

Summary of the Opening Session

This session was chaired by Mr. Kiyoto Tanabe and the rapporteur was Ms. Takako Ono (JICA, Viet Nam). Ms. Ono summarized the presentations and discussions of the Opening Session. The outline and abstract of each presentation are given on pp. 15-18.

Summary of Session I

This session was chaired by Mr. Kamal Uy (Cambodia) and the rapporteur was Mr. Kazumasa Kawashima (Japan). Mr. Kawashima reported the summary of presentations made by Indonesia, Malaysia, Thailand and Viet Nam and the discussions of Session I concerning: submission date of SNC; methodologies and data used; key categories; improvements from INC; improvement plans for the TNC, etc. The outlines and abstracts of each presentation are given on pp. 18-20 (Table 1).

Summary of Session II

This session was chaired by Mr. Leandro Buendia (SEA GHG Project) and the rapporteur was Dr. Simon Eggleston (IPCC TFI TSU). Dr. Eggleston summarized the presentations made by China, Thailand, Malaysia, the Philippines and India along with the subsequent discussions. The experts were of the view that the inventory, if it is appropriately compiled, could be used as a basis for developing mitigation measures and as an index for evaluating their effects; therefore, the inventory was found to be useful to support the implementation of mitigation actions in a sustainable manner. On the other hand, it was also recognized that care should be taken in using inventory methodologies for mitigation planning and implementation so as to avoid unsound overestimation of mitigation effects. Furthermore, India and the Philippines reported on their research activities for developing emission factors that could improve their inventory and contribute to the evaluation of mitigation measures. In the overall discussions, it was recommended that inventory compilers and policy makers strengthen their cooperation in order to assure a close linkage between inventory and mitigation measures.

Summary of Session III

Waste WG

In this working group, the WGIA Secretariat reported the result of the analysis of the questionnaire survey conducted prior to the workshop and introduced the categorization for the accuracy of waste inventory of each member country. Following that, member countries presented their latest inventories. The issues in regards to the elaboration of activity data and the discrepancy between emission factors and the actual condition of waste management were pointed out. For regions, where waste statistics are not fully established, a number of assumptions are included when calculating activity data. Therefore, it was pointed out that searching for statistics by region through the collaboration between departments in charge of waste, regional offices and experts of the waste sector was important and that research and surveys needed to be conducted. Also, in regards to the regional characteristics of emission factors, enhancement of information sharing through the WGIA- and IPCC-database was suggested.

Inventory (Non-CO_2 gases) WG

Experts exchanged information on Non-CO_2 gases (CH_4, N_2O, HFCs, PFC and SF_6) reported in the latest inventory of the member countries. Considering the fact that CH_4 from the Agriculture sector is the most significant emission source in many of the member countries, it was recognized that continuous discussions on how to improve estimation methodologies, and on mitigation measures were needed. Furthermore, for those courtiers which have not reported F-gases yet, it was recommended that they estimate those gases, especially HFCs used as refrigerant, with a Tier 1 methodology given in the 2006 IPCC Guidelines, even though reporting of those gases was currently not required for Non-Annex I Parties.

Transport WG

With the increase in the number of automobiles in Asian countries, GHG emissions from the transportation sector have been rapidly increasing. In this working group, experts shared information on the emission status of each member country with special emphasis on CO_2 and details of estimation methodologies and mitigation measures, and also confirmed the status of this sector in each member country based on the questionnaire survey conducted prior to the workshop. The experts recognized, among others, that in order to better contribute to future mitigation work, it would become necessary to generate more precise and real-time emission inventories because the number and type of vehicles, traffic patterns, etc. were rapidly changing.

Inventory (QA/QC) WG

Against the backdrop of the Cancun Agreements, the importance of inventory preparation by developing countries has been growing and the assurance of inventory quality is expected to be a challenge. In this working group, it was confirmed that each member country had some activities practically functioning as QA/QC, even though those activities were not recognized as QA/QC activities for the inventories at this moment. Also, experts reaffirmed the importance of documenting these activities and archiving them, and they confirmed that these activities could become the basis for official QA/QC plans in the future.

Mutual learning: Energy Sector

Indonesia and Mongolia attended the mutual learning in the energy sector. Prior to the workshop, both countries had submitted their GHG emissions estimation documents to each other. Almost 30 questions had been raised for each country and the answers were prepared. Through the mutual learning at the workshop, several issues and good practices of the GHG estimation were pointed out for each country. Most of the issues are not immediately solved, but declared to be carefully reexamined after the participants return to the country.

Mutual learning: LULUCF Sector

Lao P.D.R. and Japan joined the mutual learning for LUCF sector. Japan asked about estimation methods of carbon stock changes in forest land and so on, while Lao P.D.R. was interested in data collection scheme and archiving. After discussion, both Japan and Lao P.D.R. pointed out good practices and issues of each other's inventory. Lao P.D.R. indicated that since they were still working on the inventory, some suggestions from Japan would be considered for further improvement.

Mutual learning: Waste Sector

The Mutual Learning for the Waste sector was implemented among Cambodia, Indonesia, and the Republic of Korea. This valuable and rare opportunity to obtain useful knowledge facilitating the improvement of national GHG inventories was fully utilized by means of learning from the national GHG inventories of partner countries focusing on institutional arrangements, data collection, and the use of emission factors. Furthermore, the participants exchanged good practices and experiences, exploring the possibility of applying the findings to their future national inventories.

Overall

The overall discussions were opened by the chair by referring to three keywords:

- Continuous improvements
  The chair commented that the countries which made presentations in Session I had made a number of improvements in their INCs. He shared his view that continuous effort making and an accumulation of small improvements for inventory preparation may be more meaningful than making big improvements with long intervals.
- Transparent reporting
  The chair stated that this aspect of inventory would become more and more important for NAI parties in the near future in the context of NAMAs, BRs and MRV. Mutual learning conducted in this workshop for the first time would provide a good opportunity to efficiently enhance inventory reporting in a transparent manner. For the countries which attended the mutual learning, he recommended to look through the Q&A sheets again, as they provided hints for improvements.
- Interaction or intercommunication between various experts
  - Inventory compilers and stakeholders (data providers): Institutionalization is important.
  - Inventory team and mitigation team: These teams do not have to be identical, but they should collaborate with each other.
  - Inventory compilers from various countries: Inventory compilers could improve the inventory in an efficient manner by communicating with each other. Mutual

learning would be a good opportunity, as inventory compilers can exchange their views face to face.

Many experts supported his view. Especially those who attended the mutual learning supported the continuation of this activity and the other experts also expressed their interest in this activity. The WGIA was found again as a good platform for inventory experts in Asia to get together and exchange useful information with each other.

Regarding the linkage between inventory and mitigations, the use of the same data sets and the collaboration between inventory compilers and policy makers were pointed out as essential to ensure a close linkage. When the incorporation of CDM in the national inventory was considered, the application of EFs used for a CDM project to the national inventory was cautioned, since the EFs might not be representative on a national scale.

It was recommended that an agenda should be developed for the next WGIA by taking into account the outcomes of COP17 to be held in Durban, South Africa this year. Furthermore, considering the fact that the next WGIA is the 10th session, the chair suggested to review the activities of WGIA and member countries in the past ten years, and also to consider how this workshop could change to a better format in the future.

The closing remarks were delivered by Mr. Sum Thy, Director Department of Climate Change of MOE, Cambodia, and Dr. Yukihiro Nojiri, Manager of GIO, Japan. They thanked all participants for their presentations and contributions to the fruitful discussions in the workshop.

4. Abstracts

4.1 Opening Session

Overview of WGIA9

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Abstract

Non-Annex I (NAI) Parties under the United Nations Framework Convention on Climate Change (UNFCCC) are required to prepare GHG inventories as part of National Communications (NCs) to be periodically submitted to the Conference of the Parties (COP) under the UNFCCC. Some of them have already submitted GHG inventories as part of their second NCs; while the others are currently preparing them to be included in the NCs (Note: NC1 for Myanmar; while NC3 for Republic of Korea). Although they had gained knowledge and experiences through preparing their second inventories, they still face a number of problems.

The workshop on GHG Inventories in Asia (WGIA) organized by the Ministry of the Environment of Japan (MOEJ) and the National Institute for Environmental Studies (NIES) has been held on an annual basis since 2003. Since its 6th session, the WGIA has been held as a capacity building workshop for measurability reportability and verifiability (MRV) by taking into account the Bali Action Plan (Dec. 2007) and the G8 Environment Ministers Meeting in Kobe (May 2008). The impotence of reliable GHG inventory and its further improvement has been continuously considered in the international negotiation process, as it is the key to the evaluation of Nationally Appropriate Mitigation Actions (MANA).

The upcoming WGIA9 is to be held 13-15 July 2011 in Phnom Penh, Cambodia and convened by the MOEJ and NIES together with the local host organization, Ministry of Environment of Cambodia (MOEC). By taking into account the international negotiation process and the outcomes of the past WGIAs, the WGIA9 aims at exchanging information and options on: 1) to share information on the latest NCs (inventories) being submitted to the UNFCCC secretariat and discuss future activities beyond the latest inventories, 2) to clarify the relationships between inventory and mitigations, 3) to conduct mutual learning, and 4) to discuss sector-specific issues.

About 75 participants are expected to be present in the workshop. They are government official and researchers from 14 countries in Asia (Cambodia, China, India, Indonesia, Japan, Republic of Korea, Lao P.D.R., Malaysia, Mongolia, Myanmar, Philippines, Singapore, Thailand and Viet Nam) and are experts from international organizations (UNFCCC, IPCC TFI TSU), USEPA and a project (SEA GHG Project).

References

UNFCCC, 2007. Report of the Conference of the Parties on its thirteenth session, held in Bali from 3 to 15 December 2007 (Decision 1/CP.13, Bali Action Plan). FCCC/CP/2007/6/Add.1, 3-7.

G8 Environment Ministers Meeting, 2008. Chair's Summary G8 Environment Ministers Meeting, Kobe, Japan, May 24-26, 2008, 1-11.

Access to relevant information

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

Japan's Climate Change Policies

Ayako SUZUKI
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Abstract

Having a clear understanding of the current state of GHG emissions and taking appropriate measures to combat climate change are important for both developed and developing countries to achieve the UNFCCC's ultimate goal. Although developed countries should make more efforts to reduce their emissions, the need for action by developing countries considering emission projection is also increasing.

Cancun Agreements, which were adopted at COP 16 held on 29 November to 11 December in 2010 in Mexico created a foundation to go forward, through globally recognizing that the global temperature rise should be kept below 2 degrees, and formally anchoring targets of Annex I Parties and actions of Non-Annex I Parties in a COP decision as inscribed in the Copenhagen Accord. Especially, it is decided that both Annex I parties and Non-Annex I parties should submit their national communications and biennial update reports. Furthermore, for Annex I parties, it is decided to establish a process for international assessment of emissions and removals; while for Non-Annex I parties, it is regulated that internationally supported mitigation actions which will be measured, reported and verified, domestically supported mitigation actions which will be measured, reported and verified, and a process for international consultations and analysis. Therefore, internationally, it is considered to be important for a process of MRV (measured, reported and verified) concerning action for emission reduction.

Japan itself, as one of the developed countries, is also making efforts to reduce its GHG emissions. Japan's total greenhouse gas emissions in FY 2009 were 1,209 million tonnes of CO_2 equivalents. This was a decrease of 4.1% compared to the base year under the Kyoto Protocol and a decrease of 5.6% compared to FY 2008. The primary reason for the decrease was the drop in energy demand within all the sectors, including the Industries sector, due to the severe economic recession induced by the financial crisis in the second half of FY 2008. Further analysis was done on the contribution of factors to emission trends by breaking down emissions into a product of three factors; basic unit of CO_2 emissions; basic unit of energy consumption; and the amount of activity. This analysis further enables the adaptation of effective measures to tackle the issue.

In Japan, nuclear disaster due to big earthquake on 11 March 2011 might cause increase in GHG emissions. The immediate task is to settle down the nuclear crisis and to deal with power shortage, saving energy measures has become a major national concern. In the long run, Japan has set GHG reduction targets; as for the Mid-term Goal, the target is 25% reduction below 1990 levels by 2020; and as for the Long-term Goal, the target is 80% reduction below 1990 levels by 2050. In order to achieve these targets, energy policy must be deliberated on as one of the important measure of GHG reduction.

Access to relevant information

"Japan's National Greenhouse Gas Emissions for FY 2009"
http://www.env.go.jp/en/headline/headline.php?serial=1580

"Mid-and Long-term Roadmap for Global Warming Measures"
http://www.challenge25.go.jp/roadmap/index_en.html

4.2 Session I

Malaysia's Second National Communication with Special Emphasis on Greenhouse Gas Inventory

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Abstract

Malaysia has completed her Second National Communication (NC2) and submitted the Communications to the UNFCCC in April 2011. The NC2 covered eight chapters consisting of national circumstances, greenhouse gas inventory (GHG Inventory), mitigation analysis, adaptation, and issues in terms of capacity building, technology, research and constrains.

The NC2 is a much improved with the involvement of national experts through a series of national consultations. Three thematic working groups were established under the NC2 project with responsibilities of developing main chapters of the Communications. The details of the Communication could be downloaded from through UNFCCC website.

The greenhouse gas inventory forms the Chapter 2 of the Communication. The GHG inventory was conducted following the IPCC's 1996 Revised Guidelines with Good Practice Guidance characteristic. It covered all the five sectors, namely energy, industrial processes, agriculture, Land use, land use change and forestry (LULUCF) and waste. Generally, all sectors showed good improvement, either in the completeness of the activity data or the emission factors used. In addition, three sectors, namely energy, industrial processes and LULUCF had significant improvement and uncertainty assessment was also conducted for these sectors. Key categories were disaggregated and expanded in the Energy sector while additional categories had been included in the Industrial Processes and LULUCF.

In the year 2000, Malaysia's total emissions were 223 million tonne CO_2 e while the total removal was 250 million tonne CO_2 e. The energy sector contributed the largest emission of 147 million tonne of CO_2e followed by LULUCF and waste. Analysis of key sources showed that energy industries, transport and manufacturing industries and construction were the top three emitters. Unlike some countries in the region, the agriculture sector in particular rice production did not rank high in the key source.

The GHG inventory was the basis for the mitigation analysis. Mitigations actions were proposed based on the key sources identified. Malaysia is committed to reducing the GHG emissions on a voluntary basis and efforts are being undertaken to achieve this.

Gaps in conducting the GHG Inventory were identified and actions are being undertaken to improve them. Local emissions factors are being enhanced together with activity data. A workshop will be held in October 2011 to develop the national template for GHG inventory.

Thailand's Second National Communication:

Methodology and Main Results[9]

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Abstract

Thailand has been classified as a non-Annex I Party in the UNFCCC members. The country is not obligated to reduce CO_2 emissions during the first commitment period (2008-2012) as notified in the Kyoto Protocol. With respect to the Protocol's requirement, the initial national communication (INC) report on GHG inventories for Thailand was launched in 1994. This paper presents an overview of emissions levels estimated for Thailand's second national communication (SNC) in which the year 2000 was placed as a baseline for emission quantification. The document has outlined the inventory procedures and methods used in the SNC. The overall results of GHG emissions investigated from both sources and sinks have been showed that can be further used to suggest policy design associated with mitigation options. The same methods have been also applied to observe shares of emissions by gas types in sectoral scales.

It is notable that the inventory processes were conducted underlying limitations due to the inaccessibility of useful data and associated emission factors. The compatible methodology employed in the inventories is considered to be sound that can support a reliable process and an acceptable value of emissions production. Several factors can still provide uncertainty to the resultant values. In addition, the different period of making the INC and the SNC is 6 years. This duration can inform possible changes imposed in socio-economic and environmental systems which are evolved by time. The increase in population number and economic growth appear to be key drivers of GHG emissions whilst an expansion of forest areas becomes the only factor that helps decrease emission levels.

References

(1) UNFCCC, 1998. *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. http://unfccc.int/resource/docs/convkp/kpeng.pdf

(2) UNFCCC, 2007. *Report of the Conference of the Parties on Its Eight Session, held at New Delhi from 23 October to 1 November 2002 (Decision 17/CP.8) FCCC/CP/2002/Add.2.* http://unfccc.int/resource/docs/cop8/07a02.pdf#page=2

(3) Office of Environmental Policy and Planning, 2000. *Thailand's Initial National Communication under the United Nations Framework Convention on Climate Change,* Ministry of Science, Technology and Environment. http://unfccc.int/resource/docs/natc/thainc1.pdf

(4) Office of Natural Resources and Environmental Policy and Planning, 2011. Thailand's Second National Communication under the United Nations Framework Convention on Climate Change, Ministry of Natural Resources and Environment. http://unfccc.int/files/national_reports/non-annex_i_natcom/submitted_natcom/application/pdf/snc_thailand.pdf

[9] Presented in the 9th Workshop on GHG Inventories in Asia (WGIA)—Capacity Building for Measurability, Reportability, and Verifiability in Phnom Pehn, Cambodia, July 13th-15th 2011 by Woranuch Emmanoch, the Office of Climate Change Coordination, Thailand.

4.3 Session II

GHG inventory & mitigation measures
- Introduction-

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Abstract

The importance of continues improvement of inventories in the sense of transparency, accuracy, consistency, completeness, comparability has been stressed so far, since inventories can show a country's emission/removal status and are often referred to as a basis for developing mitigation measures for a country. Theoretically speaking, inventories should also reflect the impact of mitigation measures on emissions/removals; however, in order to do so, certain points should be taken into consideration while developing inventories (e.g., adoption of appropriate emission factors, activity data, and influence of CDM). In this session, participants will try to clarify the relationships between inventories and mitigation actions (incl. CDM) and discuss as to how we can better estimate emissions/removals that reflect the impact of mitigation measures. Points of discussion of this session are:

- ✓ How do we use our national inventory?
- ✓ Can we evaluate the impact of mitigation actions with a national inventory?
  - ✓ If yes, what kind of points one should keep in mind when developing inventory in order to reflect the impact of mitigation measures in a timely manner?
  - ✓ If not, what are the barriers? Any other indices besides national inventories?
- ✓ Can we incorporate the effects of CDM in a national inventory?

After the introductory presentation, some issues of Japan on this matter will also be introduced.

References

- Japan Business Federation: Results of the Fiscal 2010 Follow-up to the Keidanren Voluntary Action Plan on the Environment (Summary) —Section on Global Warming Measures— < Performance in Fiscal 2009 >, November 16, 2010
- Japan's Fifth National Communication, Government of Japan, Jan. 2010.

Access to relevant information

- GIO website: http://www-gio.nies.go.jp/index.html
- WGIA website: http://www-gio.nies.go.jp/wwd/wgia/wgiaindex-e.html

Inventory and mitigation measures for waste sector in China

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(CRAES)

Abstract

China is a developing country. Urban population is necessary collecting data for national GHG inventory. The total urban population in China is 515.11 million (1996) and over 606.67 million (2008). Total Population is 1.32802 billion (about 20% of total population in the world, about 33% of total population in the Asian). Since 2008, under the project "Enabling China to Prepare Its Second National Communication To the UNFCCC" China is starting work of Second National Inventory. This presentation introduced the circumstances for the inventory.

Chinese Government has adopted proactive steps to promote the transformation of economic growth means and readjustment of economic structure formulated a number of laws for protecting resources and environment revised and improved many other laws. In the meantime has formulated and implemented a series of financial, credit, tax incentive policies.

Chinese Government to standardize municipal waste treatment and disposal, the Chinese government has successively promulgated a series of technical policies and standards. Pushed by the Chinese government, the reform of waste management system is accelerating, a competition mechanism is introduced, and a bidding process has been used for the selection of qualified enterprises running civil waste treatment.

China is surely pushing forward with a framework for CDM cooperation with other countries. By April 2011，China has already approved the 2941 CDM project, of which 1295 project register in the EB, hereinto，new and renewable energy project quantity 71%, energy saving and improving energy efficiency project accounts for 17.2%, methane recovery of 6.8%.

CDM projects have to reduce fossil energy consumption and have contributed significantly. In 2009, China has approved the project to avoid the consumption of fossil fuels accounts for provinces where the proportion of total energy consumption is between 0.04% and 3.81%. Higher proportion (greater than 2.0%) including Yunnan, Gansu, Sichuan and Inner Mongolia provinces

References

The people's Republic of China Second National Communication on Climate Change. (not published yet)

Access to relevant information

None

Inventory and Mitigation Measures for Waste Sector in Thailand

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Abstract

In 2000, Thailand emitted 9.32 Mt of CO_2 eq from waste sector mainly from solid waste disposal on land (6A) and wastewater handling (6B). It is accounted for 3.9% of total national emission. The development of inventory was based on 1996 IPCC revised guideline-Tier II approach using waste statistics at national and local levels as activity data and combination of default value and country specific emission factors. In mitigation study, the emission in BAU scenario was estimated based on Tier I approach at national level from 2000-2050. Solid waste and wastewater generation rates were derived as a function of GDP growth. For mitigating those emissions, both management and technology approaches are considered. In management aspect, control of waste generation rate and recycling of wastes as proposed in national policy are being implemented. In technology options, utilization of methane and its avoidance through aerobic treatment are considered. It was anticipated that the emission during 2000-2050 will increase by 2.5 times in BAU scenario whereas the combination of management and technology mitigation measures could mostly level off the emission during the same period.

References

Office of Natural Resources and Environmental Policy and Planning, National Greenhouse Gas Inventories of Thailand, Second National Communications, 2010.

Thailand Greenhouse Gas Management Organization, Development of Database and Model for Emission Inventory of Thailand: Mitigation Aspects, 2010.

Linking Greenhouse Gas Inventory with Mitigation Actions

Elizabeth Philip and Abdul Rahim Nik
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Abstract

The Greenhouse Gas (GHG) Inventory undertaken in Second National Communication (NC2) provided a good platform for Malaysia to develop her national mitigation options. The NC2 used both current and historical data to project future emissions to initiate the process of planning and implementing of emissions reductions strategies with the greatest impact at national level. At the UNFCCC's COP15, our Rt Honorable Prime Minister announced that Malaysia would voluntarily reduce its emissions intensity of the GDP by up to 40% based on the 2005 levels by 2020. This initiative is conditional on technology transfer and financial support from developed countries.

Based on the GHG inventories done between 2000 and 2007, the emission scenarios were developed. The scenarios considered the existing initiatives or policies guiding Malaysia's development that could potentially result in emissions reductions.

Potential sub sectors for emissions reductions were developed based on the key source analysis of the GHG inventory. The energy industries and solid waste sectors were identified as key areas for mitigation.

The enhancement of renewable energy and energy efficiency could potentially reduce emissions up to 20 million tonne of CO_2. Likewise, the mitigation strategies for solid waste which focused only on organic portions could be achieved in three stages:

a. Reduction in organic waste generation and disposal minimized
b. Proper treatment or recycling of organic waste
c. Proper landfill management to ensure GHG are captured for flaring and recovery

The use of renewable energy and solid waste management is a more recent development and its impacts will be assessed in the due course. The incentive provided through the Fit in Tariff for renewable energy will encourage greater use of renewable energy. The government has also provided tax incentives for waste management and green buildings. However, the impacts of these incentives in terms of GHG emissions have yet to be assessed due to its early stage of development.

Based on a CDM project in the cement industry GHG emissions by 10% could be reduced during the calcinations. Reducing clinker and addition of additives could reduce emissions due calcinations. The impacts could be evaluated through the CER generated.

itigation actions have been an on-going activity in Malaysia. Implementation of sustainable forest management and forest certification are some of the efforts in reducing the GHG emissions in the LULUCF sector. This process has also contributed to the high amounts of GHG removal. Besides, the biogas generation from palm oil mill is also an on-going activity and its impacts are assessed through life cycle assessment for palm oil products.

Currently, a roadmap is being developed to identify mitigation options and the technological needs of the country in order to emissions intensity reduction of the GDP by up to 40% based on the 2005 levels by 2020.

4.4 Session III

NITROUS OXIDE AND METHANE EMISSIONS FROM HEDGEROW SYSTEMS IN CLAVERIA, MISAMIS ORIENTAL, PHILIPPINES: AN INVENTORY

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Abstract

Reports on N_2O emissions from tree-based agricultural systems in the humid tropics is very minimal even though these systems are widely practiced in these areas. This study estimated nitrous oxide emissions through inorganic fertilizer application, tree litterfall and decomposition, maize residue incorporation and livestock manure in *G. arborea* and *E. deglupta* hedgerow agroforestry systems. Methane emissions from livestock holdings in smallholder farms in Claveria, Misamis Oriental, Philippines were likewise estimated following IPCC 2006 guidelines for national GHG inventories. Total emissions from the hedgerow systems studied ranged from 3.56 to 7.46 kg N_2O ha^{-1} yr^{-1}. The major source of N_2O emissions is direct N_2O emissions from soil, ranging from 2.08 to 5.08 kg N_2O ha^{-1} yr^{-1}. Inorganic fertilizer applied, maize crop residue incorporation, and leaf litter fall were the major sources of direct N_2O emissions from the soil. Indirect N_2O emission from leaching is another source of N_2O emissions with values ranging from 0.74 to 1.41 N_2O ha^{-1} yr^{-1}. N_2O emissions from these hedgerow systems can be minimized with the proper design of the hedgerow system, proper component tree species and soil fertility management. Enteric fermentation is the major source of methane emissions from domestic livestock in Claveria. Non-dairy cattle were the main contributor of CH_4 emissions from enteric fermentation. Swine manure contributed largely to CH_4 emissions from manure management. N_2O emissions from the study site is comparable to reported emissions from improved agroforestry systems and mixed fallow system in tropical areas in Kenya and Peruvian Amazon. On the other hand, methane emissions from enteric fermentation of dairy cattle in the study area is low compared to dairy cattle in developed countries.

Inventory and mitigation measures for enteric methane emissions from livestock in India

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Abstract

Nature has gifted India with large livestock population and diverse animal genetic and plant genetic biodiversity. Animals are reared primarily on the diverse crop residues (straws, stovers, dry grass etc.) often supplemented with different green fodders (cultivated crops as well as tree leaves) and concentrate feeds (composed of different energy and protein sources). Enteric methane which is produced due to fermentation of feeding stuff in the rumen result in gross energy loss of 6-12 % as CH_4 depending up on the chemical nature of the fodder/feeds, their digestibility and their level of intake. For inventory preparation on enteric CH_4 emission livestock population has been categorized into different groups of sex, age and production type (Singhal et al, 2005). Average weight of the animals was used from the body weight range of Indian livestock breeds (Nivsarkar et al. 2000). For dry matter intake level of fodder/feeds and diets their chemical composition was taken into account. In the present study inventories of enteric CH_4 emission of Indian livestock are based on the CH_4 emission from 30 diets (composed of different dry roughages, green fodder and concentrate mixtures in different ratio) incubated in vitro using inoculums of buffalo, sheep and goats. The dry matter intake of the diets varied from 1.68-2.65% of body weight, while the gross energy values of diets ranged between 3.91 to 4.41 Kcal/g. Conversion of gross energy to CH_4 from dry, green and concentrate feeds ranged between 5.89 to 12.5, 5.20 to 12.4 and 5.98 to 12.23 % in goat, sheep and buffalo respectively. For the different diets conversion of energy to CH_4 varied from 6.84-11.56, 6.16-12.62 and 6.60-11.72 % for buffalo, sheep and goats, respectively. Methane emission from different diets ranged 8.70-19.10, 10.97-23.18 and 10.42-21.82 g/Kg DM for buffalo, sheep and goats, respectively. On the other hand methane emission from these diets varied from 21.67-35.28, 20.50-36.07 and 22.3-38.8 g/Kg DDM in buffalo, sheep and goats, respectively, depending on the digestibility of diet. Conversion rate of gross energy of green, dry roughages and concentrate feeds ranged from 20.36-35.21, 16.69-31.00 & 22.24-35.97 in buffaloes, 25.47-34.8, 27.25-44.10 & 18.35-40.96 in sheep and 19.5-40.8, 21.0-51.40 and 20.6-36.3 g/KG DDM for goats, respectively.

There are several chemical and biochemical means of methane mitigation, but dietary means through it ingredients seems to be the most viable and economic alternate to methane sink. Inventories made for the enteric methane emission for Indian livestock are based on diets of diverse nature composed of dry basal fodders, green fodders and concentrate mixtures of different energy and protein sources. Methane production from tree leaves (Leucaena leucocephala and Grewia optiva) supplemented diets are low in ruminant animals than other diets. Diets supplemented with berseem lucerne and other green fodders like oat resulted in low methane emission. Further the use of coconut cake as protein sources in diets resulted in less methane emission in ruminant animal. Conversion of gross energy to methane from tree leaves and coconut cake based diets was low compared to other diets. Use of basal dry feeds, green fodders and concentrate mixtures (energy and protein feeds) of diverse chemical nature provides a natural means to abate the methane emission. Thus the inventories of enteric methane emission of Indian livestock are based on dietary approach of methane mitigation.

Development of waste statistics to estimate activity data

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Abstract

Under the recommendation from waste sector working group of WGIA8, the secretariat conducted the follow up of the survey and analysis of the current status of each party's inventory in waste sector. It reveals the fact that although China, Korea, Philippines and Thailand have employed high tier methodology, most of parties have only partially obtained activity in estimation of GHG emissions in their recent inventory compilation.

Table: Completeness and accuracy of each party's' waste sector inventory

Gas		Category	Cambodia	China	Indonesia	Japan	Korea	Malaysia	Mongolia	Philippines	Thailand	Vietnam
CO_2	6C1	Biogenic	NA-	E(full)T1	NE-	E(full)CS	NA-	NA-	ET1	NE-	NA-	NA-
	6C2	Other (please specify)	NA-	E(full)T1	E(part)T1	E(full)CS	E(full)T2	NA-	NA-	NA-	NE-	NA-
	6D	Other	NA-	NA-	NA-	E(full)CS	NA-	NA-	NA-	NA-	NA-	NA-
CH_4	6A1	Managed Waste Disposal on Land	E(part)T1	E(full)T2	NA-	E(full)T3	E(full)T1	ET1	ET1	E(full)T2	E(full)T2	E(part)T1
	6A2	Unmanaged Waste Disposal Site	E(part)T1	E(full)T2	E(part)T1	NA-	E(full)T1	NE-	ET1	E(part)T2	E(full)T2	E(part)T1
	a	Deep (>5m)	E(part)T1	E(full)T2	E(part)T1	NA-	E(full)T1	NE-	IE-	E(part)T2	E(full)T2	E(part)T1
	b	Shallow (<5m)	E(part)T1	E(full)T2	NA-	NA-	E(full)T1	NE-	IE-	E(part)T2	E(full)T2	E(part)T1
	6A3	Other (please specify)	NA-	NA-	E(part)T1	E(full)T3	NA-	NE-	NA-	NA-	NA-	NA-
	6B1	Industrial Waste Water	E(part)T1	E(full)T1	E(part)T1	E(full)CS	E(part)T2	E(part)T1	ET1	E(part)T2	E(full)T2	E(part)T1
	a	Waste Water	E(part)T1	E(full)T1	E(part)T1	E(full)CS	E(full)T2	E(part)T1	ET1	E(part)T2	E(full)T2	IE-
	b	Sludge	E(part)T1	E(full)T1	NE-	IE-	NE-	E(part)T1	ET1	NE-	E(full)T2	IE-
	6B2	Domestic and Commercial Wastewater	E(part)T1	E(full)T1	E(part)T1	E(full)CS	E(full)T2	E(full)T1	ET1	E(part)T2	E(full)T2	E(part)T1
	a	Waste Water	E(part)T1	E(full)T1	E(part)T1	E(full)CS	E(full)T2	E(full)T1	ET1	E(full)T2	E(full)T2	IE-
	b	Sludge	E(part)T1	E(full)T1	NE-	IE-	IE-	E(full)T1	NE-	E(part)T2	E(full)T2	IE-
	6B3	Other (please specify)	NA-	NO-	NE-	NO-	NE-	NO-	NA-	NA-	NA-	NA-
	6C1	Biogenic	NA-	NO-	NO-	E(full)CS	NA-	NA-	ET1	NA-	NE-	NA-
	6C2	Other (please specify)	NA-	NO-	NO-	E(full)CS	NE-	NA-	NA-	NA-	E(full)T1	NA-
	6D	Other (please specify)	NA-	NA-	NA-	E(full)T1	E(full)T1	NA-	NA-	NA-	NE-	NA-
N_2O	6B1	Industrial Waste Water	NA-	E(full)T1	E(part)T1	E(full)CS	NE-	NA-	NA-	NA-	NE-	NA-
	a	Waste Water	NA-	E(full)T1	E(part)T1	E(full)CS	NE-	NA-	NA-	NA-	NE-	NA-
	b	Sludge	NA-	E(full)T1	NE-	IE-	NE-	NA-	NA-	NA-	NE-	NA-
	6B2	Domestic and Commercial Wastewater	NA-	E(full)T1	E(part)T1	E(full)CS	NE-	NA-	NA-	NA-	NE-	NA-
	a	Waste Water	NA-	E(full)T1	E(part)T1	E(full)CS	NE-	NA-	NA-	NA-	NE-	NA-
	b	Sludge	NA-	E(full)T1	NE-	IE-	NE-	NA-	NA-	NA-	NE-	NA-
		N2O from human sewage	E(part)T1	NE-	NE-	E(full)CS	E(full)T1	NA-	NE-	E(full)T2	E(full)T1	E(part)T1
	6B3	Other (please specify)	NA-	NE-	NA-	NO-	NA-	NA-	NA-	NA-	NE-	NA-
	6C1	Biogenic	NA-	NE-	NO-	E(full)CS	NA-	NA-	NA-	NA-	NA-	NA-
	6C2	Other (please specify)	NA-	NE-	NO-	E(full)CS	E(full)T2	NA-	NA-	NA-	NE-	NA-
	6D	Other (please specify)	NA-	NE-	NA-	E(full)T1	E(full)T1	NA-	NA-	NA-	NA-	NA-

Legend:

E (full): Fully Estimated	D (IPCC default)
E(part): Partly Estimated	T1 (IPCC Tier 1)
NE: Not Estimated	T1a, T1b, T1c (IPCC Tier 1a, Tier 1b and Tier 1c, respectively)
NO: Not Occurred	T2 (IPCC Tier 2)
IE: Included Elsewhere	T3 (IPCC Tier 3)
NA: Not Applicable	CS (Country Specific)
	OTH (Other)

One of the major obstacles in the way of improving GHG emission estimates from the waste sector is the insufficiency of statistics to obtain activity data. Therefore, on this working group at WGIA9, the secretariat plans to focus on the importance of key elements (relevant domestic laws, statistical survey methods, and survey implementing agencies setup) to compile waste statistics.

References

Takefumi Oda, 2010, Result of the Survey for Waste Sector Inventory Status of Each Country, Proceedings of WGIA8, CGER-I096-2010, NIES, Japan, 81-89

GHG Emission Estimation in Waste Sector

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Abstract

Waste inventory of Greenhouse Gases for the Year 2000 has been developed following the Revised 1996 IPCC Guidelines, and the UNFCCC software for use in calculating and estimating emissions (Version 1.3.2, 28 January 2007), complemented by the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.

Using default values, a total of 170 Gg of municipal solid waste was disposed to unmanaged sites in the year 2000, which resulted in total net methane emissions from land disposal of solid waste of 9.69 Gg. There was no methane recovery or flaring facility in Cambodia in the year 2000 for industrial wastewater. Net methane emissions from wastewater handling were negligible and amounted to less than a Gg in the year 2000. By using the protein consumption of 18.6 kg/capita/year for Cambodian people in 2000, and IPCC default factor, Annual Nitrous Oxide Emissions from human sewage were insignificant. The total emission from waste was accounted for 229.24 Gg CO_2 eq.

Gaps in specific national data have presented considerable challenges to the development of GHG inventory in general. This inventory has made extensive use of IPCC default emission factors, and in some cases, default activity data. Despite these limitations, every effort was undertaken to make this inventory as complete and representative as possible.

GHG Emissions from Waste Sector in Malaysia

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Abstract

GHG emissions from the waste sectors contributed to about 12% of the total GHG emission. Sub sectors covered were emissions from solid waste, industrial and domestic waste water treatment. Emissions from solid waste ranked fourth in the key source analysis while emissions from industrial and domestic waste water was not ranked significantly.

Emissions factors used were mostly from the IPCC's EFDB except for waste water treatments from rubber factories and palm oil mills. The lack of centralized activity data collection and compilation is one of the main constrain in this sector. Waste management in Malaysia involves the participation of several agencies and this enhancement in coordination is needed.

The waste sector would need to expand the activity data for industrial waste water. Emissions from food and beverage factories need to be included. Additionally, activity data for solid waste need to be expanded. Improving the 3R (reduce, reuse and recycle) implementation would provide better data sets. A one day workshop will be organized to develop national activity data for the solid waste sector and also to build capacity amongst inventory compilers.

GHG INVENTORY FROM THE WASTE SECTOR IN THE PHILIPPINES

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Abstract

The Philippines as a party to the United Nations Framework Convention on Climate Change (UNFCCC) is committed to submit its National Communication. This contains the plans and strategies of the country to address the impacts of climate change and includes an inventory of a country's greenhouse gas (GHG) emissions in a given year. This report is envisioned to guide policymakers in crafting appropriate mitigation and adaptation laws, policies and strategies.

In the year 2000, the Philippines submitted its Initial National Communication (INC) with 1994 as the baseline for its GHG inventory. Emissions from the five sectors namely Energy, Industrial Processes and Product Use, Agriculture, Land Use Change and Forestry (LUCF), and Waste were accounted for. The country followed the 1996 IPCC Guidelines for conducting the inventory of its GHG emissions.

This paper focuses on the waste sector with an initial 7,094 Gg CO_2 eq emissions in 1994 as the baseline data for the INC. The Second National Communication (SNC) reported an emission of 11,599.07 Gg CO_2 eq projecting a 64% increase from the INC data.

The waste sector has been divided into solid waste, municipal wastewater, industrial wastewater and human waste. The relative contributions of GHG emissions from the four subsectors for the year 2000 did not significantly vary from the 1994 inventory. The solid waste subsector is still the major source of GHG emissions accounting for almost half (47%) of the total GHG emissions.

The SNC used the First Order Decay Model (FOD) instead of the Mass Balance Approach for estimating CH_4 from the decomposition of solid wastes during the INC (1994). This is a major modification in the calculation for the solid waste for the 2000 inventory.

Some provisions in the country that mitigated problems of GHG emissions are the Republic Act 8749 (Clean Air Act) in 1999 that prohibits incineration of wastes and the R.A 9003. (Ecological Solid Waste Management Act) that mandated the conversion of all open sites to sanitary landfills by 2006.

References

Department of Environment and Natural Resources and Asian Development Bank (2003). Metro Manila Solid Waste Management Project (TA 3848-PHI): Waste Analysis and Characterization Study.

IPCC, 1996. Guidelines for National Greenhouse Gas Inventories (Workbook and Reference Manual)

IPCC, 2006. Guidelines for National Greenhouse Gas Inventories (Workbook and Reference Manual)

JICA-MMDA, 1998. The Study on Solid Waste Management for Metro Manila in the Republic of the Philippines. Master Plan Report, Pacific Consultants International, Kokusai Kogyo Co., Ltd Metropolitan Manila Development Authority (MMDA), Metropolitan Solid Waste Management Office (2008). Ang Basura ng Metro Manila.

National Solid Waste Management Commission, Office of the Secretariat (2000). List of

Controlled Disposal Facilities in the Philippines
National Solid Waste Management Commission, Office of the Secretariat (2000). List of Open Dumpsites in the Philippines
National Solid Waste Management Commission, Office of the Secretariat (2000). List of Sanitary Landfills in the Philippines
National Statistical Coordination Board (2003). Balance Sheet of the Philippines
National Statistics Office (2007). Population and Annual Growth Rates by Region, Province, and Highly Urbanized City: Population Censuses 1995, 2000, and 2007
Senate Planning Economic Office (2005). Philippine Evnironment Quality: At a Glance
Villarin, J.T., Narisma, G.T., Reyes, M.S., Macatangay, S.M., and Ang, M.T. (1999). Tracking Greenhouse Gases: A Guide for Country Inventories
World Bank, 2003. Philippines Environment Monitor: Water Quality

Development of Waste Statistics to Estimate Activity Data: Waste Sector in Thailand

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Abstract

Waste statistics including waste quantities and characteristics are essential for accurate estimation of greenhouse gas emission from waste sector. In Thailand, waste quantities are monitored through weight or volume measurement on regular basis for cities and municipalities. Nevertheless, such information for small local authorities such as sub-district administrative organizations is usually not available and the quantities were estimated from per capita waste generation rates. Recycled waste amount were also studied but they were not continuously monitored. As for waste characteristics, waste composition in municipalities are occasionally surveyed but rarely monitored on regular basis. The available waste statistics in Thailand enabled the estimation of greenhouse gas from waste sector at Tier II approach. It is recommended that further monitoring of waste quantities from all solid waste disposal sites and waste composition should be carried out to upgrade the development of greenhouse gas inventory to the higher tier level.

References

Office of Natural Resources and Environmental Policy and Planning, National Greenhouse Gas Inventories of Thailand, Second National Communications, 2010.

Emission-Trend, Methodology and Mitigation-Measures of HFCs, PFC and SF_6 in JAPAN

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Abstract

Based on “Montreal Protocol”, developed countries and developing countries already finished abolition of CFC (Chloro Fluoro Carbon) and Halon (Alkyl Halide containing Br) before 2010. And HCFC (Hydro Chloro Fluoro Carbon) will be abolished in developed countries by 2020. SF_6 (Sulphur hexafluoride), PFCs (Per fluoro carbons) and HFCs (Hydro fluoro carbons) are not Ozone-Depleting Gases but are Greenhouse Gases, of which emissions shall be reported to UNFCCC by Annex 1 parties.

Emission-trend analysis of Non-CO_2 gases showed that “HFCs-emission” is the most concerned issue for Japan. Emissions of SF_6 and PFCs have been becoming smaller recently due to attachment of destruction units, etc. On the contrary, “HFCs-emission” from “Refrigeration and Air-Conditioning Equipment” has been becoming larger continuously since 1995.

HFCs are emitted from “Domestic refrigeration”, “Automatic Vending Machine”, “Commercial Refrigeration”, “Stationary Air-Conditioning (house hold)” and “Mobile (car) Air-Conditioning”. Among these, “Commercial Refrigeration (large-scale refrigerator)” was found to be the worst contributor. The GWP of coolant for “Commercial Refrigeration” has been becoming larger continuously, while GWP of coolants for “Stationary Air-Conditioning” and “Mobile Air-Conditioning” have been kept steady. So, for reducing HFCs-emissions, “Using Lower-GWP HFCs” seems to be the 1st priority.

Concerning emission from “Mobile Air-Conditioning”, a combination of “Act (Law) on Recycling, etc. of End-of-Life Vehicles” with “The technology of recycling HFCs from scrapped car” was identified to be the most successful Mitigation-Measure in Japan.

“Leak during production of automobiles, which have air-conditioning” occupies only < 1% of total emission from “Mobile Air-Conditioning”. So, whether producing cars or not, does not give an impact. Also, the Methodology is not complicated because the Activity Data is just the number of cars, air-conditioners and refrigerators. All Asian countries must have and use cars, air-conditioners and refrigerators. Accordingly, if not yet, to try estimating emissions of F-gases for next NC is strongly recommended.

References

1) UN Environment Programme
2) White Paper on Environment by Japanese Ministry of Environment
3) Second Assessment Report by IPCC (1955)
4) National Greenhouse Gas Inventory Report and CRF of JAPAN

National Greenhouse Gas Inventory for the year 2000

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Abstract

Cambodia's Inventory of Greenhouse Gases for the Year 2000 has been developed following the Revised 1996 IPCC Guidelines, and the UNFCCC software for use in calculating and estimating emissions (Version 1.3.2, 28 January 2007), complemented by the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, and the IPCC Good Practice Guidance on Land-Use, Land-Use Change and Forestry (GPG LULUCF).

Following Paragraph 14 of Decision 17/CP.8 of the UNFCCC, Cambodia provides in its national inventory, to the extent possible, estimates of anthropogenic emissions for the following three gases by sources and removals by sinks: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The sectors covered in this inventory are: Energy, Agriculture, Land Use Change and Forestry, and Waste. Cambodia does not currently process or produce minerals, chemicals or metals. Thus, Cambodia's emissions are nought in industrial processes. The Solvent and Other Product Use sector is only a significant source of non-methane volatile organic compounds (NMVOCs) and are not reported here.

Gaps in specific national data have presented considerable challenges to the development of Cambodia's GHG inventory, in particular in the energy sector, where disaggregate information is not available. This inventory has made extensive use of IPCC default emission factors, and in some cases, default activity data. Despite these limitations, every effort was undertaken to make this inventory as complete and representative as possible.

Activity data used in the Cambodian inventory have been collected by national and international agencies. As data is only irregularly collected or remains unavailable, uncertainty levels are high for the source categories approach of the energy sector, as well as the Land Use Change and Forestry sector.

Total emissions in Cambodia for the year 2000 amounted to 48383.43 Gg CO_2 eq., in which 24906.39 Gg was CO_2, 973.14 Gg was CH_4 and 9.81Gg was N_2O. The highest contributor was Land Use Change and Forestry, which accounted for 49 % of total national emissions, followed by agriculture with 44%, energy (7%), and waste (less than 1%). Forest and grassland conversion play important role in CO_2 emission in Land Use Change and Forestry sector, which accounted for 22858.73 Gg. In this sector, however, changes in forest and other woody biomass stocks and abandonment of managed lands can remove 48165.86 Gg CO_2 eq. Transport accounted for the highest proportion of CO_2 emissions in the energy sector, followed by energy industries. In agriculture, rice cultivation was the highest contributor of methane emissions, followed by enteric fermentation from domestic livestock. Methane emissions from the waste sector remained minimal, which accounted for 229.24 Gg CO_2 eq. Thus, total net emissions in Cambodia for the year 2000 are estimated at 219.83 Gg CO_2eq.

Reference: Ministry of Environment, 2009. National Greenhouse Gases Inventory for the year 2000.

Emissions from Agriculture Sector in Laos in the year 2000 "Preliminary Findings"

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Abstract

Based on the draft report being prepared for Lao PDR's , Second National Communications, On Greenhouse Gas Inventory (GHGI), the inventory, under the agriculture sector, covered emissions from livestock enteric fermentation, manure management, rice cultivation, savanna burning, agricultural residue burning and agriculture soil. With the use of UNFCCC NAI Software version 1.3.2, revised IPCC guideline 1996 particularly Tier 1 approach and defaults factors; the results indicated that the total emissions from agriculture were 7,675.91 Gg of CO_2eq which accounted for 14.51% of total emissions of the country in the year 2000 and without including LULUCF, agriculture was the single largest emission sector. The key source of emissions were rice cultivation which covered 37.65% of the total emission from this sector. Agriculture soil was the second largest contributer amounting to 31.18%; followed by livestock enteric fermentation 27.47%; manure management 3.56% and the rest were from agricultural residue and savanna burning which were 0.14% and 0.01% respectively. The main gases were CH_4 with emission amount of 251.41 Gg and N_2O 7.73 Gg which mostly generated from agriculture soil. In addition, there were emissions of other gases such as NOx and CO in the amount of 0.32 Gg and 8.39 Gg respectively.

Reference

Water resource and Environment Administration (2011): National Greenhouse Gas for Lao PDR, 2000. For Second National Communication on Climate Change. Final draft, 2011.

GHG Inventory in Myanmar: INC Report

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Abstract

Myanmar ratified UNFCCC in 1994 as a non-Annex I Party and it needs to fulfill its commitments and obligations for preparing and reporting its Initial National Communication (INC) according to the Article 12.5 of the UNFCCC. In this context, the National Commission for Environmental Affairs (NCEA) of Myanmar launched an INC-project in 2008 with the financial assistance from GEF/UNEP. GHG inventory and mitigation option analysis team successfully accomplished national GHG inventories in energy, industrial processes and product use, agriculture, forestry and other land use, and waste sectors with the base year of 2000. The GHG inventories on emissions by sources and removals by sinks covers carbon dioxide, methane and nitrous oxide, and Non-Methane Volatile Organic Carbon (NMVOC). Since research and studies concerning with climate change issues are very limited in Myanmar and the country specific emission factors are not available, the GHG inventory generally used the emission factors and default values as described in IPCC 2006 Guidelines.

The total CO_2 emission in Myanmar for the year 2000 was estimated to be 74402.03 Gg, among which 54.3%, 30.7%, 10.6%, 3.8% are emitted from forestry, agriculture, energy, and waste sectors, respectively. Forestry sector contributed the most GHG emissions with 40404.73 Gg CO_2e. However, due to the biomass growth in natural forests, forest plantations, road side trees and home garden trees, land use change and forestry absorbed/ removed CO_2, amounting to 142,221.2 Gg. As a consequence, the country's net emission figures turned out to be – 67819.2 Gg CO_2e which means 67.8 million tons of CO_2 are being absorbed by forestry sector in the year 2000.

The trend analysis in energy sector (Energy sector plus Industrial processes and product use sector) for the short term (2000-2005) and in long-term (1990-2030) indicated that there will be many fluctuations in estimating GHG emissions in this sector. The main GHG sources in energy sector include energy industries and transportation which are responsible for most CO_2 emissions. Thus, the industrial and economic development in these years will largely influence the GHG emissions from the country. The trends for CH_4 and N_2O emissions in agriculture and livestock sector also clearly highlight a sharp increase in short-term and in long-term periods. With the increase in the net sown area especially for rice production and more inputs in intensive commercial agricultural systems, the GHG emissions in agriculture sector are likely to increase. Waste sector also shows an increase in CH_4 emissions because of the ever increasing population especially in urban areas. Land use change and forestry sector is the major emitter of the country. The main emissions come from deforestation, shifting cultivation and land clearing for forest plantations. Moreover, total annual CO_2 removals by natural forests are declining steadily due to the decrease in area of natural forests. It is estimated that although the removals by forests are declining, GHG removals in Myanmar still have an outstanding surplus till 2030. Thus, land use change and forestry sector, which has a major role in GHG removal of the country, should be given special attention whenever

mitigation activities are to be conducted. The agriculture sector will stand as a large emission sector in the years to come, and therefore the mitigation measures should be incorporated into the agriculture development policies, especially in rice production.

GHG emissions, estimation method and mitigation for Transport in Japan

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Abstract

Japan estimates GHG Emissions from Civil Aviation, Road Transportation, Railways and Navigation in Transport sector. CO_2 Emissions from transport section were 223 Mt-CO_2 in FY 2009, which is about 20% of national total CO_2 emission and increased by 5.6% compared to FY 1990. About 90% of transportation emissions were from road transportation.

In the '90s, emissions from road transport increased by the increase of the number of automobiles. However, emissions in the '2000s have decreased by the improvement of gasoline mileage owing to Top Runner Approach regulated by the Act on the Rational Use of Energy.

In Japan, the *Statistical Yearbook of Motor Vehicle Transport*, by Ministry of Land, Infrastructure, Transport and Tourism (MLIT) is used as primary statistics in road transportation to estimate CO_2 emissions and the *General Energy Statistics* by Agency for Natural Resources and Energy (ANRE) is used as secondary statistics.

For the *Statistical Yearbook of Motor Vehicle Transport*, data are collected by sample survey by questionnaire. Questionnaire is distributed to 30,000 automobiles at random (79,000,000 automobiles are registered in Japan). Survey period is 7 days each month. Objectives of this statistics are 1) to promote policy and measure as a base material for transport, 2) to estimate GHG emissions and energy consumption, 3) to be a base material to promote 'modal shift'. This statistics include not only fuel consumption, but also travel distance, transport frequency, passenger transport volume (passengers-km) and cargo transport volume (tons-km).

Bonded import and bonded export, which is described in the *Yearbook of Mineral Resources and Petroleum Products Statistics* by Ministry of Economy, Trade and Industry (METI), represent bunker fuel.

For mitigation action in transport sector, MLIT, METI and MOE are key ministries in Japan. Relevant laws to promote mitigation are the *Act on Promotion of Global Warming Countermeasure* and the *Act on the Rational Use of Energy*. The *Act on Promotion of Global Warming Countermeasure* include the *Revised Kyoto Protocol Target Achievement Plan*, which also indicate policy and measures for transportation such as Transportation Demand Management (TDM), Introduction of Intelligent Transport Systems (ITS), Eco-Drive promotion activities, etc. The *Act on the Rational Use of Energy* includes the Top Runner Approach, which improved gasoline mileage for passenger vehicle in 2000s.

References

Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Statistical Yearbook of Motor Vehicle Transport

Access to relevant information

Guide to official statistics in Japan, 9. Transport and communications;
http://www.stat.go.jp/english/index/official/209.htm

Indonesia Second National Communication GHGs emissions from Transportation sector (part of Energy sector)

Agus Gunawan (*MOE, Republic of Indonesia*), Retno Gumilang Dewi (*ITB*)

Abstract

Indonesia as developing country which population growth number is about 1.05% has energy consumption of about 5.7% per annum at last decades. The energy source potential are widely spread in this country, but still need to explore and develop as way out of energy security matter problem.

Indonesia has develop the Second National Communication and submitted to the Secretariat of UNFCCC on 14 January 2011. Transportation sector is part of the emission contribution from energy sector. This sector contributes 20% of CO_2-eq emission in 2000, which means second source after LUCF. And transport is 24.5% from total 0.418 Gton CO_2-eq generated from energy utilization.

The energy demand and supply is still dominate by fossil fuel, and will have challenge of renewable energy provision. The target of Indonesia Energy mix is reducing of fossil fuel dependence, and increasing role of new-renewable energy (biofuel, geothermal, biomass, nuclear, hydropower, solar, wind power and liquefaction coal) at all sectors. In National Energy Plan, new-renewable energy will be promoted but targetted increase of its share in energy supply mix is based on supply security and resource availability considerations and it is not within GHGs reduction and climate change mitigation framework.

REFF Burn is carry out by integrating efforts and technologies on reducing emissions from fossil fuels burning through three levels. The first is an effort before Pre Combustion or effort of fossil fuel combustion emission prevention. This effort is conduct by utilizing of fossil fuel consumption technology, and implement of renewable energy. Second is effort During Combustion, which means also fossil fuel combustion emission reduction. This carries out by set up low emission technologies during fossil fuel combustion (clean fossil technology). Third is undertaken after or Post Combustion which is fossil fuel combustion emission processing. This effort was undertaken by technology that capture of emission and stored in the system of carbon accumulation by injected into the soil (Carbon Capture and Storage), for example in unused oil wells.

References

Ministry of Environment, Republic of Indonesia, 2010, Indonesia Second National Communication Under The United Nations Framework Convention on Climate Change, II-3 – 13

Transport Sector in Myanmar

Hnin Hnin Aye
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Abstract

Transportation in Myanmar is composed not only by transportation vehicles such as cars, bus, railways, airplane, motorbike, bicycle but also transportation infrastructure, transportation control and transportation management. Transport is also associated with significant environmental and health concerns including pollution and climate change.

Inadequate infrastructure of roads, bridges, railways, ports and communication facilities impedes economic growth of Myanmar. In year 2000, the transport sector account for 28% of the CO_2 emissions and this sector is one of the major sectors in which measures to mitigate the adverse effect on climate are required to be taken. According to the GHGs Inventory in year 2000, the share of road transportation is more than 80% on the whole transportation sector. Therefore, it is necessary to maximize the opportunities that offered by effective and efficient sustainable transportation.

Environmental issues related to transportation are the growing traffic congestion and related pollution problems and inadequate capacity to enforce standards and regulations. Sustainability is also a relevant issue for transport because on one hand, transport is connected to economic growth, while at the same time it puts enormous pressure on the environment.

Myanmar seeks to improve urban transportation system through the fuel switching from diesel and gasoline to CNG and introducing electric vehicles in hotel zones, zoological garden and hospitals to reduce the heavy rely on fossil fuel.

Myanmar expectation is to reduce in road traffic congestion and travel time through the introduction of mass transit system and maintenance, renovation and extension of existing roads. Environmental actions to be taken in Myanmar are environmental awareness in Policies of Ministries concerned, improvement of infrastructures and inducement of the use of rail transport modes.

Japan's QA/QC System

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Abstract

Quality Assurance/Quality Control (QA/QC) activities are key in developing the quality and completeness of GHG Inventories, and are implemented in accordance with each country's QA/QC Plans.

In Japan's case, QC is done mainly by the Greenhouse Gas Inventory Office (GIO), the Ministry of Environment, relevant ministries/agencies/organizations, the Committee for the Greenhouse Gas Emission Estimation, and private consultants.

QC activities include Tier 1 QC by compilers, and Tier 2 QC for each category by private consultants and relevant ministries and agencies. General QC procedures (Tier 1) are conducted mainly by Sectoral Experts and the National Inventory Compiler. It includes confirmation of general items related to calculation, data processing, completeness, documentation, and archiving for all emission source and sink categories. QC procedures for each category (Tier 2) is external QC on the CRF and NIR drafts, and estimation files prepared by GIO, or confirmation and verification of the content of the CRF and NIR drafts and estimation files, as well as drafts of press releases, for categories relevant to each ministry or agency. Relevant organizations and the Committee for the Greenhouse Gas Emission Estimation Methods also provide QC functions.

As for QA procedures, Japan reformed its QA process in 2009, by inviting experts who are not involved in the inventory preparation process to conduct expert peer review of the inventory. Since then, Agriculture and Waste sectors (2009), Industrial Processes and Solvent and Other Product Use sectors (2010), and the Energy sector (currently ongoing) have been taken up. The scope of the review is mainly: 1) confirming the soundness of estimation methods, activity data, emission factors, and other items, and 2) confirming the soundness of content reported in the CRF and NIR.

The QA reviews were conducted with regard to these points: 1) appropriate implementation of improvements to the previous-year inventory, 2) the appropriateness of estimation methods and data used, and 3) the appropriateness of reporting. Through the process, 1) key data and the methods of estimation used in these sectors were validated; 2) issues were identified, and were submitted to the Committee for the GHG Emissions Estimation Methods; and 3) insufficient explanations and incorrect descriptions in the NIR were identified and addressed, in order to improve transparency and accuracy.

References

NIES, 2011. National Greenhouse Gas Inventory Report of JAPAN (2011). Annex 6.

National Greenhouse Gas Inventory QA/QC Plan of Mongolia

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Abstract

Introduction

The Mongolian Greenhouse Gas (GHG) Inventory follows the methodologies recommended by the IPCC (IPCC, 1996). In most instances, the main obstacle was the lack of reliable data for the calculations. It was possible to obtain only general activity data, such as fuel consumption, cement production, domestic animal population, area of cultivated land, etc. and some factors for the energy content of Mongolian coal and the oxidation coefficient of fuel burned for power generation. In most cases, specialized data such as emission factors and country-specific emission ratios of gases have not been worked out for Mongolia. Therefore, the IPCC recommended default values were typically used in the GHG Inventory calculations.

For the future improvement and recalculation of GHG inventory by using IPCC Good Practice Guidance it is important to develop and implement Quality Assurance/Quality Control (QA/QC) Plan. The Development of the Inventory QA/QC plan is made according to the General QC Procedures (Tier 1) of IPCC Good Practice Guidance.

Key elements of QA/QC planning

To ensure the best possible inventory quality a clear quality assurance/ quality control (QA/QC) system is needed. This will need to cover a clear documented approach as follows (GPGUM):

- Checks and internal review of the data used for the calculations and the results;
- Comprehensive documentation;
- External audit of the entire inventory, and
- Inventory reviews including expert (peer review, stakeholder review and public review).
-

QA/QC plan

A QA/QC plan is a fundamental element of a QA/QC system, and it is *good practice* to develop one. The plan should, in general, outline QA/QC activities that will be implemented, and include a scheduled time frame that follows inventory preparation from its initial development through to final reporting in any year. It should contain an outline of the processes and schedule to review all source categories. The QA/QC plan is an internal document to organize, plan, and implement QA/QC activities.

Development of the inventory QC/QC plan for sectors

QC Plan developed by sector category for Energy sector (Stationary combustion and Mobile combustion) and Industry.
QC Activity focused on activity data, emission factors and comparison of emission estimates using different approaches
QC procedures focused on sector specific checks and controls
QC plan included responsible and contribution organizations, time frame of implementation and others

An Overview of GHG Inventory QA/QC system in Korea

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Abstract

2006 IPCC Guideline Chapter 6(QA/QC and Verification) presents general guideline and good practice on QA/QC procedure of GHG inventory.

Countries or relevant bodies that have established GHG inventory need to proceed QA/QC procedure to improve the transparency, consistency, comparability, completeness, and accuracy of greenhouse gas inventories.

Although Korea is classified in non-Annex Ⅰ group, the government and GIR(Greenhouse gas Inventory & Research center)are in the effort of establishment of GHG inventory.
As a result of the effort, Inventory Report on waste sector is being annually prepared by Ministry of Environment and submitted to GIR.

And also the local governments are required to prepare「local government's green growth plan」including GHG inventory and quantified GHG emission.

Korea Environment Corporation (KECO) is responsible for drawing up IR on waste sector and Local government GHG inventory report.

Therefore, KECO is in the process of development of definite QA/QC procedure to meet the inventory quality according to 2006 IPCC Guideline.

The 2 practical examples of KECO's QA/QC procedure in drawing up IR and local government GHG inventory report can offer some information about actual QA/QC procedure and primary review points in the field.

At the moment, GHG Inventory QA/QC procedure is not specified in 2006 IPCC Guideline and Each country's NIR and it is in the process of Research and Development.

For systematic and reliable GHG Inventory QA/QC procedure, scientific and definite QA/QC method should be developed through in-depth case studies on other countries' GHG Inventory Report. And also, definite QA/QC standard method, for example ISO Standard, should be developed and applied at the earliest possible moment.

Results of Questionnaire Survey of the Transport Working Group

Greenhouse Gas Inventory Office of Japan (edited by Kohei Sakai)

In this WG, the WGIA secretariat collected the responses to a questionnaire survey for the transport section in each country to grasp the status of the member countries.

Although we were not able to acquire complete and sufficient information from all countries, these results may still include useful information. Therefore, we describe the results of the questionnaire below.

The surveyed items are as follows:

1. Category & Gas
2. Emissions Trend
3. Activity Data and Statistics
4. Emission Factors
5. Bunker Fuel
6. Issues and Challenges

(7. Comments /Questions)

The respondent countries are as follows:

Thailand, Myanmar, China, Laos, the Philippines, Mongolia and Japan (7 countries)

1. Category & Gas

Table 1 shows the categories and gases estimated for the transport section (1.A.3.) in each country. Road transport and civil aviation are estimated in all seven countries.

Table 1 Estimated Categories and Gases (including CO_2 CH_4 and N_2O)

	Road transport	Civil aviation	Railway	Navigation
China	E	E	E	E
Thailand	E	E	E	E
Myanmar	E	E	CO_2:E CH_4,N_2O:NE	CO_2:E CH_4,N_2O:NE
Laos	E	E	NE	NE
Philippines	E	E	E	E
Mongolia	E	E	E	NE
Japan	E	E	E	E

E: estimated

NE: Not estimated (including ‘Not Occur’ and ‘Not Applicable’)

2. Emissions Trend

Table 2 shows estimated years, proportion of transport, proportion of road transport, and emissions trend. Some countries have time series data, while others do not have sufficient time series data to understand their country’s trend. The emissions trend is not necessarily an increase in all countries, but emissions from the transport section have a significant proportion in most of the countries. Particularly, the road transport has a significant proportion in the transport section.

Table 2 Estimated years, proportion of transport, proportion of road transport, and emissions trend

	Year	*Proportion* Transport /Total	*Proportion* Road /Transport	Emissions trend during the period
China	1994			
Thailand	1994, 2000-2004	30% (of Energy)		Steady increase
Myanmar	2000-2006	28%	83%	Fluctuation
Laos	2000 (and 1994)		67%	Steady increase
Philippines	1994 and 2000		87%	
Mongolia	1990-2006	17%	79%	Decrease in the beginning of the ’90s, Increase from the mid- ’90s
Japan	1990-2009	20%	90%	Increase in the ‘90s, Decrease in the 2000s

3. Activity Data and Statistics

Table 3 shows the subcategories of activity data in the road transport to estimate CO_2 emissions. Four countries clarify sub-categories in the road transport and separate Freight and Passenger Cars. Bus is categorized in three countries, and Motorcycle (two-wheel cars) is categorized in two countries.

Table 3 Subcategories of activity data in the road transport to estimate CO_2 emissions

China	Passenger Vehicles (Large, Medium, Small, Minicar) Passenger Car	Freight, Freight Truck and Lorry (Heavy, Medium, Light, Mini)
Myanmar	Passenger car (Gasoline / Diesel Oil) Passenger Bus (Gasoline / Diesel Oil) Two Wheeler (Gasoline)	Heavy/Light Duty Truck (Gasoline / Diesel Oil,CNG)
Philippines	Car Motorcycle/Tricycle(Gasoline) Bus (Gasoline/ Diesel Oil) Utility vehicle ((Gasoline/ Diesel Oil)	Trucks in general (Gasoline/ Diesel Oil)
Japan	Passenger Car (Gasoline, Diesel oil, LPG) Passenger Bus (Gasoline, Diesel oil)	Freight, Freight Truck and Lorry (Gasoline, Diesel oil)
THA, LAO, MNG: Road transport doesn’t have any disaggregated level.		

Table 4 shows statistics of activity data in the transport section to estimate CO_2 emissions. Some countries make separate statistics by category while other countries compile all transport statistics in one statistics.

Table 4　Statistics of activity data in the transport section to estimate CO_2 emissions

	Statistics	Publisher (Ministry / Department)	Collection method
China	Energy Statistical Yearbook, Transportation Statistical Yearbook	National Bureau of Statistics of China	Sample survey by questionnaire
Thailand	Statistics of secondary data from the National Report on Energy Situation in Thailand	(secondary data) Department of Alternative Energy Development and Efficiency	
Myanmar		<Road> Road Transport Administration Department <Aviation> Myanmar Airways <Railway> Myanmar Railways <Navigation> Ministry of Transport	
Laos	<Road> Statistical Yearbook of Transport <Aviation> Lao Aviation Annual Statistics and Report	Ministry of Public Work and Transport	Sample survey by questionnaire
	Import and export statistics	Ministry of Industry and Commerce	Through record at check points
Philippines		Department of Transport and Communications	
Mongolia		<Road> Road Inspection Agency <Railway> Railway Management Agency	
	<Aviation> Mongolian civil aviation statistics		
Japan	<Road> Statistical Yearbook of Motor Vehicle Transport <Aviation> Statistical Yearbook of Air Transport <Railway> Statistical Yearbook of Railway Transport <Navigation> Statistical Yearbook of Coastwise Vessel Transport	Ministry of Land, Infrastructure, Transport and Tourism	Sample survey by questionnaire
	*Secondary statistic is the *General Energy Statistics*, which integrates all fuel consumption for fuel combustion categories including transport statistics, published by the *Agency for Natural Resources and Energy*.		

4. Category & Gas

Table 5 shows emission factors of CO_2 used in the road transport. Some countries use default emission factors, while others use country-specific emission factors.

Table 5 Emission factors of CO_2 used in road transport

	Year	Note
China	CS	
Thailand	D (1996)	
Myanmar	D (2006)	
Laos	D (1996)	
Mongolia	D (1996)	
Japan	CS	Described in NIR

CS: Country Specific Emission Factor
D(1996): the Revised 1996 IPCC Guidelines
D(2006): the 2006 IPCC Guidelines

5. Bunker Fuel

Table 6 shows bunker fuel emissions and basic statistics or estimation methods of bunker fuel emissions. Some countries estimate Bunker fuel emissions by using different statistics from domestic fuel statistics.

Table 6 Bunker fuel emissions and based statistics or estimation method of bunker fuel emissions

	International Navigation		International Aviation	
China	Yes	China Customs Statistics Yearbook	Yes	China Customs Statistics Yearbook
Thailand	No		No	
Myanmar	Yes	Myanmar Petroleum Product Enterprises data include national domestic fuel and international bunker fuel. Bunker fuel estimation is based on Statistical Yearbook of Myanmar.	Yes	Myanmar Petroleum Product Enterprises data include national domestic fuel and international bunker fuel. Myanmar Airways includes only domestic fuel.
Laos	No	*Domestic consumption is NE.*	Yes	Data of fuel used for aviation is separately recorded by Lao Aviation and Import and Export Department of the Ministry of Industry and Commerce.
Philippines	Yes		Yes	
Mongolia	No	*Domestic consumption is NE.*	No	
Japan	Yes	Yearbook of Mineral Resources and Petroleum Products Statistics	Yes	Yearbook of Mineral Resources and Petroleum Products Statistics

'Yes' in this table means that bunker fuels are separate from national transport emissions.

6. Issues and Challenges

Table 7 shows issues and challenges. Some countries answered that activity data collection was the most important issue.

Table 7 Issues and Challenges

China	**The activity data collection is the main challenge** in China due to the rapid increase of automobiles. With the enhancement and application of new techniques, the EFs will be adjusted in the future.
Thailand	**The investigation of activity data** that can support the completion of the national communication report with respect to the availability of domestic know-how and sufficient technology.
Myanmar	(1) **Updating inventory data** is required on a continuous basis in order to facilitate various related energy software. (2) **Absence of national air quality standards** makes it harder for the authorities to implement pollution control measures. (3) **Monitoring equipment** is required to inspect the actual emission performance of motor vehicles.
Laos	**There is neither record nor study of the fuel combustion** in transport and transport sub-sectors including types of vehicles. Existing imported fuel data are different from e each other and seems sensitive to share.
Philippines	The Department of Energy is responsible for the calculation of GHG emissions. GHG emissions from the transport subsector are being managed by the Department of Transport and Communications. A data collection and compilation system has to be in place**. Data should be of easy access.** There should be **logistical support for the procurement** of quality instruments for measuring GHGs. **Capacity building** for people involved in GHG measurements is also necessary.

Annex I: Agenda

Day 1, Wednesday 13th July		
08:00~08:30	**Participant Registration**	
08:30~10:20	**Opening Session**	***Grand ballroom***
	Chair: Kiyoto Tanabe	Rapporteur: Takako Ono
08:30~08:35	Ayako Suzuki	Welcome address (MOE, Japan)
08:35~08:40	H.E. Thuk Kroeun Vutha	Welcome address (MOE, Cambodia)
08:40~08:50	Hiroshi Ito	Overview of WGIA9
08:50~09:00	All	Q&A
09:00~09:20	Ayako Suzuki	Japan's climate change policies (MOE, Japan)
09:20~09:40	Sum Thy	Climate change activities in Cambodia (MOE, Cambodia)
09:40~09:50	Kiyoto Tanabe (Dominique Revet)	Update on non-Annex I national communications
09:50~10:05	Simon Eggleston	IPCC developments
10:05~10:20	All	Discussion
10:20~10:40		***Group Photo & Tea Break***
10:40~12:10	**Session I: Report of the latest NCs (inventories) recently submitted**	***Grand ballroom***
	Chair: Kamal Uy	Rapporteur: Kazumasa Kawashima
10:40~ 11:00	Retno Gumilang Dewi	Indonesia's national communication
11:00~ 11:20	Abdul Rahim Nik	Malaysia's second national communication with special emphasis on GHG inventory
11:20~ 11:40	Woranuch Emmanoch	GHG inventories for Thailand's second national communication 2000
11:40~ 12:00	Cuong Mong Nguyen	Vietnam – National communication report
12:00~ 12:10	All	Discussion
12:10~13:30		***Lunch***
13:30~17:00	**Session II: Relationships between inventory and mitigation measures**	***Grand ballroom***
	Chair: Leandro Buendia	Rapporteur: Simon Eggleston
13:30~ 13:50	Junko Akagi	Section overview
13:50~ 14:10	Qingxian Gao	Inventory and mitigation measures for Waste sector in China
14:10~ 14:30	Chart Chiemchaisri	Inventory and mitigation measures for waste sector in Thailand
14:30~ 14:50	Elizabeth M.P. Philip	Linking GHG inventory with mitigation actions (Malaysia)
14:50~ 15:10	Damasa Magcale -Macandog	Inventory and mitigation measures for LUCF sector in Philippines

15:10~ 15:30	Sultan Singh	Inventory and mitigation measures for enteric CH_4 emissions from livestock in India
15:30~15:50		***Tea Break***
15:50~ 17:00	All	Discussion
18:30~		***Dinner (at Imperial Room 1)***

Day 2, Thursday 14th July		
	Session III: Working Group (WG) Discussions & Mutual learning (ML)	
	Participants split into 2 groups in the morning and 2 groups in the afternoon. *Note: For those who attend mutual learning, please go to the following rooms:* *8:30- 12:00 ML1: Energy (Boardroom)* *13:30- 17:00 ML2: LULUCF (Boardroom)* *13:30- 17:00 ML3: Waste (Phnom Penh Room)*	
8:30~12:00	**WG 1: Waste** ***Phnom Penh Room*** **Theme: Development of waste statistics to estimate activity data** Chair: Tomonori Ishigaki Rapporteur: Rias Parinderati, Wukir Amintari Rukmi	
	Takefumi Oda	Introductory presentation (GIO)
	Kamal Uy	Waste sector in Cambodia
	Elizabeth Philip	GHG emissions from Waste sector in Malaysia
	Teresita Ramos Perez	Philippines GHG emissions : Waste sector Institutionalization of the GHG inventory: Waste sector
	Chart Chiemchaisri	Waste sector in Thailand
	Wonseok Baek	Waste statistics in Korea
		Discussion
8:30~12:00	**WG2: Inventory (cross-cutting issues)** ***Sihanoukville Room*** **Theme: The latest and future NCs focusing on estimation of non-CO_2 gases** Chair: Damasa Magcale Macandog Rapporteur: Atsushi Sato	
	Keizo Hirai	Introductory presentation (GIO)
	Keizo Hirai	Emission-trend, methodology and mitigation -measures of HFCs, PFC and SF_6 in Japan
	Phirum Am	Cambodia‘s GHG inventory for the year 2000
	Mone Nouansyvong	Emissions from Agriculture sector in 2000, SNC Lao PDR
	Khin Lay Swe	GHG inventory in Myanmar: INC report
		Discussion
12:00~13:30		***Lunch***
13:30~17:00	**WG 3: Transport** ***Siem Reap Room*** **Theme: Estimation of CO_2 emissions from transportation sector** Chair: Takahiko Hiraishi Rapporteur: Kohei Sakai	
	Kohei Sakai	Introductory presentation (GIO)
	Kohei Sakai	GHG emissions, statistics and mitigation for transport sector in Japan

	Agus Gunawan	GHGs emissions from Transportation sector
	Hnin Hnin Aye	Transport sector in Myanmar
	WGIA secretariat (edited by Kohei Sakai)	Transport WG - Result of questionnaire
		Discussion
13:30~17:00	**WG 4: Inventory (cross-cutting issues)**	***Sihanoukville Room***
	Theme: Sharing experiences gained through preparing NCs and identifying key elements for QA/QC systems	
	Chair: Mausami Desai	Rapporteur: Elsa Hatanaka
	Elsa Hatanaka	Introductory presentation (GIO)
	Elsa Hatanaka	Japan's QA/QC system
	Dorjpurev Jargal	Inventory QA/QC planning in Mongolia
	Mihyeon Lee	An overview of GHG inventory QA/QC system in Korea
	Takako Ono	Improvement of QA/QC in Vietnam by JICA supported for national GHG inventory
	Mausami Desai	Highlights of QA/QC procedures applied in U.S. GHG inventory system
		Discussion
Day 3, Friday 15th July		
8:30~12:30	**Wrap-up Session**	***Grand ballroom***
	Chair: Kiyoto Tanabe	
	Rapporteurs will present the summary of each session, group discussion and mutual learning	
8:30~8:45	Opening Session	Summary of opening session
8:45~9:00	Session I	Summary of session I
9:00~9:15	Session II	Summary of session II
9:15~11:00	Session III	Summary of WG1: Waste
		Summary of WG2: Inventory (non-CO_2)
		Summary of WG3: Transport
		Summary of WG4: Inventory (QA/QC)
		Summary of ML1: Energy
		Summary of ML2: LULUCF
		Summary of ML3: Waste
11:00~11:20		***Tea Break***
11:20~12:20	All	Discussion and wrap-up
12:20~12:25	Sum Thy	Closing remarks (MOE, Cambodia)
12:25~12:30	Yukihiro Nojiri	Closing remarks (GIO/NIES, Japan)

Annex II: List of Participants

CAMBODIA

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